

Memorandum

To	Greg Heffer	Page	1
CC	Jennifer Bixby		
Subject	Barton Road Interchange Improvement Project: Roundabout Analyses		
From	Randy Dunsey, PE Krishna Satti, PE, PTOE		
Date	August 20, 2013		

1. Purpose

A *Traffic Operations Analysis* report was prepared for the Interstate 215 (I-215)/Barton Road Interchange Improvement Project by ITERIS dated December 21, 2011. The report included seven alternatives which were analyzed for both year 2016 and 2040 in the AM and PM peak hours.

Alternative 7 is a Type L-7/L-1 cloverleaf/tight diamond interchange and is the locally preferred alternative. This alternative is used as the basis for a modification to the ramp intersections that is the focus of this memorandum. The ramp intersections include a cloverleaf at the intersection of Barton Road and I-215 Southbound (SB) Ramps and a diamond configuration at the northbound (NB) ramps. This memorandum analyzes a modification that includes two roundabout options at the I-215 NB and SB ramp intersections on Barton Road.

2. Methodology

Synchro/SimTraffic Version 8 (build 802 rev. 685) and Rodel software programs were used to analyze the Barton Road Corridor and the roundabouts. Synchro follows the methodologies set forth by the Highway Capacity Manual (HCM) to analyze intersection operations. Synchro is a macroscopic model that is an excellent tool to use for optimizing traffic signal timings and splits and reporting LOS analysis results. Synchro provides control delay at an intersection as a measure of effectiveness. SimTraffic in contrast is a microscopic simulation add-on tool to Synchro. In SimTraffic, individual vehicles that are entering/exiting the network are modeled and displayed as a 2D simulation. SimTraffic yields average delay at an intersection as a measure of effectiveness. The program provides the flexibility to modify the default parameters (e.g., peak hour factor, truck percentages, etc.) in order to accurately reflect the real time traffic conditions. Synchro provides results for individual intersections while SimTraffic models the interaction between multiple intersections on a roadway corridor. Queue lengths and network operations are observed from the simulation SimTraffic produces. The Synchro files and signal timings for Alternative 7 from the *Traffic Operations*

Analysis report dated December 21, 2011 were used to create the roadway network in this memorandum. Signal timings were then optimized within Synchro to minimize queue lengths and prioritize the Barton Road corridor. A maximum cycle length of 120 seconds was considered. The optimal cycle length used in all analyses was 90 seconds.

Rodel is a macroscopic model that uses empirical equations to analyze roundabout operations and utilizes geometric data to predict roundabout capacity. Rodel is an interactive analysis tool that allows the user to input planning level design elements to meet the needs of each site specific intersection.

The *Traffic Operations Analysis* report provides AM and PM peak hour traffic volumes for year 2040. The year 2040 PM peak hour volumes were used to analyze the corridor in SimTraffic as these volumes are generally higher than the AM peak hour. Analyses using Rodel were performed for both AM and PM peak hour volumes.

3. Rodel Analysis

The Rodel software program was used to analyze the proposed roundabouts at the intersections of the I-215 SB Ramps and I-215 NB Ramps on Barton Road. Rodel analyzes each roundabout independently and does not analyze multiple roundabouts on a corridor. To be consistent with other signalized and unsignalized capacity analysis methods, each roundabout was analyzed using a 50-percent confidence level (CL). The roundabouts were further evaluated with an 85-percent CL as a sensitivity analysis.

The peak hour traffic volumes at each intersection are used to determine the size of the roundabout and the lane configuration. The 2040 peak hour volumes at the I-215 NB ramps indicated the roundabout would need to accommodate two lanes east-west and one lane north-south. Additionally, the I-215 NB Ramp roundabout was analyzed with bypass lanes for the westbound to northbound movement and the northbound to eastbound movement, due to the high volumes. Including bypass lanes for these movements improves the operation of the roundabout to an acceptable level of service (LOS).

Peak hour volumes for the I-215 SB Ramp indicated this roundabout would also need two lanes east-west and one lane north-south. In addition, an exclusive right turn for the southbound to westbound movement was analyzed based on the travel volumes and directional splits on the southbound approach, which improves the overall LOS for 85-percent CL. Tables 1 and 2 summarize the results from Rodel. Appendix A of this memorandum includes the complete output from Rodel and Appendix B provides illustrations of the roundabout configurations.

Table 1 – Rodel Delay and LOS Results for Roundabouts

Roundabout Intersection	2040 AM Peak Hour				2040 PM Peak Hour			
	50% CL		85% CL		50% CL		85% CL	
	Ave Delay (Sec)	LOS	Ave Delay (Sec)	LOS	Ave Delay (Sec)	LOS	Ave Delay (Sec)	LOS
Barton Road/I-215 SB Ramps	7	A	27	C	45	D	132	F
Barton Road/I-215 SB Ramps with Exclusive Right Turn (SB-WB)	5	A	7	A	9	A	17	B
Barton Road/I-215 NB Ramps	158	F	294	F	279	F	428	F
Barton Road/I-215 NB Ramps with Bypass Lanes (WB-NB and NB-EB)	5	A	7	A	6	A	10	B

I-215 SB Ramp roundabout LOS and delay significantly improves with the addition of the exclusive SB-WB right turn. Although the 50% CL shows acceptable LOS D, the evaluation using an 85% CL indicates the roundabout is likely on the cusp of failure.

I-215 NB Ramp roundabout fails without exclusive right-turn lanes to/from I-215. The LOS and delay significantly improve when bypass lanes are added for the WB-NB and NB-EB movements. The bypass for the NB-EB movement would require an additional lane to be added in the eastbound direction on Barton Road that will need to either be merged into the existing outside travel lane or become a dedicated right-turn lane at the intersection of Barton Road and Commerce Way.

Table 2 – Rodel Queue Length Results for Roundabouts

Roundabout Intersection	Max Queue Length (ft) - 2040 AM Peak Hour				Max Queue Length (ft) – 2040 PM Peak Hour			
	50% CL		85% CL		50% CL		85% CL	
	EB	WB	EB	WB	EB	WB	EB	WB
Barton Road/I-215 SB Ramps	25	75	28	113	120	60	175	90
Barton Road/I-215 SB Ramps with Exclusive Right Turn (SB-WB)	23	75	30	13	148	60	380	88
Barton Road/I-215 NB Ramps	30	5,785	38	9,338	118	1,440	220	3,663
Barton Road/I-215 NB Ramps with Bypass Lanes (WB-NB and NB-EB)	30	70	38	118	118	60	220	85

At the I-215 SB Ramp roundabout, the overall maximum queue lengths are acceptable. Of note, the EB queue increases with the addition of the SB-WB right-turn lane due to improved SB volume to capacity (V/C) ratio and increased traffic flow into the roundabout.

At the I-215 NB Ramp roundabout, the maximum queue lengths are unacceptable for the westbound approach without bypass lanes. With the addition of the WB to NB bypass the LOS and queue length improve significantly. With the addition of the NB to EB bypass, the 50% CL queue length on the NB approach decreases from 15,990 feet to 5 feet in the PM peak hour (not included in the table).

4. Corridor Synchro/SimTraffic Analysis

Synchro/SimTraffic software was utilized to evaluate the operational analysis of Barton Road with roundabouts at both of the ramp intersections. From the preliminary design, the distance between Grand Terrace Road and the I-215 SB Ramps is approximately 365 feet. The distance between I-215 SB Ramps and I-215 NB Ramps is approximately 435 feet, and the distance between I-215 NB Ramps and Commerce Way is approximately 700 feet. The intersection of Barton Road and Grand Terrace Road was evaluated with a westbound left turn only lane with separate signal phase in order to provide a sufficient gap for U-turn vehicles. Table 3 presents the Synchro and Rodel results for 2040 PM peak hour at each intersection and Table 4 illustrates the queue lengths calculated from SimTraffic.

Table 3 – Synchro Analysis Results for 2040 PM Peak Hour

Synchro/ Rodel Analysis			Roundabout at Both Ramp Intersections				Roundabout at SB Ramps and Signal at NB Ramps			
Intersection	Distance Btwn Intersections (ft)		95th Queue Length per lane (ft)		LOS	Delay (Sec)	95th Queue Length per lane (ft)		LOS	Delay (Sec)
	EB	WB	EB	WB			EB	WB		
Barton Road/ Grand Terrace Road **	-	365	342	76	B	13	343	76	B	13
Barton Road/ I-215 SB Ramps with Exclusive Right Turn (SB-WB) *	365	435	23	75	A	5	23	75	A	5
Barton Road/ I-215 NB Ramps with Bypass Lanes (WB-NB and NB-EB)*	435	700	30	70	A	5	449	528	C	30
Barton Road/ Commerce Way **	700	-	638	456	D	38	697	483	D	44

* Rodel results for roundabout intersections based on 50% CL

** Synchro results for signalized intersections

The Synchro results indicate the EB queue length on Barton Road between Commerce Way and the NB ramp is less than 700 foot spacing between the intersections with roundabouts at both ramp intersections.

Table 4 – SimTraffic Analysis Results for 2040 PM Peak Hour

SimTraffic Analysis		Roundabout at Both Ramp Intersections		Roundabout at SB Ramps and Signal at NB Ramps		
Intersection	Distance Btwn Intersections (ft)		95th Queue Length per lane (ft)		95th Queue Length per lane (ft)	
	EB	WB	EB	WB	EB	WB
Barton Road/Grand Terrace Road	-	365	225	90	248	87
Barton Road/I-215 SB Ramps with Exclusive Right Turn (SB-WB)	365	435	202	136	217	319
Barton Road/I-215 NB Ramps with Bypass Lanes (WB-NB and NB-EB)	435	700	305	91	320	200
Barton Road/Commerce Way	700	-	904 ⁺	1049	587	880

+Spillover Queue (204ft) is added to upstream intersection approach

The SimTraffic results indicate the Barton Road EB queue length from Commerce Way would extend beyond the I-215 NB ramp intersection with roundabouts at both intersections. The 904 foot queue length exceeds the 700 foot intersection spacing which would cause the roundabout intersection to fail. As traffic backs up into the roundabout, the roundabout would “lock up” resulting in failure of both the intersection and the corridor operations. The EB queue length at Commerce Way is likely due to the free-flow operating condition at the I-215 NB Ramp roundabout; a traffic signal at this intersection would “meter” the traffic flows eastbound and westbound thereby resulting in shorter queues on these reaches.

In an effort to reduce the queue length between the I-215 NB Ramps and Commerce Way, the SimTraffic model was adjusted so that traffic from the NB-EB Roundabout Bypass lane was able to utilize the third lane along Barton Road as an auxiliary lane before entering the trap lane of the right turn pocket to Commerce Way. Under this condition the queue was reduced to 721 feet which slightly exceeds the available distance of 700 feet (results not shown in tables). However, other criteria also control the operation of the bypass lane/third lane operations. The weave length for this lane was checked using guidelines from the National Cooperative Highway Research Program (NCHRP) Report 420, Table 85. For a weaving volume of 2,400 vehicles per hour (vph) and 40 miles per hour (mph) speed, the estimated required weaving distance is 2,050 feet, which exceeds the available distance of

approximately 350 feet (700 feet total minus the right turn pocket length and minus the gore area of the bypass lane). The Synchro/SimTraffic output reports are provided in Appendix C.

Next, a Synchro/SimTraffic analysis was performed to measure the effectiveness of a traffic signal at the Barton Road/I-215 NB ramps intersection and a roundabout at the Barton Road/I-215 SB ramps intersection. The Synchro results indicate the EB queue on Barton Road between Commerce Way and the I-215 NB ramps will extend nearly to the I-215 NB ramp intersection (697 foot queue length with 700 foot intersection spacing – Table 3). As a signalized intersection, this condition would not increase delay at the I-215 NB Ramps or cause a break-down of the corridor.

The SimTraffic results indicate that the EB queue length at Barton Road and Commerce Way is reduced to 587ft (<700 ft). Also, the queue lengths for the EB and WB directions between the I-215 SB Ramp and I-215 NB Ramp on Barton Road are less than the 435 foot separation between the intersections.

5. Summary

The analysis for the Barton Road and I-215 SB Ramp intersection concludes:

- A roundabout at Barton Road and I-215 SB Ramp intersection with an exclusive SB-WB right turn lane operates at LOS A.
- The queue lengths calculated in Rodel are acceptable for all future peak hours at both 50% CL and 85% CL.
- The queue lengths calculated from SimTraffic are significantly greater than Rodel but are not likely to extend from adjacent intersections into the roundabout.

The analysis for the Barton Road and I-215 NB Ramp intersection concludes:

- A roundabout at Barton Road and I-215 NB Ramp intersection with Bypass lanes (WB-NB and NB-EB) operate at LOS A.
- A roundabout without the bypass lane will operate at LOS F.
- Construction of bypass lanes at this roundabout would involve additional right-of-way to accommodate the additional EB lane needed between I-215 NB Ramp and Commerce Way.
- The queue lengths calculated in Rodel are acceptable for all future peak hours at both 50% CL and 85% CL.
- The queue lengths calculated from SimTraffic indicate the eastbound queue at Commerce Way will extend into the I-215 NB Ramp roundabout. This is likely due to the free-flow operations of the roundabout. If this occurs, the roundabout will “lock-up” and all traffic movements on Barton Road and the I-215 exit ramps will experience unacceptable delays.

The analysis for the Barton Road corridor concludes:

- Roundabout at I-215 NB Ramp intersection could fail as a roundabout due to the eastbound traffic volumes and queue lengths at the adjacent Commerce Way intersection.
- I-215 SB Ramp intersection operates at an acceptable LOS as a roundabout.

Appendix A – Rodel Results

17:9:12		Barton Rd and SB Ramps				11			
E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90		
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15		
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75		
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00		
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75		
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH		
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM		
LEG NAME	PCU	TURNS (1st exit, 2nd..U)			FLOF	CL	FLOW RATIO	FLOW TIME	
SB RAMPS	1.07	306	000	382	0	1.00	50	0.75 1.125 0.75	15 45 75
W BARTON	1.07	003	0754	119	0	1.00	50	0.75 1.125 0.75	15 45 75
LA CROSSE	1.07	017	000	000	0	1.00	50	0.75 1.125 0.75	15 45 75
E BARTON	1.07	907	591	000	0	1.00	50	0.75 1.125 0.75	15 45 75
FLOW	veh	688	876	17	1498	AVEDEL	s	7.4	
CAPACITY	veh	920	2015	572	2207	LOS SIG		A	
AVE DELAY	secs	17.6	3.1	6.4	5.2	LOS UNSIG		A	
MAX DELAY	secs	30.0	4.3	9.0	7.9				
AVE QUEUE	veh	3.5	0.8	0.0	2.2	VEHIC HRS		6.3	
MAX QUEUE	veh	5.3	0.9	0.0	3.0	COST	\$	95	

17:9:12

Barton Rd and SB Ramps

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E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
SB RAMPS	1.04	360	000	523	0	1.00	50	0.75	1.125	0.75	15	45	75
W BARTON	1.04	003	1255	258	0	1.00	50	0.75	1.125	0.75	15	45	75
LA CROSSE	1.04	063	000	000	0	1.00	50	0.75	1.125	0.75	15	45	75
E BARTON	1.04	615	776	000	0	1.00	50	0.75	1.125	0.75	15	45	75

FLOW	veh	883	1516	63	1391	AVEDEL	s	45.0
CAPACITY	veh	859	2003	218	2171	LOS SIG		D
AVE DELAY	secs	173.1	7.8	30.8	4.7	LOS UNSIG		E
MAX DELAY	secs	346.3	12.5	56.1	7.0			
AVE QUEUE	veh	49.9	3.4	0.6	1.9	VEHIC HRS		48.1
MAX QUEUE	veh	85.4	4.8	0.9	2.4	COST	\$	722

17:9:12

Barton Rd and SB Ramps

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E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO				FLOW TIME		
SB RAMPS	1.07	306	000	382	0	1.00	85	0.75	1.125	0.75	15	45	75	
W BARTON	1.07	003	0754	119	0	1.00	85	0.75	1.125	0.75	15	45	75	
LA CROSSE	1.07	017	000	000	0	1.00	85	0.75	1.125	0.75	15	45	75	
E BARTON	1.07	907	591	000	0	1.00	85	0.75	1.125	0.75	15	45	75	

FLOW	veh	688	876	17	1498	AVEDEL	s	26.5
CAPACITY	veh	727	1824	381	2013	LOS SIG	C	
AVE DELAY	secs	97.5	3.7	9.7	7.5	LOS UNSIG	D	
MAX DELAY	secs	198.0	5.1	13.9	12.0			
AVE QUEUE	veh	19.8	0.9	0.0	3.2	VEHIC HRS		22.7
MAX QUEUE	veh	40.6	1.1	0.1	4.5	COST	\$	341

17:9:12		Barton Rd and SB Ramps				12			
E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90		
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15		
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75		
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00		
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75		
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH		
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM		
LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO	FLOW TIME
SB RAMPS	1.04	360	000	523	0	1.00	85	0.75 1.125 0.75	15 45 75
W BARTON	1.04	003	1255	258	0	1.00	85	0.75 1.125 0.75	15 45 75
LA CROSSE	1.04	063	000	000	0	1.00	85	0.75 1.125 0.75	15 45 75
E BARTON	1.04	615	776	000	0	1.00	85	0.75 1.125 0.75	15 45 75
FLOW	veh	883	1516	63	1391	AVEDEL s			131.6
CAPACITY	veh	660	1876	71	1972	LOS SIG			F
AVE DELAY	secs	487.2	10.9	63.0	6.5	LOS UNSIG			F
MAX DELAY	secs	883.0	18.2	63.0	10.2	VEHIC HRS			140.8
AVE QUEUE	veh	147.8	4.8	16.1	2.6	COST			\$ 2112
MAX QUEUE	veh	232.0	7.0	32.5	3.6				

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Barton Rd and NB Ramps

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E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
NB ENT	1.07	000	000	000	0	1.00	50	0.75	1.125	0.75	15	45	75
W BARTON	1.07	000	0909	227	0	1.00	50	0.75	1.125	0.75	15	45	75
NB EXIT	1.07	574	000	132	0	1.00	50	0.75	1.125	0.75	15	45	75
E BARTON	1.07	868	1366	000	0	1.00	50	0.75	1.125	0.75	15	45	75

FLOW	veh	0	1136	706	2234	AVEDEL	s	157.5
CAPACITY	veh	524	2294	635	2044	LOS SIG		F
AVE DELAY	secs	0.0	3.1	285.0	195.8	LOS UNSIG		F
MAX DELAY	secs	0.0	4.2	571.8	408.1			
AVE QUEUE	veh	0.0	1.0	67.6	148.9	VEHIC HRS		178.4
MAX QUEUE	veh	0.0	1.2	109.2	231.4	COST	\$	2676

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Barton Rd and NB Ramps

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E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
NB ENT	1.04	000	000	000	0	1.00	50	0.75	1.125	0.75	15	45	75
W BARTON	1.04	000	1512	267	0	1.00	50	0.75	1.125	0.75	15	45	75
NB EXIT	1.04	901	000	034	0	1.00	50	0.75	1.125	0.75	15	45	75
E BARTON	1.04	655	1357	000	0	1.00	50	0.75	1.125	0.75	15	45	75

FLOW	veh	0	1779	935	2012	AVEDEL	s	279.3
CAPACITY	veh	549	2360	334	2156	LOS	SIG	F
AVE DELAY	secs	0.0	6.7	935.0	45.3	LOS	UNSIG	F
MAX DELAY	secs	0.0	10.6	935.0	102.8			
AVE QUEUE	veh	0.0	3.4	413.2	25.8	VEHIC	HRS	366.6
MAX QUEUE	veh	0.0	4.7	639.6	57.6	COST	\$	5500

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Barton Rd and NB Ramps

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E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO				FLOW TIME		
NB ENT	1.07	000	000	000	0	1.00	85	0.75	1.125	0.75	15	45	75	
W BARTON	1.07	000	0909	227	0	1.00	85	0.75	1.125	0.75	15	45	75	
NB EXIT	1.07	574	000	132	0	1.00	85	0.75	1.125	0.75	15	45	75	
E BARTON	1.07	868	1366	000	0	1.00	85	0.75	1.125	0.75	15	45	75	

FLOW	veh	0	1136	706	2234	AVEDEL	s	294.3
CAPACITY	veh	395	2101	441	1874	LOS	SIG	F
AVE DELAY	secs	0.0	3.7	706.0	310.2	LOS	UNSIG	F
MAX DELAY	secs	0.0	5.1	706.0	711.5			
AVE QUEUE	veh	0.0	1.2	172.8	238.3	VEHIC	HRS	333.2
MAX QUEUE	veh	0.0	1.5	272.3	373.5	COST	\$	4997

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Barton Rd and NB Ramps

17

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
NB ENT	1.04	000	000	000	0	1.00	85	0.75	1.125	0.75	15	45	75
W BARTON	1.04	000	1512	267	0	1.00	85	0.75	1.125	0.75	15	45	75
NB EXIT	1.04	901	000	034	0	1.00	85	0.75	1.125	0.75	15	45	75
E BARTON	1.04	655	1357	000	0	1.00	85	0.75	1.125	0.75	15	45	75

FLOW	veh	0	1779	935	2012	AVEDEL	s	427.6
CAPACITY	veh	390	2161	135	1962	LOS SIG		F
AVE DELAY	secs	0.0	11.2	935.0	129.4	LOS UNSIG		F
MAX DELAY	secs	0.0	19.6	935.0	268.6			
AVE QUEUE	veh	0.0	5.7	583.6	85.4	VEHIC HRS		561.4
MAX QUEUE	veh	0.0	8.8	885.4	146.5	COST	\$	8421

17:9:12

Barton Rd and NB Ramps bypass

19

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
NB ENT	1.07	000	000	000	0	1.00	50	0.75	1.125	0.75	15	45	75
W BARTON	1.07	000	0909	227	0	1.00	50	0.75	1.125	0.75	15	45	75
NB EXIT	1.07	000	000	132	0	1.00	50	0.75	1.125	0.75	15	45	75
E BARTON	1.07	000	1366	000	0	1.00	50	0.75	1.125	0.75	15	45	75

FLOW	veh	0	1136	132	1366	AVEDEL	s	4.6
CAPACITY	veh	445	2294	635	2031	LOS SIG	A	
AVE DELAY	secs	0.0	3.1	7.2	5.6	LOS UNSIG	A	
MAX DELAY	secs	0.0	4.2	10.2	8.6			
AVE QUEUE	veh	0.0	1.0	0.3	2.2	VEHIC HRS		3.4
MAX QUEUE	veh	0.0	1.2	0.3	3.0	COST	\$	51

17:9:12

Barton Rd and NB Ramps bypass

17

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
NB ENT	1.04	000	000	000	0	1.00	50	0.75	1.125	0.75	15	45	75
W BARTON	1.04	000	1512	267	0	1.00	50	0.75	1.125	0.75	15	45	75
NB EXIT	1.04	000	000	034	0	1.00	50	0.75	1.125	0.75	15	45	75
E BARTON	1.04	000	1357	000	0	1.00	50	0.75	1.125	0.75	15	45	75

FLOW	veh	0	1779	34	1357	AVEDEL	s	5.9
CAPACITY	veh	537	2360	333	2140	LOS SIG	A	
AVE DELAY	secs	0.0	6.7	13.2	4.7	LOS UNSIG	A	
MAX DELAY	secs	0.0	10.6	21.2	7.0			
AVE QUEUE	veh	0.0	3.4	0.1	1.8	VEHIC HRS	5.2	
MAX QUEUE	veh	0.0	4.7	0.2	2.4	COST	\$	78

17:9:12

Barton Rd and NB Ramps bypass

18

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
NB ENT	1.07	000	000	000	0	1.00	85	0.75	1.125	0.75	15	45	75
W BARTON	1.07	000	0909	227	0	1.00	85	0.75	1.125	0.75	15	45	75
NB EXIT	1.07	000	000	132	0	1.00	85	0.75	1.125	0.75	15	45	75
E BARTON	1.07	000	1366	000	0	1.00	85	0.75	1.125	0.75	15	45	75

FLOW	veh	0	1136	132	1366	AVEDEL	s	6.6
CAPACITY	veh	252	2101	441	1838	LOS SIG		A
AVE DELAY	secs	0.0	3.7	12.1	8.4	LOS UNSIG		A
MAX DELAY	secs	0.0	5.1	18.3	13.7			
AVE QUEUE	veh	0.0	1.2	0.5	3.3	VEHIC HRS		4.8
MAX QUEUE	veh	0.0	1.5	0.6	4.7	COST	\$	72

17:9:12

Barton Rd and NB Ramps bypass

20

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
NB ENT	1.04	000	000	000	0	1.00	85	0.75	1.125	0.75	15	45	75
W BARTON	1.04	000	1512	267	0	1.00	85	0.75	1.125	0.75	15	45	75
NB EXIT	1.04	000	000	034	0	1.00	85	0.75	1.125	0.75	15	45	75
E BARTON	1.04	000	1357	000	0	1.00	85	0.75	1.125	0.75	15	45	75

FLOW	veh	0	1779	34	1357	AVEDEL	s	10.3
CAPACITY	veh	338	2161	135	1941	LOS SIG		B
AVE DELAY	secs	0.0	11.2	34.0	6.5	LOS UNSIG		B
MAX DELAY	secs	0.0	19.6	34.0	10.0			
AVE QUEUE	veh	0.0	5.7	1.2	2.5	VEHIC HRS		9.1
MAX QUEUE	veh	0.0	8.8	2.7	3.4	COST	\$	136

17:9:12

Barton Rd and SB Ramps bypass

13

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
SB RAMPS	1.07	000	000	382	0	1.00	50	0.75	1.125	0.75	15	45	75
W BARTON	1.07	003	0754	119	0	1.00	50	0.75	1.125	0.75	15	45	75
LA CROSSE	1.07	017	000	000	0	1.00	50	0.75	1.125	0.75	15	45	75
E BARTON	1.07	907	591	000	0	1.00	50	0.75	1.125	0.75	15	45	75

FLOW	veh	382	876	17	1498	AVEDEL	s	4.8
CAPACITY	veh	920	2014	572	2207	LOS SIG		A
AVE DELAY	secs	6.6	3.1	6.4	5.2	LOS UNSIG		A
MAX DELAY	secs	9.3	4.3	9.0	7.9			
AVE QUEUE	veh	0.7	0.8	0.0	2.2	VEHIC HRS		3.7
MAX QUEUE	veh	0.9	0.9	0.0	3.0	COST	\$	55

17:9:12

Barton Rd and SB Ramps bypass

14

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
SB RAMPS	1.04	000	000	523	0	1.00	50	0.75	1.125	0.75	15	45	75
W BARTON	1.04	003	1255	258	0	1.00	50	0.75	1.125	0.75	15	45	75
LA CROSSE	1.04	063	000	000	0	1.00	50	0.75	1.125	0.75	15	45	75
E BARTON	1.04	615	776	000	0	1.00	50	0.75	1.125	0.75	15	45	75

FLOW	veh	523	1516	63	1391	AVEDEL	s	8.6
CAPACITY	veh	859	1977	199	2171	LOS	SIG	A
AVE DELAY	secs	11.3	9.0	61.9	4.7	LOS	UNSIG	A
MAX DELAY	secs	17.6	15.4	63.0	7.0			
AVE QUEUE	veh	1.7	3.9	1.1	1.9	VEHIC	HRS	8.3
MAX QUEUE	veh	2.3	5.9	2.3	2.4	COST	\$	125

17:9:12

Barton Rd and SB Ramps bypass

15

E (m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L' (m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V (m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD (m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI (d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA (m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD SEP	0	0	0	0	FLOW PEAK	am/op/pm	AM

LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
SB RAMPS	1.07	000	000	382	0	1.00	85	0.75	1.125	0.75	15	45	75
W BARTON	1.07	003	0754	119	0	1.00	85	0.75	1.125	0.75	15	45	75
LA CROSSE	1.07	017	000	000	0	1.00	85	0.75	1.125	0.75	15	45	75
E BARTON	1.07	907	591	000	0	1.00	85	0.75	1.125	0.75	15	45	75

FLOW	veh	382	876	17	1498	AVEDEL	s	6.8
CAPACITY	veh	727	1821	379	2013	LOS	SIG	A
AVE DELAY	secs	10.6	3.8	10.1	7.5	LOS	UNSIG	A
MAX DELAY	secs	15.6	5.3	14.8	12.0			
AVE QUEUE	veh	1.2	0.9	0.0	3.2	VEHIC	HRS	5.2
MAX QUEUE	veh	1.5	1.2	0.1	4.5	COST	\$	78

17:9:12

Barton Rd and SB Ramps bypass

17

E	(m)	4.30	8.00	4.30	8.00	TIME PERIOD	min	90
L'	(m)	40.00	40.00	40.00	40.00	TIME SLICE	min	15
V	(m)	3.65	7.30	3.65	7.30	RESULTS PERIOD	min	15 75
RAD	(m)	20.00	20.00	20.00	20.00	TIME COST	\$/hr	15.00
PHI	(d)	25.00	25.00	25.00	25.00	FLOW PERIOD	min	15 75
DIA	(m)	54.00	54.00	54.00	54.00	FLOW TYPE	pcu/veh	VEH
GRAD	SEP	0	0	0	0	FLOW PEAK	am/op/pm	PM

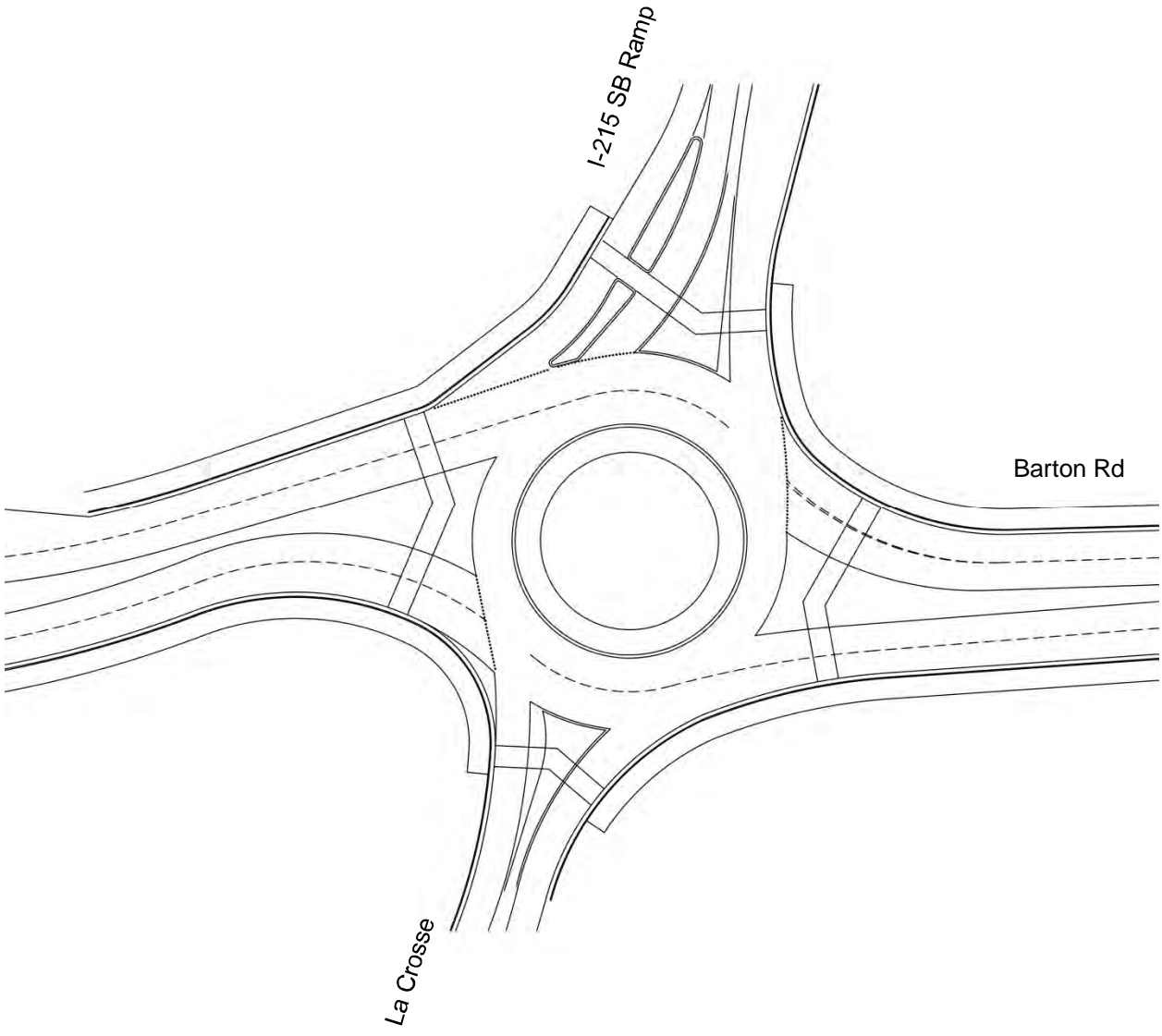
LEG NAME	PCU	TURNS (1st exit, 2nd..U)				FLOF	CL	FLOW RATIO			FLOW TIME		
SB RAMPS	1.04	000	000	523	0	1.00	85	0.75	1.125	0.75	15	45	75
W BARTON	1.04	003	1255	258	0	1.00	85	0.75	1.125	0.75	15	45	75
LA CROSSE	1.04	063	000	000	0	1.00	85	0.75	1.125	0.75	15	45	75
E BARTON	1.04	615	776	000	0	1.00	85	0.75	1.125	0.75	15	45	75

FLOW	veh	523	1516	63	1391	AVEDEL	s	17.2
CAPACITY	veh	660	1779	45	1972	LOS	SIG	B
AVE DELAY	secs	34.7	19.4	57.7	6.5	LOS	UNSIG	C
MAX DELAY	secs	66.0	38.7	63.0	10.1			
AVE QUEUE	veh	5.2	8.4	1.3	2.6	VEHIC	HRS	16.7
MAX QUEUE	veh	9.1	15.2	2.5	3.5	COST	\$	251

Appendix B – Roundabout Layouts



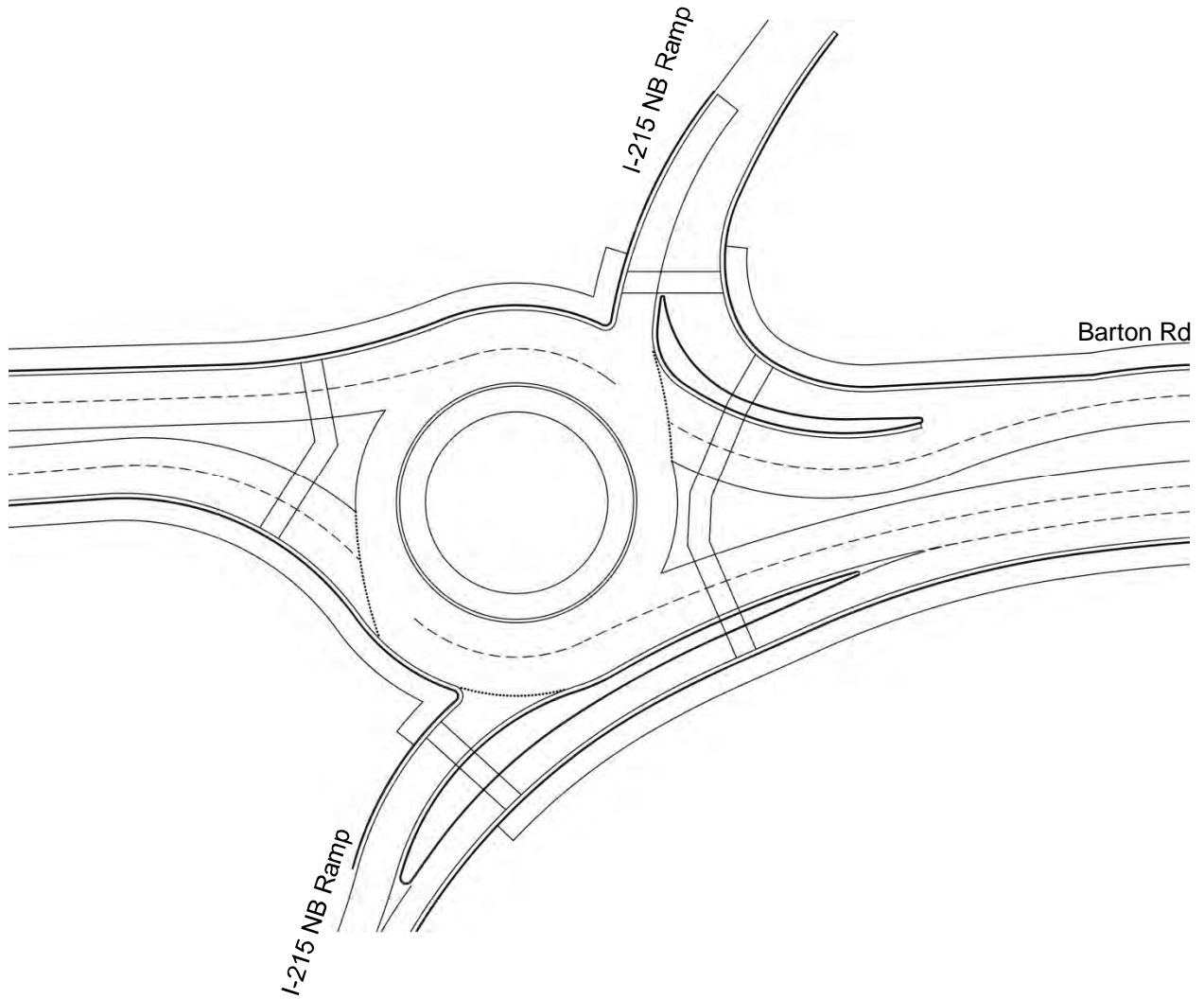
NOT TO SCALE



Barton Rd and I-215 SB Ramp Roundabout with Exclusive S-W Right Turn Lane



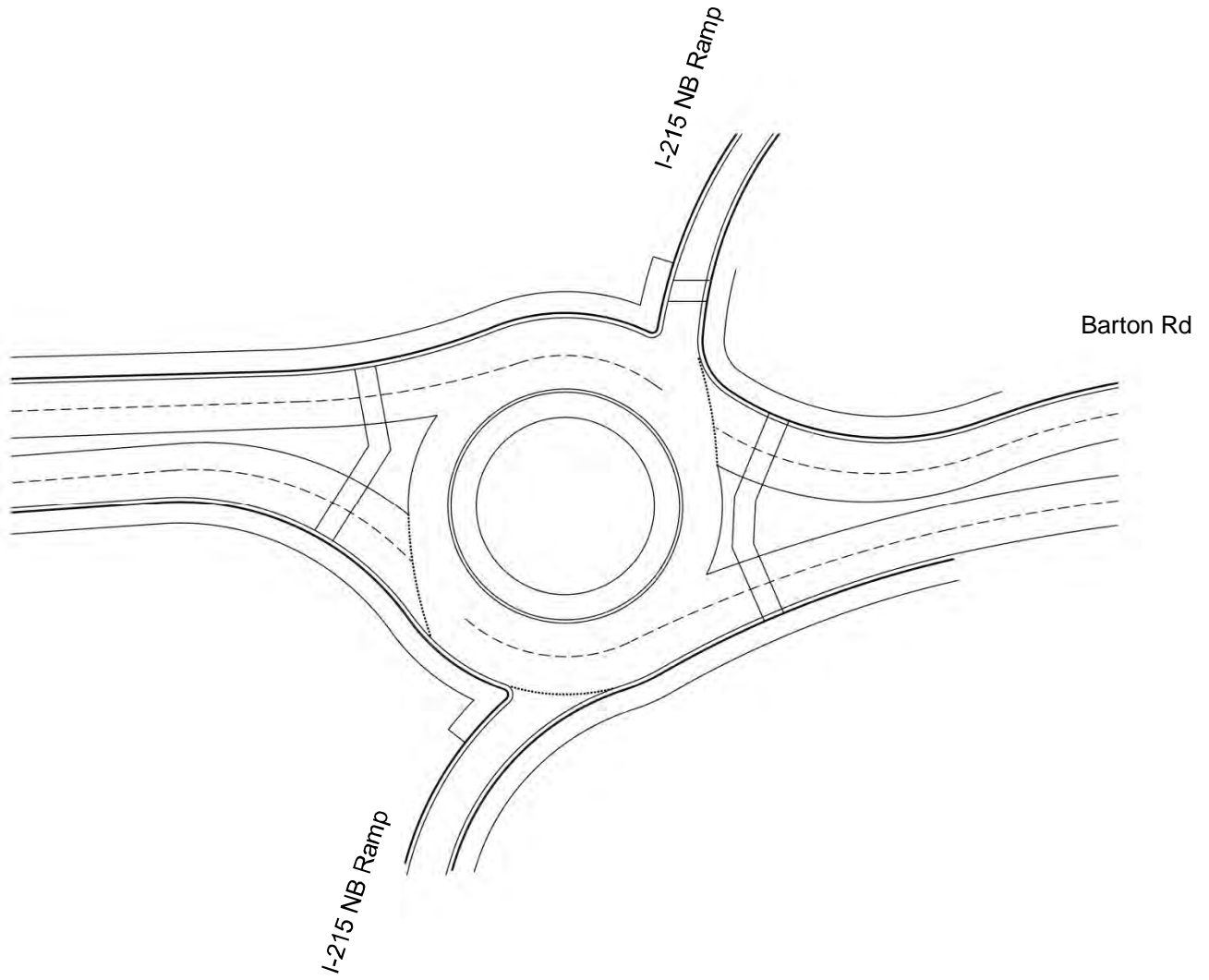
NOT TO SCALE



Barton Rd and I-215 NB Ramp Roundabout with Bypass Lanes (W-N and N-E)



NOT TO SCALE



Barton Rd and I-215 NB Ramp Roundabout Without Bypass Lanes

Appendix C – Synchro and SimTraffic Results

HCM Signalized Intersection Capacity Analysis - Analysis 7 - Roundabouts at Both Ramp Intersections
 1: La Canada Dr & Barton Rd

Timing Plan: PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	322	0	133	0	0
Lane Group Flow (vph)	359	384	2497	264	718	2088
Turn Type	NA	Perm	NA	Perm	Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	255	241	1735	776	456	2776
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.25		0.17		
v/c Ratio	1.41	1.59	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	1.24	2.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	204.1	285.2	201.0	1.2	269.0	1.9
Delay (s)	251.2	361.5	223.5	14.7	301.5	6.5
Level of Service	F	F	F	B	F	A
Approach Delay (s)	324.3		194.8			81.9
Approach LOS	F		F			F

Intersection Summary

HCM 2000 Control Delay	168.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis - Analysis 7 - Roundabouts at Both Ramp Intersections

2: New Street/Grand Terrace Rd & Barton Rd

Timing Plan: PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕		↖	↕↕	↗		↕			↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0		2.0	2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95		1.00	0.95	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.88			0.99	
Flt Protected		1.00		0.95	1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462		1644	3471	1553		1598			1737	
Flt Permitted		0.86		0.95	1.00	1.00		0.98			0.41	
Satd. Flow (perm)		2975		1644	3471	1553		1576			748	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	4	0	162	0	0	3	0
Lane Group Flow (vph)	0	1437	0	61	1106	23	0	40	0	0	40	0
Turn Type	Perm	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2					6	8			4		
Actuated Green, G (s)		63.4		5.7	73.1	73.1		8.9			8.9	
Effective Green, g (s)		65.4		7.7	75.1	75.1		10.9			10.9	
Actuated g/C Ratio		0.73		0.09	0.83	0.83		0.12			0.12	
Clearance Time (s)		4.0		4.0	4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2161		140	2896	1295		190			90	
v/s Ratio Prot				c0.04	0.32							
v/s Ratio Perm		c0.48				0.01		0.03			c0.05	
v/c Ratio		0.66		0.44	0.38	0.02		0.21			0.45	
Uniform Delay, d1		6.5		39.1	1.8	1.3		35.7			36.8	
Progression Factor		2.40		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2		0.7		2.2	0.4	0.0		0.6			3.5	
Delay (s)		16.3		41.3	2.2	1.3		36.2			40.3	
Level of Service		B		D	A	A		D			D	
Approach Delay (s)		16.3			4.2			36.2			40.3	
Approach LOS		B			A			D			D	
























Intersection Summary

HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	92.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis - Analysis 7 - Roundabouts at Both Ramp Intersections

7: Commerce Way & Barton Rd

Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1814	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	1.0	2.0	2.0		1.0	1.0	2.0	1.0	1.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3463		3190	1827	1553	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.80	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3463		3190	1827	1553	1385	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1909	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	67	0	1	0	0	0	40	0	26	0
Lane Group Flow (vph)	47	1909	581	273	1569	0	543	103	266	3	9	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Perm	NA	
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8		4	
Actuated Green, G (s)	7.8	52.0	64.0	9.0	53.2		12.0	18.0	27.0	3.0	3.0	
Effective Green, g (s)	9.8	54.0	68.0	11.0	55.2		14.0	20.0	31.0	5.0	5.0	
Actuated g/C Ratio	0.11	0.60	0.76	0.12	0.61		0.16	0.22	0.34	0.06	0.06	
Clearance Time (s)	4.0	4.0	3.0	4.0	4.0		3.0	3.0	4.0	3.0	3.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	179	2082	1173	200	2123		496	406	534	76	89	
v/s Ratio Prot	0.03	c0.55	0.08	c0.17	0.45		c0.17	0.06	c0.06		0.01	
v/s Ratio Perm			0.30						0.11	0.00		
v/c Ratio	0.26	0.92	0.50	1.36	0.74		1.09	0.25	0.50	0.04	0.10	
Uniform Delay, d1	36.8	16.0	4.3	39.5	12.3		38.0	28.8	23.3	40.2	40.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.8	7.9	0.3	192.9	2.4		68.7	0.3	0.7	0.2	0.5	
Delay (s)	37.6	23.9	4.6	232.4	14.7		106.7	29.2	24.1	40.4	40.8	
Level of Service	D	C	A	F	B		F	C	C	D	D	
Approach Delay (s)		19.3			46.9			71.7			40.8	
Approach LOS		B			D			E			D	

Intersection Summary

HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	97.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues

Alternative 7 - Roundabouts at Both Ramp Intersections

1: La Canada Dr & Barton Rd

Timing Plan: PM Peak



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	359	706	2497	397	718	2088
v/c Ratio	1.41	1.25	1.44	0.44	1.57	0.75
Control Delay	240.3	152.6	224.6	6.2	296.0	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	240.3	152.6	224.6	6.2	296.0	6.7
Queue Length 50th (ft)	~290	~330	~1024	39	~585	230
Queue Length 95th (ft)	#463	#550	#1162	99	#799	303
Internal Link Dist (ft)	532		796			938
Turn Bay Length (ft)					250	
Base Capacity (vph)	255	563	1735	909	456	2776
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.41	1.25	1.44	0.44	1.57	0.75

Intersection Summary

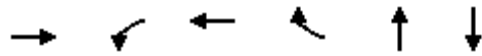
- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues

Alternative 7 - Roundabouts at Both Ramp Intersections

2: New Street/Grand Terrace Rd & Barton Rd

Timing Plan: PM Peak



Lane Group	EBT	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	1437	61	1106	27	202	43
v/c Ratio	0.66	0.37	0.38	0.02	0.57	0.46
Control Delay	17.8	44.8	2.3	0.6	14.5	51.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.8	44.8	2.3	0.6	14.5	51.1
Queue Length 50th (ft)	392	33	59	0	9	21
Queue Length 95th (ft)	m342	72	76	3	72	56
Internal Link Dist (ft)	1111		486		525	729
Turn Bay Length (ft)		100		240		
Base Capacity (vph)	2189	165	2896	1300	369	102
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.37	0.38	0.02	0.55	0.42

Intersection Summary

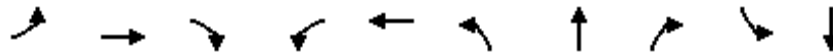
m Volume for 95th percentile queue is metered by upstream signal.

Queues

Alternative 7 - Roundabouts at Both Ramp Intersections

7: Commerce Way & Barton Rd

Timing Plan: PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	47	1909	648	273	1570	543	103	306	3	34
v/c Ratio	0.20	0.92	0.52	1.36	0.72	1.09	0.25	0.52	0.04	0.30
Control Delay	35.3	24.8	2.7	226.4	15.4	106.1	30.9	21.8	41.3	26.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.3	24.8	2.7	226.4	15.4	106.1	30.9	21.8	41.3	26.2
Queue Length 50th (ft)	23	465	27	~206	356	~181	49	107	2	4
Queue Length 95th (ft)	54	#638	47	#359	456	#282	93	187	11	34
Internal Link Dist (ft)		337			969		480			643
Turn Bay Length (ft)	230		230	230		145				
Base Capacity (vph)	274	2082	1254	200	2187	496	406	591	76	114
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.92	0.52	1.36	0.72	1.09	0.25	0.52	0.04	0.30

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Intersection: 1: La Canada Dr & Barton Rd

Movement	WB	WB	B9	B9	NB	NB	NB	SB	SB	SB
Directions Served	L	R	T	T	T	T	R	L	T	T
Maximum Queue (ft)	623	605	297	315	911	900	897	275	1044	1027
Average Queue (ft)	446	381	57	63	875	872	871	275	1008	998
95th Queue (ft)	655	678	214	234	899	891	888	275	1032	1021
Link Distance (ft)	532	532	1133	1133	848	848	848		981	981
Upstream Blk Time (%)	21	21			63	90	73		74	22
Queuing Penalty (veh)	114	112			0	0	0		0	0
Storage Bay Dist (ft)								250		
Storage Blk Time (%)								79	3	
Queuing Penalty (veh)								789	18	

Intersection: 2: New Street/Grand Terrace Rd & Barton Rd

Movement	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	LT	TR	L	T	T	R	LTR	LTR
Maximum Queue (ft)	243	236	110	71	97	31	183	81
Average Queue (ft)	131	140	50	36	58	3	96	28
95th Queue (ft)	208	225	97	63	90	17	163	60
Link Distance (ft)	1133	1133		405	405		558	745
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100			240		
Storage Blk Time (%)			3					
Queuing Penalty (veh)			17					

Intersection: 4: I-215 SB Ramps & Barton Rd

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	193	234	142	168	96	778	525
Average Queue (ft)	121	113	48	52	29	331	101
95th Queue (ft)	182	202	96	136	68	646	431
Link Distance (ft)	405	405	368	368	526	763	
Upstream Blk Time (%)						1	
Queuing Penalty (veh)						0	
Storage Bay Dist (ft)							500
Storage Blk Time (%)						10	0
Queuing Penalty (veh)						35	1

Intersection: 5: I-215 NB Ramps & Barton Rd

Movement	EB	EB	WB	WB	NE	NE
Directions Served	LT	T	T	T	<L	R
Maximum Queue (ft)	135	153	94	120	44	98
Average Queue (ft)	31	30	50	24	14	10
95th Queue (ft)	92	101	88	91	34	55
Link Distance (ft)	368	368	363	363	486	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					500	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 7: Commerce Way & Barton Rd

Movement	EB	EB	EB	EB	B8	B8	B8	WB	WB	WB	NB	NB
Directions Served	L	T	T	R	T	T		L	T	TR	L	L
Maximum Queue (ft)	245	417	436	255	362	430	410	255	1061	1059	158	170
Average Queue (ft)	37	259	300	193	88	150	74	255	1027	1020	156	168
95th Queue (ft)	119	352	431	326	334	473	333	255	1049	1044	162	171
Link Distance (ft)		345	345		363	363	363		998	998		
Upstream Blk Time (%)		1	3		0	5	1		91	37		
Queuing Penalty (veh)		11	40		1	38	9		0	0		
Storage Bay Dist (ft)	230			230				230			145	145
Storage Blk Time (%)	0	8	8	0				98	1		7	70
Queuing Penalty (veh)	0	4	47	4				720	2		7	68

Intersection: 7: Commerce Way & Barton Rd

Movement	NB	NB	SB
Directions Served	T	R	TR
Maximum Queue (ft)	542	551	69
Average Queue (ft)	519	396	18
95th Queue (ft)	534	667	49
Link Distance (ft)	499	499	667
Upstream Blk Time (%)	74	7	
Queuing Penalty (veh)	0	0	
Storage Bay Dist (ft)			
Storage Blk Time (%)	5		
Queuing Penalty (veh)	26		

Network Summary

Network wide Queuing Penalty: 2061

Intersection: 1: La Canada Dr & Barton Rd

Movement	WB	WB	B9	B9	NB	NB	NB	SB	SB	SB
Directions Served	L	R	T	T	T	T	R	L	T	T
Maximum Queue (ft)	628	642	463	462	911	911	893	275	1033	1044
Average Queue (ft)	466	460	157	166	873	877	868	274	1005	997
95th Queue (ft)	733	744	429	445	895	900	883	275	1025	1027
Link Distance (ft)	532	532	1133	1133	848	848	848		981	981
Upstream Blk Time (%)	45	44			63	89	74		60	10
Queuing Penalty (veh)	241	234			0	0	0		0	0
Storage Bay Dist (ft)								250		
Storage Blk Time (%)								77	0	
Queuing Penalty (veh)								764	2	

Intersection: 2: New Street/Grand Terrace Rd & Barton Rd

Movement	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	LT	TR	L	T	T	R	LTR	LTR
Maximum Queue (ft)	216	244	117	133	115	31	184	62
Average Queue (ft)	117	130	46	45	61	4	82	17
95th Queue (ft)	199	216	88	93	100	19	143	49
Link Distance (ft)	1133	1133		405	405		558	745
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100			240		
Storage Blk Time (%)			0	0				
Queuing Penalty (veh)			2	0				

Intersection: 4: I-215 SB Ramps & Barton Rd

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	177	144	144	209	54	815	525
Average Queue (ft)	113	103	57	87	21	589	311
95th Queue (ft)	167	150	116	196	50	975	735
Link Distance (ft)	405	405	370	370	526	763	
Upstream Blk Time (%)						42	
Queuing Penalty (veh)						0	
Storage Bay Dist (ft)							500
Storage Blk Time (%)						45	1
Queuing Penalty (veh)						161	4

Intersection: 5: I-215 NB Ramps & Barton Rd

Movement	EB	WB	WB	NE	NE
Directions Served	LT	T	T	<L	R
Maximum Queue (ft)	74	120	139	495	499
Average Queue (ft)	19	59	50	38	83
95th Queue (ft)	59	105	116	204	368
Link Distance (ft)	370	767	767	486	
Upstream Blk Time (%)				0	1
Queuing Penalty (veh)				0	0
Storage Bay Dist (ft)					500
Storage Blk Time (%)				0	1
Queuing Penalty (veh)				1	0

Intersection: 7: Commerce Way & Barton Rd

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	TR	L	L	T	R	L
Maximum Queue (ft)	254	780	813	838	255	1061	1050	158	170	526	514	29
Average Queue (ft)	54	363	382	178	254	1010	1000	156	169	514	403	3
95th Queue (ft)	166	651	721	599	256	1122	1120	161	171	519	676	18
Link Distance (ft)		767	767	767		998	998			499	499	667
Upstream Blk Time (%)		0	1	1		84	48			73	2	
Queuing Penalty (veh)		2	12	6		0	0			0	0	
Storage Bay Dist (ft)	230				230			145	145			
Storage Blk Time (%)		13			98	4		8	73	0		
Queuing Penalty (veh)		6			720	11		8	71	2		

Intersection: 7: Commerce Way & Barton Rd

Movement	SB
Directions Served	TR
Maximum Queue (ft)	69
Average Queue (ft)	27
95th Queue (ft)	55
Link Distance (ft)	667
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 2248

HCM Signalized Intersection Capacity Analysis
 1: La Canada Dr & Barton Rd

Alternative 7 - Roundabout at SB Ramps
 Timing Plan: PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	322	0	133	0	0
Lane Group Flow (vph)	359	384	2497	264	718	2088
Turn Type	NA	Perm	NA	Perm	Prot	NA
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	255	241	1735	776	456	2776
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.25		0.17		
v/c Ratio	1.41	1.59	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	1.26	2.03	1.00	1.00	1.00	1.00
Incremental Delay, d2	204.1	285.2	201.0	1.2	269.0	1.9
Delay (s)	252.1	362.4	223.5	14.7	301.5	6.5
Level of Service	F	F	F	B	F	A
Approach Delay (s)	325.3		194.8			81.9
Approach LOS	F		F			F

Intersection Summary

HCM 2000 Control Delay	168.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

2: New Street/Grand Terrace Rd & Barton Rd

Alternative 7 - Roundabout at SB Ramps

Timing Plan: PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕		↖	↕↕	↖		↕			↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0		2.0	2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95		1.00	0.95	1.00		1.00			1.00	
Frt		1.00		1.00	1.00	0.85		0.88			0.99	
Flt Protected		1.00		0.95	1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462		1644	3471	1553		1598			1737	
Flt Permitted		0.86		0.95	1.00	1.00		0.98			0.41	
Satd. Flow (perm)		2975		1644	3471	1553		1576			748	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	4	0	162	0	0	3	0
Lane Group Flow (vph)	0	1437	0	61	1106	23	0	40	0	0	40	0
Turn Type	Perm	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2					6	8			4		
Actuated Green, G (s)		63.4		5.7	73.1	73.1		8.9			8.9	
Effective Green, g (s)		65.4		7.7	75.1	75.1		10.9			10.9	
Actuated g/C Ratio		0.73		0.09	0.83	0.83		0.12			0.12	
Clearance Time (s)		4.0		4.0	4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2161		140	2896	1295		190			90	
v/s Ratio Prot				c0.04	0.32							
v/s Ratio Perm		c0.48				0.01		0.03			c0.05	
v/c Ratio		0.66		0.44	0.38	0.02		0.21			0.45	
Uniform Delay, d1		6.5		39.1	1.8	1.3		35.7			36.8	
Progression Factor		2.47		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2		0.7		2.2	0.4	0.0		0.6			3.5	
Delay (s)		16.7		41.3	2.2	1.3		36.2			40.3	
Level of Service		B		D	A	A		D			D	
Approach Delay (s)		16.7			4.2			36.2			40.3	
Approach LOS		B			A			D			D	






















Intersection Summary

HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	92.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Barton Rd

Alternative 7 - Roundabout at SB Ramps

Timing Plan: PM Peak
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	267	1574	0	0	1357	655	34	0	901	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1644	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1644	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	1657	0	0	1428	689	36	0	948	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	390	0	41	41	0	0	0
Lane Group Flow (vph)	281	1657	0	0	1428	299	36	433	433	0	0	0
Turn Type	Prot	NA			NA	Perm	Prot	NA	Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	14.0	55.0			37.0	37.0	27.0	27.0	27.0			
Effective Green, g (s)	16.0	57.0			39.0	39.0	29.0	29.0	29.0			
Actuated g/C Ratio	0.18	0.63			0.43	0.43	0.32	0.32	0.32			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	292	2198			1504	672	529	475	450			
v/s Ratio Prot	c0.17	0.48			c0.41		0.02	0.29				
v/s Ratio Perm						0.19			c0.31			
v/c Ratio	0.96	0.75			0.95	0.44	0.07	0.91	0.96			
Uniform Delay, d1	36.7	11.6			24.6	17.9	21.1	29.3	30.0			
Progression Factor	1.00	1.00			0.71	0.89	1.00	1.00	1.00			
Incremental Delay, d2	42.2	2.5			8.9	1.2	0.1	21.6	32.5			
Delay (s)	78.9	14.0			26.4	17.1	21.2	50.8	62.5			
Level of Service	E	B			C	B	C	D	E			
Approach Delay (s)		23.4			23.3			55.3			0.0	
Approach LOS		C			C			E			A	

Intersection Summary

HCM 2000 Control Delay	29.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Commerce Way & Barton Rd

Alternative 7 - Roundabout at SB Ramps
Timing Plan: PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1814	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3463		3190	1827	1553	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.67	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3463		3190	1827	1553	1154	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1909	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	93	0	1	0	0	0	39	0	25	0
Lane Group Flow (vph)	47	1909	555	273	1569	0	543	103	267	3	9	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Perm	NA	
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8		4	
Actuated Green, G (s)	6.6	50.0	63.0	7.0	50.4		13.0	21.0	28.0	4.0	4.0	
Effective Green, g (s)	8.6	52.0	67.0	9.0	52.4		15.0	23.0	32.0	6.0	6.0	
Actuated g/C Ratio	0.10	0.58	0.74	0.10	0.58		0.17	0.26	0.36	0.07	0.07	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	157	2005	1156	164	2016		531	466	586	76	107	
v/s Ratio Prot	0.03	c0.55	0.08	c0.17	0.45		c0.17	0.06	c0.05		0.01	
v/s Ratio Perm			0.28						0.13	0.00		
v/c Ratio	0.30	0.95	0.48	1.66	0.78		1.02	0.22	0.46	0.04	0.08	
Uniform Delay, d1	37.9	17.8	4.6	40.5	14.4		37.5	26.4	22.3	39.3	39.4	
Progression Factor	1.01	1.05	0.66	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	7.2	0.2	324.4	3.0		44.9	0.2	0.6	0.2	0.3	
Delay (s)	38.7	26.0	3.2	364.9	17.4		82.4	26.7	22.9	39.5	39.7	
Level of Service	D	C	A	F	B		F	C	C	D	D	
Approach Delay (s)		20.6			68.9			57.2			39.7	
Approach LOS		C			E			E			D	

Intersection Summary		
HCM 2000 Control Delay	43.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.98	D
Actuated Cycle Length (s)	90.0	Sum of lost time (s)
Intersection Capacity Utilization	97.5%	8.0
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		F

Queues

Alternative 7 - Roundabout at SB Ramps

1: La Canada Dr & Barton Rd

Timing Plan: PM Peak



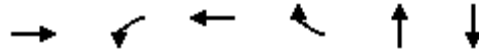
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	359	706	2497	397	718	2088
v/c Ratio	1.41	1.25	1.44	0.44	1.57	0.75
Control Delay	240.8	152.7	224.6	6.2	296.0	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	240.8	152.7	224.6	6.2	296.0	6.7
Queue Length 50th (ft)	~290	~330	~1024	39	~585	230
Queue Length 95th (ft)	#464	#551	#1162	99	#799	303
Internal Link Dist (ft)	456		796			938
Turn Bay Length (ft)					250	
Base Capacity (vph)	255	563	1735	909	456	2776
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.41	1.25	1.44	0.44	1.57	0.75

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
2: New Street/Grand Terrace Rd & Barton Rd

Alternative 7 - Roundabout at SB Ramps
Timing Plan: PM Peak



Lane Group	EBT	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	1437	61	1106	27	202	43
v/c Ratio	0.66	0.37	0.38	0.02	0.57	0.46
Control Delay	18.3	44.8	2.3	0.6	14.5	51.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.3	44.8	2.3	0.6	14.5	51.1
Queue Length 50th (ft)	393	33	59	0	9	21
Queue Length 95th (ft)	m343	72	76	3	72	56
Internal Link Dist (ft)	1146		487		525	729
Turn Bay Length (ft)		100		240		
Base Capacity (vph)	2189	165	2896	1300	369	102
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.37	0.38	0.02	0.55	0.42

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Queues
5: I-215 NB Ramps & Barton Rd

Alternative 7 - Roundabout at SB Ramps
Timing Plan: PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	281	1657	1428	689	36	474	474
v/c Ratio	0.96	0.75	0.95	0.65	0.09	0.92	0.97
Control Delay	82.9	14.4	27.8	3.1	23.3	51.2	61.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	82.9	14.4	27.8	3.1	23.3	51.2	61.1
Queue Length 50th (ft)	160	313	267	5	14	241	247
Queue Length 95th (ft)	#315	401	m#528	m59	36	#445	#461
Internal Link Dist (ft)		488	735			427	
Turn Bay Length (ft)	350			300	270		
Base Capacity (vph)	292	2198	1504	1063	529	516	491
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.96	0.75	0.95	0.65	0.07	0.92	0.97

Intersection Summary

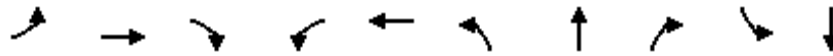
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Queues

Alternative 7 - Roundabout at SB Ramps

7: Commerce Way & Barton Rd

Timing Plan: PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	47	1909	648	273	1570	543	103	306	3	34
v/c Ratio	0.23	0.95	0.52	1.66	0.76	1.02	0.22	0.49	0.04	0.26
Control Delay	36.4	27.0	1.5	353.6	17.9	83.5	28.0	20.0	40.7	23.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.4	27.0	1.5	353.6	17.9	83.5	28.0	20.0	40.7	23.8
Queue Length 50th (ft)	26	563	2	~228	377	~165	46	103	2	4
Queue Length 95th (ft)	m31	m#697	m11	#381	483	#271	89	180	10	33
Internal Link Dist (ft)		735			817		412			643
Turn Bay Length (ft)	230		230	230		145				
Base Capacity (vph)	237	2005	1249	164	2079	531	466	624	76	132
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.95	0.52	1.66	0.76	1.02	0.22	0.49	0.04	0.26

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Intersection: 1: La Canada Dr & Barton Rd

Movement	WB	WB	B9	B9	NB	NB	NB	SB	SB	SB
Directions Served	L	R	T	T	T	T	R	L	T	T
Maximum Queue (ft)	560	562	720	711	906	906	906	275	1037	1026
Average Queue (ft)	532	532	445	466	880	879	874	275	1003	987
95th Queue (ft)	552	553	775	775	902	899	890	275	1026	1007
Link Distance (ft)	451	451	1168	1168	854	854	854		974	974
Upstream Blk Time (%)	87	79			66	89	75		66	13
Queuing Penalty (veh)	465	421			0	0	0		0	0
Storage Bay Dist (ft)								250		
Storage Blk Time (%)								81	0	
Queuing Penalty (veh)								802	2	

Intersection: 2: New Street/Grand Terrace Rd & Barton Rd

Movement	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	LT	TR	L	T	T	R	LTR	LTR
Maximum Queue (ft)	242	266	71	89	110	41	140	83
Average Queue (ft)	124	134	29	37	43	5	81	29
95th Queue (ft)	219	248	61	69	87	22	128	62
Link Distance (ft)	1168	1168		402	402		553	750
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			100			240		
Storage Blk Time (%)				0				
Queuing Penalty (veh)				0				

Intersection: 4: La Crosse/I-215 SB Ramps & Barton Rd

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	TR	LT	TR	LTR	LT	R
Maximum Queue (ft)	191	259	473	466	52	554	525
Average Queue (ft)	116	126	109	132	24	250	51
95th Queue (ft)	185	217	305	319	49	488	297
Link Distance (ft)	402	402	425	425	576	717	
Upstream Blk Time (%)			0	0			
Queuing Penalty (veh)			1	3			
Storage Bay Dist (ft)							500
Storage Blk Time (%)						2	0
Queuing Penalty (veh)						7	0

Intersection: 5: I-215 NB Ramps & Barton Rd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	T	R	L	TR	R
Maximum Queue (ft)	364	372	402	196	216	226	294	411	406
Average Queue (ft)	199	203	228	104	118	94	70	276	242
95th Queue (ft)	318	313	320	178	200	182	220	412	384
Link Distance (ft)		425	425	699	699			458	458
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	350					300	270		
Storage Blk Time (%)	0	0						12	
Queuing Penalty (veh)	0	1						4	

Intersection: 7: Commerce Way & Barton Rd

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	TR	L	L	T	R	L
Maximum Queue (ft)	254	517	581	255	255	884	883	157	170	459	435	22
Average Queue (ft)	88	371	401	224	254	866	862	155	169	438	343	2
95th Queue (ft)	238	523	587	335	255	880	876	171	170	450	556	12
Link Distance (ft)		699	699			845	845			420	420	665
Upstream Blk Time (%)						96	22			67	1	
Queuing Penalty (veh)						0	0			0	0	
Storage Bay Dist (ft)	230			230	230			145	145			
Storage Blk Time (%)	0	17	15	0	100	1		8	70	4		
Queuing Penalty (veh)	0	8	95	2	731	2		8	68	21		

Intersection: 7: Commerce Way & Barton Rd

Movement	SB
Directions Served	TR
Maximum Queue (ft)	104
Average Queue (ft)	21
95th Queue (ft)	64
Link Distance (ft)	665
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

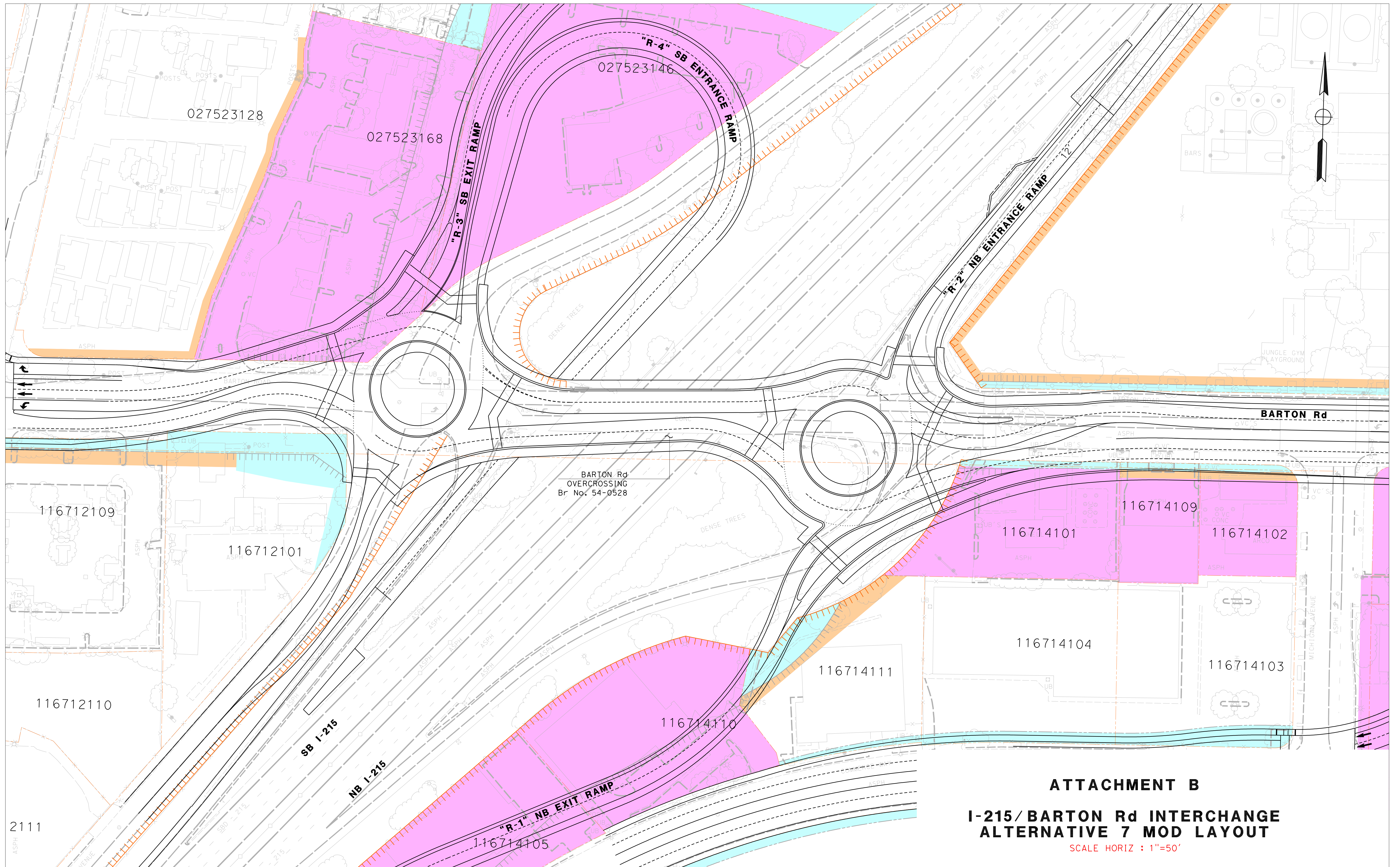
Network Summary

Network wide Queuing Penalty: 2642

ATTACHMENT B

LAYOUT PLAN OPTION A –

TWO ROUNDABOUTS AT I-215 BARTON ROAD

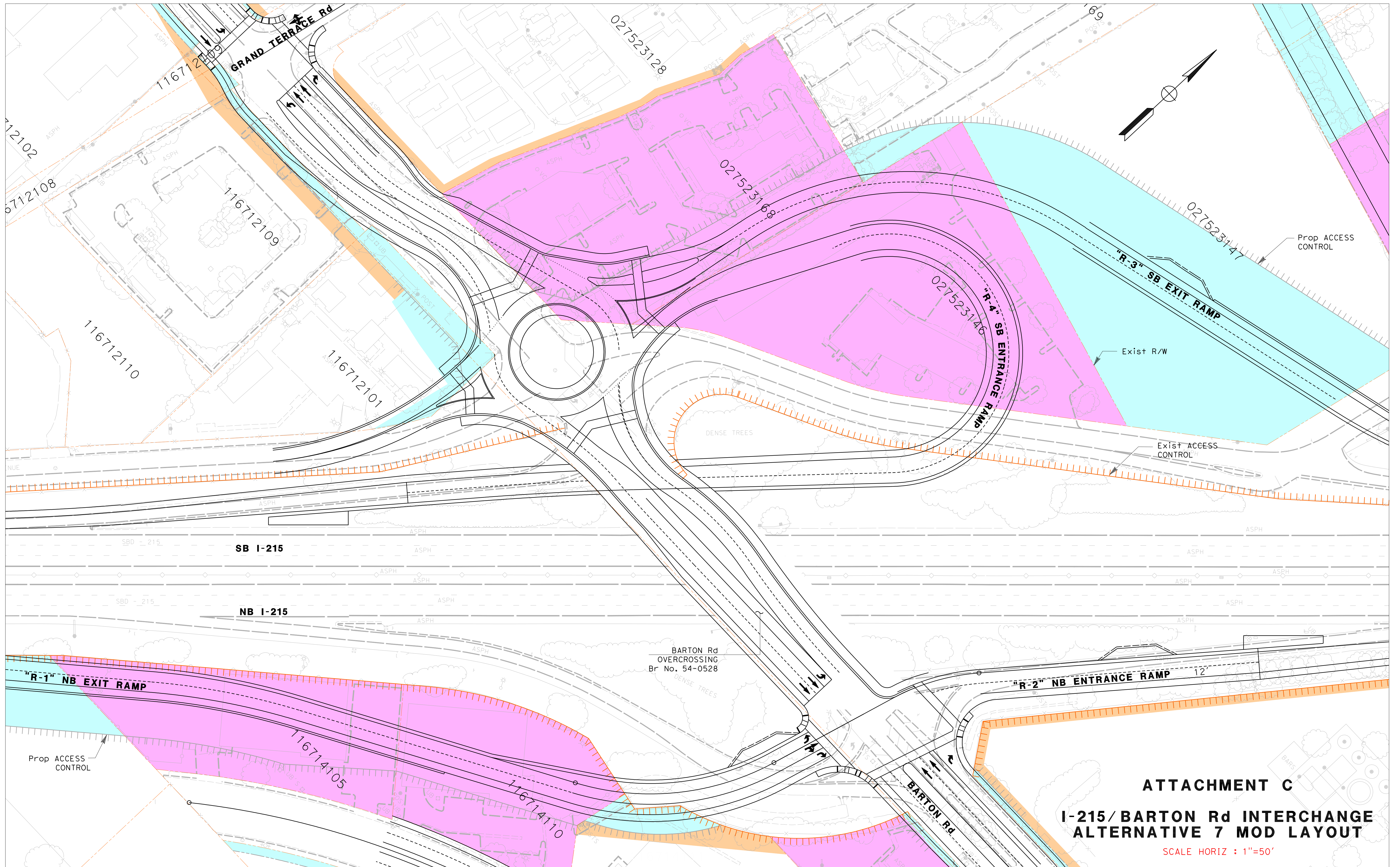


ATTACHMENT B
I-215/BARTON Rd INTERCHANGE
ALTERNATIVE 7 MOD LAYOUT
 SCALE HORIZ : 1"=50'

ATTACHMENT C

LAYOUT PLAN OPTION B –

ONE ROUNDABOUT AT I-215 BARTON ROAD S/B RAMPS



Interstate 215/Barton Road Interchange Improvement Project

08-SBd-215-PM 0.58/1.66

Revised Traffic Operations Analysis

Caltrans Project No. 0800000282 (0J0700)

Prepared for:



Under contract to AECOM

Prepared by:



December 21, 2011

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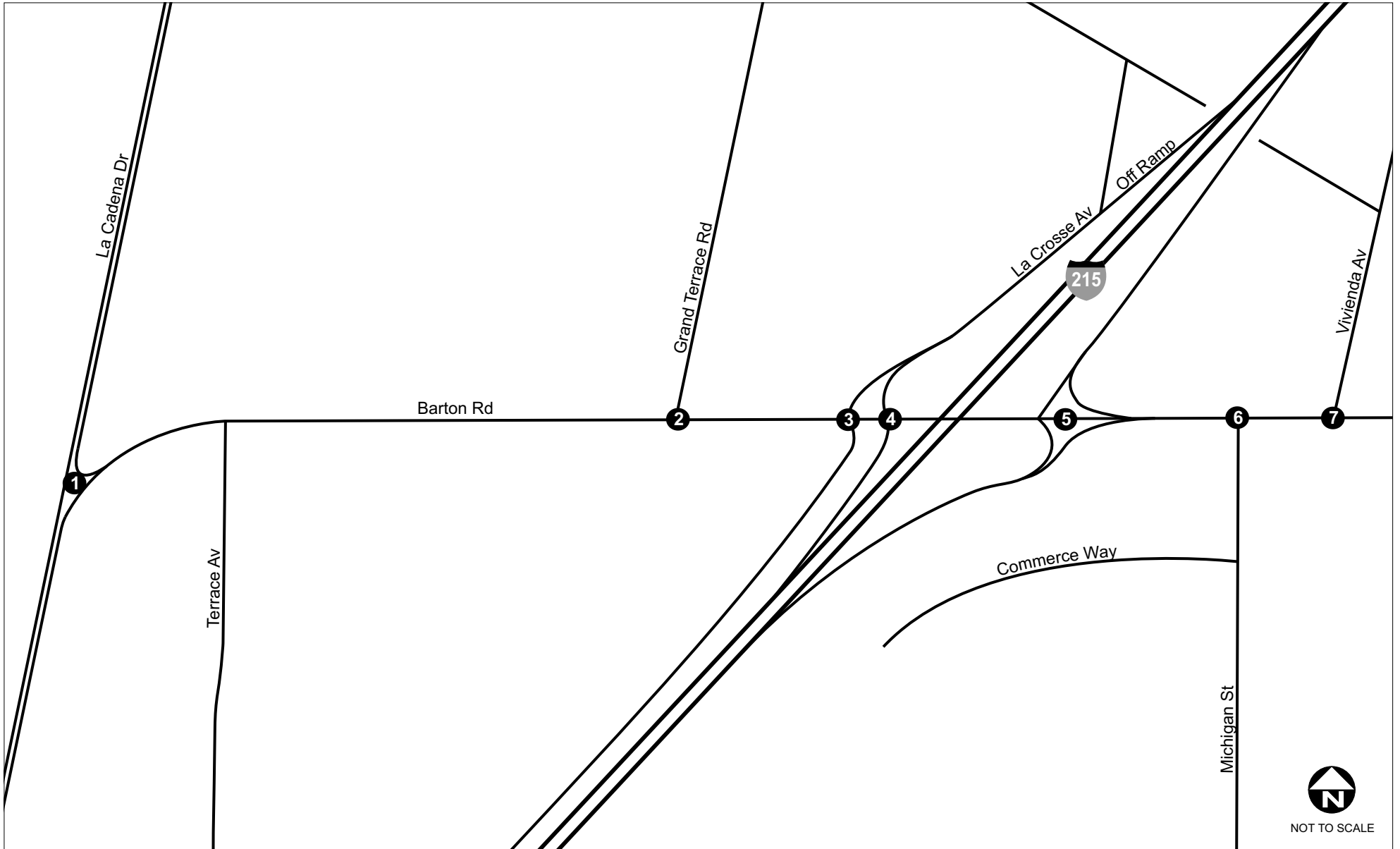
INTRODUCTION

This report documents the traffic operations analysis in relation to the proposed reconstruction of the Barton Road interchange on Interstate 215 (I-215), in the City of Grand Terrace in San Bernardino County. The existing Barton Road interchange cannot accommodate the projected growth in auto and truck traffic based on the traffic projections and the existing and future land uses in the vicinity. The existing bridge overcrossing between the two ramp terminus intersections is narrow (one lane each direction) with limited queuing space for left turns, resulting in long queues that back up onto the freeway mainline. The primary purpose of the proposed project is to improve traffic operations and accommodate anticipated growth in automobile and truck traffic in the vicinity of the interchange by addressing the substandard features of the existing interchange. The Barton Road interchange improvements will be completed in the year 2016. Seven alternatives, including the No-Build alternative, for the Barton Road interchange improvements are analyzed in this report. This analysis examines traffic volumes and levels of service in the vicinity of the interchange for each alternative under the following conditions:

- Existing Conditions
- Opening year (2016) without project conditions
- Opening year (2016) with project conditions
- Design year (2040) without project conditions
- Design year (2040) with project conditions

For each of the seven alternatives, the study area includes the freeway mainline, ramps, and intersections in the vicinity of the Barton Road/I-215 interchange. Intersections studied along Barton Road include those at La Cadena Drive, La Crosse Avenue, I-215 Southbound Ramps, I-215 Northbound Ramps, Michigan Street and Vivienda Avenue. **Figure 1** illustrates the study area and the locations of the study intersections.

The reconstruction of the Barton Road interchange will be completed prior to the I-215 Bi-County Corridor Improvement project and after the High Occupancy Vehicle (HOV) Gap Closure project. The Bi-County project is a 6.5-mile project extending from Orange Show Road in San Bernardino through the cities of Colton, Grand Terrace, and Riverside to the SR-60/SR-91/I-215 interchange in Riverside County. The Bi-County project is designed to relieve traffic congestion by the addition of mixed flow lanes and other freeway operational improvements including interchange modifications. The HOV Gap Closure project is designed to meet the demand for HOV travel by the addition of a carpool or HOV lane in each direction along the I-215 Corridor. The Gap Closure project will be completed in the year 2014. The Bi-County Corridor Improvement project is expected to be completed by 2040.



Legend

⊗ Study Intersection



Barton Road Interchange Improvement Project

FIGURE 1
Study Area and Study Intersections

INTERCHANGE ALTERNATIVES

Six alternative interchange designs, in addition to the No-Build alternative, are examined in this traffic operations analysis. Each of the build alternatives is designed to accommodate the ultimate widening of the freeway to four mixed-flow lanes in each direction in the horizon year and the addition of one HOV lane in each direction in the opening year. The alternatives are described in detail below.

Alternative 1: No-Build

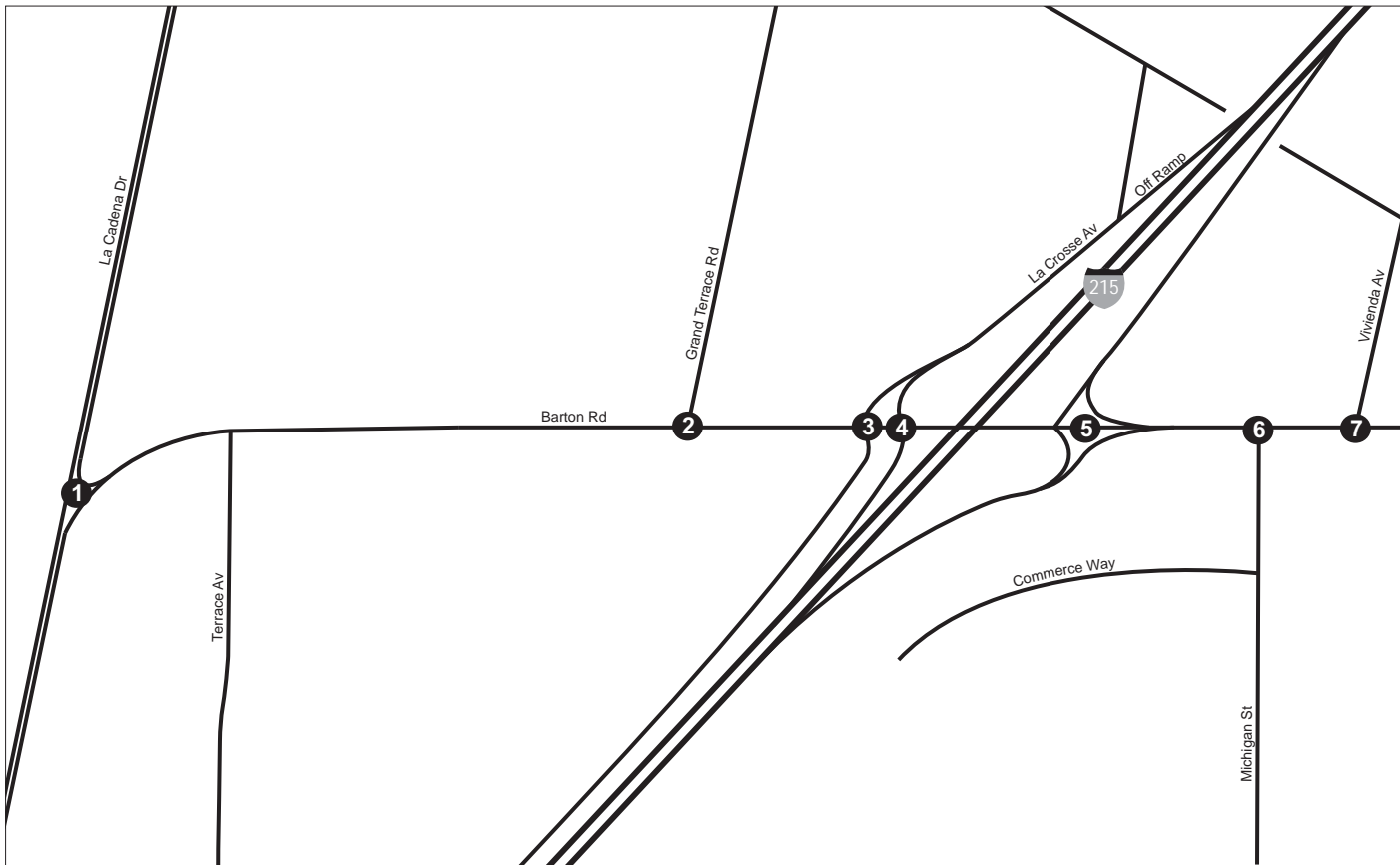
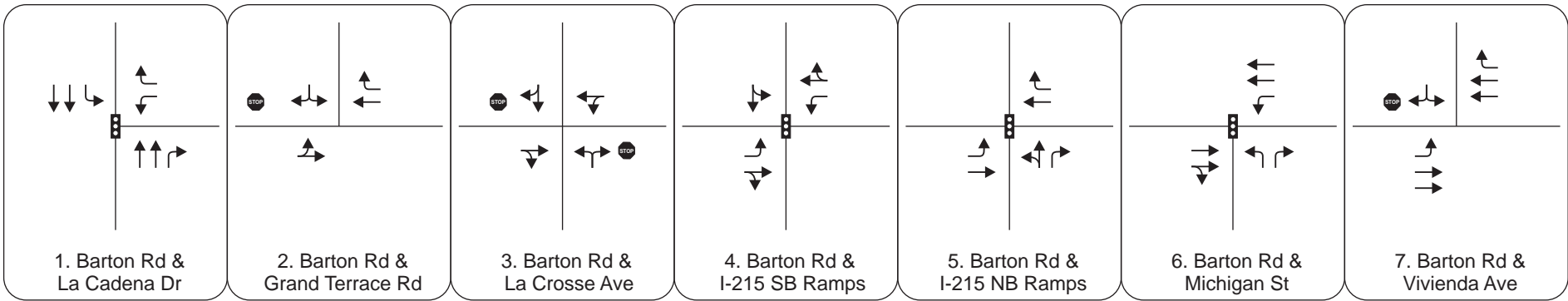
This alternative would maintain the existing facility in its current condition. No improvements would be made, and this alternative would not address the existing non-standard features of the interchange. The existing geometrics at the intersections on Barton Road between La Cadena Drive and Vivienda Avenue are illustrated in **Figure 2**.

Alternative 2: Type L-2, Spread Diamond Interchange

Under Alternative 2, the Barton Road entrance and exit ramps will be reconstructed in a standard spread diamond configuration. The bridge over the freeway will be widened to six lanes, with two through lanes in each direction and dual back-to-back left turn lanes for freeway-bound traffic in each direction. In addition, right turn lanes will be provided for eastbound right turns from Barton Road onto the southbound on-ramp and for westbound right turns onto the northbound on-ramp. Barton Road will be widened to two through lanes in each direction from the northbound ramps to the Union Pacific Railroad bridge, tapering to one lane at the bridge, to provide adequate capacity to the local street system along with the freeway.

The northbound and southbound off-ramps at Barton Road will be improved to a Caltrans standard two-lane exit ramp with an auxiliary lane, and will be widened to provide additional queuing space and turn lanes at Barton Road. The northbound and southbound on-ramps will be metered and improved to two mixed-flow lanes and an HOV preferential lane at the meter, tapering to a single lane before the gore point. The southbound auxiliary lane, including the second lane on the exit ramp, will be added as part of the I-215 Bi-County Corridor Improvement Project and will therefore not be in place at the opening of this project.

In addition to the interchange improvements, the existing intersections of Barton Road & La Crosse Avenue, Barton Road & Michigan Street, and La Crosse Avenue & I-215 Southbound Off-Ramp will be eliminated. La Crosse Avenue north of Barton Road will be terminated in a cul-de-sac. Grand Terrace Road north of Barton Road will be realigned to intersect Barton Road farther to the west to provide standard intersection spacing from the southbound ramps. The existing segment of La Crosse Avenue south of Barton Road will be eliminated, and a new road will be created farther to the west to align with Grand Terrace Road, resulting in a signalized four-way intersection. Commerce Way will be realigned and connected to the “T” intersection of Vivienda Avenue and Barton Road, resulting in a signalized four-legged intersection. Michigan Street will no longer connect to Barton Road and will instead terminate at Commerce Way. **Figure 3** illustrates the proposed design of Alternative 2, including the number of lanes on each approach at each intersection. The proposed layout for Alternative 2 is included in **Appendix A**.

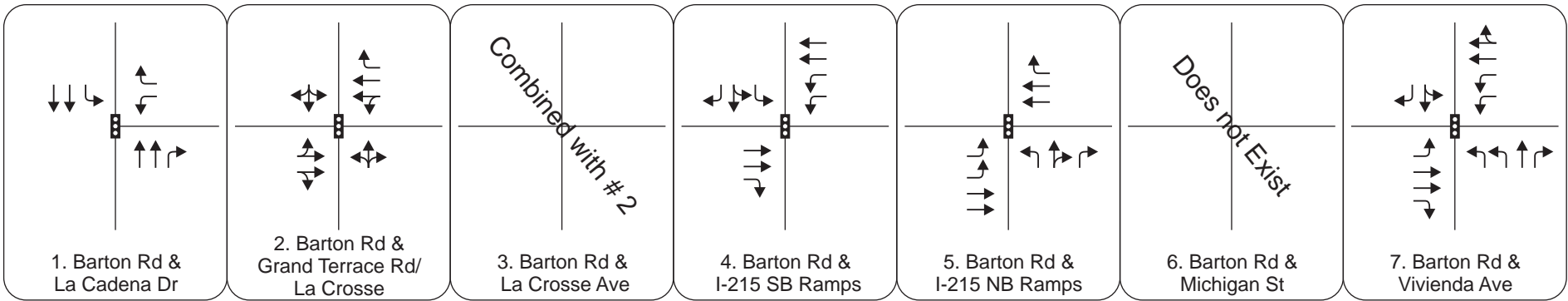


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Alternative 3: Type L-7 Interchange

Under Alternative 3, the interchange will be reconstructed as a Type L-7 interchange. The northbound entrance and exit ramps will be on the southern side of Barton Road, and the southbound entrance and exit ramps will be on the northern side of Barton Road. The bridge over the freeway will be widened to four lanes, with two through lanes in each direction. Dual left turn lanes will be provided for eastbound left turns from Barton Road onto the southbound on-ramp and for westbound left turns onto the northbound on-ramp. Barton Road will be widened to two through lanes in each direction from the northbound ramps to the Union Pacific Railroad bridge, tapering to one lane at the bridge, to provide adequate capacity to the local street system along with the freeway.

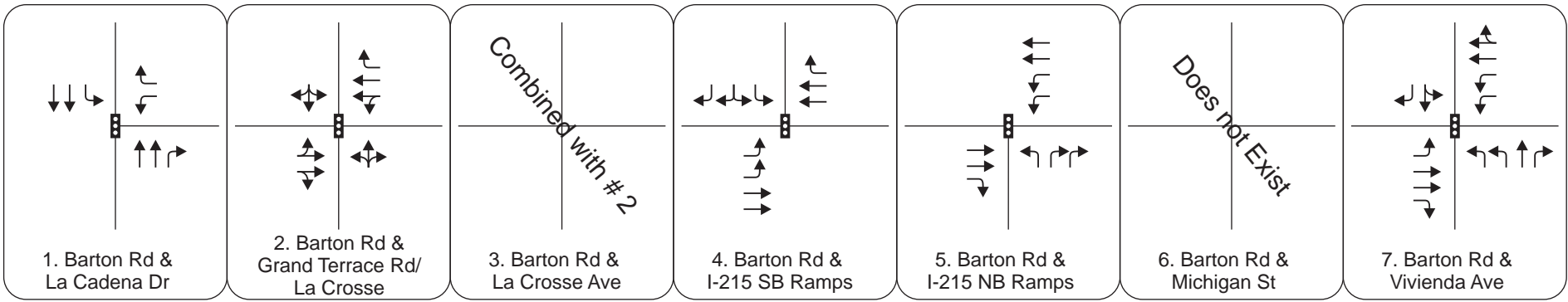
The northbound and southbound off-ramps at Barton Road will be improved to a Caltrans standard two-lane exit ramp with an auxiliary lane, and will be widened to provide additional queuing space and turn lanes at Barton Road. The northbound and southbound on-ramps will be metered and improved to two mixed-flow lanes and an HOV preferential lane at the meter, tapering to a single lane before the gore point. The southbound auxiliary lane, including the second lane on the exit ramp, will be added as part of the I-215 Bi-County Corridor Improvement Project and will therefore not be in place at the opening of this project.

In addition to the interchange improvements, the existing intersections of Barton Road & La Crosse Avenue, Barton Road & Michigan Street, and La Crosse Avenue & I-215 Southbound Off-Ramp will be eliminated. La Crosse Avenue north of Barton Road will be terminated in a cul-de-sac. Grand Terrace Road north of Barton Road will be realigned to intersect Barton Road farther to the west to provide standard intersection spacing from the southbound ramps. The existing segment of La Crosse Avenue south of Barton Road will be eliminated, and a new road will be created farther to the west to align with Grand Terrace Road, resulting in a signalized four-way intersection. Commerce Way will be realigned and connected to the “T” intersection of Vivienda Avenue and Barton Road, resulting in a signalized four-legged intersection. Michigan Street will no longer connect to Barton Road and will instead terminate at Commerce Way. **Figure 4** illustrates the proposed design of Alternative 3, including the number of lanes on each approach at each intersection. The proposed layout for Alternative 3 is included in **Appendix A**.

Alternative 4: Type L-7/L-8 Interchange

Under Alternative 4, the interchange will be reconstructed as Type L-7/L-8 interchange, with all ramps on the north side of Barton Road. The northbound ramps will align with Michigan Street. The bridge over the freeway will be widened to four lanes, with two through lanes in each direction. In addition, a westbound right turn pocket for the northbound on-ramp and dual eastbound left turn lanes for the southbound on-ramp will be provided. Barton Road will be widened to two through lanes in each direction from the northbound ramps to the Union Pacific Railroad bridge, tapering to one lane at the bridge, to provide adequate capacity to the local street system along with the freeway.

The northbound and southbound off-ramps at Barton Road will be improved to a Caltrans standard two-lane exit ramp with an auxiliary lane, and will be widened to provide additional queuing space and turn lanes at Barton Road. The northbound and southbound on-ramps will be metered and improved to two mixed-flow lanes and an HOV preferential lane at the meter, tapering to a single lane before the gore point. The southbound auxiliary lane, including the second lane on the exit ramp, will be added as part of the I-215 Bi-County Corridor Improvement Project and will therefore not be in place at the opening of this project.



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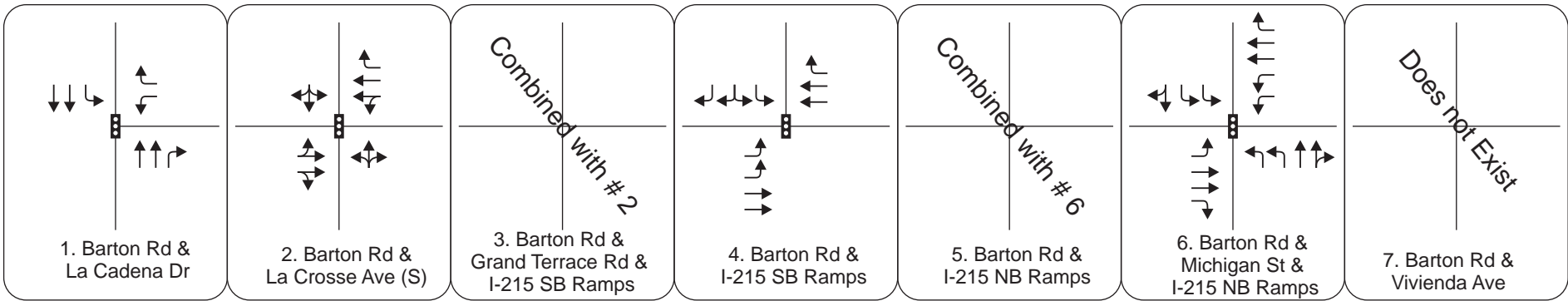
In addition to the interchange improvements, the existing intersections of Barton Road & La Crosse Avenue, Barton Road & Michigan Street, and La Crosse Avenue & I-215 Southbound Off-Ramp will be eliminated. La Crosse Avenue north of Barton Road will be terminated in a cul-de-sac. Grand Terrace Road north of Barton Road will be realigned to intersect Barton Road farther to the west to provide standard intersection spacing from the southbound ramps. The existing segment of La Crosse Avenue south of Barton Road will be eliminated, and a new road will be created farther to the west to align with Grand Terrace Road, resulting in a signalized four-way intersection. Commerce Way will be realigned and connected to the intersection of I-215 Northbound Ramps and Barton Road, resulting in a signalized four-legged intersection. Michigan Street will no longer connect to Barton Road and will instead terminate at Commerce Way. **Figure 5** illustrates the proposed design of Alternative 4, including the number of lanes on each approach at each intersection. The proposed layout for Alternative 4 is included in **Appendix A**.

Alternative 5: Single Point Interchange

Under Alternative 5, all four entrance and exit ramps will be reconstructed to connect to a single intersection on Barton Road west of the freeway. The bridge over the freeway will be widened to seven lanes, with two through lanes in each direction, a westbound right turn lane for the northbound on-ramp and dual westbound left turn lanes for the southbound on-ramp. Barton Road will be widened to two through lanes in each direction from the northbound ramps to the Union Pacific Railroad bridge, tapering to one lane at the bridge, to provide adequate capacity to the local street system along with the freeway.

The northbound and southbound off-ramps at Barton Road will be improved to a Caltrans standard two-lane exit ramp with an auxiliary lane, and will be widened to provide additional queuing space and turn lanes at Barton Road. The northbound and southbound on-ramps will be metered and improved to one mixed-flow lane and an HOV preferential lane at the meter, tapering to a single lane before the gore point. The southbound auxiliary lane, including the second lane on the exit ramp, will be added as part of the I-215 Bi-County Corridor Improvement Project and will therefore not be in place at the opening of this project.

In addition to the interchange improvements, the existing intersections of Barton Road & La Crosse Avenue, Barton Road & Michigan Street, and La Crosse Avenue & I-215 Southbound Off-Ramp will be eliminated. La Crosse Avenue north of Barton Road will be terminated in a cul-de-sac. Grand Terrace Road north of Barton Road will be realigned to intersect Barton Road farther to the west to provide standard intersection spacing from the southbound ramps. The existing segment of La Crosse Avenue south of Barton Road will be eliminated, and a new road will be created farther to the west to align with Grand Terrace Road, resulting in a signalized four-way intersection. Commerce Way will be realigned and connected to the “T” intersection of Vivienda Avenue and Barton Road, resulting in a signalized four-legged intersection. Michigan Street will no longer connect to Barton Road and will instead terminate at Commerce Way. **Figure 6** illustrates the proposed design of Alternative 5, including the number of lanes on each approach at each intersection. The proposed layout for Alternative 5 is included in **Appendix A**.

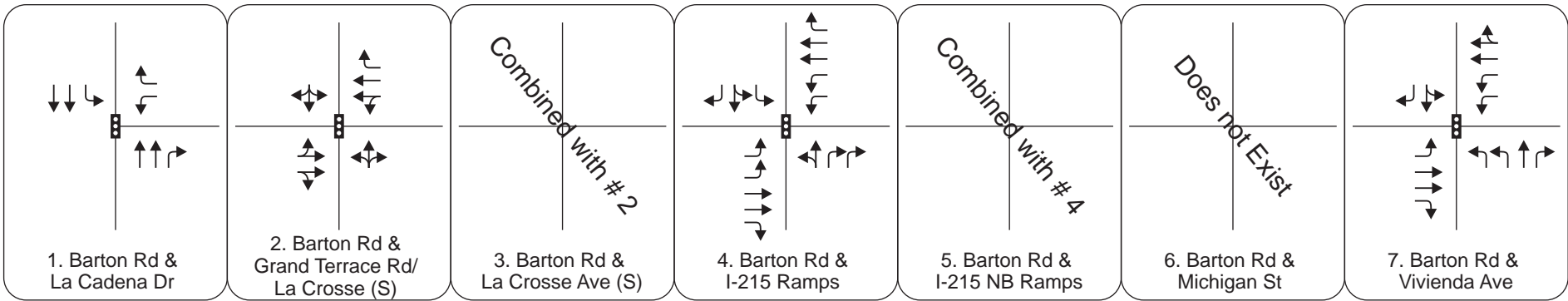


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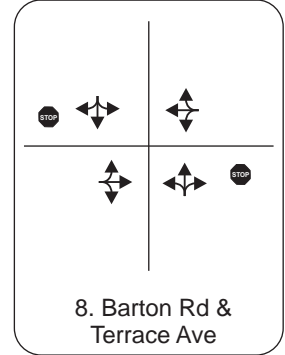
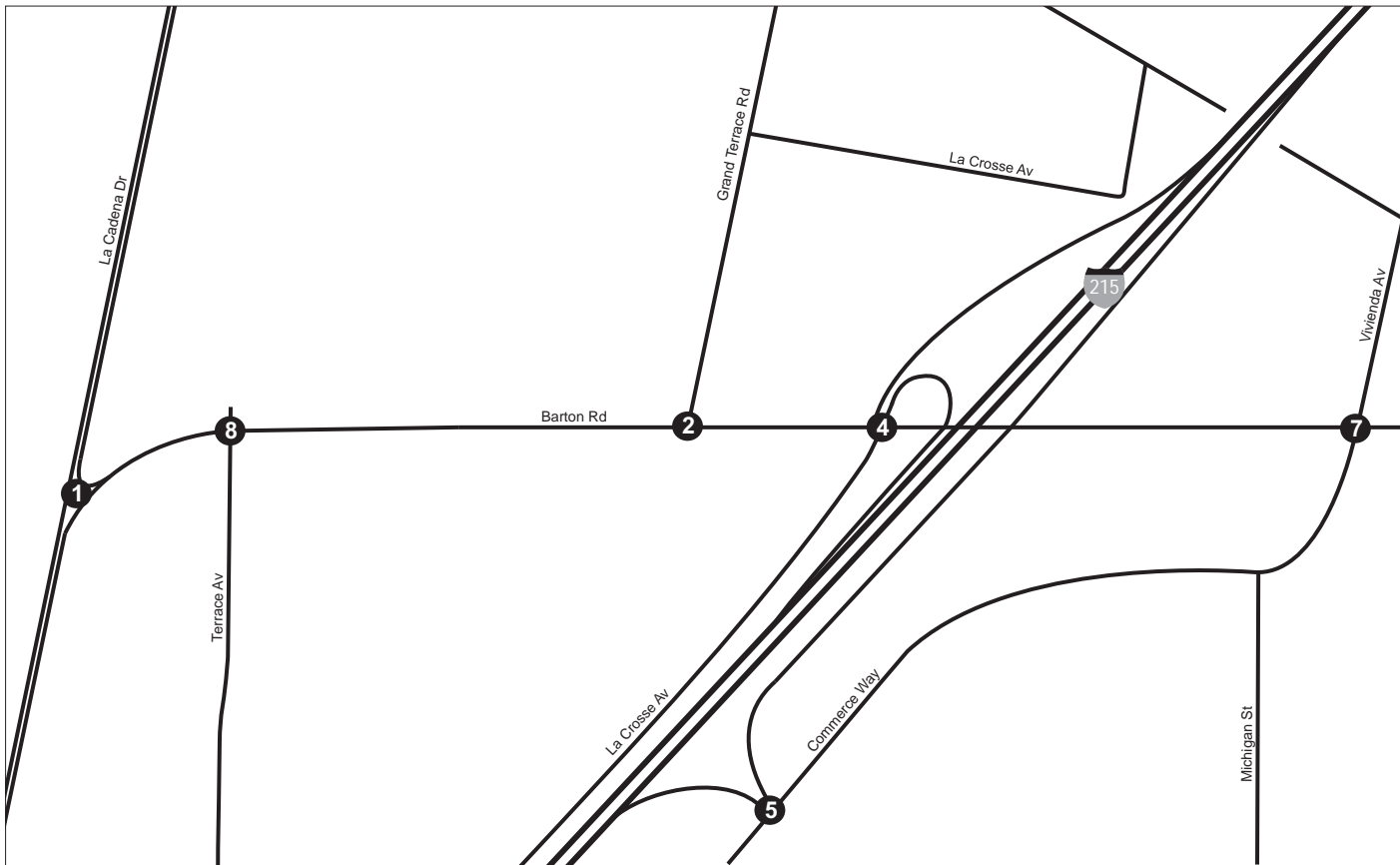
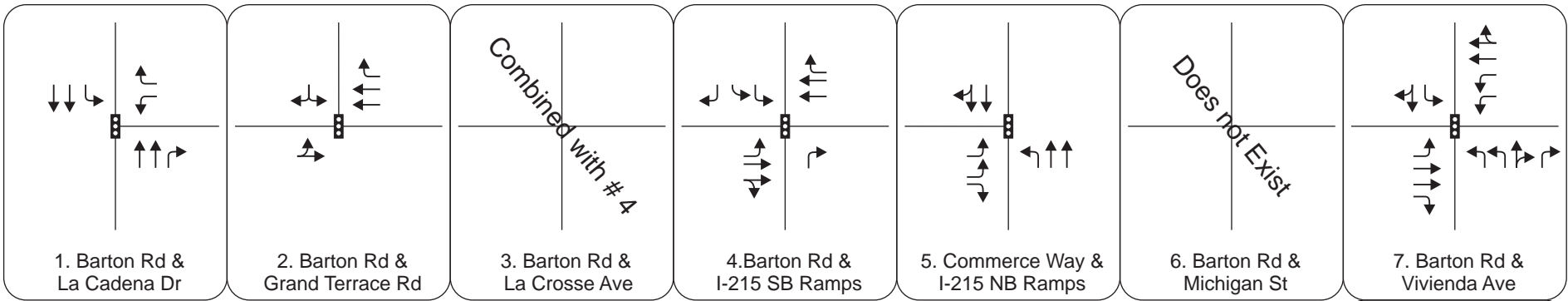
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Alternative 6: Type L-7/L-6 Interchange

Under Alternative 6, a loop on-ramp will be constructed in the southbound direction. In the northbound direction, hook ramps will be constructed to an extension of Commerce Way which will be realigned to connect to Barton Road at the location of the existing Vivienda Avenue intersection.

The northbound and southbound off-ramps at Barton Road will be improved to a Caltrans standard two-lane exit ramp with an auxiliary lane, and will be widened to provide additional queuing space and turn lanes at Barton Road and Commerce Way. The northbound and southbound on-ramps will be metered and improved to one mixed-flow lane and an HOV preferential lane at the meter, tapering to a single lane before the gore point. The southbound auxiliary lane, including the second lane on the exit ramp, will be added as part of the I-215 Bi-County Corridor Improvement Project and will therefore not be in place at the opening of this project.

In addition to the interchange improvements, the existing intersections of Barton Road & Michigan Street, and La Crosse Avenue & I-215 Southbound Off-Ramp will be eliminated. La Crosse Avenue north of Barton Road will be terminated in a cul-de-sac. Commerce Way will be realigned and connected to the “T” intersection of Vivienda Avenue and Barton Road, resulting in a signalized four-legged intersection. Michigan Street will no longer connect to Barton Road and will instead terminate at Commerce Way, resulting in a signalized three-legged intersection. In the opening year La Crosse Avenue south of Barton Road will be realigned to connect with the southbound ramps with a ‘right-in right-out’ configuration. In 2040 La Crosse Avenue south of Barton Road will be realigned to connect to Grand Terrace Road west of I-215 to accommodate future widening of the freeway. **Figure 7** shows Alternative 6 as it would be constructed in 2016. **Figure 8** shows Alternative 6 as it would exist in 2040. The proposed layout for Alternative 6 is included in **Appendix A**.

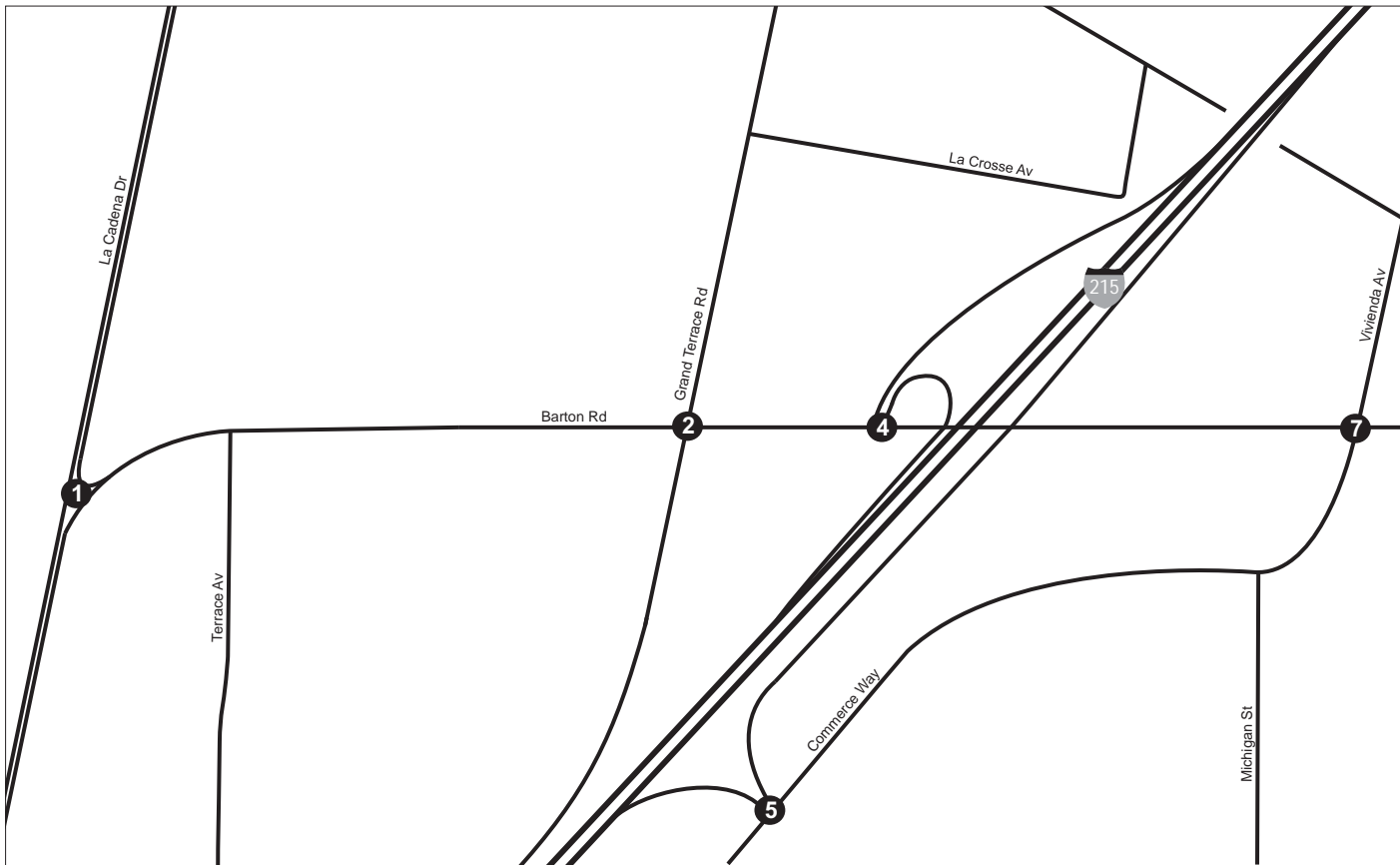
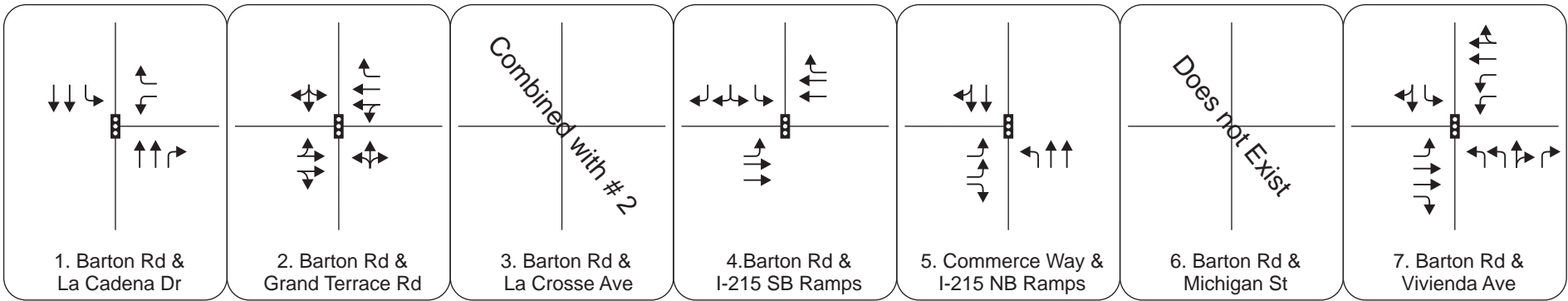


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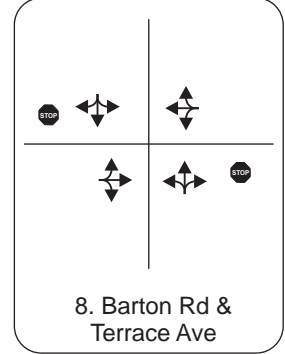
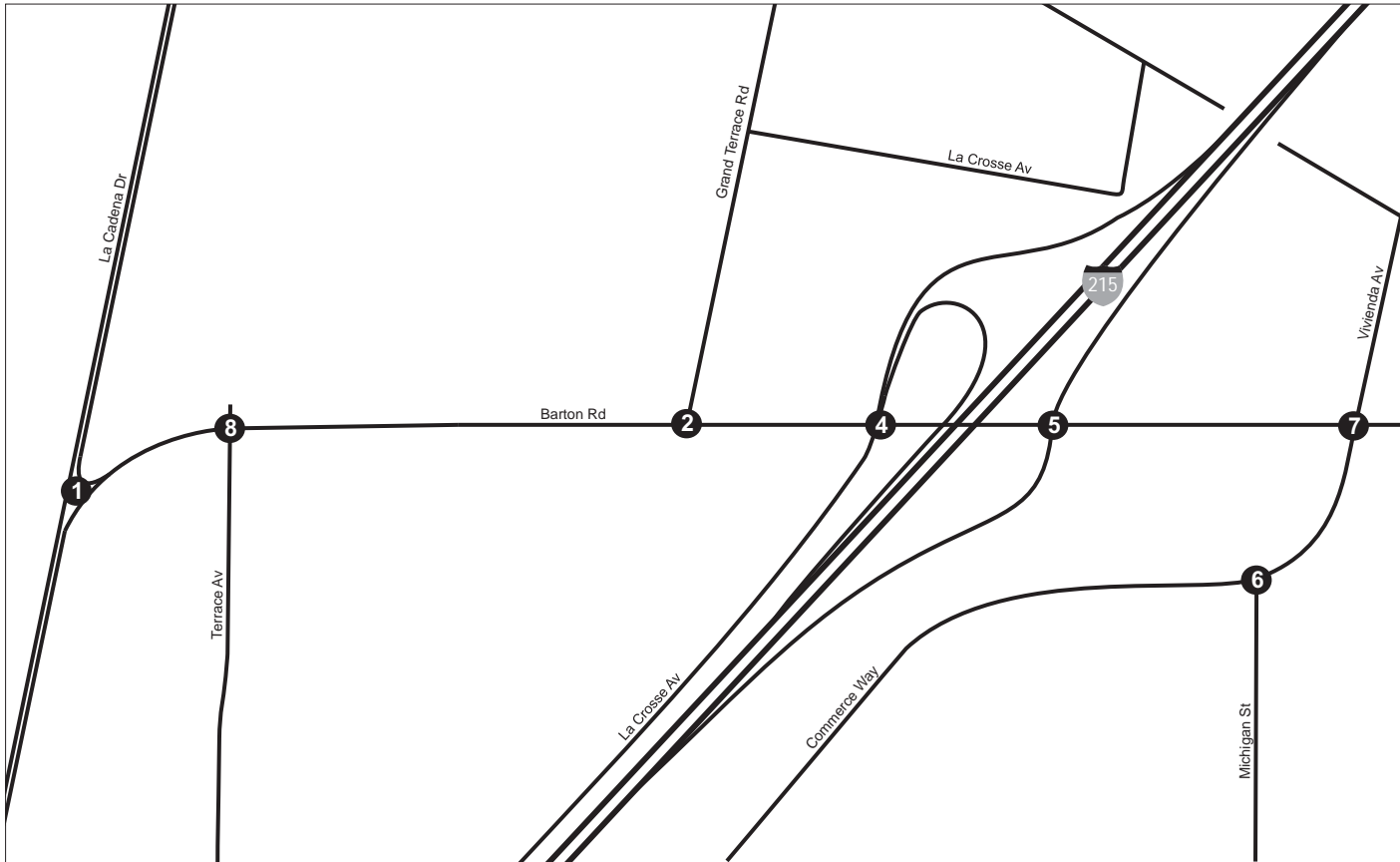
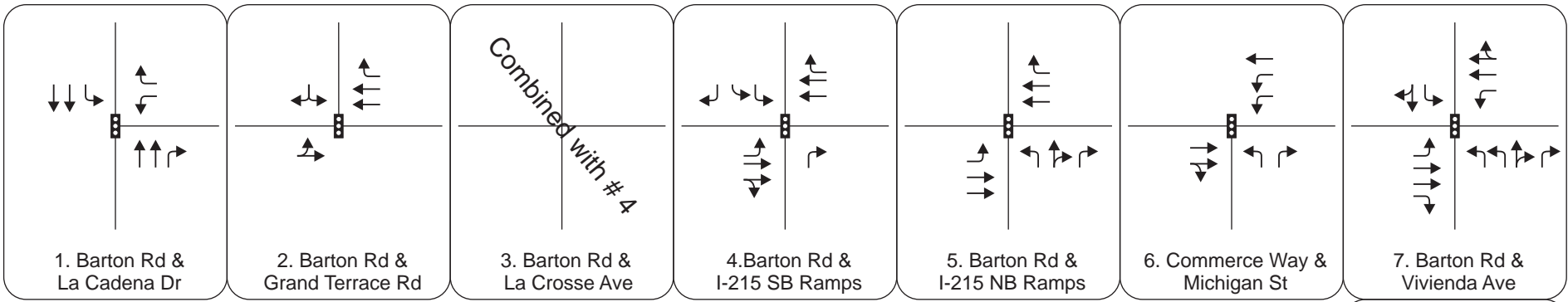


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Alternative 7: Type L-7/L-1 Interchange

Under Alternative 7, a loop on-ramp will be constructed in the southbound direction. The northbound and southbound off-ramps at Barton Road will be improved to a Caltrans standard two-lane exit ramp with an auxiliary lane, and will be widened to provide additional queuing space and turn lanes at Barton Road. The southbound on-ramp will be metered and improved to one mixed-flow lane and an HOV preferential lane at the meter, tapering to a single lane before the gore point. The southbound auxiliary lane, including the second lane on the exit ramp, will be added as part of the I-215 Bi-County Corridor Improvement Project and will therefore not be in place at the opening of this project. The northbound on-ramp will be metered and improved to two mixed-flow lanes at the meter, tapering to a single lane before the gore point.

In addition to the interchange improvements, the existing intersections of Barton Road & Michigan Street, and La Crosse Avenue & I-215 Southbound Off-Ramp will be eliminated. La Crosse Avenue north of Barton Road will be terminated in a cul-de-sac. Commerce Way will be realigned and connected to the “T” intersection of Vivienda Avenue and Barton Road, resulting in a signalized four-legged intersection. Michigan Street will no longer connect to Barton Road and will instead terminate at Commerce Way, resulting in a signalized three-legged intersection. In the opening year La Crosse Avenue south of Barton Road will be realigned to connect with the southbound ramps with a ‘right-in right-out’ configuration. In 2040 La Crosse Avenue south of Barton Road will be realigned to connect to Grand Terrace Road west of I-215 to accommodate future widening of the freeway. **Figure 9** shows Alternative 7 as it would be constructed in 2016. **Figure 10** shows Alternative 7 as it would exist in 2040. The proposed layout for Alternative 7 is included in **Appendix A**.

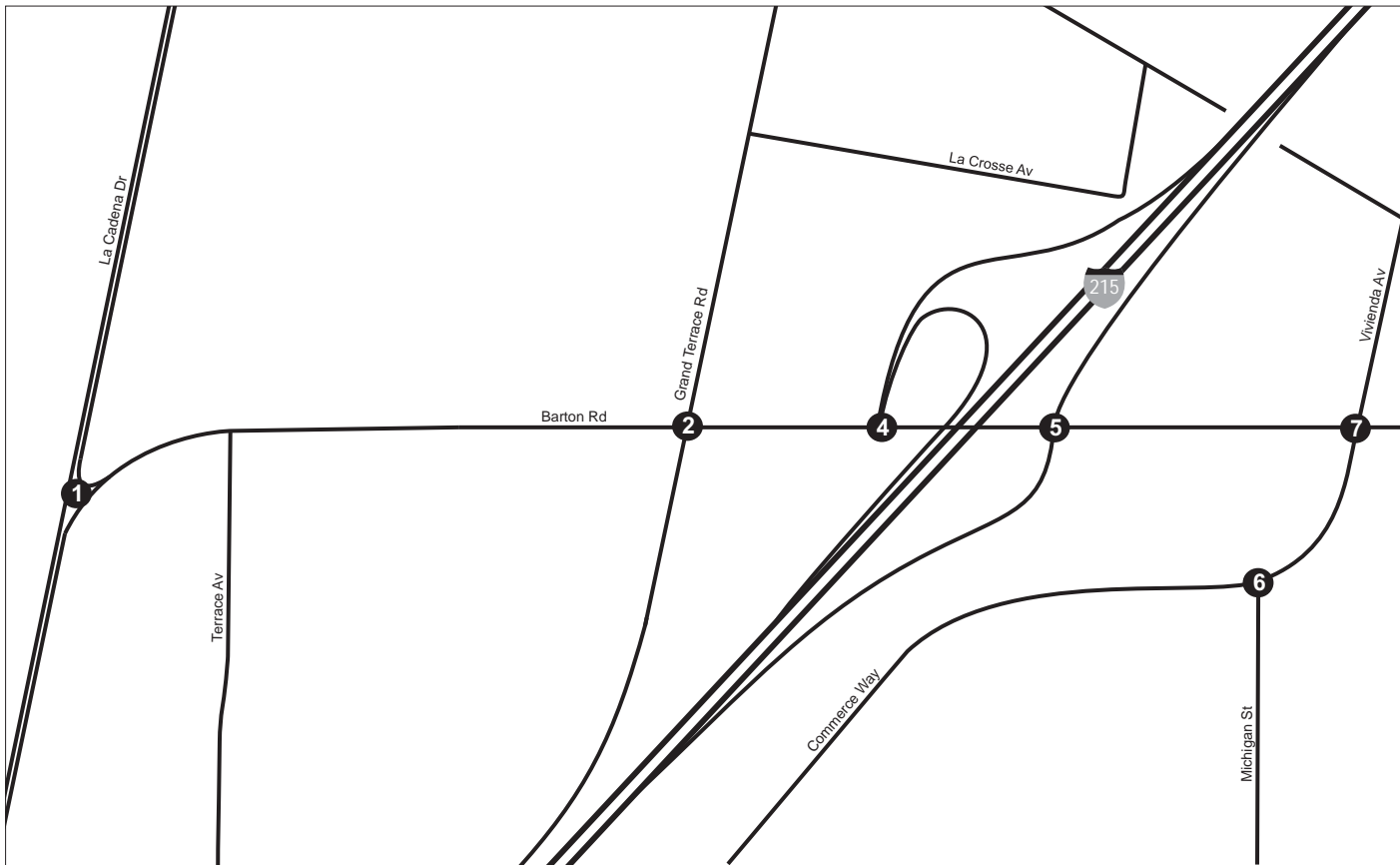
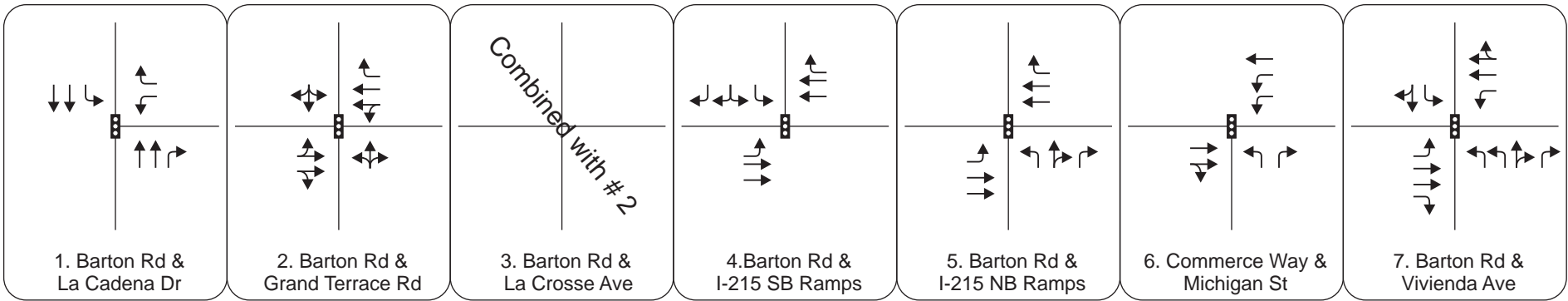


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STUDY AREA

For the purposes of this analysis, the study area includes the freeway mainline, ramps, and intersections in the vicinity of the Barton Road/I-215 interchange. Intersections analyzed for each alternative are as follows:

Alternative 1:

- Barton Road/La Cadena Drive
- Barton Road/Grand Terrace Road
- Barton Road/La Crosse Avenue
- Barton Road/I-215 SB Ramps
- Barton Road/I-215 NB Ramps
- Barton Road/Michigan Street
- Barton Road/Vivienda Avenue
- Barton Road/Terrace Avenue (Opening year)

Alternative 2:

- Barton Road/La Cadena Drive
- Barton Road/Grand Terrace Road/La Crosse Avenue
- Barton Road/I-215 SB Ramps
- Barton Road/I-215 NB Ramps
- Barton Road/Vivienda Avenue/Michigan Street

Alternative 3:

- Barton Road/La Cadena Drive
- Barton Road/Grand Terrace Road/La Crosse Avenue
- Barton Road/I-215 SB Ramps
- Barton Road/I-215 NB Ramps
- Barton Road/Vivienda Avenue/Michigan Street

Alternative 4:

- Barton Road/La Cadena Drive
- Barton Road/Grand Terrace Road/La Crosse Avenue
- Barton Road/I-215 SB Ramps
- Barton Road/Michigan St/I-215 NB Ramps

Alternative 5:

- Barton Road/La Cadena Drive
- Barton Road/Grand Terrace Road/La Crosse Avenue
- Barton Road/I-215 Ramps
- Barton Road/Vivienda Avenue/Michigan Street

Alternative 6:

- Barton Road/La Cadena Drive
- Barton Road/Grand Terrace Road/La Crosse Avenue
- Barton Rd/I-215 SB Ramps
- Commerce Way/I-215 NB Ramps
- Barton Road/Vivienda Avenue
- Barton Road/Terrace Avenue (Opening year)

Alternative 7:

- Barton Road/La Cadena Drive
- Barton Road/Grand Terrace Road/La Crosse Avenue
- Barton Rd/I-215 SB Ramps
- Barton Road/I-215 NB Ramps
- Commerce Way/Michigan Street
- Barton Road/Vivienda Avenue
- Barton Road/Terrace Avenue (Opening year)

Freeway ramps, weaving and mainline segments analyzed for all the alternatives are as follows:

Freeway Ramps:

- I-215 Northbound Iowa Avenue Off Ramp
- I-215 Northbound Iowa Avenue On Ramp
- I-215 Northbound Barton Road Off Ramp
- I-215 Northbound Barton Road On Ramp
- I-215 Northbound Mount Vernon Avenue Off Ramp
- I-215 Northbound Mount Vernon Avenue On Ramp
- I-215 Southbound Washington Street Off Ramp
- I-215 Southbound Washington Street On Ramp
- I-215 Southbound Barton Road Off Ramp
- I-215 Southbound Barton Road On Ramp
- I-215 Southbound La Cadena Drive Off Ramp
- I-215 Southbound La Cadena Drive On Ramp

Freeway Weaving Segment (Alternative 6):

- I-215 Northbound Iowa Avenue On Ramp to Barton Road Off Ramp

Freeway Mainline Segments:

- I-215 Northbound Iowa Avenue On Ramp to Barton Road Off Ramp
- I-215 Northbound Barton Road Off Ramp to Barton Road On Ramp
- I-215 Northbound Barton Road On Ramp to Washington Street Off Ramp
- I-215 Southbound Washington Street On Ramp to Barton Road Off Ramp
- I-215 Southbound Barton Road Off Ramp to Barton Road On Ramp
- I-215 Southbound Barton Road On Ramp to La Cadena Dr Off Ramp

TRAFFIC VOLUME DEVELOPMENT

Existing Traffic Volumes

Existing a.m. and p.m. peak period intersection turning movement counts were collected at all study intersections in February 2009. Truck percentages of 7% in the a.m. peak hour and 4% in the p.m. peak hour were used for the intersection level of service analysis. These percentages are based on the *I-215 Bi-County Corridor Improvement Project, Traffic Volumes Forecast Report* (April 2007 & December 2007). The peak hour was determined by taking the peak one-hour interval within the two-hour peak period. Traffic volumes at adjacent intersections were balanced to maintain consistent flows. Freeway ramp volumes were determined from the approach and departure volumes at the ramp terminus intersections. Count sheets are included in **Appendix B**.

It should be noted that the 2009 intersection turning movement counts are generally lower than the 2004 counts used in a previous traffic operations analysis report submitted on January 12, 2009. The reduction in traffic volumes is likely due to the relocation of the Stater Bros. distribution center, formerly located southwest of the interchange, and the current economic recession. The average drop in traffic volumes is approximately 12 percent in the a.m. peak hour and 4 percent in the p.m. peak hour.

Existing freeway mainline volumes were obtained through the freeway Performance Measurement System (PeMS). Volumes in the peak periods from Tuesday through Thursday were averaged in the month of February 2009. The highest peak hour was used. The segment volumes between the I-10 westbound and the I-10 eastbound ramps were collected from PeMS, and the remaining segment volumes were calculated by subtracting and adding ramp volumes. For I-215 northbound volumes, vehicle detection stations (VDS) 805941 was used. For I-215 southbound volumes, VDS 806890 was used. Truck percentages of 7% in the a.m. peak hour and 4% in the p.m. peak hour were used for the freeway mainline and ramp junction analysis. These percentages are based on the *I-215 Bi-County Corridor Improvement Project, Traffic Volumes Forecast Report*. Existing freeway volumes are generally higher than the 2004 freeway volumes.

Development of Future Traffic Volumes

Year 2040 Traffic Volumes

Turning Movement Volumes

The data sources used for the development of future traffic volumes were the *I-215 Bi-County Corridor Improvement Project, Traffic Volumes Forecast Report*. These reports had volumes for two scenarios, 'I-215 Widening' and 'I-215 No-Widening'. The 2040 turning movement volumes for the study intersections were included in the 'No-Widening' scenario, whereas the 2040 ramp volumes at the Barton Road interchange were included in the 'Widening' scenario. As mentioned earlier in the 'Interchange Alternatives' section, this analysis assumes the widening of the Interstate 215 freeway by 2040. Therefore the future volumes for each of the alternatives in this analysis were developed as follows:

1. The 2040 ramp volumes were taken from the 'I-215 Widening' scenario.
2. Intersection turning movement proportions were determined from the 'I-215 No-Widening' scenario. These proportions were then applied to the 2040 ramp volumes to determine the turning movement volumes at the intersections of the I-215 ramps and Barton Road.
3. Weighted average ramp growth rates from the 'I-215 Widening' scenario were applied to the remaining eastbound and westbound through movements.

4. For the study intersections other than I-215 Ramps & Barton Road, the same growth rates were applied to the existing volumes, to determine the future turning movement volumes.

Volumes were redistributed manually depending on the design of each alternative. Detailed volume development worksheets for 2040 traffic volumes are included in **Appendix C**.

Freeway Mainline and Ramp Volumes

Year 2040 freeway mainline and ramp volumes for the segments of I-215 between Iowa Avenue and Washington Street were taken from the ‘I-215 Widening’ scenario of the *I-215 Bi-County Corridor Improvement Project, Traffic Volumes Forecast Report* (December 2007). As the freeway mainline and ramp merge/diverge areas are similar in each of the alternatives, volumes for all the alternatives are the same.

Year 2016 Traffic Volumes

Since this project will be completed after the HOV Gap Closure project, it was necessary to develop year 2016 freeway volumes with the implementation of the HOV Gap Closure project. For each of the seven alternatives, year 2016 traffic volumes without the HOV Gap Closure project were developed by interpolating between existing (2009) volumes and year 2040 ‘No I-215 Widening’ volumes, assuming linear growth. These opening year ‘No Gap Closure’ volumes were then adjusted to reflect the HOV Gap Closure project using the Riverside County Transportation Analysis Model (RIVTAM) as follows:

- Opening Year ‘No Gap Closure’ and ‘HOV Gap Closure’ scenarios were run using the RIVTAM model, and percentage increases from the ‘No Gap Closure’ to ‘Gap Closure’ scenario in the model volumes for each ramp and mainline segment within the study area were calculated.
- These percentage increases were applied to the interpolated opening year traffic volumes to determine the ‘Gap Closure’ opening year traffic volumes.

Detailed volume development worksheets for the year 2016 scenarios are included in **Appendix C**. The freeway mainline and ramp volumes are summarized in **Tables 1** and **2**, respectively.

Table 1: Freeway Mainline Volumes

Freeway Segment Between	Direction	Existing Volume			2016 Volume			2040 Volume		
		2009 ADT	2009 AM Peak Hour	2009 PM Peak Hour	ADT	AM Peak Hour	PM Peak Hour	ADT	AM Peak Hour	PM Peak Hour
Washington St & Barton Rd	Northbound	71,000	4881	5677	93,900	6089	6975	172,400	10188	11402
	Southbound	71,000	6069	5276	91,200	6926	6372	160,400	9863	10128
Barton Rd & Iowa Ave	Northbound	69,500	4876	5685	89,400	5987	6979	157,600	9798	11416
	Southbound	69,500	6198	5346	87,300	7144	6487	148,500	10207	10122

Table 2: Freeway Ramp Volumes

Ramp	2009 Volume		2016 Volume		2040 Volume	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Washington St NB On Ramp*	761	491	811	533	-	-
Mt. Vernon Av/Washington St NB On Ramp	663	653	670	655	1678	1338
Mt. Vernon Av/Washington St NB Off Ramp	847	826	1047	954	1731	1391
Mt. Vernon Av/Washington St SB On Ramp	613	973	686	1077	935	1432
Mt. Vernon Av/Washington St SB Off Ramp	1018	1316	1062	1415	1212	1755
Barton Rd NB On Ramp	370	406	544	549	1095	922
Barton Rd NB Off Ramp	365	414	442	553	706	935
Barton Rd SB On Ramp	462	431	639	618	1047	883
Barton Rd SB Off Ramp	333	361	421	503	703	890
Iowa Av NB On Ramp	1004	909	1074	1100	1312	1754
Iowa Av NB Off Ramp	241	289	349	380	720	692
La Cadena Dr SB On Ramp	354	285	531	438	1136	964
La Cadena Dr SB Off Ramp	188	291	410	583	1169	1582

* This on-ramp will be removed as part of the Washington Street Interchange Improvement Project.

ANALYSIS METHODOLOGIES

This study evaluates existing (2009), opening year 2016, and design year 2040 conditions within the study area under each of the proposed interchange alternatives. The following operational factors are analyzed in this report for existing, opening year, and design year conditions:

- Intersection levels of service
- Queuing analysis
- Freeway ramp (merge/diverge) analysis
- Freeway mainline analysis

Intersection Level of Service Analysis

The intersections at the northbound and southbound ramps of the existing interchange are signalized and operated as part of a coordinated system. The intersections of Barton Road at Grand Terrace Road, La Crosse Avenue, and Vivienda Avenue are unsignalized. The study intersections type and configurations will not change under the No-Build alternative. However, all of the study intersections are analyzed as signalized in the build alternatives. Intersection levels of service were calculated using the *Highway Capacity Manual 2000* (HCM 2000) analysis methodologies, using the Synchro 7 software, which accounts for the effects of signal coordination and platoon formation on intersection operations.

Intersection Queuing Analysis

Intersection queuing analysis was conducted for the intersections of Barton Road and I-215 Freeway Ramps for each of the alternatives to determine queuing lengths at the left turns onto the ramps. The queue lengths were calculated using the Synchro 7 software, which accounts for 50th and 95th percentile queue lengths.

Freeway Ramp (Merge/Diverge) Analysis

Peak hour ramp volumes are analyzed using the methodology contained in “Chapter 13 – Freeway Concepts” and “Chapter 25 – Ramps and Ramp Junctions” of the *Highway Capacity Manual*, with calculations performed using the *Highway Capacity Software* (HCS Plus, Version 5.21). This analysis examines the levels of service within the ramp influence areas of the freeway. The analysis of the on-ramps examines the impact of merging onto the freeway, while the analysis of the off-ramps examines the impacts of diverging from the freeway. Consistent with HCM 2000 procedures, a single-lane on-ramp that results in a lane addition is not analyzed as a merge area (HCM 2000, p. 25-9). A dual-lane off-ramp that results in a lane drop is analyzed as a major diverge area. Lane additions and major diverge areas are analyzed by means of a capacity analysis at each leg of the lane addition or major diverge area.

Ramp Meter Queuing Analysis

No ramp meter queuing analysis was conducted for existing conditions and the No Build alternative because the existing ramps are not metered, and no ramp meters will be installed under the No Build alternative. For all the proposed build alternatives, ramp meter queuing analysis was conducted, as ramp meters are proposed in the build alternatives for both the southbound and northbound on-ramps. Ramp meter queuing analysis was conducted using the standard service rate of a metered ramp (900 vehicles per hour for one metered lane and 1500 vph for two metered lanes).

Freeway Weaving Analysis

A weaving segment is a segment in which two streams of traffic must cross within 2500 feet or less, such as in an auxiliary lane connecting an on-ramp to an off-ramp. Weaving analysis for Alternative 6 was conducted because the distance between the on-ramp at the I-215/Iowa Avenue interchange and the off-ramp at the I-215/Barton Road interchange is approximately 1490 feet in the northbound direction in this alternative in the opening year. The weaving distance will be approximately 2400 feet in the year 2040 as the Iowa Avenue on ramp will be relocated by the Bi-County Corridor Improvement Project. No freeway weaving analysis was conducted for Alternative 2, 3, 4, 5, 7 and no-build condition because there are no weaving segments in the study area under these alternatives. Weaving segments are analyzed using the methodology contained in “Chapter 13 – Freeway Concepts” and “Chapter 24 – Freeway Weaving” of the *Highway Capacity Manual*, with calculations performed using the Highway Capacity Software (HCS Plus, Version 5.21).

Freeway Mainline Analysis

Peak hour volumes along the freeway mainline are analyzed using the methodology contained in “Chapter 13 – Freeway Concepts” and “Chapter 23 – Basic Freeway Segments” of the *Highway Capacity Manual*, with calculations performed using the Highway Capacity Software (HCS Plus, Version 5.21). Volumes in the HOV lane are included in all freeway mainline volume tables. However, they are not included in the HCS analysis of mainline operations because the HOV lanes will carry less volume than each mixed-flow lane, so doing so would result in inappropriately high levels of service in the mixed-flow lanes.

Level of Service Standards

As noted earlier, the Barton Road interchange project is an advance project of the I-215 Bi-County Corridor Improvement Project. Since the Bi-County Project is a multi-jurisdictional effort, the Project Development Team (PDT) agreed upon a common set of analysis parameters and LOS standards for the corridor. These LOS parameters and LOS standards are as follows:

- Capacity of a mixed-flow lane: 2300 vehicles per hour
- Capacity of a high occupancy vehicle lane: 1600 vehicles per hour
- Lost time per signal phase: 2 seconds
- Minimum green time per signal phase: 7 seconds
- Minimum LOS standard for freeways: LOS E
- Minimum LOS standard for intersections: LOS D

Based on vehicle classification counts conducted at the Barton Road interchange, the following truck percentages were used in the LOS analysis:

- Percentage of trucks during the a.m. peak hour: 7%
- Percentage of trucks during the p.m. peak hour: 4%

These parameters and LOS standards are used in this study for consistency with other analyses of the corridor.

EXISTING TRAFFIC CONDITIONS

Intersection Levels of Service

Existing a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 11**. A level of service analysis using the previously described methodologies was conducted to evaluate existing traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 3**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 3: Existing Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	14.0	0.35	B	16.0	0.53
2. Barton Road/Grand Terrace Road*	B	14.8	-	C	15.8	-
3. Barton Road/La Crosse Avenue*	B	13.1	-	B	14.5	-
4. Barton Road/I-215 SB Ramps	B	15.1	0.66	C	25.0	0.82
5. Barton Road/I-215 NB Ramps	B	12.9	0.52	B	11.8	0.52
6. Barton Road/Michigan Street	B	12.5	0.52	B	10.0	0.50
7. Barton Road/Vivienda Avenue*	B	14.0	-	B	14.5	-

Notes:

HCM 2000 Operations Methodology.

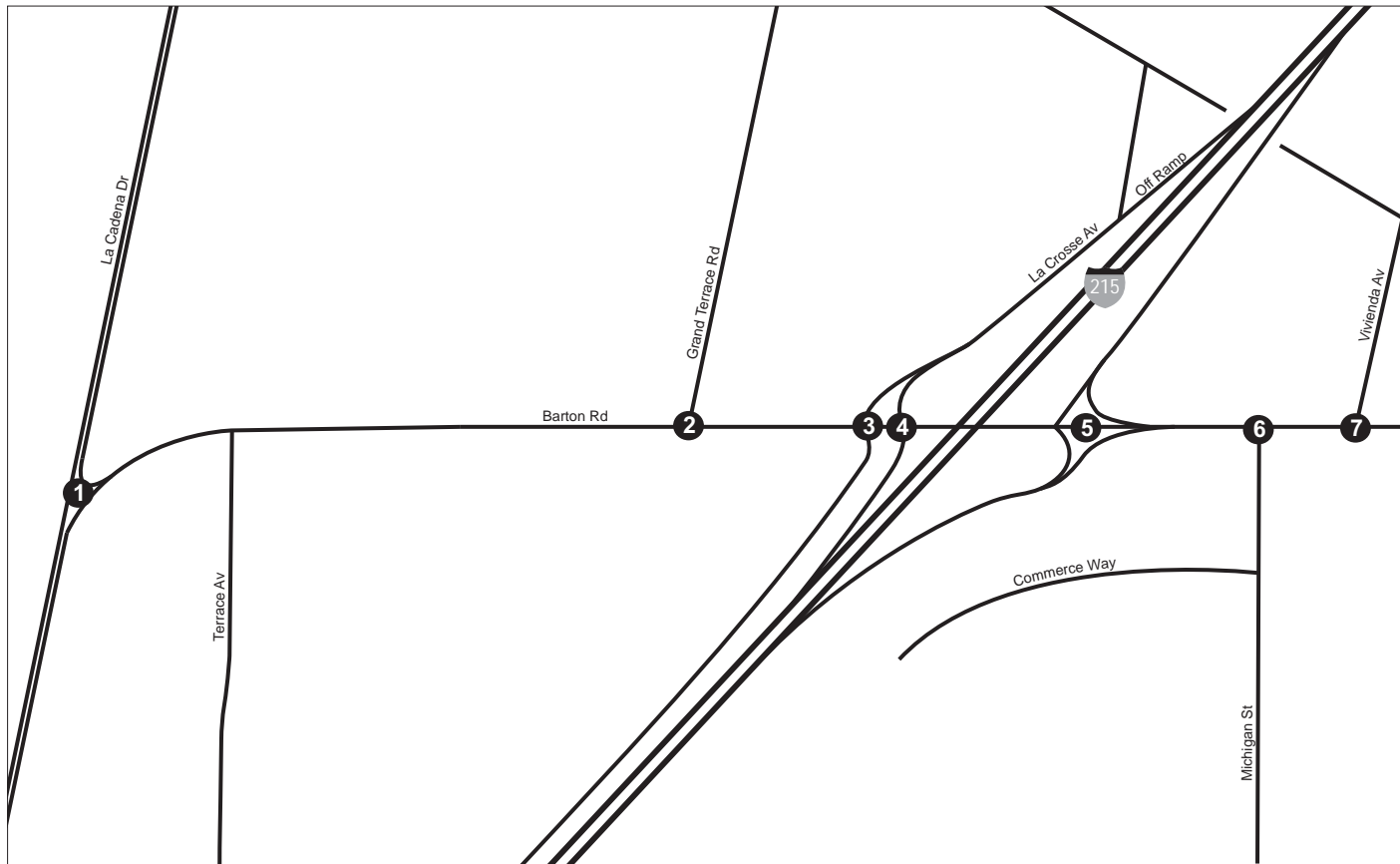
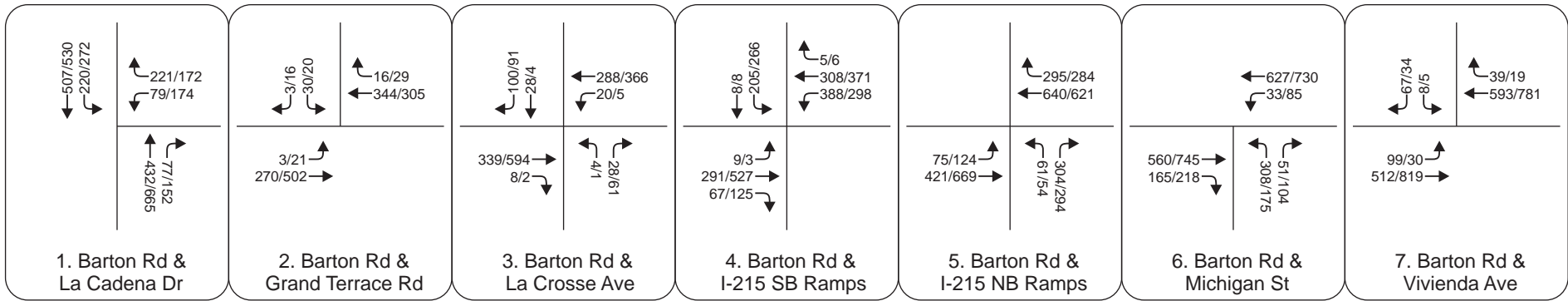
LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

*Delay for stop-controlled approach; V/C not applicable

An examination of the data in **Table 3** indicates that all study intersections are currently operating at satisfactory levels of service.

Intersection Queuing Analysis

A queuing analysis using the previously described methodologies was conducted to determine the queue lengths at the left turn lanes at Barton Road onto the I-215 freeway ramps. The results of the queuing analysis are summarized in **Table 4**. Detailed queuing reports are included in **Appendix D**.



Legend
 X Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



Barton Road Interchange Improvement Project

FIGURE 11
Existing (2009) Peak Hour Volumes

Table 4: Existing Intersection Queue Lengths

Intersection	AM Peak Hour		PM Peak Hour	
	Space Provided (Ft)	Queue Length 95 th %ile (Ft)	Space Provided (Ft)	Queue Length 95 th %ile (Ft)
Barton Road/I-215 SB Ramps – Westbound left turn lane	120	213	120	297
Barton Road/I-215 NB Ramps – Eastbound left turn lane	150	76	150	89

Notes: **BOLD** indicates inadequate queuing distance.

As can be seen in **Table 4**, the westbound left turn lane at the intersection of Barton Road & I-215 Southbound Ramps has inadequate queuing distance during both the a.m. and p.m. peak hours. Long queues form that prevent both through traffic and left turning traffic from progressing through the interchange.

Freeway Ramp Analysis

Existing a.m. and p.m. peak hour levels of service for the Barton Road/I-215 freeway interchange and adjacent interchange ramp influence areas are summarized in **Table 5**. The freeway ramp LOS calculation sheets are included in **Appendix E**. As Table 7 indicates, all freeway ramp junctions are currently operating at satisfactory levels of service (LOS E or better), with the following exception.

- I-215 Southbound Washington Street Off Ramp (a.m. peak hour)

Table 5: Existing Freeway Ramp Levels of Service

Ramp	AM Peak Hour				PM Peak Hour			
	Ramp Volume	Speed ¹ (mph)	Density (pc/mi/ln)	LOS	Ramp Volume	Speed ¹ (mph)	Density (pc/mi/ln)	LOS
Northbound								
Iowa Av Off Ramp	241	54.6	27.1	C	289	54.5	31.4	D
Iowa Av On Ramp	1004	55.0	29.3	D	909	54.0	32.7	D
Barton Rd Off Ramp	365	54.3	31.0	D	414	54.2	34.0	D
Barton Rd On Ramp	370	56.0	27.5	C	406	55.0	30.9	D
Mt. Vernon Av On Ramp	663	55.0	29.8	D	653	53.0	33.1	D
Mt. Vernon Av Off Ramp	847	53.2	31.9	D	826	53.3	34.8	D
Southbound								
Washington St Off Ramp	1018	52.9	38.6	F	1316	52.2	35.6	E
Washington St On Ramp	613	53.0	34.2	D	973	55.0	30.8	D
Barton Rd Off Ramp	333	54.4	36.1	E	361	54.4	32.8	D
Barton Rd On Ramp	462	52.0	34.4	D	431	55.0	29.6	D
La Cadena Dr Off Ramp	188	54.7	36.2	E	291	54.5	31.1	D
La Cadena Dr On Ramp	354	52.0	34.8	D	285	56.0	27.4	C

Notes:

¹ Speed in ramp influence area. All ramps are a single lane at the gore point.

Level of Service (LOS) criteria are provided in the *Highway Capacity Manual*, and are based on density.

Freeway Mainline Analysis

Existing a.m. and p.m. peak hour levels of service for the study area freeway segments are summarized in **Table 6**. The freeway mainline LOS calculation sheets are contained in **Appendix E**. As **Table 6** indicates, all the freeway segments in the study area are currently operating at satisfactory levels of service during both the a.m. and p.m. peak hours.

Table 6: Existing Freeway Mainline Levels of Service

Freeway Segment	AM Peak Hour				PM Peak Hour			
	Volume	Speed ¹ (mph)	Density (pc/mi/ln)	LOS	Volume	Speed ¹ (mph)	Density (pc/mi/ln)	LOS
Northbound								
Iowa Avenue On Ramp to Barton Road Off Ramp	4876	59.8	29.6	D	5685	57.4	35.4	E
Barton Road Off Ramp to Barton Road On Ramp	4511	60.0	27.3	D	5271	59.1	31.9	D
Barton Road On Ramp to Washington Street Off Ramp	4881	59.8	29.7	D	5677	57.5	35.4	E
Southbound								
Washington Street On Ramp to Barton Road Off Ramp	6069	53.9	40.9	E	5276	59.1	31.9	D
Barton Road Off Ramp to Barton Road On Ramp	5736	56.6	36.8	E	4915	59.8	29.4	D
Barton Road On Ramp to La Cadena Dr Off Ramp	6198	52.6	42.8	E	5346	58.9	32.5	D

Notes:

¹ Average passenger-car speed.

Level of Service (LOS) criteria are provided in the *Highway Capacity Manual*, and are based on density.

YEAR 2016 TRAFFIC CONDITIONS

Year 2016 traffic volumes for the freeway segments and intersections within the study area were developed using the methodology described in the “Traffic Volume Development” section above.

Intersection Levels of Service

Alternative 1

Year 2016 Alternative 1 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 12**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2016 Alternative 1 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 7**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 7: Year 2016 Alternative 1 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	11.4	0.52	C	24.3	0.86
2. Barton Road/Grand Terrace Road*	F	69.1	-	F	54.4	-
3. Barton Road/La Crosse Avenue*	B	13.9	-	C	18.7	-
4. Barton Road/I-215 SB Ramps	C	26.8	0.83	F	98.9	1.02
5. Barton Road/I-215 NB Ramps	B	15.1	0.65	C	28.4	0.86
6. Barton Road/Michigan Street	B	14.6	0.59	B	17.2	0.69
7. Barton Road/Vivienda Avenue*	C	19.1	-	C	18.0	-
8. Barton Road/Terrace Avenue*	C	16.5	-	C	17.2	-

Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio.

Per the CMP, V/C > 1 is considered LOS F regardless of delay.

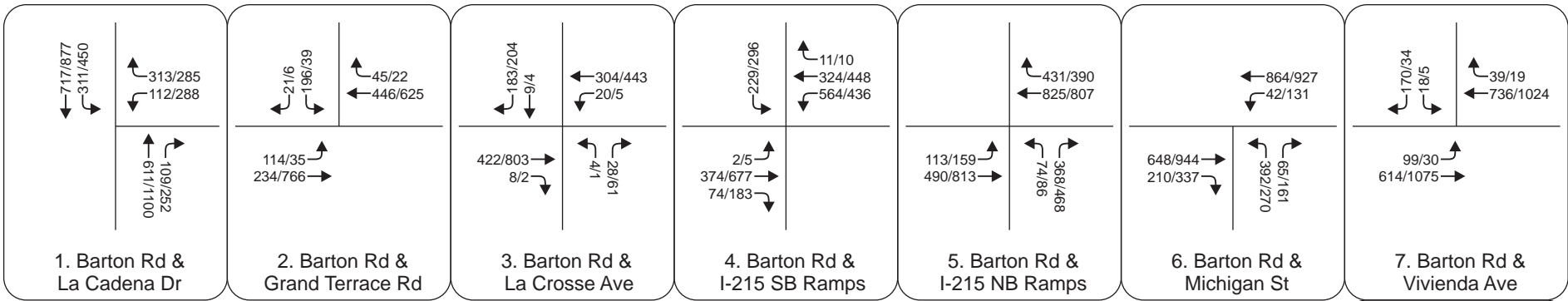
*Delay for stop-controlled approach; v/c not applicable.

An examination of the data in **Table 7** indicates that all study intersections are projected to operate at satisfactory levels of service, with the following exception:

- Barton Road & Grand Terrace Road (a.m. & p.m. peak hours)
- Barton Road & I-215 Southbound Ramps (p.m. peak hour)

Alternative 2

Year 2016 Alternative 2 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 13**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2016 Alternative 2 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 8**. Detailed levels of service calculation worksheets are included in **Appendix D**.

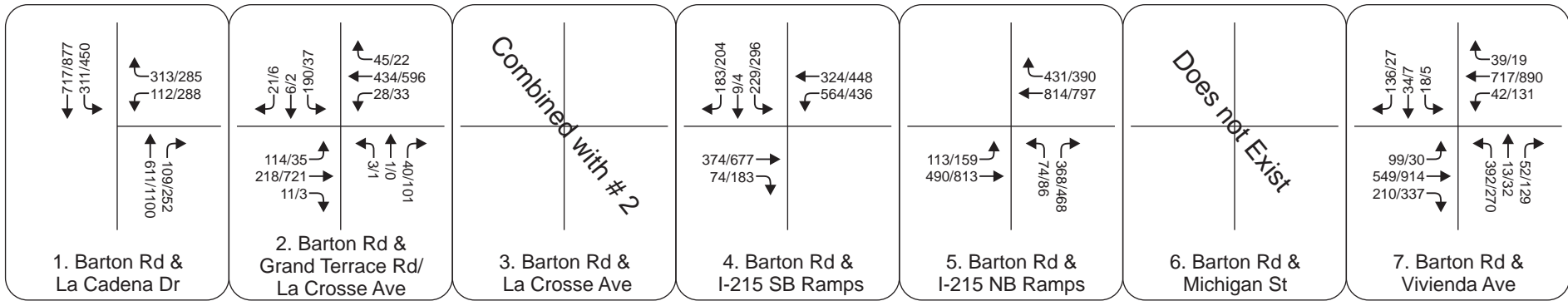


Legend

⊗ Study Intersection



NOT TO SCALE



Legend

X Study Intersection

XXX/XXX AM/PM Peak Hour Volume



Table 8: Year 2016 Alternative 2 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	13.2	0.51	C	21.6	0.87
2. Barton Road/Grand Terrace Road	A	7.9	0.33	A	4.7	0.30
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	11.6	0.42	A	9.3	0.49
5. Barton Road/I-215 NB Ramps	A	6.8	0.37	A	7.2	0.39
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	B	15.9	0.51	B	14.1	0.54

Notes:

HCM 2000 Operations Methodology

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 8** indicates that all study intersections are projected to operate at satisfactory levels of service.

Alternative 3

Year 2016 Alternative 3 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 14**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2016 Alternative 3 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 9**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 9: Year 2016 Alternative 3 Intersection Levels of Service

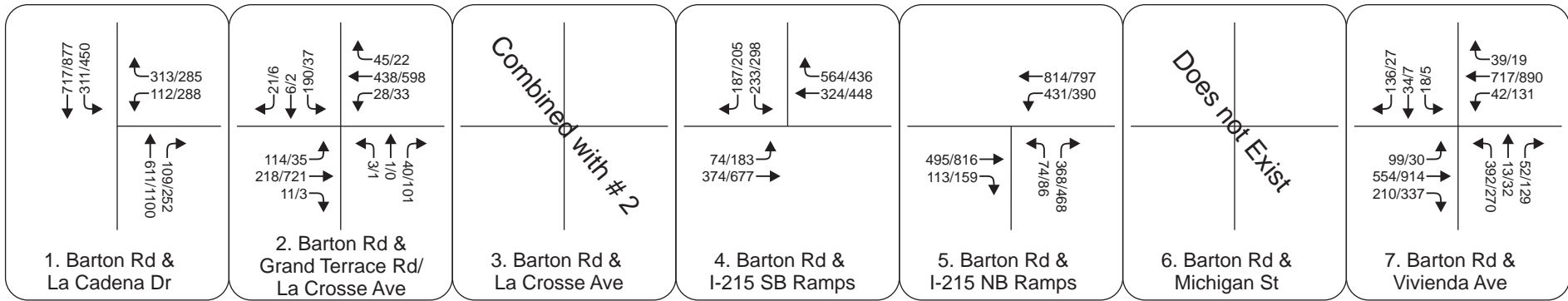
Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	12.1	0.51	C	20.8	0.87
2. Barton Road/Grand Terrace Road	A	6.0	0.33	A	2.9	0.30
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	A	6.4	0.35	A	6.8	0.33
5. Barton Road/I-215 NB Ramps	A	6.7	0.38	A	8.9	0.46
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	B	15.2	0.52	B	13.9	0.51

Notes:

HCM 2000 Operations Methodology.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 9** indicates that all of the study intersections are projected to operate at satisfactory levels of service.



Legend
 X Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



Alternative 4

Year 2016 Alternative 4 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 15**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2016 Alternative 4 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 10**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 10: Year 2016 Alternative 4 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	13.9	0.52	C	23.3	0.85
2. Barton Road/Grand Terrace Road	A	5.1	0.35	A	3.6	0.30
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	13.6	0.39	B	11.4	0.35
5. Barton Road/I-215 NB Ramps	Does Not Exist					
6. Barton Road/I-215 NB Ramps/Michigan Street	B	14.9	0.44	C	20.4	0.47
7. Barton Road/Vivienda Avenue	Does Not Exist					

HCM 2000 Operations Methodology. LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 10** indicates that all of the study intersections are projected to operate at satisfactory levels of service.

Alternative 5

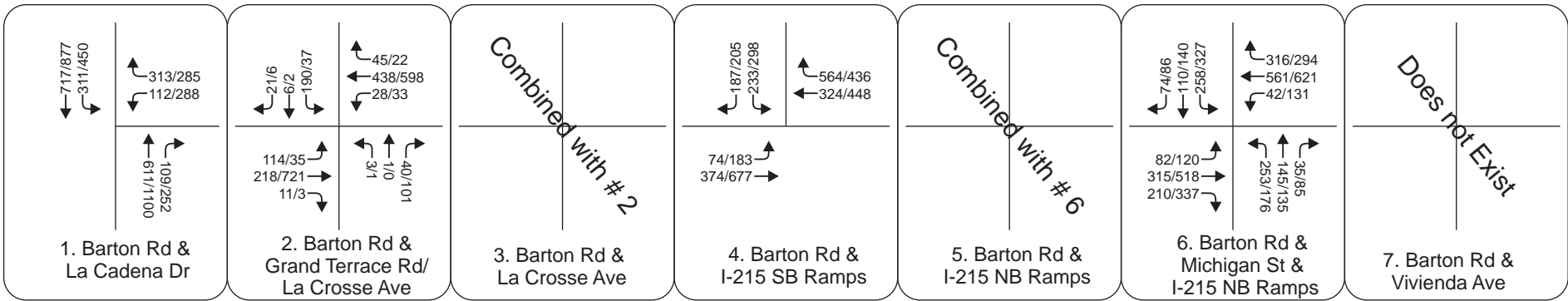
Year 2016 Alternative 5 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 16**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2016 Alternative 5 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 11**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 11: Year 2016 Alternative 5 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	13.2	0.52	C	22.0	0.87
2. Barton Road/Grand Terrace Road	A	5.8	0.35	A	3.9	0.30
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	C	20.1	0.43	B	13.3	0.51
5. Barton Road/I-215 NB Ramps	Does Not Exist					
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	C	20.1	0.51	B	15.9	0.49

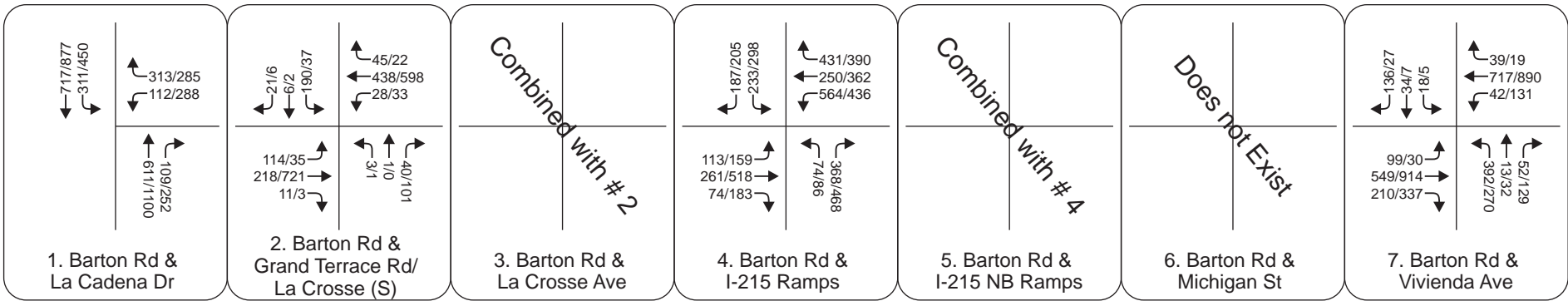
HCM 2000 Operations Methodology. LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 11** indicates that all of the study intersections are projected to operate at satisfactory levels of service.



Legend
 (X) Study Intersection
 XXX/XXX AM/PM Peak Hour Volume





Legend
 X Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



Alternative 6

Year 2016 Alternative 6 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 17**. A level of service analysis was conducted to evaluate year 2016 Alternative 6 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 12**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 12: Year 2016 Alternative 6 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	11.8	0.51	C	22.4	0.88
2. Barton Road/Grand Terrace Road	A	6.4	0.31	A	3.2	0.50
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	14.1	0.39	C	21.2	0.39
5. Commerce Way/I-215 NB Ramps	B	12.7	0.39	B	12.8	0.44
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	B	19.9	0.50	B	19.2	0.55
8. Barton Road/Terrace Avenue	C	18.9	-	C	20.9	-

Notes:

HCM 2000 Operations Methodology.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio.

An examination of the data in **Table 12** indicates that all study intersections are projected to operate at satisfactory levels of service.

Alternative 7

Year 2016 Alternative 7 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 18**. A level of service analysis was conducted to evaluate year 2016 Alternative 7 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 13**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 13: Year 2016 Alternative 7 Intersection Levels of Service

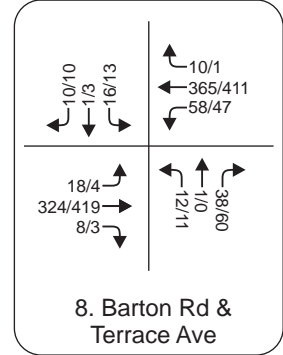
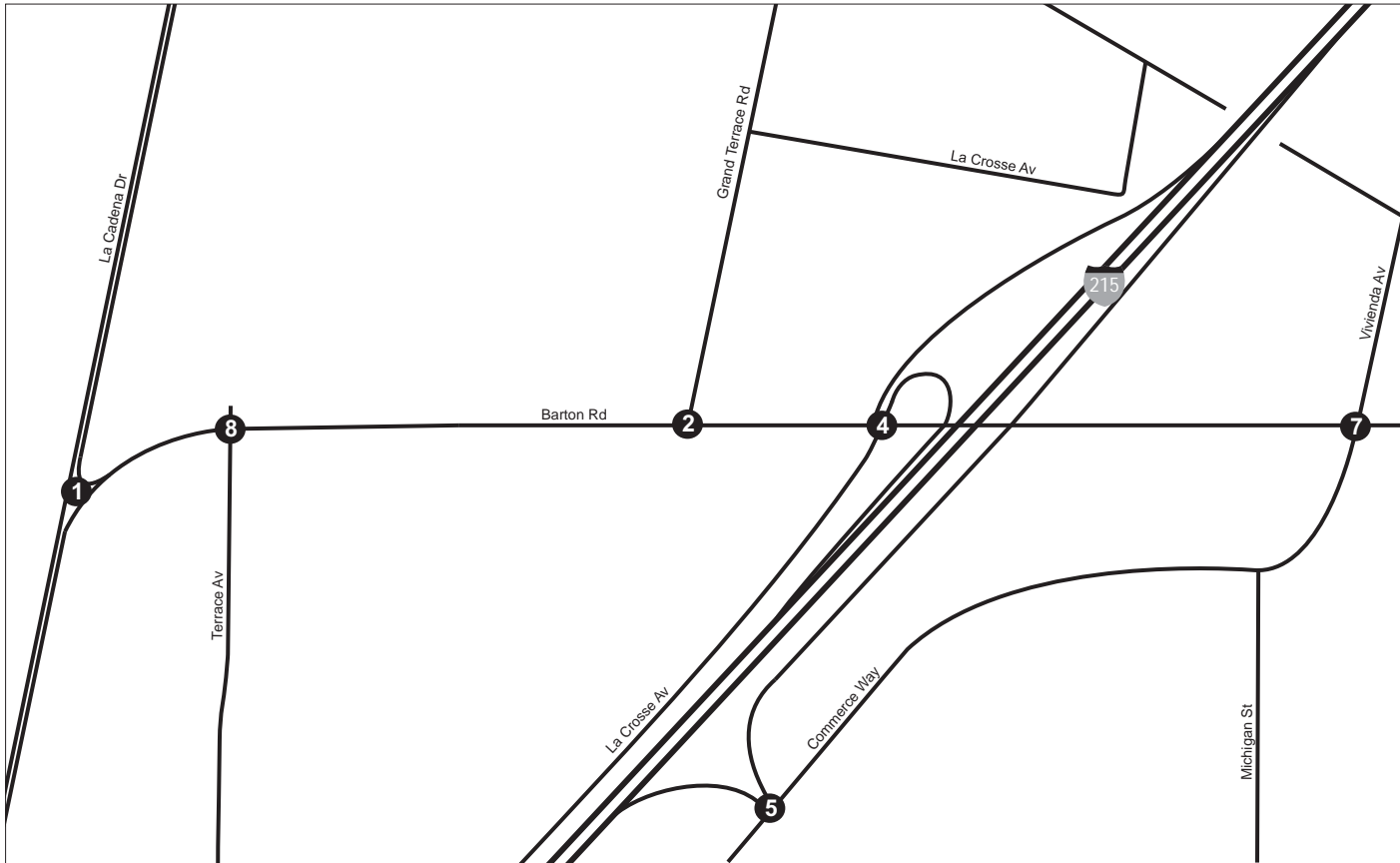
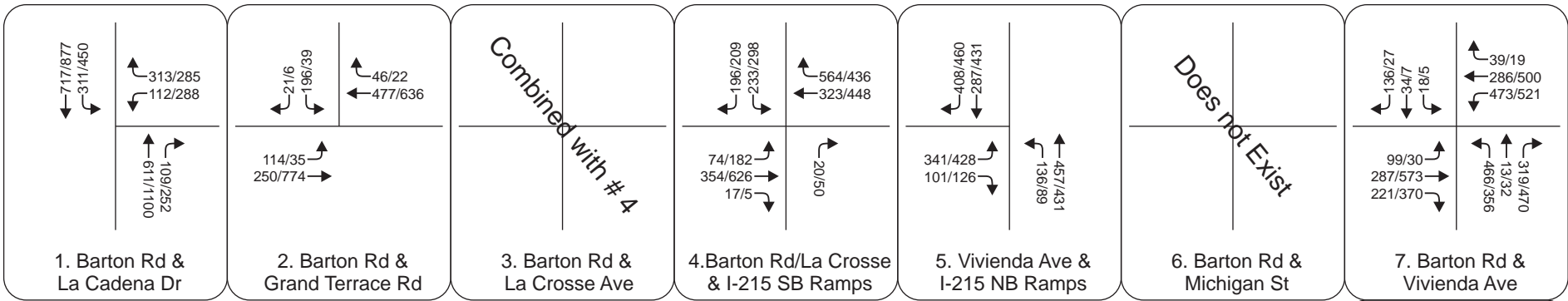
Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	B	13.2	0.51	C	24.4	0.85
2. Barton Road/Grand Terrace Road	A	9.9	0.43	A	2.7	0.53
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	11.5	0.37	B	14.5	0.39
5. Barton Road/I-215 NB Ramps	B	10.5	0.40	B	12.4	0.42
6. Commerce Way/Michigan Steet	C	20.5	0.23	C	21.0	0.26
7. Barton Road/Vivienda Avenue	C	20.2	0.50	B	13.7	0.47
8. Barton Road/Terrace Avenue	C	17.9	-	C	17.6	-

Notes:

HCM 2000 Operations Methodology.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio.

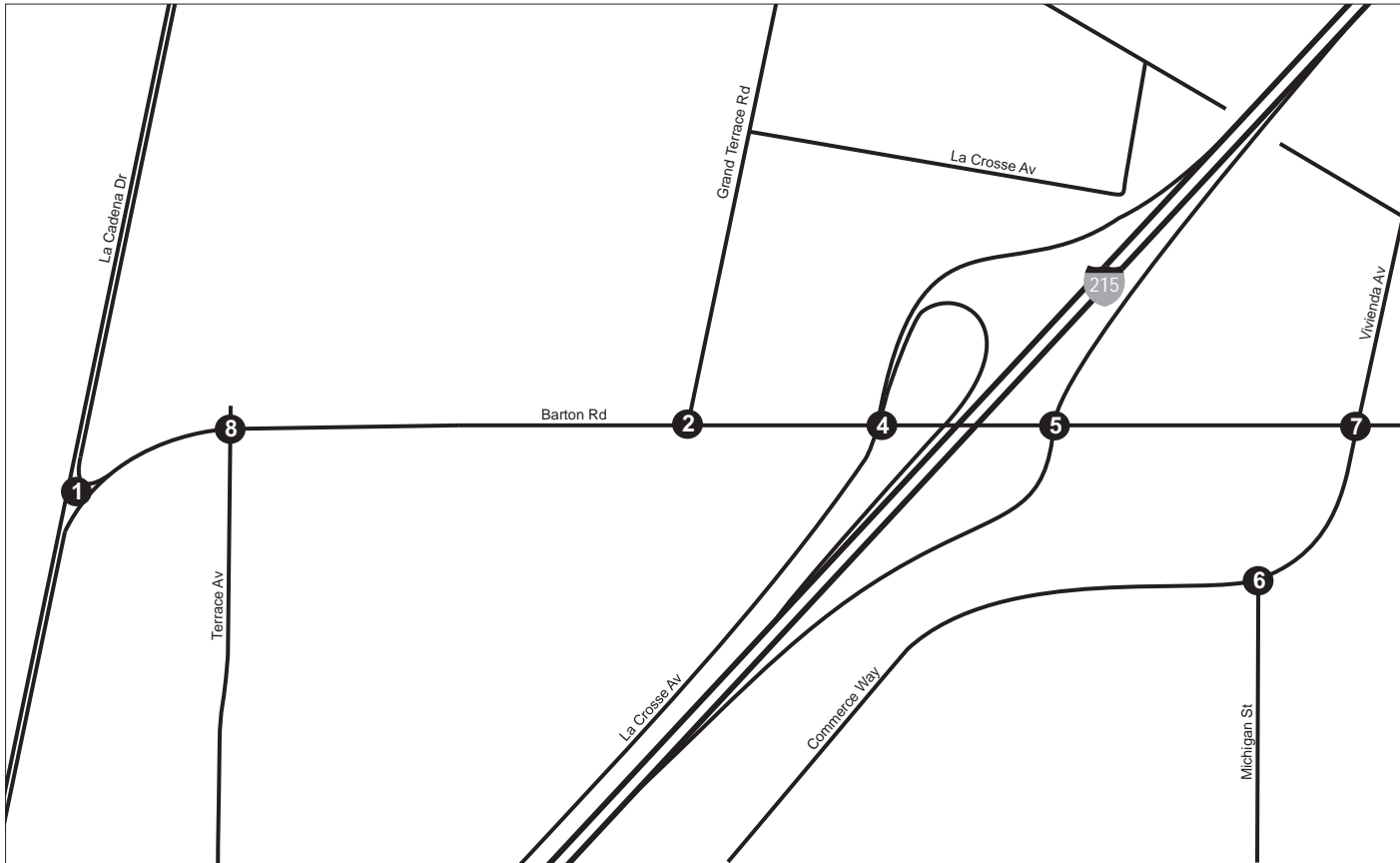
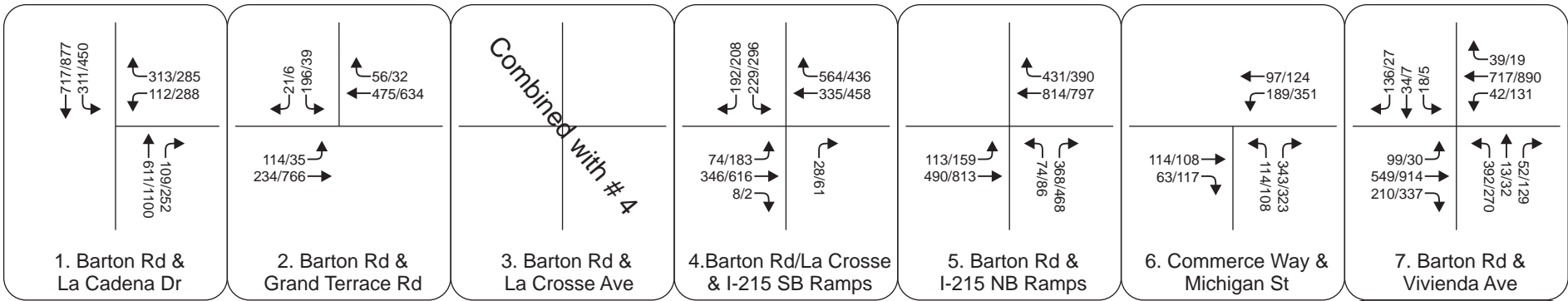
An examination of the data in **Table 13** indicates that all study intersections are projected to operate at satisfactory levels of service.



Legend
 Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



NOT TO SCALE



Legend
 X Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



NOT TO SCALE

Intersection Queuing Analysis

A queuing analysis using the previously described methodologies was conducted to determine the queue lengths at the left turn lanes at Barton Road onto the I-215 freeway ramps, for each of the alternatives. The results of the queuing analysis are summarized in **Table 14**. Detailed queuing reports are included in **Appendix D**.

Table 14: Year 2016 Intersection Queue Lengths

Intersection	AM Peak Hour		PM Peak Hour	
	Space Provided (Ft)	Queue Length 95 th %ile (Ft)	Space Provided (Ft)	Queue Length 95 th %ile (Ft)
Alternative 1				
Barton Road/I-215 SB Ramps – Westbound left turn lane	120	478	120	231
Barton Road/I-215 NB Ramps – Eastbound left turn lane	150	77	150	91
Alternative 2				
Barton Road/I-215 SB Ramps – Westbound left turn lanes	315	125	315	38
Barton Road/I-215 NB Ramps – Eastbound left turn lanes	300	19	300	27
Alternative 3				
Barton Road/I-215 SB Ramps – Eastbound left turn lanes	220	20	220	41
Barton Road/I-215 NB Ramps – Westbound left turn lanes	220	58	220	125
Alternative 4				
Barton Road/I-215 SB Ramps – Eastbound left turn lanes	260	45	260	78
Barton Road/Michigan Street/I-215 NB Ramps – Eastbound left turn lane	400	70	400	87
Alternative 5				
Barton Road/I-215 Ramps – Westbound left turn lanes	540	167	540	130
Barton Road/I-215 Ramps – Eastbound left turn lanes	270	60	270	38
Alternative 6				
Barton Road/I-215 SB Ramps – Eastbound left turn lane	250	85	250	183
Commerce Way/I-215 NB Ramps – Northbound left turn lane	410	87	410	64
Alternative 7				
Barton Road/I-215 SB Ramps – Eastbound left turn lane	250	78	250	129
Barton Road/I-215 NB Ramps – Eastbound left turn lanes	320	114	320	141

Notes: **BOLD** indicates inadequate queuing distance.

The ‘Space Provided’ and ‘Queue Lengths’ shown in **Table 14** are per lane for dual left turn lanes. As can be seen in **Table 14**, under the No Build alternative (Alternative 1), the westbound left turn lane at the intersection of Barton Road and I-215 Southbound Ramps has inadequate queuing distance during both the a.m. and p.m. peak hours. Long queues will form that prevent both through traffic and left turning traffic from progressing through the interchange.

Under all proposed build alternatives, the eastbound and westbound left turn lanes onto the ramps have adequate queuing distance during both the a.m. and p.m. peak hours. Queue lengths for both off-ramps were also calculated and analyzed. The calculated queues are not expected to exceed the acceleration distance provided for the off-ramps for all alternatives.

Freeway Ramp Analysis

The ramp merge/diverge areas are similar in each of the alternatives, except for the Barton Road northbound off ramp, which is different in the No Build condition as a second lane will be added to the Barton Road northbound off ramp in all the Build alternatives in the year 2016. The ramp analysis for all the alternatives are the same for rest of the merge/diverge areas. Year 2016 a.m. and p.m. peak hour levels of service for the Barton Road/I-215 freeway ramp influence areas are summarized in **Table 15**. The freeway ramp LOS calculation sheets are included in **Appendix E**. An examination of **Table 15** indicates that all freeway ramp junctions are projected to operate at LOS E or better.

Table 15: Year 2016 Freeway Ramp Levels of Service

Ramp	AM Peak Hour				PM Peak Hour			
	Ramp Volume	Speed ¹ (mph)	Density (pc/mi/ln)	LOS	Ramp Volume	Speed ¹ (mph)	Density (pc/mi/ln)	LOS
Northbound								
Iowa Av Off Ramp	349	54.4	29.1	D	380	54.3	32.6	D
Iowa Av On Ramp	1074	54.3	31.4	D	1100	51.5	35.3	E
Barton Rd Off Ramp (No Build)	442	54.2	32.8	D	553	53.9	36.1	E
Barton Rd Off Ramp (Build)	442	54.2	14.6	B	553	53.9	17.4	B
Barton Rd On Ramp	544	55.0	30.1	D	549	53.0	33.7	D
Mt. Vernon Av Off Ramp	1047	52.8	34.1	D	954	53.0	36.7	E
Mt. Vernon Av On Ramp	670	55.6	28.7	D	655	53.8	32.3	D
Southbound								
Washington St Off Ramp	1062	52.8	37.7	E	1415	52.0	36.2	E
Washington St On Ramp	686	52.7	34.0	D	1077	53.5	32.6	D
Barton Rd Off Ramp	421	54.2	35.8	E	503	54.0	33.9	D
Barton Rd On Ramp	639	52.2	34.6	D	618	54.5	31.3	D
La Cadena Dr Off Ramp	410	54.2	36.4	E	583	53.9	34.0	D
La Cadena Dr On Ramp	531	52.1	34.9	D	438	55.1	30.1	D

Notes: ¹ Speed in ramp influence area. All ramps are a single lane at the gore point.

Level of Service (LOS) criteria are provided in the Highway Capacity Manual, and are based on density.

Ramp Meter Queuing Analysis

The northbound and southbound on-ramp volumes are the same in each of the build alternatives, but the ramp meter queuing analysis for all the build alternatives is not the same as the on-ramps will be improved to two mixed-flow lanes and an HOV preferential lane at the meter under Alternatives 2, 3 and 4, whereas under Alternatives 5 and 6 the on-ramps will be improved to one mixed-flow lane and an

HOV preferential lane at the meter. Year 2016 a.m. and p.m. peak hour volumes and ramp metering rates on the northbound and southbound Barton Road/I-215 freeway on-ramps are summarized in **Table 16**. As can be seen in **Table 16**, no queues will form at the northbound and southbound on-ramps, as the volumes are less than the service rates of ramp meters in all the alternatives during both the a.m. and p.m. peak hours.

Table 16: Year 2016 Ramp Meter Queued Volumes

Metered Ramp	Lanes		Maximum Meter Throughput*		AM Peak Hour				PM Peak Hour			
					Volume		Queued Volume		Volume		Queued Volume	
	MF [†]	HOV	MF	HOV	MF	HOV	MF	HOV	MF	HOV	MF	HOV
Alternatives 2,3 & 4												
Barton Road/I-215 NB On Ramp	2	1	1500	600	462	82	0	0	467	82	0	0
Barton Road/I-215 SB On Ramp	2	1	1500	600	543	96	0	0	526	93	0	0
Alternatives 5,6 & 7												
Barton Road/I-215 NB On Ramp	1	1	900	600	462	82	0	0	467	82	0	0
Barton Road/I-215 SB On Ramp	1	1	900	600	543	96	0	0	526	93	0	0

* Service rate of a single metered lane on a ramp is 900 vph. Each additional lane is assumed to add an additional 600 vph.

[†]MF = Mixed-Flow

Freeway Weaving Analysis

For Alternative 2, 3, 4, 5 and 7, the segment between the ramps at the I-215/Iowa Avenue interchange and those at the I-215/Barton Road interchange is not a weaving segment as the length of the segment is greater than 2500 feet in the northbound and the southbound direction. Therefore, a weaving analysis was not conducted for alternatives 2, 3, 4, 5 and 7.

Weaving analysis for Alternative 6 was conducted because the distance between the on-ramp at the I-215/Iowa Avenue interchange and the off-ramp at the I-215/Barton Road interchange is approximately 1490 feet in the northbound direction. The segment in the southbound direction is not a weaving segment as the distance is greater than 2500 feet.

Alternative 6

Year 2016 a.m. and p.m. peak hour levels of service for the study area freeway weaving segment are summarized in **Table 17**. The freeway weaving LOS calculation sheets are contained in **Appendix E**. As **Table 17** indicates, the freeway weaving segment is projected to operate at satisfactory levels of service during both the a.m. and p.m. peak hours.

Table 17: Year 2016 Alternative 6 Freeway Weaving Segment Levels of Service

	Non-Weaving Volume	Weaving Volume	Density (pc/mi/ln)	LOS	Non-Weaving Volume	Weaving Volume	Density (pc/mi/ln)	LOS
Northbound								
Iowa Av On Ramp to Barton Rd Off Ramp	3915	1335	30.8	D	4644	1454	35.8	E

Notes:

Level of Service (LOS) criteria are provided in the *Highway Capacity Manual*, and are based on density.

Freeway Mainline Analysis

The freeway mainline traffic operations are similar in each of the alternatives, except for the northbound segment between Iowa Avenue on ramp and Barton Road off ramp in the no build condition as an auxiliary lane will be added to this segment in all the Build alternatives in the year 2016. The freeway mainline analysis for all the alternatives is the same for rest of the segments. Year 2016 a.m. and p.m. peak hour levels of service for the study area freeway segments are summarized in **Table 18**. The freeway mainline LOS calculation sheets are contained in **Appendix E**. An examination of **Table 18** indicates that all freeway segments are projected to operate at LOS E or better.

Table 18: Year 2016 Freeway Mainline Levels of Service

	AM Peak Hour					PM Peak Hour				
	HOV Vol	MF Vol	Mixed Flow			HOV Vol	MF Vol	Mixed Flow		
			Speed ¹	Density (pc/mi/ln)	LOS			Speed ¹	Density (pc/mi/ln)	LOS
Northbound										
Iowa Avenue On Ramp to Barton Road Off Ramp (No Build)	737	5250	59.0	32.3	D	881	6098	54.5	40.0	E
Iowa Avenue On Ramp to Barton Road Off Ramp* (Build)	737	5250	60.0	23.8	C	881	6098	60.0	27.3	D
Barton Road Off Ramp to Barton Road On Ramp	782	4764	59.9	28.9	D	874	5552	58.1	34.2	D
Barton Road On Ramp to Washington Street Off Ramp	782	5308	58.8	32.8	D	874	6101	54.5	40.1	E
Southbound										
Washington Street On Ramp to Barton Road Off Ramp	935	5990	54.7	39.8	E	794	5577	58.0	34.4	D
Barton Road Off Ramp to Barton Road On Ramp	1003	5502	58.0	34.5	D	909	4960	59.8	29.7	D
Barton Road On Ramp to La Cadena Dr Off Ramp	1003	6140	53.2	41.9	E	909	5578	58.0	34.4	D

Notes:

¹ Average passenger-car speed.

Level of Service (LOS) criteria are provided in the Highway Capacity Manual, and are based on density.

* This segment is a weaving segment in Alternative 6.

YEAR 2040 TRAFFIC CONDITIONS

Year 2040 traffic volumes for the freeway segments and intersections within the study area were developed using the methodology described in the “Traffic Volume Development” section above.

Intersection Levels of Service

Alternative 1

Year 2040 Alternative 1 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 19**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2040 Alternative 1 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 19**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 19: Year 2040 Alternative 1 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	C	31.4	0.94	F	169.3	1.51
2. Barton Road/Grand Terrace Road*	F	>500	-	F	>500	-
3. Barton Road/La Crosse Avenue*	F	223.4	-	F	>500	-
4. Barton Road/I-215 SB Ramps	F	184.8	1.40	F	290.6	1.70
5. Barton Road/I-215 NB Ramps	F	99.7	1.31	F	251.3	1.66
6. Barton Road/Michigan Street	F	101.7	1.20	F	135.7	1.32
7. Barton Road/Vivienda Avenue*	F	434.9	-	F	>500	-

Notes:

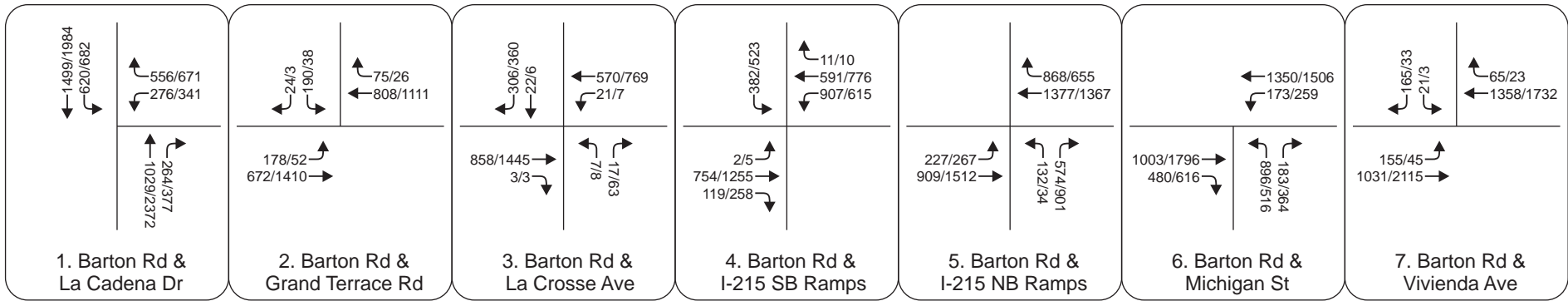
HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

*Delay for stop-controlled approach; v/c not applicable

An examination of the data in **Table 19** indicates that all study intersections are projected to operate at unsatisfactory levels of service, as follows:

- Barton Road & La Cadena Drive (p.m. peak hour)
- Barton Road & Grand Terrace Road (a.m. & p.m. peak hours)
- Barton Road & La Crosse Avenue (a.m. & p.m. peak hours)
- Barton Road & I-215 Southbound Ramps (a.m. & p.m. peak hours)
- Barton Road & I-215 Northbound Ramps (a.m. & p.m. peak hours)
- Barton Road & Michigan Street (a.m. & p.m. peak hours)
- Barton Road & Vivienda Avenue (a.m. & p.m. peak hours)



Legend
 Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



Alternative 2

Year 2040 Alternative 2 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 20**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2040 Alternative 2 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 20**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 20: Year 2040 Alternative 2 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	D	37.5	0.96	F	167.1	1.49
2. Barton Road/Grand Terrace Road	A	9.7	0.61	A	5.0	0.60
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	18.3	0.72	B	19.8	0.80
5. Barton Road/I-215 NB Ramps	B	11.5	0.64	B	19.3	0.86
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	D	38.7	0.90	C	29.2	0.89

Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

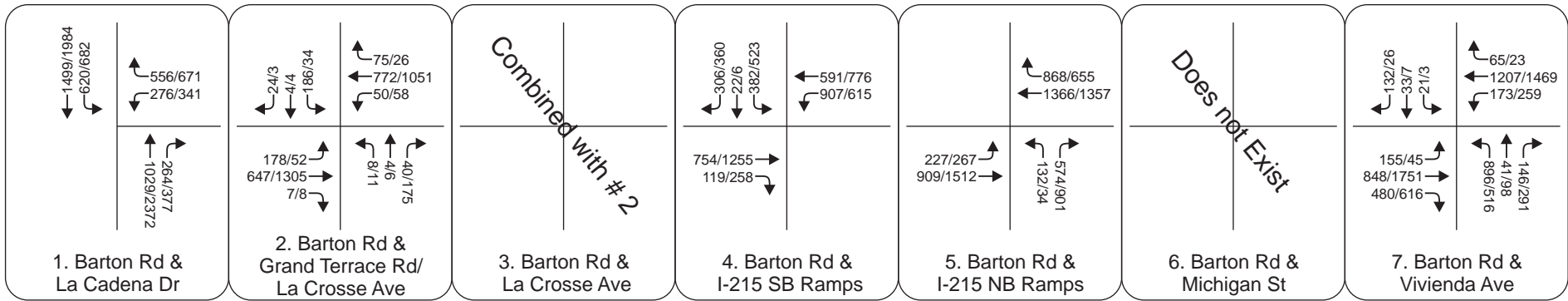
LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 20** indicates that all of the study intersections are projected to operate at satisfactory levels of service, with the exception of the following:

- Barton Road & La Cadena Drive (p.m. peak hour)

Alternative 3

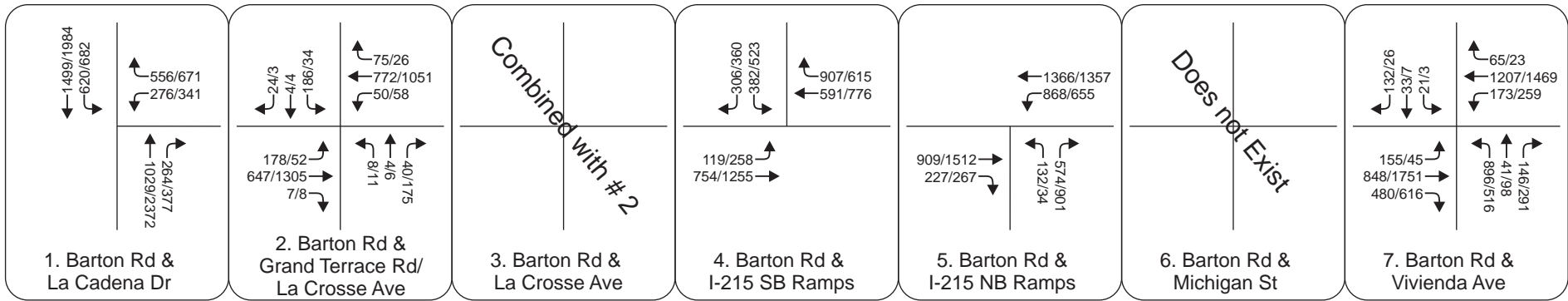
Year 2040 Alternative 3 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 21**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2040 Alternative 3 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 21**. Detailed levels of service calculation worksheets are included in **Appendix D**.



Legend

- ⊗ Study Intersection
- XXX/XXX AM/PM Peak Hour Volume





Legend

⊗ Study Intersection

XXX/XXX AM/PM Peak Hour Volume



NOT TO SCALE

Table 21: Year 2040 Alternative 3 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	D	35.5	0.97	F	163.7	1.49
2. Barton Road/Grand Terrace Road	A	6.3	0.60	A	5.4	0.60
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	14.6	0.68	B	12.9	0.61
5. Barton Road/I-215 NB Ramps	A	9.5	0.71	B	13.7	0.83
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	D	45.7	0.91	D	38.8	0.90

Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 21** indicates that all of the study intersections are projected to operate at satisfactory levels of service, with the exception of the following:

- Barton Road & La Cadena Drive (p.m. peak hour)

Alternative 4

Year 2040 Alternative 4 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 22**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2040 Alternative 4 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 22**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 22: Year 2040 Alternative 4 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	C	35.0	0.97	F	166.5	1.49
2. Barton Road/Grand Terrace Road	A	6.4	0.60	A	5.7	0.60
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	14.9	0.69	B	12.3	0.59
5. Barton Road/I-215 NB Ramps	Does Not Exist					
6. Barton Road/I-215 NB Ramps/Michigan Street	C	26.8	0.75	D	44.7	0.95
7. Barton Road/Vivienda Avenue	Does Not Exist					

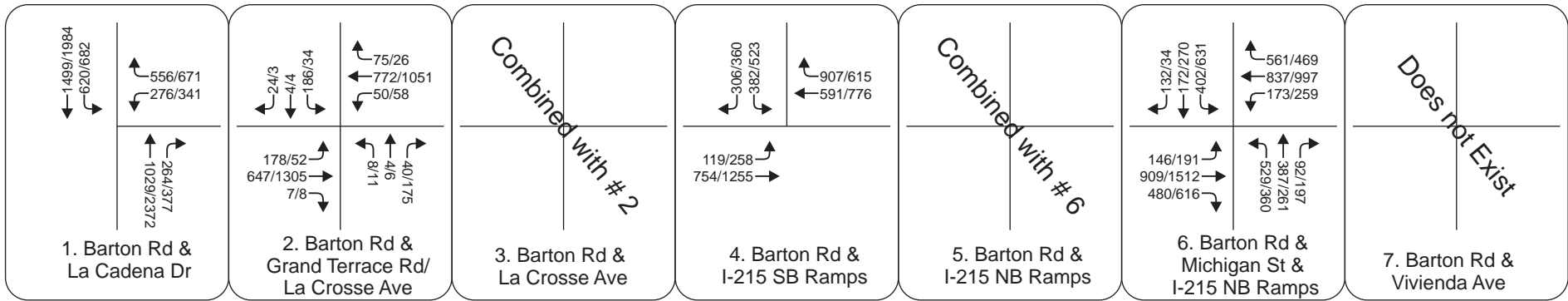
Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 22** indicates that all of the study intersections are projected to operate at satisfactory levels of service, with the exception of the following:

- Barton Road & La Cadena Drive (p.m. peak hour)



Legend
 (X) Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



Alternative 5

Year 2040 Alternative 5 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 23**. A level of service analysis using the previously described methodologies was conducted to evaluate year 2040 Alternative 5 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 23**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 23: Year 2040 Alternative 5 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	C	34.5	0.97	F	167.0	1.49
2. Barton Road/Grand Terrace Road	A	7.6	0.60	A	5.9	0.60
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	C	23.8	0.75	C	31.8	0.87
5. Barton Road/I-215 NB Ramps	Does Not Exist					
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	D	43.4	0.91	C	32.4	0.90

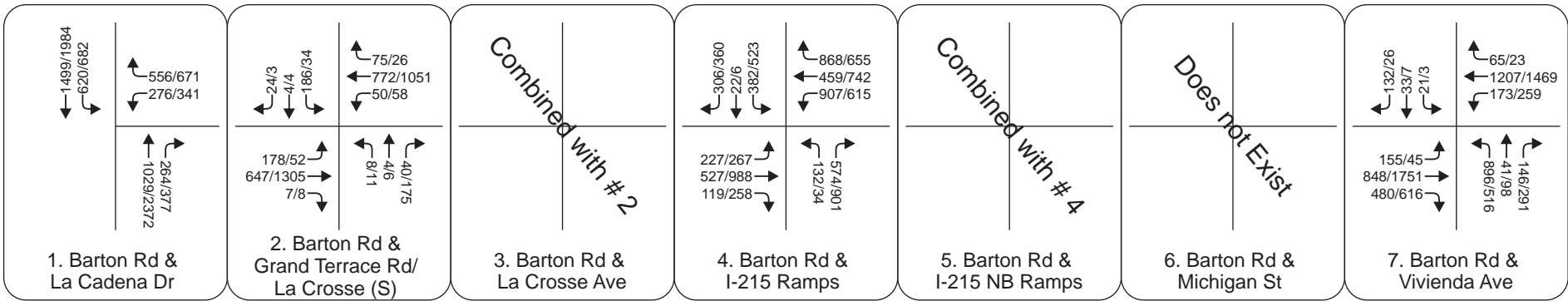
Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 23** indicates that all of the study intersections are projected to operate at satisfactory levels of service, with the exception of the following:

- Barton Road & La Cadena Drive (p.m. peak hour)



Legend
 x Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



Alternative 6

Year 2040 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 24**. A level of service was conducted to evaluate year 2040 Alternative 6 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 24**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 24: Year 2040 Alternative 6 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	D	39.0	0.96	F	165.7	1.49
2. Barton Road/Grand Terrace Road	A	7.5	0.61	A	6.3	0.58
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	C	20.3	0.68	B	16.3	0.63
5. Commerce Way/I-215 NB Ramps	C	23.3	0.90	B	19.1	0.83
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	D	50.7	0.93	D	49.8	0.95

Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

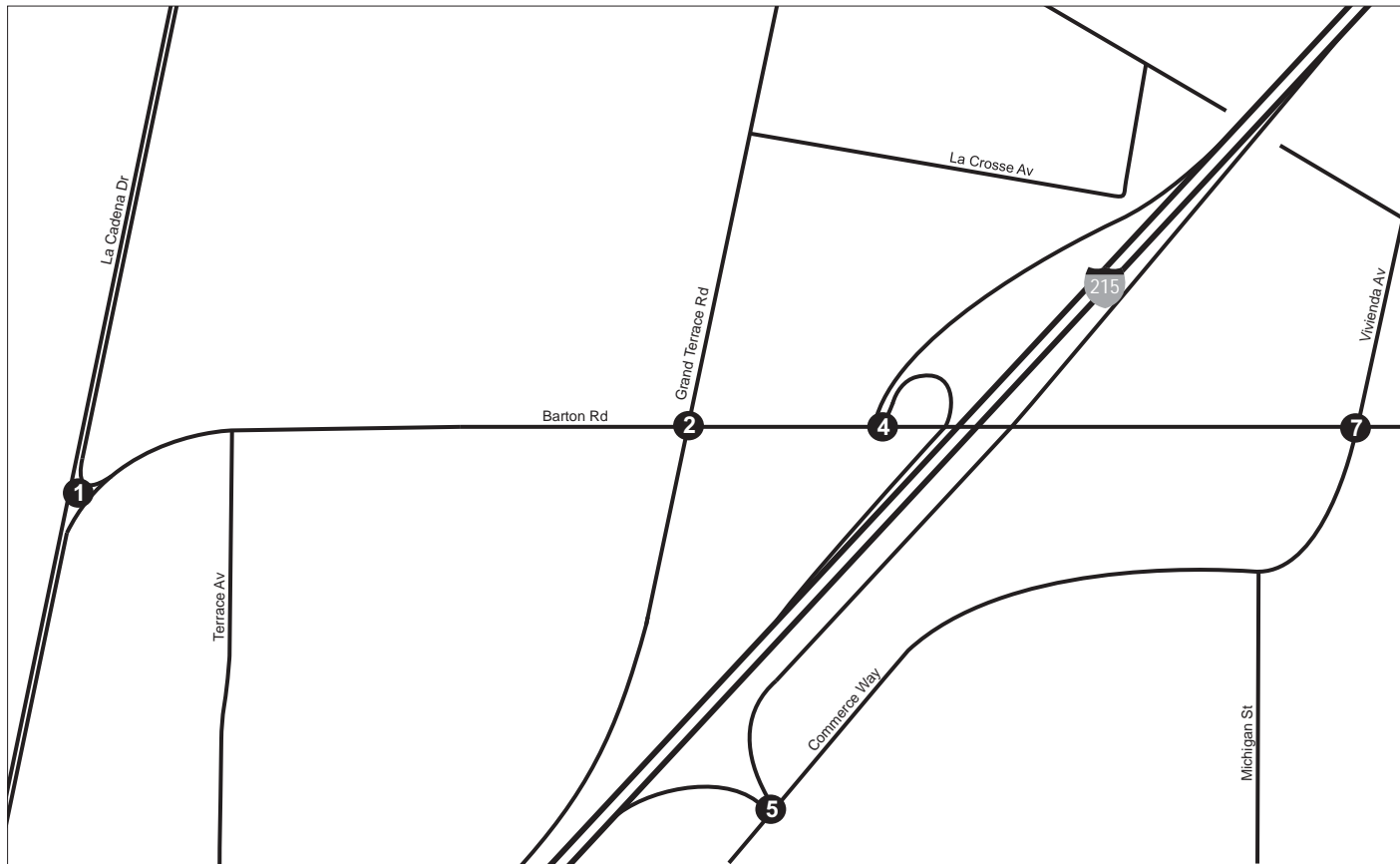
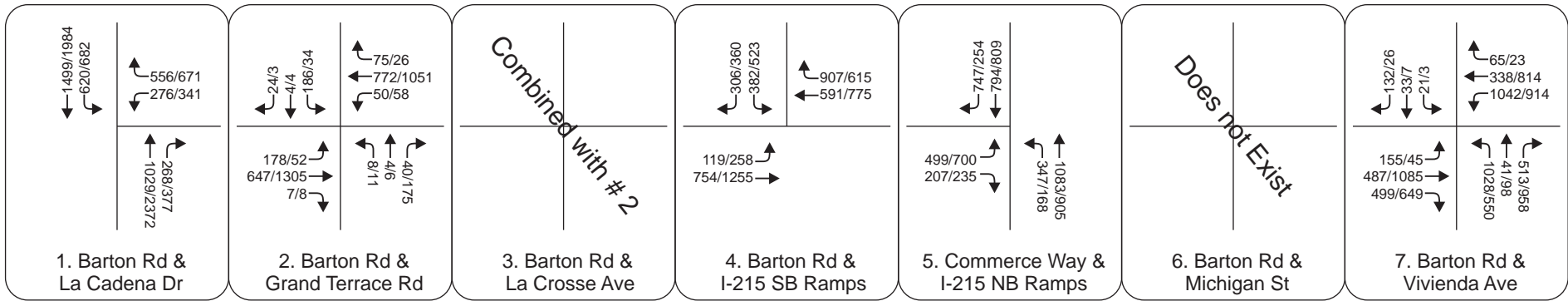
An examination of the data in **Table 24** indicates that the following study intersection is projected to operate at an unsatisfactory level of service:

- Barton Road/La Cadena Drive (p.m. peak hour)

In order to achieve a satisfactory LOS at the intersection of La Cadena Drive/Barton Road, which is in the City of Colton, La Cadena Drive will need to be widened to six lanes. The Nexus Study Arterial Project List includes the widening of La Cadena Road to six lanes through this portion of the City of Colton.

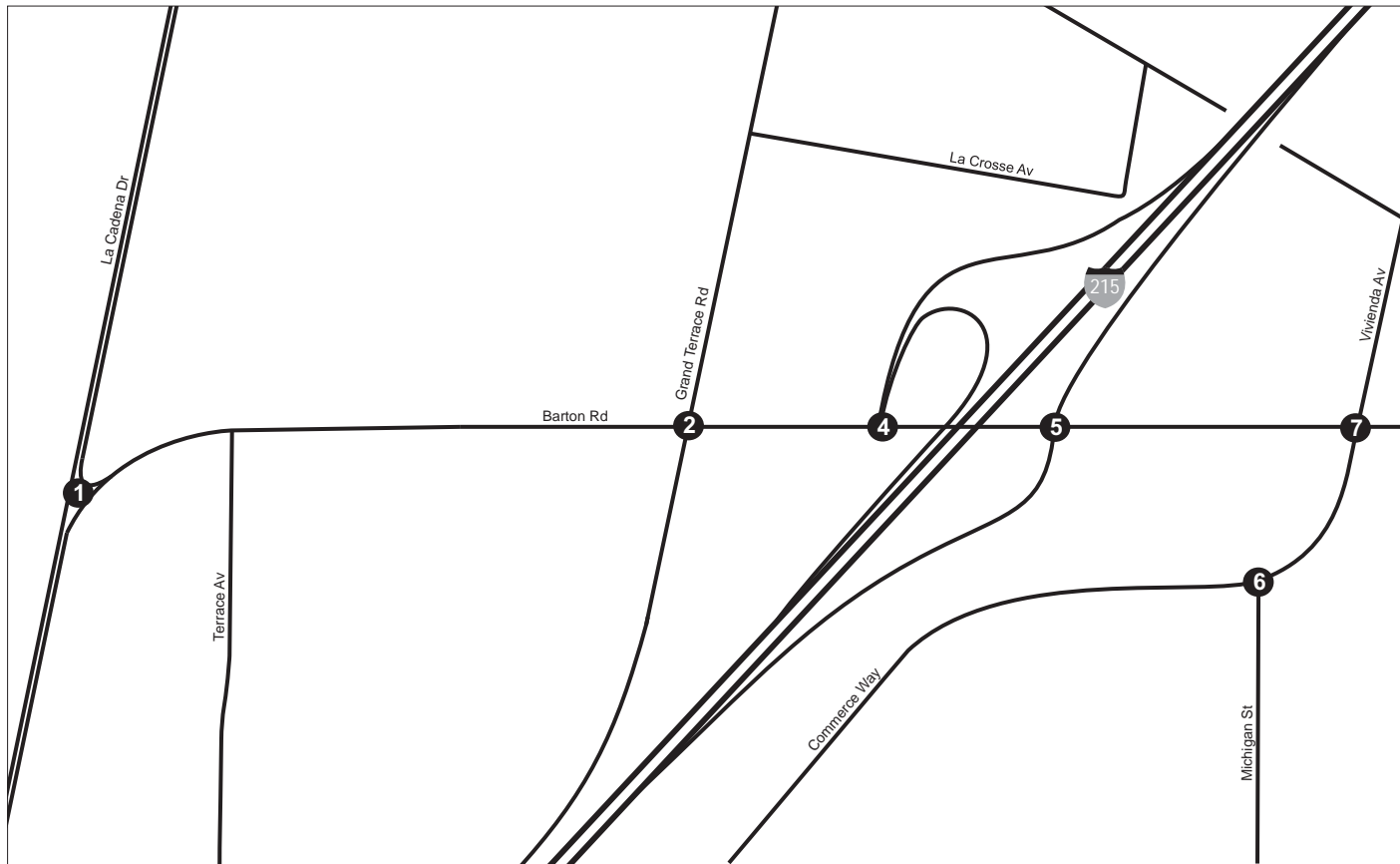
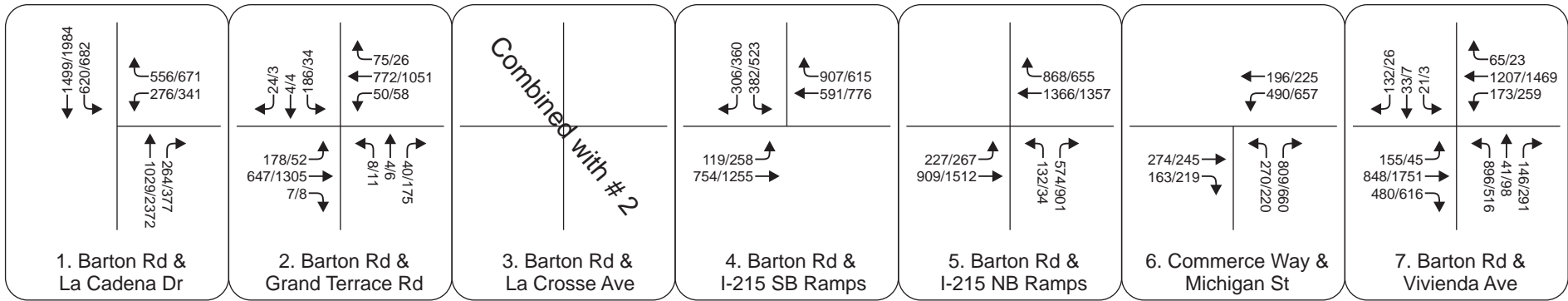
Alternative 7

Year 2040 a.m. and p.m. peak hour traffic volumes at the study intersections are illustrated in **Figure 25**. A level of service was conducted to evaluate year 2040 Alternative 7 traffic conditions in the study area. The results of the intersection level of service analysis are summarized in **Table 25**. Detailed levels of service calculation worksheets are included in **Appendix D**.



Legend
 X Study Intersection
 XXX/XXX AM/PM Peak Hour Volume





Legend
 X Study Intersection
 XXX/XXX AM/PM Peak Hour Volume



Table 25: Year 2040 Alternative 7 Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	D	42.3	0.97	F	168.9	1.49
2. Barton Road/Grand Terrace Road	B	10.2	0.62	A	5.4	0.58
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	B	13.5	0.69	B	11.3	0.62
5. Barton Road/I-215 NB Ramps	B	14.0	0.70	C	30.5	0.95
6. Commerce Way/Michigan Street	C	26.7	0.69	C	23.3	0.55
7. Barton Road/Vivienda Avenue	D	51.8	0.90	D	45.2	0.97

Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

An examination of the data in **Table 25** indicates that the following study intersection is projected to operate at an unsatisfactory level of service:

- Barton Road/La Cadena Drive (p.m. peak hour)

In order to achieve a satisfactory LOS at the intersection of La Cadena Drive/Barton Road, which is in the City of Colton, La Cadena Drive will need to be widened to six lanes. The Nexus Study Arterial Project List includes the widening of La Cadena Road to six lanes through this portion of the City of Colton.

Intersection Queuing Analysis

A queuing analysis using the previously described methodologies was conducted to determine the queue lengths at the left turn lanes at Barton Road onto the I-215 freeway ramps, for each of the alternatives. The results of the queuing analysis are summarized in **Table 26**. Detailed queuing reports are included in **Appendix D**.

The ‘Space Provided’ and ‘Queue Lengths’ shown in **Table 26** are per lane for dual left turn lanes. As can be seen in **Table 26**, under the no-build alternative, the westbound left turn lane at the intersection of Barton Road and I-215 Southbound Ramps has inadequate queuing distance during both the a.m. and p.m. peak hours. Long queues will form that prevent both through traffic and left turning traffic from progressing through the interchange.

Under all proposed build alternatives, the eastbound and westbound left turn lanes onto the ramps have adequate queuing distance during both the a.m. and p.m. peak hours.

Table 26: Year 2040 Intersection Queue Lengths

Intersection	AM Peak Hour		PM Peak Hour	
	Space Provided (Ft)	Queue Length 95 th %ile (Ft)	Space Provided (Ft)	Queue Length 95 th %ile (Ft)
Alternative 1				
Barton Road/I-215 SB Ramps – Westbound left turn lane	120	491	120	252
Barton Road/I-215 NB Ramps – Eastbound left turn lane	150	102	150	89
Alternative 2				
Barton Road/I-215 SB Ramps – Westbound left turn lanes	315	298	315	156
Barton Road/I-215 NB Ramps – Eastbound left turn lanes	300	111	300	114
Alternative 3				
Barton Road/I-215 SB Ramps – Eastbound left turn lanes	220	53	220	85
Barton Road/I-215 NB Ramps – Westbound left turn lanes	220	156	220	181
Alternative 4				
Barton Road/I-215 SB Ramps – Eastbound left turn lanes	260	51	260	110
Barton Road/Michigan Street/I-215 NB Ramps – Eastbound left turn lane	400	165	400	215
Alternative 5				
Barton Road/I-215 Ramps – Westbound left turn lanes	540	183	540	202
Barton Road/I-215 Ramps – Eastbound left turn lanes	270	104	270	120
Alternative 6				
Barton Road/I-215 SB Ramps – Eastbound left turn lane	225	130	225	191
Commerce Way/I-215 NB Ramps – Northbound left turn lane	410	390	410	198
Alternative 7				
Barton Road/I-215 SB Ramps – Eastbound left turn lane	300	124	300	195
Barton Road/I-215 NB Ramps – Eastbound left turn lanes	320	211	320	296

Notes: **BOLD** indicates inadequate queuing distance.

Freeway Ramp Analysis

As the freeway mainline and ramp traffic operations are similar in each of the alternatives, the freeway mainline and ramp analysis for all the alternatives is the same. Even in the no-build alternative for the Barton Road interchange, the I-215 Bi-County Corridor Improvement Project will improve the ramp merge/diverge areas. Year 2040 a.m. and p.m. peak hour levels of service for the Barton Road/I-215 freeway interchange and adjacent interchange ramp influence areas are summarized in **Table 27**. The

freeway ramp LOS calculation sheets are included in **Appendix E**. As **Table 27** indicates, all freeway ramp junctions are projected to operate at LOS D or better.

Table 27: Year 2040 Freeway Ramp Levels of Service

Ramp	AM Peak Hour				PM Peak Hour			
	Ramp Volume	V/C Ratio	Density (pc/mi/ln)	LOS	Ramp Volume	V/C Ratio	Density (pc/mi/ln)	LOS
Northbound								
Iowa Av Off Ramp	720	0.17	6.9	A	692	0.16	6.5	A
Iowa Av On Ramp	1312	0.62	25.1	C	1754	0.82	33.0	D
Barton Rd Off Ramp	706	0.17	6.8	A	935	0.22	8.8	A
Barton Rd On Ramp	1095	0.52	21.0	C	922	0.43	17.3	B
Washington St Off Ramp	1731	0.41	16.6	B	1391	0.32	13.1	B
Washington St On Ramp	1678	0.80	32.1	D	1338	0.62	25.1	C
Southbound								
Washington St Off Ramp	1212	0.29	11.6	B	1755	0.41	16.5	B
Washington St On Ramp	935	0.45	17.9	B	1432	0.67	26.9	C
Barton Rd Off Ramp	703	0.17	6.7	A	890	0.21	8.4	A
Barton Rd On Ramp	1047	0.50	20.1	C	883	0.41	16.6	B
La Cadena Dr Off Ramp	1169	0.28	11.2	B	1582	0.37	14.9	B
La Cadena Dr On Ramp	1136	0.54	21.8	C	964	0.45	18.1	B

Notes:

On ramps are single lanes and off ramps are dual lanes at the gore point.

Level of Service (LOS) criteria are provided in the *Highway Capacity Manual*, and are based on Density.

Ramp Meter Queuing Analysis

The northbound and southbound on-ramp volumes are the same in each of the build alternatives, but the ramp meter queuing analysis for all the build alternatives is not the same as the on-ramps will be improved to two mixed-flow lanes and an HOV preferential lane at the meter under alternatives 2, 3 and 4, whereas under alternatives 5 and 6 the on-ramps will be improved to one mixed-flow lane and an HOV preferential lane at the meter. Under Alternative 7, the southbound on-ramp will be improved to one mixed-flow lanes and an HOV preferential lane at the meter and the northbound on-ramp will be improved to two mixed-flow lanes at the meter. Year 2040 a.m. and p.m. peak hour volumes and ramp metering rates on the northbound and southbound Barton Road/I-215 freeway on-ramps are summarized in **Table 28**.

As can be seen in **Table 28**, a queue of 31 vehicles will form at the northbound on-ramp during the a.m. peak hour in Alternatives 5 and 6, as the mixed-flow volume is greater than the service rate of a single lane metered ramp (900 vehicles per hour). Based on an average queuing spacing of 30 feet per vehicle, the total queue length will be 930 feet long. The distance from the ramp meter to the intersection at the northbound on-ramp is greater than 1200 feet in Alternatives 5 and 6. Therefore, the northbound on-ramp has adequate queuing space under these alternatives. No queues will form at the on-ramps under Alternatives 2, 3, 4 and 7, as the volumes are less than the service rates of ramp meters in these alternatives during both the a.m. and p.m. peak hours.

Table 28: Year 2040 Ramp Meter Queued Volumes

Metered Ramp	Lanes		Maximum Meter Throughput*		AM Peak Hour				PM Peak Hour			
					Volume		Queued Volume		Volume		Queued Volume	
	MF†	HOV	MF	HOV	MF	HOV	MF	HOV	MF	HOV	MF	HOV
Alternatives 2,3 & 4												
Barton Road/I-215 NB On Ramp	2	1	1500	600	931	164	0	0	784	138	0	0
Barton Road/I-215 SB On Ramp	2	1	1500	600	890	157	0	0	751	132	0	0
Alternatives 5 & 6												
Barton Road/I-215 NB On Ramp	1	1	900	600	931	164	31	0	784	138	0	0
Barton Road/I-215 SB On Ramp	1	1	900	600	890	157	0	0	751	132	0	0
Alternative 7												
Barton Road/I-215 NB On Ramp	2	0	1500	0	1095	0	0	0	922	0	0	0
Barton Road/I-215 SB On Ramp	1	1	900	600	890	157	0	0	751	132	0	0

* Service rate of a single metered lane on a ramp is 900 vph. Each additional lane is assumed to add an additional 600 vph.

† MF = Mixed-Flow

Freeway Weaving Analysis

For Alternative 2, 3, 4 and 5, the segment between the on-ramp at the I-215/Iowa Avenue interchange and the off-ramp at the I-215/Barton Road interchange is not a weaving segment as the length of the segment is greater than 2500 feet in the northbound and the southbound direction. Therefore, a weaving analysis was not conducted for alternatives 2, 3, 4, 5 and 7.

Weaving analysis for Alternative 6 was conducted because the distance between the on-ramp at the I-215/Iowa Avenue interchange and the off-ramp at the I-215/Barton Road interchange will be approximately 2400 feet in the northbound direction in the year 2040 as the Iowa Avenue on ramp will be relocated by the Bi-County Corridor Improvement Project. The segment in the southbound direction is not a weaving segment as the distance is greater than 2500 feet.

Alternative 6

Year 2040 a.m. and p.m. peak hour levels of service for the study area freeway weaving segment are summarized in **Table 29**. The freeway weaving LOS calculation sheets are contained in **Appendix E**. As **Table 29** indicates, the freeway weaving segment is projected to operate at satisfactory levels of service during both the a.m. and p.m. peak hours.

Table 29: Year 2040 Alternative 6 Freeway Weaving Segment Levels of Service

	Non-Weaving Volume	Weaving Volume	Density (pc/mi/ln)	LOS	Non-Weaving Volume	Weaving Volume	Density (pc/mi/ln)	LOS
Northbound								
Iowa Av On Ramp to Barton Rd Off Ramp	6619	1802	34.1	D	7506	2357	41.1	E

Notes:

Level of Service (LOS) criteria are provided in the *Highway Capacity Manual*, and are based on density.

BOLD indicates unsatisfactory level of service.

Freeway Mainline Analysis

Year 2040 a.m. and p.m. peak hour levels of service for the study area freeway segments are summarized in **Table 30**. The freeway mainline LOS calculation sheets are contained in **Appendix E**. As **Table 30** indicates, all freeway segments in the study area are projected to operate at satisfactory levels of service, with the following exception:

- I-215 Northbound Barton Road Off Ramp to Barton Road On Ramp (p.m. peak hour)

This segment is over capacity based on the assumption of a peak hour factor (PHF) of 0.95 and a capacity of 2300 vph for a mixed-flow lane, as specified in the San Bernardino County Congestion Management Program (CMP) and agreed to by the PDT. However, the CMP allows the use of a PHF of 0.98 for congested freeway conditions. Based on a PHF of 0.98 and a capacity of 2350 vph for a mixed-flow lane (per HCM), the LOS for the above mentioned freeway segment will be E.

Table 30: Year 2040 Freeway Mainline Levels of Service

	AM Peak Hour					PM Peak Hour				
	HOV Vol	MF Vol	Mixed Flow			HOV Vol	MF Vol	Mixed Flow		
			Speed ¹	Density (pc/mi/ln)	LOS			Speed ¹	Density (pc/mi/ln)	LOS
Northbound										
Iowa Avenue On Ramp to Barton Road Off Ramp †	1381	8417	59.5	30.8	D	1553	9863	55.9	37.9	E
Barton Road Off Ramp to Barton Road On Ramp	1381	7711	56.3	37.3	E	1553	8928	-	-	F*
Barton Road On Ramp to Washington Street Off Ramp	1528	8660	59.1	31.9	D	1710	9692	56.6	36.7	E
Southbound										
Washington Street On Ramp to Barton Road Off Ramp	1521	8342	59.6	30.5	D	1568	8560	59.5	30.9	D
Barton Road Off Ramp to Barton Road On Ramp	1521	7639	56.6	36.7	E	1568	7670	57.0	36.1	E
Barton Road On Ramp to La Cadena Dr Off Ramp	1531	8676	59.1	32.0	D	1518	8604	59.4	31.1	D

Notes:

¹ Average passenger-car speed. * Freeway is over capacity during peak 15 minute period. **BOLD** indicates unsatisfactory level of service.

Level of Service (LOS) criteria are provided in the *Highway Capacity Manual*, and are based on density.

† This segment is weaving segment in Alternative 6.

Traffic Index

Twenty and forty year Traffic Indices (TI) for the Barton Road Interchange are summarized in **Table 31**. In order to determine ADT volumes, the ratios of total a.m. and p.m. peak hour volumes to the daily volumes from the SCAG RTP model were calculated. These ratios were then applied to the post-processed peak hour volumes to determine the processed ADT volumes. A truck percentage of 4 percent of the ADT volume was assumed based on the SCAG 2035 travel demand model. The TIs were calculated using the methodology contained in Chapter 610, “Pavement Engineering Considerations”, of the *Highway Design Manual*. It should be noted that HDM Tables 612.2 and 613.5A contain guidance concerning minimum TIs depending on facility type and design life. This guidance may require TIs greater than those shown in **Table 31**.

It should also be noted that, based on linear growth projections, the 2060 ADT for Barton Road is shown as 70,784. However, since Barton Road will remain a 4-lane road, it is highly unlikely it could ever accommodate such a high volume of traffic. The TI calculation sheets are contained in **Appendix F**.

Table 31: Barton Road Interchange Traffic Indices

Traffic Index Segments	Year 2040 AM Peak Hour Vol	Year 2040 PM Peak Hour Vol	Peak Hr/ ADT Ratio*	Year 2040 ADT	Year 2060 ADT	20 Year TI	40 Year TI
I-215 Northbound Off Ramp at Barton Road	706	935	0.14	11,688	14,960	9.5	10.5
I-215 Northbound On Ramp at Barton Road	1095	922	0.18	11,525	14,752	9.5	10.5
I-215 Southbound Off Ramp at Barton Road	703	890	0.14	11,113	14,224	9.5	10.5
I-215 Southbound On Ramp at Barton Road	1047	883	0.18	10,988	14,064	9.5	10.5
I-215 Northbound Auxiliary Lane at Iowa Avenue On Ramp to Barton Road Off Ramp	1776	2080	0.12	33,238	42,545	11.0	12.0
Barton Road between I-215 Northbound Off Ramps and Vivienda Avenue	2634	3170	0.10	55,300	70,784	10.5	12.0
Commerce Way between I-215 Northbound Ramps and Barton Road	3123	3169	0.22	29,265	37,450	10.0	11.0

* Based on SCAG RTP Model.

CONCLUSIONS

This report analyzed traffic operations in the vicinity of the Barton Road/I-215 interchange under the following scenarios:

- Existing (2009) Conditions
- Opening year (2016) Alternative 1 (No Build) conditions
- Opening year (2016) Alternative 2 conditions
- Opening year (2016) Alternative 3 conditions
- Opening year (2016) Alternative 4 conditions
- Opening year (2016) Alternative 5 conditions
- Opening year (2016) Alternative 6 conditions
- Opening year (2016) Alternative 7 conditions
- Design year (2040) Alternative 1 (No Build) conditions
- Design year (2040) Alternative 2 conditions
- Design year (2040) Alternative 3 conditions
- Design year (2040) Alternative 4 conditions
- Design year (2040) Alternative 5 conditions
- Design year (2040) Alternative 6 conditions
- Design year (2040) Alternative 7 conditions

The following analyses were conducted for each of the scenarios:

- Intersection operations
- Freeway ramp (merge/diverge) operations
- Freeway mainline operations.

The findings of this analysis are summarized as follows:

Existing Conditions

All study intersections are currently operating at satisfactory levels of service.

The westbound left turn lane at the intersection of Barton Road & I-215 Southbound Ramps has inadequate queuing distance during both the a.m. and p.m. peak hours. Long queues form that prevent both through traffic and left turning traffic from progressing through the interchange.

All freeway ramp junctions are currently operating at satisfactory levels of service (LOS E or better), with the following exception.

- I-215 Southbound Washington Street Off Ramp (a.m. peak hour)

All the freeway segments in the study area are currently operating at satisfactory levels of service, during both the a.m. and p.m. peak hours.

Year 2016 ConditionsAlternative 1

All study intersections are projected to operate at satisfactory levels of service under Alternative 1, with the following exception:

- Barton Road & Grand Terrace Road (a.m. & p.m. peak hours)
- Barton Road & I-215 Southbound Ramps (p.m. peak hour)

Alternative 2

All study intersections are projected to operate at satisfactory levels of service under Alternative 2.

Alternative 3

All study intersections are projected to operate at satisfactory levels of service under Alternative 3.

Alternative 4

All study intersections are projected to operate at satisfactory levels of service under Alternative 4.

Alternative 5

All study intersections are projected to operate at satisfactory levels of service under Alternative 5.

Alternative 6

All study intersections are projected to operate at satisfactory levels of service under Alternative 6.

Alternative 7

All study intersections are projected to operate at satisfactory levels of service under Alternative 7.

Under the No Build alternative, the westbound left turn lane at the intersection of Barton Road and I-215 Southbound Ramps has inadequate queuing distance during both the a.m. and p.m. peak hours. Long queues will form that prevent both through traffic and left turning traffic from progressing through the interchange. Under all proposed build alternatives, the eastbound and westbound left turn lanes onto the ramps have adequate queuing distance during both the a.m. and p.m. peak hours.

Under all alternatives, all freeway ramp junctions are projected to operate at LOS E or better during both the a.m. and p.m. peak hours.

Under all proposed build alternatives, the northbound and southbound on-ramps have adequate ramp meter queuing space during both the a.m. and p.m. peak hours.

Under alternative 6, the freeway weaving segment is projected to operate at a satisfactory level of service during both the a.m. and p.m. peak hours.

All freeway segments are projected to operate at LOS E or better during both the a.m. and p.m. peak hours.

Year 2040 Conditions

Alternative 1

All study intersections are projected to operate at unsatisfactory levels of service under Alternative 1, as follows:

- Barton Road & La Cadena Drive (p.m. peak hour)
- Barton Road & Grand Terrace Road (a.m. & p.m. peak hours)
- Barton Road & La Crosse Avenue (a.m. & p.m. peak hours)
- Barton Road & I-215 Southbound Ramps (a.m. & p.m. peak hours)
- Barton Road & I-215 Northbound Ramps (a.m. & p.m. peak hours)
- Barton Road & Michigan Street (a.m. & p.m. peak hours)
- Barton Road & Vivienda Avenue (a.m. & p.m. peak hours)

Alternative 2

All study intersections are projected to operate at satisfactory levels of service under Alternative 2, with the following exception:

- Barton Road & La Cadena Drive (p.m. peak hour)

Alternative 3

All study intersections are projected to operate at satisfactory levels of service under Alternative 3, with the following exception:

- Barton Road & La Cadena Drive (p.m. peak hour)

Alternative 4

All study intersections are projected to operate at satisfactory levels of service under Alternative 4, with the following exception:

- Barton Road & La Cadena Drive (p.m. peak hour)

Alternative 5

All study intersections are projected to operate at satisfactory levels of service under Alternative 5, with the following exception:

- Barton Road & La Cadena Drive (p.m. peak hour)

Alternative 6

All study intersections are projected to operate at satisfactory levels of service under Alternative 6, with the following exception:

- Barton Road & La Cadena Drive (p.m. peak hour)

Alternative 7

All study intersections are projected to operate at satisfactory levels of service under Alternative 7, with the following exception:

- Barton Road & La Cadena Drive (p.m. peak hour)

In order to achieve a satisfactory LOS at the intersection of La Cadena Drive/Barton Road, which is in the City of Colton, La Cadena Drive will need to be widened to six lanes. The Nexus Study Arterial Project List includes the widening of La Cadena Road to six lanes through this portion of the City of Colton.

Under the No Build alternative, the westbound left turn lane at the intersection of Barton Road and I-215 Southbound Ramps has inadequate queuing distance during both the a.m. and p.m. peak hours. Long queues will form that prevent both through traffic and left turning traffic from progressing through the interchange. Under all proposed build alternatives, the eastbound and westbound left turn lanes onto the ramps have adequate queuing distance during both the a.m. and p.m. peak hours.

Under all alternatives, all freeway ramp junctions are projected to operate at satisfactory levels of service.

Under all proposed build alternatives, the northbound and southbound on-ramps have adequate ramp meter queuing space during both the a.m. and p.m. peak hours.

Under alternative 6, the freeway weaving segment is projected to operate at a satisfactory level of service during both the a.m. and p.m. peak hours.

All freeway segments in the study area are projected to operate at satisfactory levels of service, with the following exception:

- I-215 Northbound Barton Road Off Ramp to Barton Road On Ramp (p.m. peak hour)

This segment is over capacity based on the assumption of a peak hour factor (PHF) of 0.95 and a capacity of 2300 vph for a mixed-flow lane, as specified in the San Bernardino County Congestion Management Program (CMP) and agreed to by the PDT. However, the CMP allows the use of a PHF of 0.98 for congested freeway conditions. Based on a PHF of 0.98 and a capacity of 2350 vph for a mixed-flow lane (per HCM), the LOS for the above mentioned freeway segment will be E.

Year 2040 Conditions without ‘I-215 Bi-County Corridor Improvement’ project

This study is based on the assumption that the ‘I-215 Bi-County Corridor Improvement’ project would be completed by 2040 and the I-215 freeway would be widened by the addition of a mixed flow lane in each direction. The analysis has indicated that inclusion of the I-215 Bi-County Corridor Improvement project does not create a significant impact on the local street volumes or ramp terminus volumes for the Barton Road project. It does, however, affect the La Crosse and Barton Road intersection since this intersection would be reconfigured to eliminate access to Barton Road from La Crosse with the I-215 Bi-County Corridor Improvement project. It is assumed that the Bi-County Corridor Improvement project would be in place by 2040.

Also, the I-215 Barton Interchange project has been designed to account for the I-215 Bi-County Corridor Improvement project by including items such as the overcrossing configuration which accommodates the full freeway widening and the ramp layouts.

As mentioned earlier in this report, intersection LOS have been calculated assuming the I-215 Bi-County Corridor Improvement project will be in place by 2040. However, it should be noted that intersection LOS for the two most preferred alternatives i.e. Alternatives 6 and 7 have been calculated assuming the Bi-County Corridor Improvement project is not built by 2040 and the La Crosse Avenue is not realigned. The LOS for all the intersections would be satisfactory under either scenario – i.e., with or without the Bi-County Corridor Improvement in place, with the exception of Barton Road & La Cadena Drive.

The results of the Alternative 6 intersection levels of service analysis are summarized in **Table 32**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 32: Year 2040 Alternative 6 (Without Bi-County & La Crosse Av Realignment)
Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	D	48.9	1.02	F	217.4	1.52
2. Barton Road/Grand Terrace Road	B	14.9	0.79	B	14.1	0.82
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	C	20.4	0.47	C	27.0	0.65
5. Commerce Way/I-215 NB Ramps	C	24.2	0.92	B	17.4	0.85
6. Barton Road/Michigan Street	Does Not Exist					
7. Barton Road/Vivienda Avenue	D	53.6	0.95	D	53.4	0.97

Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

The results of the Alternative 7 intersection levels of service analysis are summarized in **Table 33**. Detailed levels of service calculation worksheets are included in **Appendix D**.

Table 33: Year 2040 Alternative 7 (Without Bi-County & La Crosse Av Realignment)
Intersection Levels of Service

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay (Sec)	V/C	LOS	Delay (Sec)	V/C
1. Barton Road/La Cadena Drive	D	47.4	1.05	F	198.8	1.5
2. Barton Road/Grand Terrace Road	A	7.6	0.62	B	10.6	0.85
3. Barton Road/La Crosse Avenue	Does Not Exist					
4. Barton Road/I-215 SB Ramps	C	22.3	0.53	C	29.9	0.62
5. Barton Road/I-215 NB Ramps	C	24.9	0.78	D	39.6	0.94
6. Commerce Way/Michigan Street	C	28.4	0.72	C	24.9	0.53
7. Barton Road/Vivienda Avenue	D	53.0	0.92	D	35.5	0.88

Notes:

HCM 2000 Operations Methodology. **BOLD** indicates unsatisfactory level of service.

LOS = Level of Service, Delay = Average Vehicle Delay (Seconds), V/C = Volume-to-Capacity Ratio

It should be noted that the number of freeway lanes does not have a significant impact on the ramp terminus or local arterial volumes. The freeway level of service analysis was conducted for the 'HOV Gap Closure' project in June 2009 and that study concluded that all of the freeway segments in the Barton Road study area are projected to operate at LOS F in the year 2035 without the Bi-County Corridor Improvement project. With the Bi-County Corridor Improvement project in place, freeway segment LOS are satisfactory.

Interstate 215/Barton Road Interchange Improvement Project

08-SBd-215-PM 0.58/1.66

Technical Appendices

Caltrans Project No. 0800000282 (0J0700)

Prepared for:



Under contract to AECOM

Prepared by:

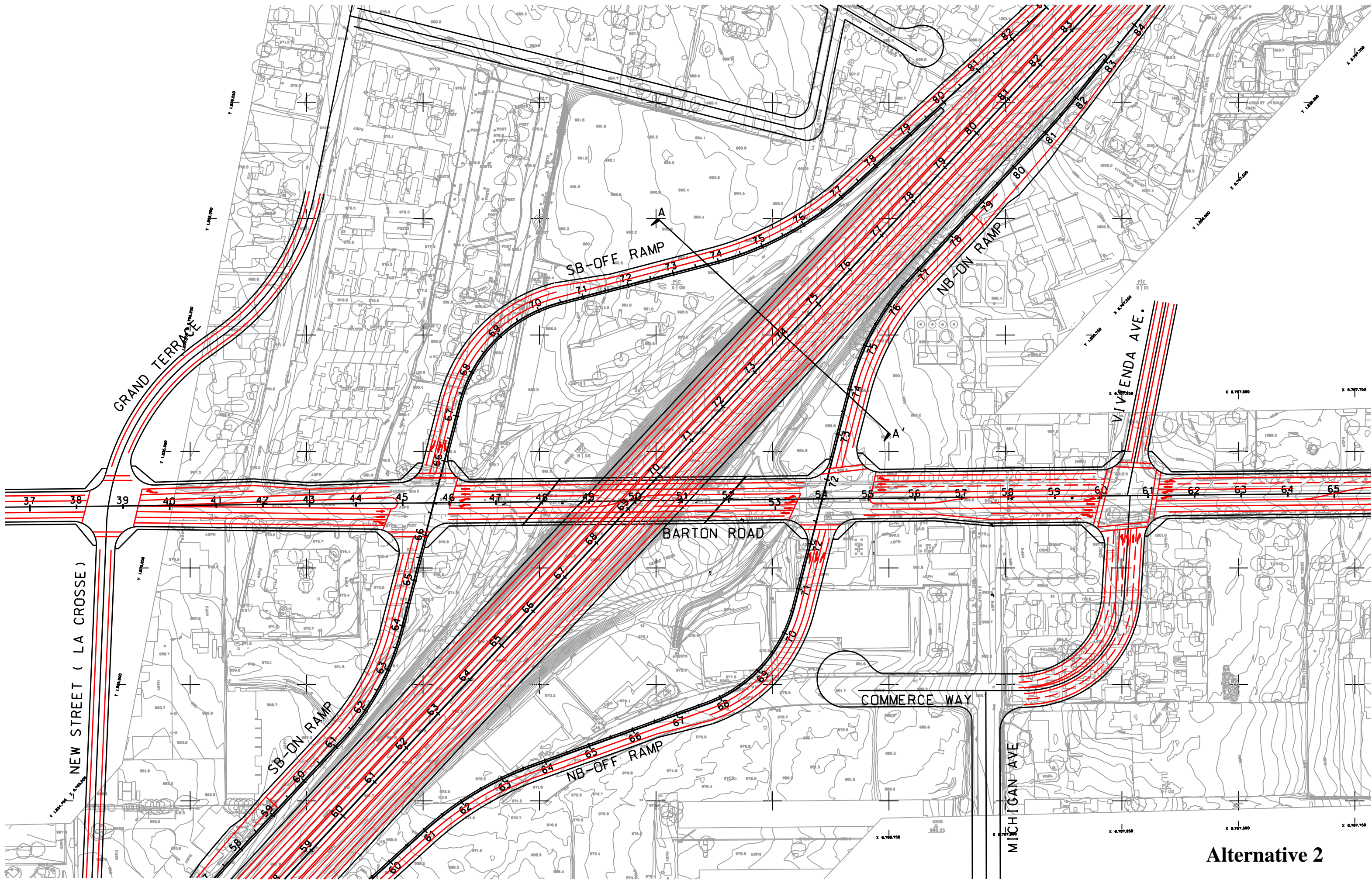


December 21, 2011

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APPENDIX A
Alternative Design Layouts

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Alternative 2

GRAND TERRACE

BARTON ROAD

VIVIENDA AVE

NEW STREET

MICHIGAN AVE

MICHIGAN AVE

SB OFF

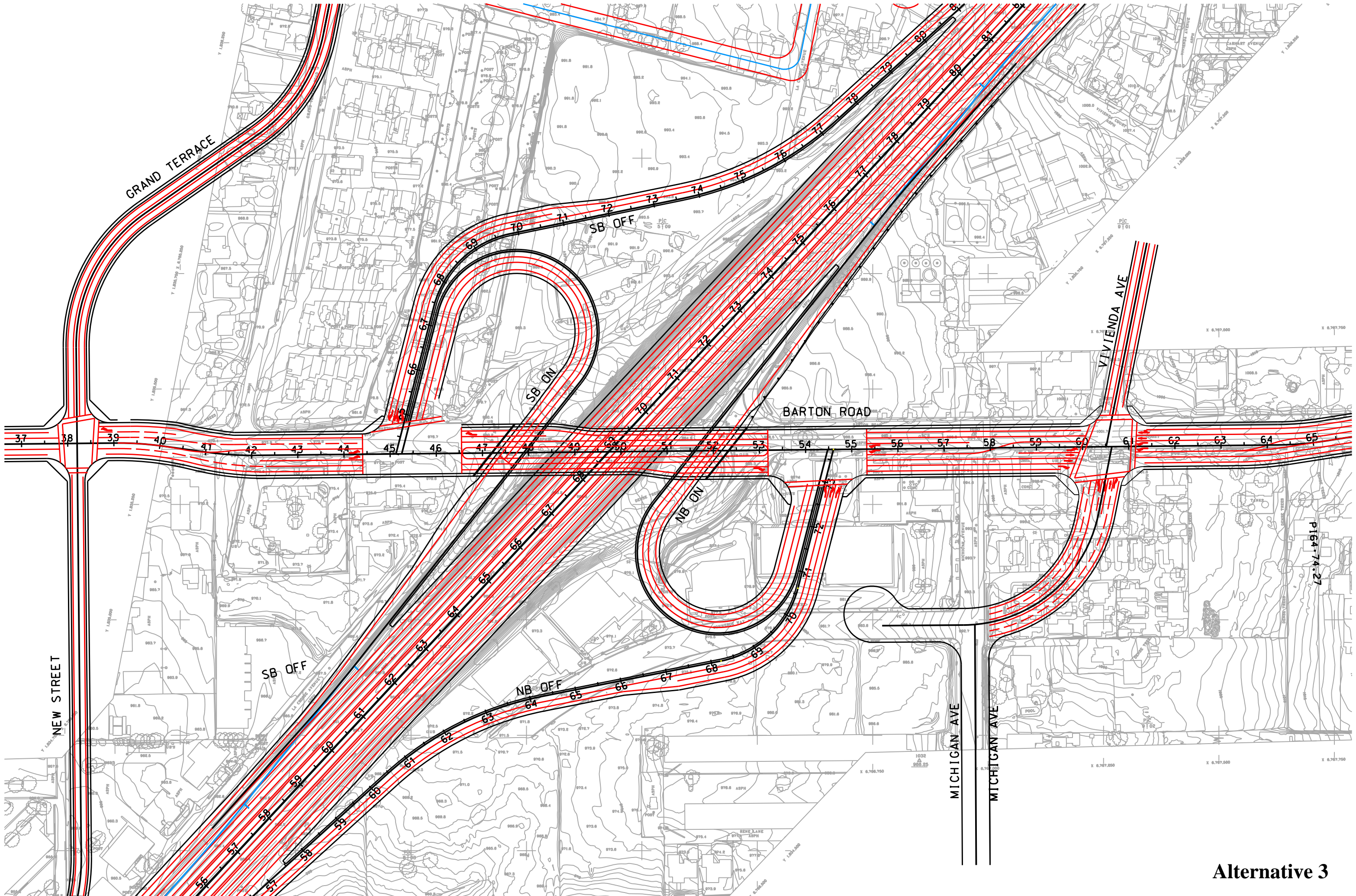
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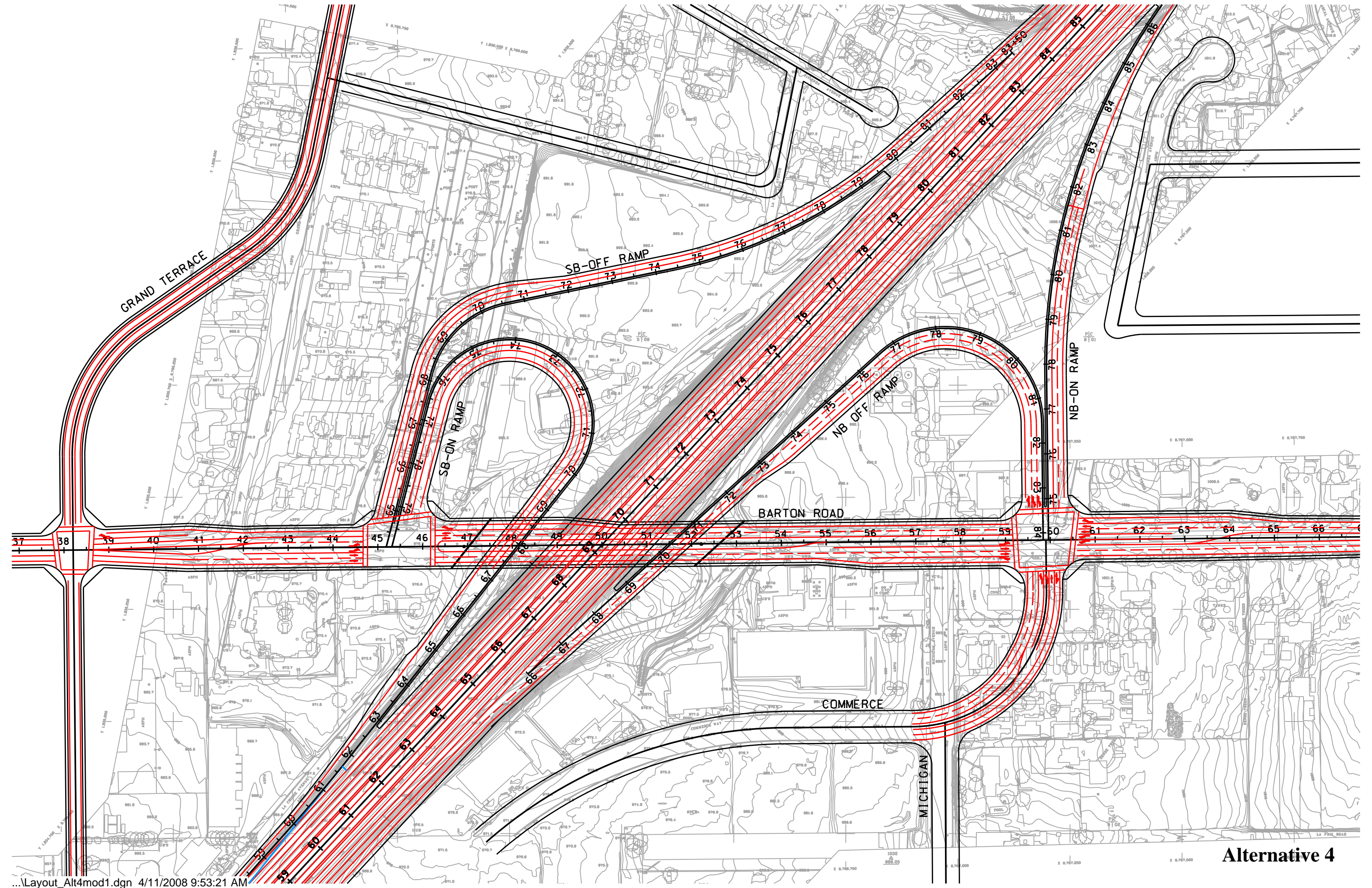
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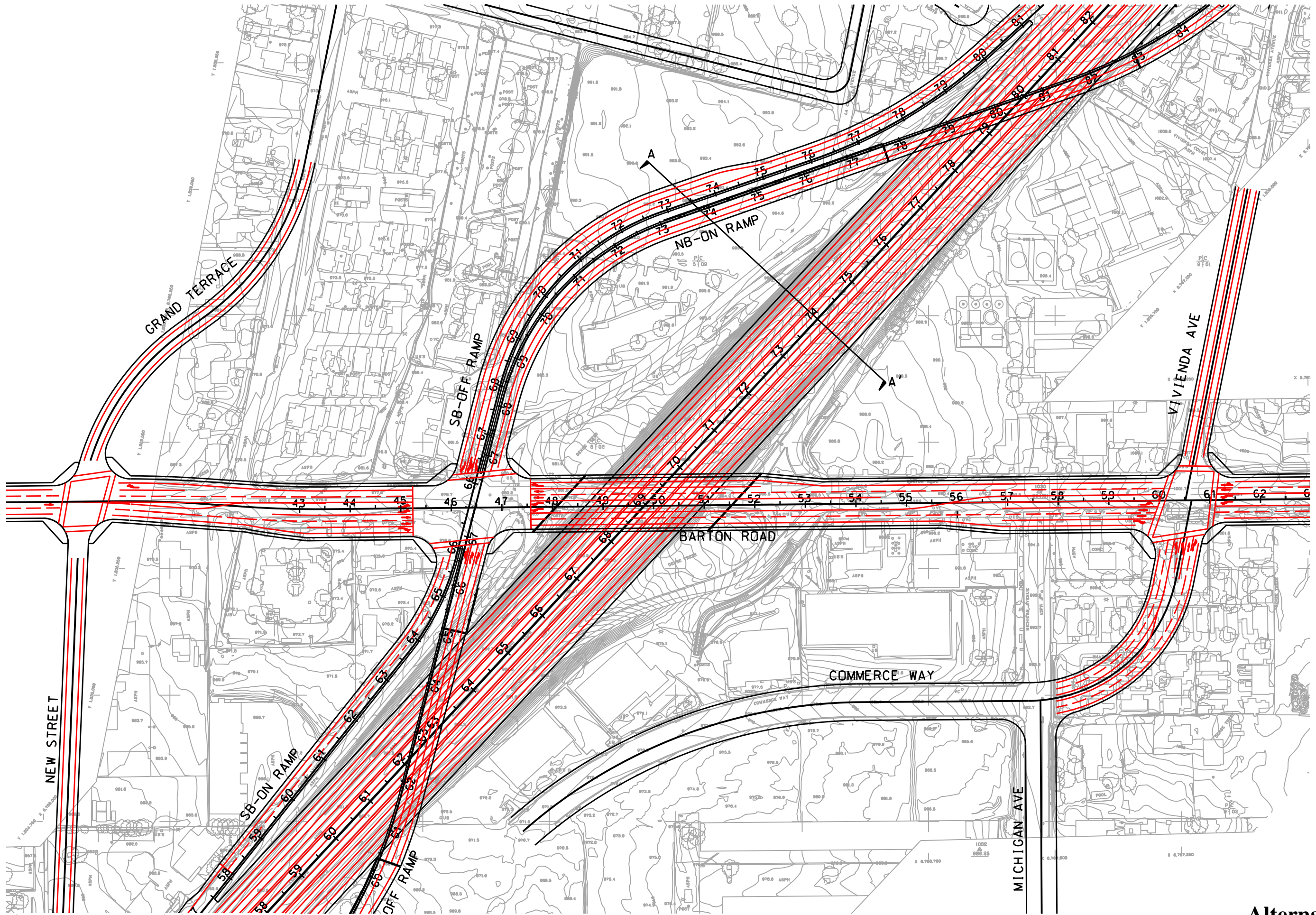
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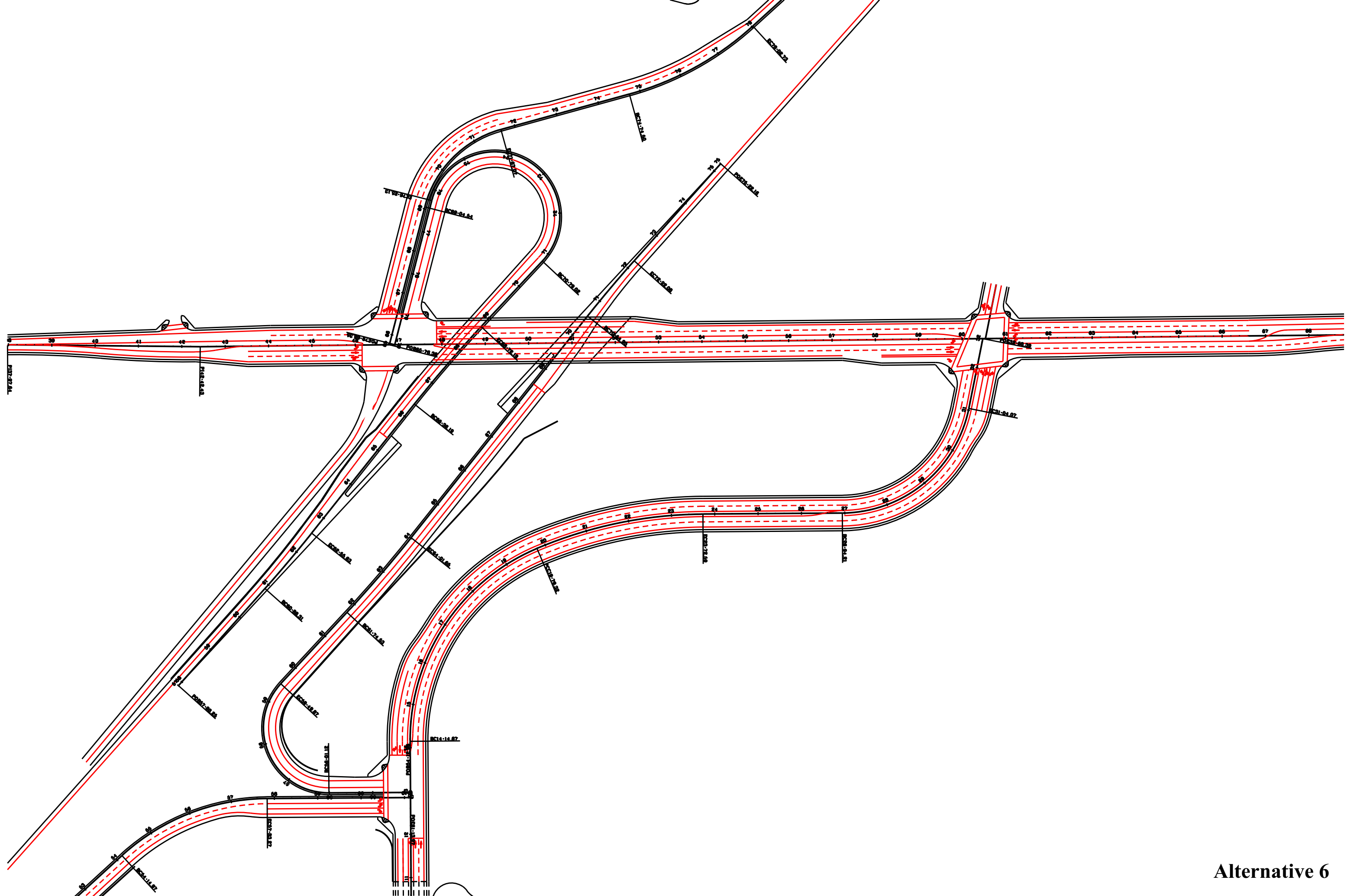
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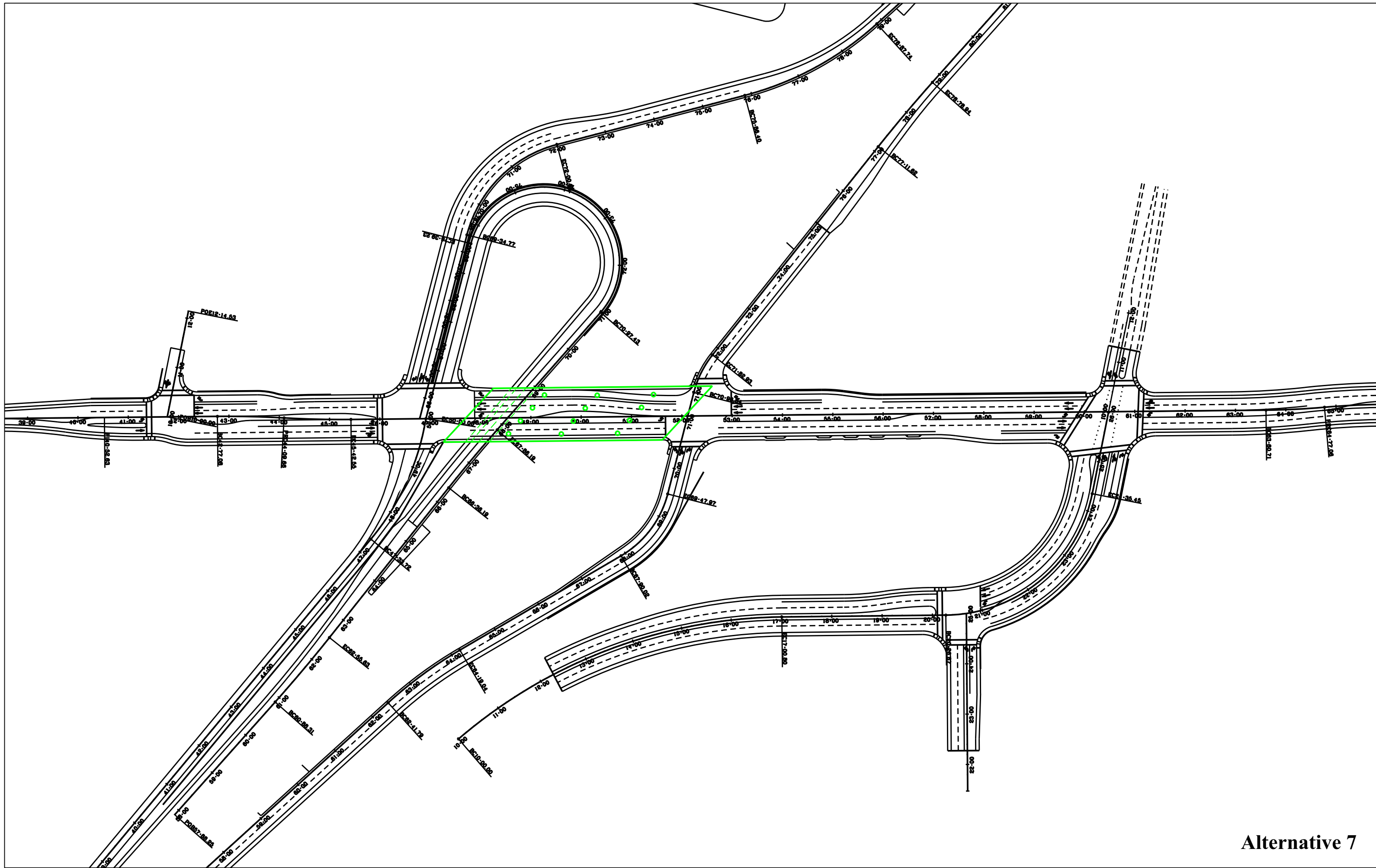


Alternative 4





Alternative 6



Alternative 7

APPENDIX B
Year 2009 Traffic Counts

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City of Grand Terrace
 N/S: La Cadena Drive
 E/W: Barton Road
 Weather: Sunny

File Name : GTRCABAAM
 Site Code : 9054028
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
07:00 AM	42	85	127	20	73	93	124	9	133	353
07:15 AM	54	127	181	23	59	82	114	20	134	397
07:30 AM	56	163	219	11	33	44	99	19	118	381
07:45 AM	68	132	200	25	56	81	95	29	124	405
Total	220	507	727	79	221	300	432	77	509	1536
08:00 AM	42	83	125	18	55	73	83	15	98	296
08:15 AM	32	73	105	15	40	55	56	19	75	235
08:30 AM	30	77	107	14	25	39	65	26	91	237
08:45 AM	31	78	109	19	28	47	84	21	105	261
Total	135	311	446	66	148	214	288	81	369	1029
Grand Total	355	818	1173	145	369	514	720	158	878	2565
Apprch %	30.3	69.7		28.2	71.8		82	18		
Total %	13.8	31.9	45.7	5.7	14.4	20	28.1	6.2	34.2	

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	42	85	127	20	73	93	124	9	133	353
07:15 AM	54	127	181	23	59	82	114	20	134	397
07:30 AM	56	163	219	11	33	44	99	19	118	381
07:45 AM	68	132	200	25	56	81	95	29	124	405
Total Volume	220	507	727	79	221	300	432	77	509	1536
% App. Total	30.3	69.7		26.3	73.7		84.9	15.1		
PHF	.809	.778	.830	.790	.757	.806	.871	.664	.950	.948

City of Grand Terrace
 N/S: La Cadena Drive
 E/W: Barton Road
 Weather: Sunny

File Name : GTRCABAPM
 Site Code : 9054028
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
04:00 PM	64	96	160	31	50	81	102	25	127	368
04:15 PM	72	107	179	30	38	68	141	29	170	417
04:30 PM	59	136	195	35	39	74	154	34	188	457
04:45 PM	68	126	194	44	42	86	155	38	193	473
Total	263	465	728	140	169	309	552	126	678	1715
05:00 PM	71	143	214	32	45	77	180	29	209	500
05:15 PM	68	159	227	47	38	85	173	46	219	531
05:30 PM	65	102	167	51	47	98	157	39	196	461
05:45 PM	63	82	145	31	36	67	131	37	168	380
Total	267	486	753	161	166	327	641	151	792	1872
Grand Total	530	951	1481	301	335	636	1193	277	1470	3587
Apprch %	35.8	64.2		47.3	52.7		81.2	18.8		
Total %	14.8	26.5	41.3	8.4	9.3	17.7	33.3	7.7	41	

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	68	126	194	44	42	86	155	38	193	473
05:00 PM	71	143	214	32	45	77	180	29	209	500
05:15 PM	68	159	227	47	38	85	173	46	219	531
05:30 PM	65	102	167	51	47	98	157	39	196	461
Total Volume	272	530	802	174	172	346	665	152	817	1965
% App. Total	33.9	66.1		50.3	49.7		81.4	18.6		
PHF	.958	.833	.883	.853	.915	.883	.924	.826	.933	.925

City of Grand Terrace
 N/S: Grand Terrace Road
 E/W: Barton Road
 Weather: Overcast

File Name : GTRGTBAAM
 Site Code : 9054025
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
07:00 AM	2	1	3	111	2	113	3	50	53	169
07:15 AM	5	1	6	79	2	81	1	61	62	149
07:30 AM	4	0	4	66	0	66	1	74	75	145
07:45 AM	5	1	6	91	5	96	2	88	90	192
Total	16	3	19	347	9	356	7	273	280	655
08:00 AM	10	0	10	112	6	118	0	49	49	177
08:15 AM	11	2	13	75	5	80	0	59	59	152
08:30 AM	8	1	9	60	10	70	0	58	58	137
08:45 AM	8	0	8	54	2	56	3	55	58	122
Total	37	3	40	301	23	324	3	221	224	588
Grand Total	53	6	59	648	32	680	10	494	504	1243
Apprch %	89.8	10.2		95.3	4.7		2	98		
Total %	4.3	0.5	4.7	52.1	2.6	54.7	0.8	39.7	40.5	

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
07:30 AM	4	0	4	66	0	66	1	74	75	145
07:45 AM	5	1	6	91	5	96	2	88	90	192
08:00 AM	10	0	10	112	6	118	0	49	49	177
08:15 AM	11	2	13	75	5	80	0	59	59	152
Total Volume	30	3	33	344	16	360	3	270	273	666
% App. Total	90.9	9.1		95.6	4.4		1.1	98.9		
PHF	.682	.375	.635	.768	.667	.763	.375	.767	.758	.867

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

City of Grand Terrace
 N/S: Grand Terrace Road
 E/W: Barton Road
 Weather: Sunny

File Name : GTRGTBAPM
 Site Code : 9054025
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
04:00 PM	4	2	6	81	4	85	3	98	101	192
04:15 PM	7	5	12	70	6	76	3	99	102	190
04:30 PM	5	5	10	74	5	79	4	102	106	195
04:45 PM	4	1	5	74	11	85	3	106	109	199
Total	20	13	33	299	26	325	13	405	418	776
05:00 PM	6	2	8	72	7	79	2	121	123	210
05:15 PM	2	7	9	73	4	77	8	136	144	230
05:30 PM	8	6	14	86	7	93	8	139	147	254
05:45 PM	7	3	10	61	5	66	4	102	106	182
Total	23	18	41	292	23	315	22	498	520	876
Grand Total	43	31	74	591	49	640	35	903	938	1652
Apprch %	58.1	41.9		92.3	7.7		3.7	96.3		
Total %	2.6	1.9	4.5	35.8	3	38.7	2.1	54.7	56.8	

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	4	1	5	74	11	85	3	106	109	199
05:00 PM	6	2	8	72	7	79	2	121	123	210
05:15 PM	2	7	9	73	4	77	8	136	144	230
05:30 PM	8	6	14	86	7	93	8	139	147	254
Total Volume	20	16	36	305	29	334	21	502	523	893
% App. Total	55.6	44.4		91.3	8.7		4	96		
PHF	.625	.571	.643	.887	.659	.898	.656	.903	.889	.879

Counts Unlimited Inc.
 25286 Jaclyn Avenue
 Moreno Valley, CA 92557
 951-485-7934

City of Grand Terrace
 N/S: I-215 SB Ramps/La Crosse Av
 E/W: Barton Road
 Weather: Sunny

File Name : GTR215SBAAM
 Site Code : 9054022
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total					
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total						
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	33	2	6	17	58	65	5	97	0	167	0	0	0	0	0	0	0	0	2	2	0	45	3	3	51	278					
07:15 AM	48	1	6	22	77	90	3	69	0	162	0	0	0	0	0	1	0	0	3	4	1	50	6	1	58	301					
07:30 AM	63	1	5	16	85	109	3	51	0	163	0	0	0	0	0	1	0	0	4	5	3	69	16	1	89	342					
07:45 AM	46	2	8	23	79	105	4	86	1	196	0	0	0	0	0	1	0	1	5	7	2	97	7	1	107	389					
Total	190	6	25	78	299	369	15	303	1	688	0	0	0	0	0	3	0	1	14	18	6	261	32	6	305	1310					
08:00 AM	50	1	8	26	85	81	6	87	3	177	0	0	0	0	0	2	0	0	5	7	3	54	7	4	68	337					
08:15 AM	46	4	7	35	92	93	7	64	1	165	0	0	0	0	0	0	0	0	13	13	1	71	9	2	83	353					
08:30 AM	45	4	4	16	69	73	4	53	3	133	0	0	0	0	0	1	0	0	4	5	1	70	8	4	83	290					
08:45 AM	46	1	5	18	70	57	4	47	2	110	0	0	0	0	0	0	0	0	13	13	2	68	11	3	84	277					
Total	187	10	24	95	316	304	21	251	9	585	0	0	0	0	0	3	0	0	35	38	7	263	35	13	318	1257					
Grand Total	377	16	49	173	615	673	36	554	10	1273	0	0	0	0	0	6	0	1	49	56	13	524	67	19	623	2567					
Apprch %	61.3	2.6	8	28.1		52.9	2.8	43.5	0.8		0	0	0	0		10.7	0	1.8	87.5		2.1	84.1	10.8	3							
Total %	14.7	0.6	1.9	6.7	24	26.2	1.4	21.6	0.4	49.6	0	0	0	0	0	0.2	0	0	1.9	2.2	0.5	20.4	2.6	0.7	24.3						

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

07:30 AM	63	1	5	16	85	109	3	51	0	163	0	0	0	0	0	1	0	0	4	5	3	69	16	1	89	342
07:45 AM	46	2	8	23	79	105	4	86	1	196	0	0	0	0	0	1	0	1	5	7	2	97	7	1	107	389
08:00 AM	50	1	8	26	85	81	6	87	3	177	0	0	0	0	0	2	0	0	5	7	3	54	7	4	68	337
08:15 AM	46	4	7	35	92	93	7	64	1	165	0	0	0	0	0	0	0	0	13	13	1	71	9	2	83	353
Total Volume	205	8	28	100	341	388	20	288	5	701	0	0	0	0	0	4	0	1	27	32	9	291	39	8	347	1421
% App. Total	60.1	2.3	8.2	29.3		55.3	2.9	41.1	0.7		0	0	0	0		12.5	0	3.1	84.4		2.6	83.9	11.2	2.3		
PHF	.813	.500	.875	.714	.927	.890	.714	.828	.417	.894	.000	.000	.000	.000	.000	.500	.000	.250	.519	.615	.750	.750	.609	.500	.811	.913

City of Grand Terrace
 N/S: I-215 Southbound Ramos/La Crosse Av
 E/W: Barton Road
 Weather: Sunny

File Name : GTR215SBAPM
 Site Code : 9054022
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	82	3	3	27	115	59	5	62	4	130	0	0	0	0	0	0	0	0	13	13	1	111	15	1	128	386
04:15 PM	48	1	5	15	69	60	1	67	2	130	0	0	0	0	0	1	0	0	11	12	0	104	10	1	115	326
04:30 PM	43	0	5	14	62	79	5	68	4	156	0	0	0	0	0	1	0	0	10	11	1	114	10	0	125	354
04:45 PM	67	7	2	27	103	68	1	64	1	134	0	0	0	0	0	0	0	0	5	5	1	111	4	0	116	358
Total	240	11	15	83	349	266	12	261	11	550	0	0	0	0	0	2	0	0	39	41	3	440	39	2	484	1424
05:00 PM	64	0	1	17	82	60	1	59	1	121	0	0	0	0	0	1	0	0	30	31	0	144	20	1	165	399
05:15 PM	63	0	1	26	90	76	2	61	0	139	0	0	0	0	0	0	0	0	14	14	0	137	15	1	153	396
05:30 PM	72	1	0	21	94	94	1	69	4	168	0	0	0	0	0	0	0	0	12	12	2	135	25	0	162	436
05:45 PM	70	1	0	15	86	56	0	58	5	119	0	0	0	0	0	0	0	0	7	7	0	125	11	1	137	349
Total	269	2	2	79	352	286	4	247	10	547	0	0	0	0	0	1	0	0	63	64	2	541	71	3	617	1580
Grand Total	509	13	17	162	701	552	16	508	21	1097	0	0	0	0	0	3	0	0	102	105	5	981	110	5	1101	3004
Apprch %	72.6	1.9	2.4	23.1		50.3	1.5	46.3	1.9		0	0	0	0		2.9	0	0	97.1		0.5	89.1	10	0.5		
Total %	16.9	0.4	0.6	5.4	23.3	18.4	0.5	16.9	0.7	36.5	0	0	0	0	0	0.1	0	0	3.4	3.5	0.2	32.7	3.7	0.2	36.7	

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 04:45 PM

04:45 PM	67	7	2	27	103	68	1	64	1	134	0	0	0	0	0	0	0	0	5	5	1	111	4	0	116	358
05:00 PM	64	0	1	17	82	60	1	59	1	121	0	0	0	0	0	1	0	0	30	31	0	144	20	1	165	399
05:15 PM	63	0	1	26	90	76	2	61	0	139	0	0	0	0	0	0	0	0	14	14	0	137	15	1	153	396
05:30 PM	72	1	0	21	94	94	1	69	4	168	0	0	0	0	0	0	0	0	12	12	2	135	25	0	162	436
Total Volume	266	8	4	91	369	298	5	253	6	562	0	0	0	0	0	1	0	0	61	62	3	527	64	2	596	1589
% App. Total	72.1	2.2	1.1	24.7		53	0.9	45	1.1		0	0	0	0		1.6	0	0	98.4		0.5	88.4	10.7	0.3		
PHF	.924	.286	.500	.843	.896	.793	.625	.917	.375	.836	.000	.000	.000	.000	.000	.250	.000	.000	.508	.500	.375	.915	.640	.500	.903	.911

City of Grand Terrace
 N/S: I-215 Northbound Ramps
 E/W: Barton Road
 Weather: Sunny

File Name : GTR215NBAAM
 Site Code : 9054043
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Passenger Vehicles - Large 2 Axle Vehicles - 3 Axle Vehicles - 4+ Axle Trucks

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
07:00 AM	0	0	0	0	0	169	78	247	10	0	61	71	14	60	0	74	392
07:15 AM	0	0	0	0	0	142	78	220	12	0	74	86	11	92	0	103	409
07:30 AM	0	0	0	0	0	163	82	245	5	0	87	92	27	116	0	143	480
07:45 AM	0	0	0	0	0	171	78	249	17	0	72	89	23	111	0	134	472
Total	0	0	0	0	0	645	316	961	44	0	294	338	75	379	0	454	1753
08:00 AM	0	0	0	0	0	158	57	215	27	0	71	98	14	100	0	114	427
08:15 AM	0	0	0	0	0	144	69	213	12	0	61	73	28	82	0	110	396
08:30 AM	0	0	0	0	0	126	63	189	15	0	60	75	18	99	0	117	381
08:45 AM	0	0	0	0	0	104	63	167	8	1	59	68	17	96	0	113	348
Total	0	0	0	0	0	532	252	784	62	1	251	314	77	377	0	454	1552
Grand Total	0	0	0	0	0	1177	568	1745	106	1	545	652	152	756	0	908	3305
Apprch %	0	0	0	0	0	67.4	32.6		16.3	0.2	83.6		16.7	83.3	0		
Total %	0	0	0	0	0	35.6	17.2	52.8	3.2	0	16.5	19.7	4.6	22.9	0	27.5	
Passenger Vehicles	0	0	0	0	0	1151	547	1698	96	1	525	622	129	720	0	849	3169
% Passenger Vehicles	0	0	0	0	0	97.8	96.3	97.3	90.6	100	96.3	95.4	84.9	95.2	0	93.5	95.9
Large 2 Axle Vehicles	0	0	0	0	0	23	18	41	1	0	15	16	9	30	0	39	96
% Large 2 Axle Vehicles																	
3 Axle Vehicles	0	0	0	0	0	2	0	2	0	0	2	2	8	4	0	12	16
% 3 Axle Vehicles	0	0	0	0	0	0.2	0	0.1	0	0	0.4	0.3	5.3	0.5	0	1.3	0.5
4+ Axle Trucks	0	0	0	0	0	1	3	4	9	0	3	12	6	2	0	8	24
% 4+ Axle Trucks	0	0	0	0	0	0.1	0.5	0.2	8.5	0	0.6	1.8	3.9	0.3	0	0.9	0.7

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	0	0	0	0	142	78	220	12	0	74	86	11	92	0	103	409
07:30 AM	0	0	0	0	0	163	82	245	5	0	87	92	27	116	0	143	480
07:45 AM	0	0	0	0	0	171	78	249	17	0	72	89	23	111	0	134	472
08:00 AM	0	0	0	0	0	158	57	215	27	0	71	98	14	100	0	114	427
Total Volume	0	0	0	0	0	634	295	929	61	0	304	365	75	419	0	494	1788
% App. Total	0	0	0	0	0	68.2	31.8		16.7	0	83.3		15.2	84.8	0		
PHF	.000	.000	.000	.000	.000	.927	.899	.933	.565	.000	.874	.931	.694	.903	.000	.864	.931

City of Grand Terrace
N/S: I-215 Northbound Ramps
E/W: Barton Road
Weather: Sunny

File Name : GTR215NBAPM
Site Code : 9054043
Start Date : 2/26/2009
Page No : 1

Groups Printed- Passenger Vehicles - Large 2 Axle Vehicles - 3 Axle Vehicles - 4+ Axle Trucks

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
04:00 PM	0	0	0	0	0	119	75	194	6	0	90	96	31	160	0	191	481
04:15 PM	0	0	0	0	0	129	74	203	9	0	80	89	25	128	0	153	445
04:30 PM	0	0	0	0	0	139	50	189	10	0	87	97	22	138	0	160	446
04:45 PM	0	0	0	0	0	126	61	187	5	0	86	91	31	149	0	180	458
Total	0	0	0	0	0	513	260	773	30	0	343	373	109	575	0	684	1830
05:00 PM	0	0	0	0	0	115	75	190	7	0	98	105	52	156	0	208	503
05:15 PM	0	0	0	0	0	139	57	196	10	0	103	113	41	147	0	188	497
05:30 PM	0	0	0	0	0	151	58	209	7	0	98	105	31	185	0	216	530
05:45 PM	0	0	0	0	0	116	46	162	2	0	105	107	35	154	0	189	458
Total	0	0	0	0	0	521	236	757	26	0	404	430	159	642	0	801	1988
Grand Total	0	0	0	0	0	1034	496	1530	56	0	747	803	268	1217	0	1485	3818
Apprch %	0	0	0	0	0	67.6	32.4		7	0	93		18	82	0		
Total %	0	0	0	0	0	27.1	13	40.1	1.5	0	19.6	21	7	31.9	0	38.9	
Passenger Vehicles	0	0	0	0	0	1023	490	1513	47	0	737	784	243	1204	0	1447	3744
% Passenger Vehicles	0	0	0	0	0	98.9	98.8	98.9	83.9	0	98.7	97.6	90.7	98.9	0	97.4	98.1
Large 2 Axle Vehicles	0	0	0	0	0	7	3	10	3	0	9	12	4	12	0	16	38
% Large 2 Axle Vehicles																	
3 Axle Vehicles	0	0	0	0	0	3	2	5	2	0	1	3	2	1	0	3	11
% 3 Axle Vehicles	0	0	0	0	0	0.3	0.4	0.3	3.6	0	0.1	0.4	0.7	0.1	0	0.2	0.3
4+ Axle Trucks	0	0	0	0	0	1	1	2	4	0	0	4	19	0	0	19	25
% 4+ Axle Trucks	0	0	0	0	0	0.1	0.2	0.1	7.1	0	0	0.5	7.1	0	0	1.3	0.7

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	0	0	0	0	126	61	187	5	0	86	91	31	149	0	180	458
05:00 PM	0	0	0	0	0	115	75	190	7	0	98	105	52	156	0	208	503
05:15 PM	0	0	0	0	0	139	57	196	10	0	103	113	41	147	0	188	497
05:30 PM	0	0	0	0	0	151	58	209	7	0	98	105	31	185	0	216	530
Total Volume	0	0	0	0	0	531	251	782	29	0	385	414	155	637	0	792	1988
% App. Total	0	0	0	0	0	67.9	32.1		7	0	93		19.6	80.4	0		
PHF	.000	.000	.000	.000	.000	.879	.837	.935	.725	.000	.934	.916	.745	.861	.000	.917	.938

City of Grand Terrace
 N/S: Michigan Street
 E/W: Barton Road
 Weather: Sunny

File Name : GTRMIBAAM1
 Site Code : 9054131
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
07:00 AM	11	138	149	89	13	102	73	39	112	363
07:15 AM	6	126	132	82	13	95	105	44	149	376
07:30 AM	5	148	153	83	15	98	145	52	197	448
07:45 AM	11	178	189	54	10	64	122	30	152	405
Total	33	590	623	308	51	359	445	165	610	1592
08:00 AM	13	117	130	66	6	72	105	35	140	342
08:15 AM	18	128	146	59	12	71	121	19	140	357
08:30 AM	23	117	140	53	33	86	118	25	143	369
08:45 AM	27	124	151	41	50	91	114	34	148	390
Total	81	486	567	219	101	320	458	113	571	1458
Grand Total	114	1076	1190	527	152	679	903	278	1181	3050
Apprch %	9.6	90.4		77.6	22.4		76.5	23.5		
Total %	3.7	35.3	39	17.3	5	22.3	29.6	9.1	38.7	

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	11	138	149	89	13	102	73	39	112	363
07:15 AM	6	126	132	82	13	95	105	44	149	376
07:30 AM	5	148	153	83	15	98	145	52	197	448
07:45 AM	11	178	189	54	10	64	122	30	152	405
Total Volume	33	590	623	308	51	359	445	165	610	1592
% App. Total	5.3	94.7		85.8	14.2		73	27		
PHF	.750	.829	.824	.865	.850	.880	.767	.793	.774	.888

City of Grand Terrace
 N/S: Michigan Street
 E/W: Barton Road
 Weather: Sunny

File Name : GTRMIBAPM2
 Site Code : 9054131
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
04:00 PM	18	113	131	62	31	93	187	26	213	437
04:15 PM	28	106	134	52	30	82	157	23	180	396
04:30 PM	25	110	135	42	22	64	163	39	202	401
04:45 PM	18	113	131	38	17	55	155	39	194	380
Total	89	442	531	194	100	294	662	127	789	1614
05:00 PM	23	138	161	63	22	85	177	49	226	472
05:15 PM	19	123	142	35	29	64	171	62	233	439
05:30 PM	21	155	176	45	26	71	186	58	244	491
05:45 PM	22	106	128	32	27	59	162	49	211	398
Total	85	522	607	175	104	279	696	218	914	1800
Grand Total	174	964	1138	369	204	573	1358	345	1703	3414
Apprch %	15.3	84.7		64.4	35.6		79.7	20.3		
Total %	5.1	28.2	33.3	10.8	6	16.8	39.8	10.1	49.9	

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	23	138	161	63	22	85	177	49	226	472
05:15 PM	19	123	142	35	29	64	171	62	233	439
05:30 PM	21	155	176	45	26	71	186	58	244	491
05:45 PM	22	106	128	32	27	59	162	49	211	398
Total Volume	85	522	607	175	104	279	696	218	914	1800
% App. Total	14	86		62.7	37.3		76.1	23.9		
PHF	.924	.842	.862	.694	.897	.821	.935	.879	.936	.916

City of Grand Terrace
 N/S: Vivienda Avenue
 E/W: Barton Road
 Weather: Sunny

File Name : GTRVIBAAM
 Site Code : 9054135
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
07:00 AM	0	0	7	7	0	151	1	152	0	0	0	0	3	87	0	90	249
07:15 AM	0	0	11	11	1	121	4	126	0	0	0	0	3	110	2	115	252
07:30 AM	2	0	6	8	0	143	5	148	2	0	0	2	11	154	1	166	324
07:45 AM	1	0	10	11	0	178	5	183	0	0	1	1	10	131	0	141	336
Total	3	0	34	37	1	593	15	609	2	0	1	3	27	482	3	512	1161
08:00 AM	1	0	8	9	3	128	3	134	1	0	0	1	7	105	0	112	256
08:15 AM	1	0	13	14	2	130	16	148	2	0	0	2	24	104	1	129	293
08:30 AM	5	0	36	41	0	109	15	124	1	0	2	3	58	94	5	157	325
08:45 AM	4	0	33	37	2	105	14	121	1	0	0	1	73	96	3	172	331
Total	11	0	90	101	7	472	48	527	5	0	2	7	162	399	9	570	1205
Grand Total	14	0	124	138	8	1065	63	1136	7	0	3	10	189	881	12	1082	2366
Apprch %	10.1	0	89.9		0.7	93.8	5.5		70	0	30		17.5	81.4	1.1		
Total %	0.6	0	5.2	5.8	0.3	45	2.7	48	0.3	0	0.1	0.4	8	37.2	0.5	45.7	

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	1	0	10	11	0	178	5	183	0	0	1	1	10	131	0	141	336
08:00 AM	1	0	8	9	3	128	3	134	1	0	0	1	7	105	0	112	256
08:15 AM	1	0	13	14	2	130	16	148	2	0	0	2	24	104	1	129	293
08:30 AM	5	0	36	41	0	109	15	124	1	0	2	3	58	94	5	157	325
Total Volume	8	0	67	75	5	545	39	589	4	0	3	7	99	434	6	539	1210
% App. Total	10.7	0	89.3		0.8	92.5	6.6		57.1	0	42.9		18.4	80.5	1.1		
PHF	.400	.000	.465	.457	.417	.765	.609	.805	.500	.000	.375	.583	.427	.828	.300	.858	.900

City of Grand Terrace
 N/S: Vivienda Avenue
 E/W: Barton Road
 Weather: Sunny

File Name : GTRVIBAPM
 Site Code : 9054135
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
04:00 PM	2	0	11	13	3	128	2	133	3	0	2	5	10	198	6	214	365
04:15 PM	2	0	22	24	3	131	10	144	0	0	9	9	23	165	3	191	368
04:30 PM	2	0	14	16	2	137	2	141	1	0	2	3	14	179	2	195	355
04:45 PM	2	0	15	17	4	145	5	154	1	0	5	6	6	185	3	194	371
Total	8	0	62	70	12	541	19	572	5	0	18	23	53	727	14	794	1459
05:00 PM	0	0	8	8	1	142	4	147	2	0	1	3	8	196	3	207	365
05:15 PM	1	0	6	7	0	156	5	161	0	0	2	2	9	209	3	221	391
05:30 PM	2	0	5	7	0	171	5	176	0	0	4	4	7	229	1	237	424
05:45 PM	0	1	4	5	1	123	1	125	2	0	1	3	9	205	1	215	348
Total	3	1	23	27	2	592	15	609	4	0	8	12	33	839	8	880	1528
Grand Total	11	1	85	97	14	1133	34	1181	9	0	26	35	86	1566	22	1674	2987
Apprch %	11.3	1	87.6		1.2	95.9	2.9		25.7	0	74.3		5.1	93.5	1.3		
Total %	0.4	0	2.8	3.2	0.5	37.9	1.1	39.5	0.3	0	0.9	1.2	2.9	52.4	0.7	56	

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	2	0	15	17	4	145	5	154	1	0	5	6	6	185	3	194	371
05:00 PM	0	0	8	8	1	142	4	147	2	0	1	3	8	196	3	207	365
05:15 PM	1	0	6	7	0	156	5	161	0	0	2	2	9	209	3	221	391
05:30 PM	2	0	5	7	0	171	5	176	0	0	4	4	7	229	1	237	424
Total Volume	5	0	34	39	5	614	19	638	3	0	12	15	30	819	10	859	1551
% App. Total	12.8	0	87.2		0.8	96.2	3		20	0	80		3.5	95.3	1.2		
PHF	.625	.000	.567	.574	.313	.898	.950	.906	.375	.000	.600	.625	.833	.894	.833	.906	.915

APPENDIX C
Volume Development
Calculation Worksheets

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2040 Volume Development

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INTERSECTION	AM EXISTING VEHICLE TURNING MOVEMENT COUNTS											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	432	77	0	0	0	220	507	0	79	0	221
2. Barton Rd & Grand Terrace Rd	0	0	0	3	270	0	30	0	3	0	344	16
3. Barton Rd & La Crosse Ave	4	0	28	0	339	8	0	28	100	20	288	0
4. Barton Rd & I-215 SB Ramps	0	0	0	9	292	66	205	8	0	388	308	5
5. Barton Rd & I-215 NB Ramps	61	0	304	75	419	0	0	0	0	0	634	295
6. Barton Rd & Michigan St	308	0	51	0	445	165	0	0	0	33	590	0
7. Barton Rd & Vivienda Ave	4	0	3	99	434	6	8	0	67	5	545	39

INTERSECTION	PM EXISTING VEHICLE TURNING MOVEMENT COUNTS											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	665	152	0	0	0	272	530	0	174	0	172
2. Barton Rd & Grand Terrace Rd	0	0	0	21	502	0	20	0	16	0	305	29
3. Barton Rd & La Crosse Ave	1	0	61	0	594	2	0	4	91	5	253	0
4. Barton Rd & I-215 SB Ramps	0	0	0	3	527	125	266	8	0	298	258	6
5. Barton Rd & I-215 NB Ramps	29	0	385	155	637	0	0	0	0	0	531	251
6. Barton Rd & Michigan St	175	0	104	0	696	218	0	0	0	85	522	0
7. Barton Rd & Vivienda Ave	3	0	12	30	819	10	5	0	34	5	614	19

INTERSECTION	AM EXISTING VEHICLE TURNING MOVEMENT - Adjustments											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave												
4. Barton Rd & I-215 SB Ramps					-1	1						
5. Barton Rd & I-215 NB Ramps					2						6	
6. Barton Rd & Michigan St					115						37	
7. Barton Rd & Vivienda Ave	-4		-3		78	-6				-5	48	

INTERSECTION	PM EXISTING VEHICLE TURNING MOVEMENT - Adjustments											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave											113	
4. Barton Rd & I-215 SB Ramps											113	
5. Barton Rd & I-215 NB Ramps	25		-91	-31	32						90	33
6. Barton Rd & Michigan St					49						208	
7. Barton Rd & Vivienda Ave	-3		-12			-10				-5	167	

INTERSECTION	AM EXISTING VEHICLE TURNING MOVEMENT - BALANCED											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	432	77	0	0	0	220	507	0	79	0	221
2. Barton Rd & Grand Terrace Rd	0	0	0	3	270	0	30	0	3	0	344	16
3. Barton Rd & La Crosse Ave	4	0	28	0	339	8	0	28	100	20	288	0
4. Barton Rd & I-215 SB Ramps	0	0	0	9	291	67	205	8	0	388	308	5
5. Barton Rd & I-215 NB Ramps	61	0	304	75	421	0	0	0	0	0	640	295
6. Barton Rd & Michigan St	308	0	51	0	560	165	0	0	0	33	627	0
7. Barton Rd & Vivienda Ave	0	0	0	99	512	0	8	0	67	0	593	39

INTERSECTION	PM EXISTING VEHICLE TURNING MOVEMENT - BALANCED											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	665	152	0	0	0	272	530	0	174	0	172
2. Barton Rd & Grand Terrace Rd	0	0	0	21	502	0	20	0	16	0	305	29
3. Barton Rd & La Crosse Ave	1	0	61	0	594	2	0	4	91	5	366	0
4. Barton Rd & I-215 SB Ramps	0	0	0	3	527	125	266	8	0	298	371	6
5. Barton Rd & I-215 NB Ramps	54	0	294	124	669	0	0	0	0	0	621	284
6. Barton Rd & Michigan St	175	0	104	0	745	218	0	0	0	85	730	0
7. Barton Rd & Vivienda Ave	0	0	0	30	819	0	5	0	34	0	781	19

INTERSECTION	AM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd	0	0	0	178	672	0	190	0	24	0	808	75
3. Barton Rd & La Crosse Ave	7	0	17	0	858	3	0	22	306	21	570	
4. Barton Rd & I-215 SB Ramps	0	0	0	2	754	119	382	0	0	907	591	11
5. Barton Rd & I-215 NB Ramps	132	0	574	227	909	0	0	0	0	0	1377	868
6. Barton Rd & Michigan St	896	0	183	0	1003	480	0	0	0	173	1350	0
7. Barton Rd & Vivienda Ave	0	0	0	155	1031	0	21	0	165	0	1358	65

INTERSECTION	PM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd	0	0	0	52	1420	0	38	0	3	0	1111	26
3. Barton Rd & La Crosse Ave	8	0	63	0	1455	3	0	6	360	7	769	
4. Barton Rd & I-215 SB Ramps	0	0	0	5	1255	258	523	0	0	615	776	10
5. Barton Rd & I-215 NB Ramps	34	0	901	267	1512	0	0	0	0	0	1367	655
6. Barton Rd & Michigan St	516	0	364	0	1796	616	0	0	0	259	1506	0
7. Barton Rd & Vivienda Ave	0	0	0	45	2115	0	3	0	33	0	1732	23

Volume same as Existing

INTERSECTION	AM Ait2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	0	754	119	382	22	306	907	591	0
5. Barton Rd & I-215 NB Ramps	132	0	574	227	909	0	0	0	0	0	1366	868
7. Barton Rd & Vivienda Ave/Michigan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM Ait2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	0	1255	258	523	6	360	615	776	0
5. Barton Rd & I-215 NB Ramps	34	0	901	267	1512	0	0	0	0	0	1357	655
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

INTERSECTION	AM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	119	754	0	382	0	306	0	591	907
5. Barton Rd & I-215 NB Ramps	132	0	574	0	909	227	0	0	0	868	1366	0
7. Barton Rd & Vivienda Ave/Michagan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	258	1255	0	523	0	360	0	776	615
5. Barton Rd & I-215 NB Ramps	34	0	901	0	1512	267	0	0	0	655	1357	0
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

INTERSECTION	AM A1t5 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 Ramps	132	0	574	227	527	119	382	22	306	907	459	868
7. Barton Rd & Vivienda Ave/Michigan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM A1t5 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 Ramps	34	0	901	267	988	258	523	6	360	615	742	655
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

INTERSECTION	AM Ait6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	119	754	0	382	0	306	0	591	907
5. Vivienda Ave & I-215 NB Ramps	348	1083		499		207		794	747			
7. Barton Rd & Vivienda Ave/Michagan	1028	41	513	155	482	499	21	33	132	1042	338	65

INTERSECTION	PM Ait6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	258	1255	0	523	0	360	0	776	615
5. Vivienda Ave & I-215 NB Ramps	168	905		700		235		809	754			
7. Barton Rd & Vivienda Ave	550	98	958	45	1085	649	3	7	26	914	814	23

INTERSECTION	AM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	119	754	0	382	0	306	0	591	907
5. Barton Rd & I-215 NB Ramps	132	0	574	227	909	0	0	0	0	0	1366	868
6. Commerce Way & Michigan Ave	270		809		274	163				490	196	
7. Barton Rd & Vivienda Ave/Michigan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	258	1255	0	523	0	360	0	776	615
5. Barton Rd & I-215 NB Ramps	34	0	901	267	1512	0	0	0	0	0	1357	655
7. Barton Rd & Vivienda Ave/Michigan	220		660		245	219				657	225	
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

2016 Volume Development

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INTERSECTION	AM Ait2 VEHICLE TURNING MOVEMENT Growth Rate Applied to Arterial Volumes											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave					435							
4. Barton Rd & I-215 SB Ramps					374							
5. Barton Rd & I-215 NB Ramps											814	
6. Barton Rd & Michigan St												
7. Barton Rd & Vivienda Ave												

INTERSECTION	PM Ait2 VEHICLE TURNING MOVEMENT Growth Rate Applied to Arterial Volumes											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave					763							
4. Barton Rd & I-215 SB Ramps					677							
5. Barton Rd & I-215 NB Ramps											797	
6. Barton Rd & Michigan St												
7. Barton Rd & Vivienda Ave												

INTERSECTION	AM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd	0	0	0	114	234	0	196	0	21	0	446	45
3. Barton Rd & La Crosse Ave	4	0	28	0	422	8	0	9	183	20	304	
4. Barton Rd & I-215 SB Ramps	0	0	0	2	374	74	229	0	0	564	324	11
5. Barton Rd & I-215 NB Ramps	74	0	368	113	490	0	0	0	0	0	825	431
6. Barton Rd & Michigan St	392	0	65	0	648	210	0	0	0	42	864	0
7. Barton Rd & Vivienda Ave	0	0	0	99	614	0	18	0	170	0	736	39

INTERSECTION	PM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd	0	0	0	35	766	0	39	0	6	0	625	22
3. Barton Rd & La Crosse Ave	1	0	61	0	803	2	0	4	204	5	443	
4. Barton Rd & I-215 SB Ramps	0	0	0	5	677	183	296	0	0	436	448	10
5. Barton Rd & I-215 NB Ramps	86	0	468	159	813	0	0	0	0	0	807	390
6. Barton Rd & Michigan St	270	0	161	0	944	337	0	0	0	131	927	0
7. Barton Rd & Vivienda Ave	0	0	0	30	1075	0	5	0	34	0	1024	19

INTERSECTION	AM Ait2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av	3	1	40	114	218	11	190	6	21	28	434	45
4. Barton Rd & I-215 SB Ramps	0	0	0	0	374	74	229	9	183	564	324	0
5. Barton Rd & I-215 NB Ramps	74	0	368	113	490	0	0	0	0	0	814	431
7. Barton Rd & Vivienda Ave/Michigan	392	13	52	99	549	210	18	34	136	42	717	39

INTERSECTION	PM Ait2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av	1	0	101	35	721	3	37	2	6	33	596	22
4. Barton Rd & I-215 SB Ramps	0	0	0	0	677	183	296	4	204	436	448	0
5. Barton Rd & I-215 NB Ramps	86	0	468	159	813	0	0	0	0	0	797	390
7. Barton Rd & Vivienda Ave/Michigan	270	32	129	30	914	337	5	7	27	131	890	19

INTERSECTION	AM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av	3	1	40	114	218	11	190	6	21	28	438	45
4. Barton Rd & I-215 SB Ramps	0	0	0	74	374	0	233	0	187	0	324	564
5. Barton Rd & I-215 NB Ramps	74	0	368	0	495	113	0	0	0	431	814	0
7. Barton Rd & Vivienda Ave/Michagan	392	13	52	99	554	210	18	34	136	42	717	39

INTERSECTION	PM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av	1	0	101	35	721	3	37	2	6	33	598	22
4. Barton Rd & I-215 SB Ramps	0	0	0	183	677	0	298	0	205	0	448	436
5. Barton Rd & I-215 NB Ramps	86	0	468	0	816	159	0	0	0	390	797	0
7. Barton Rd & Vivienda Ave	270	32	129	30	914	337	5	7	27	131	890	19

INTERSECTION	AM A15 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av	3	1	40	114	218	11	190	6	21	28	438	45
4. Barton Rd & I-215 Ramps	74	0	368	113	261	74	233		187	564	250	431
7. Barton Rd & Vivienda Ave	392	13	52	99	549	210	18	34	136	42	717	39

INTERSECTION	PM A15 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av	1	0	101	35	721	3	37	2	6	33	598	22
4. Barton Rd & I-215 Ramps	86	0	468	159	518	183	298		205	436	362	390
7. Barton Rd & Vivienda Ave	270	32	129	30	914	337	5	7	27	131	890	19

INTERSECTION	AM Ait6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd				114	230		196		21		440	46
4. Barton Rd & I-215 SB Ramps & La Crosse Av	4	20	20	54	354	17	233	9	187	28	295	564
5. Vivienda Ave & I-215 NB Ramps	136	457		341		101		287	408			
7. Barton Rd & Vivienda Ave/Michagan	466	13	319	99	287	221	18	34	136	473	286	39

INTERSECTION	PM Ait6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd				35	724		39		6		599	22
4. Barton Rd & I-215 SB Ramps & La Crosse Av	1	50	50	132	626	5	298	4	205	33	415	436
5. Vivienda Ave & I-215 NB Ramps	89	431		428		126		431	460			
7. Barton Rd & Vivienda Ave	356	32	470	30	573	370	5	7	27	521	500	19

INTERSECTION	AM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av				114	230		196		21		440	46
4. Barton Rd & I-215 SB Ramps	4	20	20	54	354	17	233	9	187	28	295	564
5. Barton Rd & I-215 NB Ramps	74	0	368	113	490	0	0	0	0	0	814	431
6. Commerce Way & Michigan Ave	114		343		114	63				189	97	
7. Barton Rd & Vivienda Ave/Michigan	392	13	52	99	549	210	18	34	136	42	717	39

INTERSECTION	PM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av				35	724		39		6		599	22
4. Barton Rd & I-215 SB Ramps	1	50	50	132	626	5	298	4	205	33	415	436
5. Barton Rd & I-215 NB Ramps	86	0	468	159	813	0	0	0	0	0	797	390
	108		323		108	117				351	124	
7. Barton Rd & Vivienda Ave/Michigan	270	32	129	30	914	337	5	7	27	131	890	19

APPENDIX D
Intersection LOS Calculation
And Queuing Analysis
Worksheets

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Existing Intersection LOS

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Barton Road Interchange Improvement Project
1: Barton Rd & La Cadena Dr

Existing
AM PEAK



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	79	221	432	77	220	507
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	233	455	81	232	534
RTOR Reduction (vph)	0	200	0	37	0	0
Lane Group Flow (vph)	83	33	455	44	232	534
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.5	9.5	41.7	41.7	16.8	62.5
Effective Green, g (s)	11.5	11.5	43.7	43.7	18.8	64.5
Actuated g/C Ratio	0.14	0.14	0.55	0.55	0.24	0.81
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	230	217	1843	824	376	2720
v/s Ratio Prot	c0.05		c0.13		c0.15	0.16
v/s Ratio Perm		0.02		0.03		
v/c Ratio	0.36	0.15	0.25	0.05	0.62	0.20
Uniform Delay, d1	30.9	30.0	9.5	8.5	27.4	1.8
Progression Factor	0.70	1.07	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.3	0.3	0.1	3.0	0.2
Delay (s)	22.6	32.4	9.8	8.6	30.4	1.9
Level of Service	C	C	A	A	C	A
Approach Delay (s)	29.8		9.7			10.6
Approach LOS	C		A			B

Intersection Summary

HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	39.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

Existing
AM PEAK



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↗	↘	
Volume (veh/h)	3	270	344	16	30	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	3	310	395	18	34	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.99				0.99	0.99
vC, conflicting volume	414				713	395
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	403				705	384
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	100				91	99
cM capacity (veh/h)	1118				390	646

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	314	395	18	38
Volume Left	3	0	0	34
Volume Right	0	0	18	3
cSH	1118	1700	1700	405
Volume to Capacity	0.00	0.23	0.01	0.09
Queue Length 95th (ft)	0	0	0	8
Control Delay (s)	0.1	0.0	0.0	14.8
Lane LOS	A			B
Approach Delay (s)	0.1	0.0		14.8
Approach LOS				B

Intersection Summary			
Average Delay		0.8	
Intersection Capacity Utilization		29.1%	ICU Level of Service A
Analysis Period (min)		15	

Barton Road Interchange Improvement Project
 3: Barton Rd & La Crosse Ave


















Existing
 AM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	339	8	20	288	0	4	0	28	0	28	100
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	373	9	22	316	0	4	0	31	0	31	110
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	316			381			863	737	377	768	742	316
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	222			381			812	676	377	710	681	222
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			98			98	100	95	100	91	85
cM capacity (veh/h)	1220			1150			211	335	659	298	333	746
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	381	338	35	141								
Volume Left	0	22	4	0								
Volume Right	9	0	31	110								
cSH	1700	1150	521	586								
Volume to Capacity	0.22	0.02	0.07	0.24								
Queue Length 95th (ft)	0	1	5	23								
Control Delay (s)	0.0	0.7	12.4	13.1								
Lane LOS		A	B	B								
Approach Delay (s)	0.0	0.7	12.4	13.1								
Approach LOS			B	B								
Intersection Summary												
Average Delay			2.8									
Intersection Capacity Utilization			48.1%		ICU Level of Service				A			
Analysis Period (min)			15									



















Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	291	67	388	308	5	0	0	0	205	8	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1598	1726		1598	1772						1694	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1598	1726		1598	1772						1694	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	10	320	74	426	338	5	0	0	0	225	9	0
RTOR Reduction (vph)	0	10	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	10	384	0	426	342	0	0	0	0	0	234	0
Turn Type	Prot			Prot						Split		
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	25.8		27.8	52.8						14.4	
Effective Green, g (s)	2.8	27.8		29.8	54.8						16.4	
Actuated g/C Ratio	0.03	0.35		0.37	0.68						0.20	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	56	600		595	1214						347	
v/s Ratio Prot	0.01	c0.22		c0.27	0.19						c0.14	
v/s Ratio Perm												
v/c Ratio	0.18	0.64		0.72	0.28						0.67	
Uniform Delay, d1	37.5	21.9		21.5	4.9						29.3	
Progression Factor	1.33	0.49		0.51	0.20						1.00	
Incremental Delay, d2	1.5	5.1		3.3	0.1						5.1	
Delay (s)	51.4	15.8		14.4	1.1						34.4	
Level of Service	D	B		B	A						C	
Approach Delay (s)		16.6			8.4			0.0			34.4	
Approach LOS		B			A			A			C	
Intersection Summary												
HCM Average Control Delay			15.1		HCM Level of Service						B	
HCM Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			64.1%		ICU Level of Service						C	
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

Existing
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	421	0	0	640	295	61	0	304	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1598	1776			1776	1509		1687	1509			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1598	1776			1776	1509		1687	1509			
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	81	453	0	0	688	317	66	0	327	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	128	0	0	253	0	0	0
Lane Group Flow (vph)	81	453	0	0	688	189	0	66	74	0	0	0
Turn Type	Prot				Perm		Split		Perm			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			8			
Actuated Green, G (s)	6.4	56.0			45.6	45.6		16.0	16.0			
Effective Green, g (s)	8.4	58.0			47.6	47.6		18.0	18.0			
Actuated g/C Ratio	0.11	0.72			0.60	0.60		0.22	0.22			
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	168	1288			1057	898		380	340			
v/s Ratio Prot	c0.05	0.26			c0.39			0.04				
v/s Ratio Perm						0.12			c0.05			
v/c Ratio	0.48	0.35			0.65	0.21		0.17	0.22			
Uniform Delay, d1	33.7	4.1			10.7	7.5		25.0	25.3			
Progression Factor	1.29	1.47			0.71	0.22		1.00	1.00			
Incremental Delay, d2	1.8	0.6			2.9	0.5		1.0	1.5			
Delay (s)	45.4	6.6			10.4	2.2		26.0	26.7			
Level of Service	D	A			B	A		C	C			
Approach Delay (s)		12.5			7.8			26.6			0.0	
Approach LOS		B			A			C			A	
Intersection Summary												
HCM Average Control Delay			12.9		HCM Level of Service					B		
HCM Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			55.4%		ICU Level of Service					B		
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

Existing
AM PEAK























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	↗
Volume (vph)	560	165	33	627	308	51
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3258		1598	3374	1598	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3258		1598	3374	1598	1509
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	636	188	38	712	350	58
RTOR Reduction (vph)	33	0	0	0	0	35
Lane Group Flow (vph)	791	0	38	712	350	23
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	33.8		4.2	42.0	30.0	30.0
Effective Green, g (s)	35.8		6.2	44.0	32.0	32.0
Actuated g/C Ratio	0.45		0.08	0.55	0.40	0.40
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1458		124	1856	639	604
v/s Ratio Prot	c0.24		0.02	c0.21	c0.22	
v/s Ratio Perm						0.02
v/c Ratio	0.54		0.31	0.38	0.55	0.04
Uniform Delay, d1	16.1		34.9	10.3	18.4	14.6
Progression Factor	0.45		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4		1.4	0.6	3.4	0.1
Delay (s)	8.6		36.3	10.9	21.8	14.7
Level of Service	A		D	B	C	B
Approach Delay (s)	8.6			12.2	20.8	
Approach LOS	A			B	C	

Intersection Summary

HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

Existing
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	99	512	0	0	593	39	0	0	0	8	0	67
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	110	569	0	0	659	43	0	0	0	9	0	74
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.93			0.93	0.93	0.93	0.93	0.93	0.93
vC, conflicting volume	702			569			1193	1491	284	1163	1448	329
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	702			378			1051	1372	71	1019	1326	329
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	87			100			100	100	100	94	100	89
cM capacity (veh/h)	858			1059			129	112	891	154	120	652
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	110	284	284	329	329	43	83					
Volume Left	110	0	0	0	0	0	9					
Volume Right	0	0	0	0	0	43	74					
cSH	858	1700	1700	1700	1700	1700	485					
Volume to Capacity	0.13	0.17	0.17	0.19	0.19	0.03	0.17					
Queue Length 95th (ft)	11	0	0	0	0	0	15					
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	0.0	14.0					
Lane LOS	A						B					
Approach Delay (s)	1.6			0.0			14.0					
Approach LOS							B					
Intersection Summary												
Average Delay			1.5									
Intersection Capacity Utilization			37.9%		ICU Level of Service			A				
Analysis Period (min)			15									

Barton Road Interchange Improvement Project
 1: Barton Rd & La Cadena Dr

Existing
 PM PEAK



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	174	172	665	152	272	530
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	187	185	715	163	292	570
RTOR Reduction (vph)	0	148	0	87	0	0
Lane Group Flow (vph)	187	37	715	76	292	570
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.9	13.9	35.5	35.5	18.6	58.1
Effective Green, g (s)	15.9	15.9	37.5	37.5	20.6	60.1
Actuated g/C Ratio	0.20	0.20	0.47	0.47	0.26	0.75
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	327	309	1627	728	423	2608
v/s Ratio Prot	c0.11		c0.21		c0.18	0.16
v/s Ratio Perm		0.02		0.05		
v/c Ratio	0.57	0.12	0.44	0.10	0.69	0.22
Uniform Delay, d1	29.0	26.3	14.2	11.9	26.8	3.0
Progression Factor	0.95	0.88	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.4	0.2	0.9	0.3	4.8	0.2
Delay (s)	29.8	23.3	15.1	12.2	31.6	3.2
Level of Service	C	C	B	B	C	A
Approach Delay (s)	26.6		14.5			12.8
Approach LOS	C		B			B

Intersection Summary

HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 2: Barton Rd & Grand Terrace Rd

Existing
 PM PEAK



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↗	↘	
Volume (veh/h)	21	502	305	29	20	16
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	24	570	347	33	23	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked						
vC, conflicting volume	380				965	347
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	380				965	347
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				92	97
cM capacity (veh/h)	1168				275	692

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	594	347	33	41
Volume Left	24	0	0	23
Volume Right	0	0	33	18
cSH	1168	1700	1700	375
Volume to Capacity	0.02	0.20	0.02	0.11
Queue Length 95th (ft)	2	0	0	9
Control Delay (s)	0.6	0.0	0.0	15.8
Lane LOS	A			C
Approach Delay (s)	0.6	0.0		15.8
Approach LOS				C

Intersection Summary			
Average Delay		1.0	
Intersection Capacity Utilization		55.9%	ICU Level of Service B
Analysis Period (min)		15	

Barton Road Interchange Improvement Project
 3: Barton Rd & La Crosse Ave


















Existing
 PM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗			↖			↕			↘	↙
Volume (veh/h)	0	594	2	5	366	0	1	0	61	0	4	91
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	653	2	5	402	0	1	0	67	0	4	100
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	402			655			1169	1067	654	1134	1068	402
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	284			655			1134	1021	654	1095	1022	284
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			99	100	86	100	98	85
cM capacity (veh/h)	1144			923			134	211	463	146	210	677
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	655	408	68	104								
Volume Left	0	5	1	0								
Volume Right	2	0	67	100								
cSH	1700	923	446	619								
Volume to Capacity	0.39	0.01	0.15	0.17								
Queue Length 95th (ft)	0	0	13	15								
Control Delay (s)	0.0	0.2	14.5	12.0								
Lane LOS		A	B	B								
Approach Delay (s)	0.0	0.2	14.5	12.0								
Approach LOS			B	B								
Intersection Summary												
Average Delay			1.9									
Intersection Capacity Utilization			46.0%		ICU Level of Service				A			
Analysis Period (min)			15									



















Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	527	125	298	371	6	0	0	0	266	8	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1774		1644	1822						1742	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1774		1644	1822						1742	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	3	579	137	327	408	7	0	0	0	292	9	0
RTOR Reduction (vph)	0	11	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	3	705	0	327	414	0	0	0	0	0	301	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	32.1		20.5	51.8						15.4	
Effective Green, g (s)	2.8	34.1		22.5	53.8						17.4	
Actuated g/C Ratio	0.03	0.43		0.28	0.67						0.22	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	58	756		462	1225						379	
v/s Ratio Prot	0.00	c0.40		c0.20	0.23						c0.17	
v/s Ratio Perm												
v/c Ratio	0.05	0.93		0.71	0.34						0.79	
Uniform Delay, d1	37.3	21.9		25.8	5.6						29.6	
Progression Factor	1.13	0.61		0.74	0.22						1.00	
Incremental Delay, d2	0.4	19.6		4.1	0.1						10.9	
Delay (s)	42.6	32.9		23.1	1.3						40.5	
Level of Service	D	C		C	A						D	
Approach Delay (s)		33.0			10.9			0.0			40.5	
Approach LOS		C			B			A			D	
Intersection Summary												
HCM Average Control Delay			25.0		HCM Level of Service						C	
HCM Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			78.3%		ICU Level of Service						D	
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

Existing
 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	669	0	0	621	284	54	0	294	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553			
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	132	712	0	0	661	302	57	0	313	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	131	0	0	236	0	0	0
Lane Group Flow (vph)	132	712	0	0	661	171	0	57	77	0	0	0
Turn Type	Prot						Perm	Split	Perm			
Protected Phases	5	2					6	8	8			
Permitted Phases							6			8		
Actuated Green, G (s)	8.8	56.0					43.2	43.2	16.0	16.0		
Effective Green, g (s)	10.8	58.0					45.2	45.2	18.0	18.0		
Actuated g/C Ratio	0.14	0.72					0.57	0.57	0.22	0.22		
Clearance Time (s)	4.0	4.0					4.0	4.0	4.0	4.0		
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	222	1325					1032	877	391	349		
v/s Ratio Prot	0.08	c0.39					c0.36			0.03		
v/s Ratio Perm							0.11		c0.05			
v/c Ratio	0.59	0.54					0.64	0.19	0.15	0.22		
Uniform Delay, d1	32.5	5.0					11.9	8.5	24.8	25.3		
Progression Factor	0.99	0.54					0.76	0.28	1.00	1.00		
Incremental Delay, d2	2.3	0.8					2.9	0.5	0.8	1.4		
Delay (s)	34.6	3.5					11.9	2.9	25.6	26.7		
Level of Service	C	A					B	A	C	C		
Approach Delay (s)	8.4						9.1	26.5		0.0		
Approach LOS	A						A	C		A		
Intersection Summary												
HCM Average Control Delay			11.8		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				4.0			
Intersection Capacity Utilization			60.1%		ICU Level of Service				B			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

Existing
PM PEAK




















Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Volume (vph)	745	218	85	730	175	104
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3353		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3353		1644	3471	1644	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	810	237	92	793	190	113
RTOR Reduction (vph)	32	0	0	0	0	83
Lane Group Flow (vph)	1015	0	92	793	190	30
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	41.0		8.0	53.0	19.0	19.0
Effective Green, g (s)	43.0		10.0	55.0	21.0	21.0
Actuated g/C Ratio	0.54		0.12	0.69	0.26	0.26
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1802		206	2386	432	408
v/s Ratio Prot	c0.30		c0.06	0.23	c0.12	
v/s Ratio Perm						0.02
v/c Ratio	0.56		0.45	0.33	0.44	0.07
Uniform Delay, d1	12.3		32.4	5.1	24.6	22.2
Progression Factor	0.46		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1		1.5	0.4	3.2	0.3
Delay (s)	6.8		34.0	5.4	27.8	22.5
Level of Service	A		C	A	C	C
Approach Delay (s)	6.8			8.4	25.8	
Approach LOS	A			A	C	

Intersection Summary

HCM Average Control Delay	10.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

Existing
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	819	0	0	781	19	0	0	0	5	0	34
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	890	0	0	849	21	0	0	0	5	0	37
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.83			0.83	0.83	0.83	0.83	0.83	0.83
vC, conflicting volume	870			890			1417	1825	445	1359	1804	424
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	870			463			1096	1587	0	1027	1562	424
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	100	96	100	94
cM capacity (veh/h)	758			898			124	84	896	149	87	573
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	33	445	445	424	424	21	42					
Volume Left	33	0	0	0	0	0	5					
Volume Right	0	0	0	0	0	21	37					
cSH	758	1700	1700	1700	1700	1700	420					
Volume to Capacity	0.04	0.26	0.26	0.25	0.25	0.01	0.10					
Queue Length 95th (ft)	3	0	0	0	0	0	8					
Control Delay (s)	10.0	0.0	0.0	0.0	0.0	0.0	14.5					
Lane LOS	A						B					
Approach Delay (s)	0.4			0.0			14.5					
Approach LOS							B					
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			36.3%		ICU Level of Service				A			
Analysis Period (min)			15									

2016 Intersection LOS















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2016 Alternative 1

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HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative1 AM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	252	0	78	0	0
Lane Group Flow (vph)	118	77	643	37	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.7	9.7	14.2	14.2	13.9	32.1
Effective Green, g (s)	11.7	11.7	16.2	16.2	15.9	34.1
Actuated g/C Ratio	0.23	0.23	0.33	0.33	0.32	0.68
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	375	355	1098	491	510	2310
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.05		0.02		
v/c Ratio	0.31	0.22	0.59	0.08	0.64	0.33
Uniform Delay, d1	15.7	15.4	14.0	11.6	14.5	3.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3	0.8	0.1	2.8	0.1
Delay (s)	16.2	15.7	14.8	11.7	17.3	3.3
Level of Service	B	B	B	B	B	A
Approach Delay (s)	15.8		14.3			7.5
Approach LOS	B		B			A
Intersection Summary						
HCM Average Control Delay			11.4		HCM Level of Service	B
HCM Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			49.8		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c	Critical Lane Group					

HCM Unsignalized Intersection Capacity Analysis

2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↕	↕	
Volume (veh/h)	114	234	446	45	196	21
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	120	246	469	47	206	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.99				0.99	0.99
vC, conflicting volume	517				956	469
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	508				951	460
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	88				16	96
cM capacity (veh/h)	1022				247	586

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	366	469	47	228
Volume Left	120	0	0	206
Volume Right	0	0	47	22
cSH	1022	1700	1700	262
Volume to Capacity	0.12	0.28	0.03	0.87
Queue Length 95th (ft)	10	0	0	185
Control Delay (s)	3.8	0.0	0.0	69.1
Lane LOS	A			F
Approach Delay (s)	3.8	0.0		69.1
Approach LOS				F

Intersection Summary			
Average Delay		15.4	
Intersection Capacity Utilization		67.2%	ICU Level of Service C
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
3: Barton Rd & La Crosse Ave

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	422	8	20	304	0	4	0	28	0	9	183
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	444	8	21	320	0	4	0	29	0	9	193
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	320			453			1008	811	448	840	815	320
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	228			453			970	757	448	789	762	228
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			98			97	100	95	100	97	74
cM capacity (veh/h)	1216			1082			150	301	600	263	299	741


















Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	453	341	34	202
Volume Left	0	21	4	0
Volume Right	8	0	29	193
cSH	1700	1082	437	693
Volume to Capacity	0.27	0.02	0.08	0.29
Queue Length 95th (ft)	0	1	6	30
Control Delay (s)	0.0	0.7	13.9	12.3
Lane LOS		A	B	B
Approach Delay (s)	0.0	0.7	13.9	12.3
Approach LOS			B	B

Intersection Summary			
Average Delay		3.1	
Intersection Capacity Utilization		53.3%	ICU Level of Service
Analysis Period (min)		15	A

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	374	74	564	324	11	0	0	0	229	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.98		1.00	0.99						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1598	1732		1598	1767						1687	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1598	1732		1598	1767						1687	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2	394	78	594	341	12	0	0	0	241	0	0
RTOR Reduction (vph)	0	8	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	464	0	594	352	0	0	0	0	0	241	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	26.7		32.5	58.4						14.8	
Effective Green, g (s)	2.8	28.7		34.5	60.4						16.8	
Actuated g/C Ratio	0.03	0.33		0.40	0.70						0.20	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	52	578		641	1241						330	
v/s Ratio Prot	0.00	c0.27		c0.37	0.20						c0.14	
v/s Ratio Perm												
v/c Ratio	0.04	0.80		0.93	0.28						0.73	
Uniform Delay, d1	40.3	26.1		24.5	4.8						32.5	
Progression Factor	1.00	1.00		0.56	0.39						1.00	
Incremental Delay, d2	0.3	11.2		14.1	0.1						8.1	
Delay (s)	40.6	37.3		27.7	1.9						40.5	
Level of Service	D	D		C	A						D	
Approach Delay (s)		37.3			18.1			0.0			40.5	
Approach LOS		D			B			A			D	
Intersection Summary												
HCM Average Control Delay				26.8	HCM Level of Service				C			
HCM Volume to Capacity ratio				0.83								
Actuated Cycle Length (s)				86.0	Sum of lost time (s)				6.0			
Intersection Capacity Utilization				80.6%	ICU Level of Service				D			
Analysis Period (min)				15								
c Critical Lane Group												

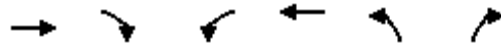
HCM Signalized Intersection Capacity Analysis
5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	490	0	0	825	431	74	0	368	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1598	1776			1776	1509		1687	1509			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1598	1776			1776	1509		1687	1509			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	516	0	0	868	454	78	0	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	174	0	0	306	0	0	0
Lane Group Flow (vph)	119	516	0	0	868	280	0	78	81	0	0	0
Turn Type	Prot				Perm		Split	Perm				
Protected Phases	5	2			6		8	8				
Permitted Phases					6				8			
Actuated Green, G (s)	7.0	62.0			51.0	51.0			16.0	16.0		
Effective Green, g (s)	9.0	64.0			53.0	53.0			18.0	18.0		
Actuated g/C Ratio	0.10	0.74			0.62	0.62			0.21	0.21		
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)	167	1322			1095	930			353	316		
v/s Ratio Prot	c0.07	0.29			c0.49				0.05			
v/s Ratio Perm					0.19				c0.05			
v/c Ratio	0.71	0.39			0.79	0.30			0.22	0.26		
Uniform Delay, d1	37.2	4.0			12.4	7.8			28.2	28.4		
Progression Factor	1.00	1.05			0.74	0.51			1.00	1.00		
Incremental Delay, d2	8.7	0.5			5.1	0.7			1.4	2.0		
Delay (s)	46.0	4.7			14.3	4.7			29.6	30.4		
Level of Service	D	A			B	A			C	C		
Approach Delay (s)	12.5				11.0				30.2		0.0	
Approach LOS	B				B				C		A	
Intersection Summary												
HCM Average Control Delay			15.1		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			86.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			65.9%		ICU Level of Service				C			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Barton Rd & Michigan St

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Volume (vph)	648	210	42	864	392	65
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3250		1598	3374	1598	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3250		1598	3374	1598	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	682	221	44	909	413	68
RTOR Reduction (vph)	34	0	0	0	0	40
Lane Group Flow (vph)	869	0	44	909	413	28
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	35.8		4.2	44.0	34.0	34.0
Effective Green, g (s)	37.8		6.2	46.0	36.0	36.0
Actuated g/C Ratio	0.44		0.07	0.53	0.42	0.42
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1428		115	1805	669	632
v/s Ratio Prot	c0.27		0.03	c0.27	c0.26	
v/s Ratio Perm						0.02
v/c Ratio	0.61		0.38	0.50	0.62	0.05
Uniform Delay, d1	18.4		38.1	12.7	19.6	14.8
Progression Factor	0.45		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7		2.1	1.0	4.2	0.1
Delay (s)	10.0		40.2	13.7	23.8	14.9
Level of Service	A		D	B	C	B
Approach Delay (s)	10.0			15.0	22.6	
Approach LOS	A			B	C	

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	99	614	0	0	736	39	0	0	0	18	0	170
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	104	646	0	0	775	41	0	0	0	19	0	179
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.87			0.87	0.87	0.87	0.87	0.87	0.87
vC, conflicting volume	816			646			1421	1671	323	1306	1629	387
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	816			299			1188	1475	0	1057	1427	387
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	87			100			100	100	100	86	100	70
cM capacity (veh/h)	776			1066			75	90	931	135	97	597
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	104	323	323	387	387	41	198					
Volume Left	104	0	0	0	0	0	19					
Volume Right	0	0	0	0	0	41	179					
cSH	776	1700	1700	1700	1700	1700	450					
Volume to Capacity	0.13	0.19	0.19	0.23	0.23	0.02	0.44					
Queue Length 95th (ft)	12	0	0	0	0	0	55					
Control Delay (s)	10.4	0.0	0.0	0.0	0.0	0.0	19.1					
Lane LOS	B						C					
Approach Delay (s)	1.4			0.0			19.1					
Approach LOS							C					
Intersection Summary												
Average Delay			2.8									
Intersection Capacity Utilization			49.4%		ICU Level of Service		A					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
 2016 Alternative1 AM PEAK

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	18	324	8	21	365	10	8	1	18	16	1	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	341	8	22	384	11	8	1	19	17	1	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539										
pX, platoon unblocked												
vC, conflicting volume	395			349			828	822	345	836	821	389
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	395			349			828	822	345	836	821	389
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			98			97	100	97	94	100	98
cM capacity (veh/h)	1137			1182			272	293	686	265	293	648

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	368	417	28	28
Volume Left	19	22	8	17
Volume Right	8	11	19	11
cSH	1137	1182	457	341
Volume to Capacity	0.02	0.02	0.06	0.08
Queue Length 95th (ft)	1	1	5	7
Control Delay (s)	0.6	0.6	13.4	16.5
Lane LOS	A	A	B	C
Approach Delay (s)	0.6	0.6	13.4	16.5
Approach LOS			B	C

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	183	0	166	0	0
Lane Group Flow (vph)	303	117	1158	99	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.2	15.2	25.7	25.7	21.0	50.7
Effective Green, g (s)	17.2	17.2	27.7	27.7	23.0	52.7
Actuated g/C Ratio	0.23	0.23	0.37	0.37	0.31	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	383	361	1301	582	512	2475
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.08		0.06		
v/c Ratio	0.79	0.33	0.89	0.17	0.93	0.37
Uniform Delay, d1	26.7	23.5	21.7	15.4	24.6	4.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.6	0.5	8.0	0.1	22.7	0.1
Delay (s)	37.3	24.1	29.6	15.6	47.4	4.2
Level of Service	D	C	C	B	D	A
Approach Delay (s)	30.7		27.0			18.9
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			24.3		HCM Level of Service	C
HCM Volume to Capacity ratio			0.86			
Actuated Cycle Length (s)			73.9		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

HCM Unsignalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↗	↘	
Volume (veh/h)	35	766	625	22	39	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	806	658	23	41	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.88				0.88	0.88
vC, conflicting volume	681				1538	658
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	574				1543	548
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				61	99
cM capacity (veh/h)	875				106	471

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	843	658	23	47
Volume Left	37	0	0	41
Volume Right	0	0	23	6
cSH	875	1700	1700	118
Volume to Capacity	0.04	0.39	0.01	0.40
Queue Length 95th (ft)	3	0	0	42
Control Delay (s)	1.1	0.0	0.0	54.4
Lane LOS	A			F
Approach Delay (s)	1.1	0.0		54.4
Approach LOS				F

Intersection Summary			
Average Delay		2.2	
Intersection Capacity Utilization		82.6%	ICU Level of Service E
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
3: Barton Rd & La Crosse Ave

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	803	2	5	443	0	1	0	61	0	4	204
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	845	2	5	466	0	1	0	64	0	4	215
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.87						0.87	0.87		0.87	0.87	0.87
vC, conflicting volume	466			847			1540	1323	846	1387	1324	466
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	308			847			1546	1296	846	1370	1297	308
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			98	100	82	100	97	66
cM capacity (veh/h)	1076			781			51	138	359	87	138	631
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	847	472	65	219								
Volume Left	0	5	1	0								
Volume Right	2	0	64	215								
cSH	1700	781	327	590								
Volume to Capacity	0.50	0.01	0.20	0.37								
Queue Length 95th (ft)	0	1	18	43								
Control Delay (s)	0.0	0.2	18.7	14.7								
Lane LOS		A	C	B								
Approach Delay (s)	0.0	0.2	18.7	14.7								
Approach LOS			C	B								
Intersection Summary												
Average Delay			2.8									
Intersection Capacity Utilization			65.0%		ICU Level of Service				C			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
 4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
 2016 Alternative1 PM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗						↖	
Volume (vph)	5	677	183	436	448	10	0	0	0	296	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1769		1644	1821						1736	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1769		1644	1821						1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	713	193	459	472	11	0	0	0	312	0	0
RTOR Reduction (vph)	0	13	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	5	893	0	459	482	0	0	0	0	0	312	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	2.4	27.0		24.2	48.8						16.8	
Effective Green, g (s)	4.4	29.0		26.2	50.8						18.8	
Actuated g/C Ratio	0.06	0.36		0.33	0.63						0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	90	641		538	1156						408	
v/s Ratio Prot	0.00	c0.51		c0.28	0.26						c0.18	
v/s Ratio Perm												
v/c Ratio	0.06	1.39		0.85	0.42						0.76	
Uniform Delay, d1	35.8	25.5		25.1	7.2						28.5	
Progression Factor	1.00	1.00		0.55	0.55						1.00	
Incremental Delay, d2	0.3	186.5		4.6	0.1						8.3	
Delay (s)	36.1	212.0		18.4	4.1						36.8	
Level of Service	D	F		B	A						D	
Approach Delay (s)		211.1			11.0			0.0			36.8	
Approach LOS		F			B			A			D	

Intersection Summary

HCM Average Control Delay	98.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	159	813	0	0	807	390	86	0	468	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	167	856	0	0	849	411	91	0	493	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	226	0	0	109	0	0	0
Lane Group Flow (vph)	167	856	0	0	849	185	0	91	384	0	0	0
Turn Type	Prot				Perm		Split	Perm				
Protected Phases	5	2			6		8	8				
Permitted Phases					6				8			
Actuated Green, G (s)	8.0	46.0			34.0	34.0			26.0	26.0		
Effective Green, g (s)	10.0	48.0			36.0	36.0			28.0	28.0		
Actuated g/C Ratio	0.12	0.60			0.45	0.45			0.35	0.35		
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)	206	1096			822	699			608	544		
v/s Ratio Prot	0.10	c0.47			c0.46				0.05			
v/s Ratio Perm							0.12			c0.25		
v/c Ratio	0.81	0.78			1.03	0.26			0.15	0.71		
Uniform Delay, d1	34.1	12.0			22.0	13.7			17.8	22.5		
Progression Factor	0.91	0.69			0.92	0.29			1.00	1.00		
Incremental Delay, d2	2.3	0.5			38.6	0.8			0.5	7.5		
Delay (s)	33.2	8.8			58.7	4.9			18.4	30.0		
Level of Service	C	A			E	A			B	C		
Approach Delay (s)	12.8				41.2				28.2		0.0	
Approach LOS	B				D				C		A	
Intersection Summary												
HCM Average Control Delay			28.4		HCM Level of Service				C			
HCM Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				4.0			
Intersection Capacity Utilization			78.4%		ICU Level of Service				D			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Barton Rd & Michigan St

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↗
Volume (vph)	944	337	131	927	270	161
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3334		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3334		1644	3471	1644	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	994	355	138	976	284	169
RTOR Reduction (vph)	45	0	0	0	0	123
Lane Group Flow (vph)	1304	0	138	976	284	46
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	39.0		9.0	52.0	20.0	20.0
Effective Green, g (s)	41.0		11.0	54.0	22.0	22.0
Actuated g/C Ratio	0.51		0.14	0.68	0.28	0.28
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1709		226	2343	452	427
v/s Ratio Prot	c0.39		c0.08	0.28	c0.17	
v/s Ratio Perm						0.03
v/c Ratio	0.76		0.61	0.42	0.63	0.11
Uniform Delay, d1	15.6		32.5	5.9	25.4	21.7
Progression Factor	1.10		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0		4.8	0.5	6.5	0.5
Delay (s)	19.2		37.3	6.4	31.9	22.2
Level of Service	B		D	A	C	C
Approach Delay (s)	19.2			10.2	28.3	
Approach LOS	B			B	C	
Intersection Summary						
HCM Average Control Delay			17.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.69			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			70.3%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑			↑↑	↗					↕	
Volume (veh/h)	30	1075	0	0	1024	19	0	0	0	5	0	34
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	32	1132	0	0	1078	20	0	0	0	5	0	36
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.72			0.72	0.72	0.72	0.72	0.72	
vC, conflicting volume	1098			1132			1769	2293	566	1707	2273	539
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1098			398			1287	2015	0	1199	1987	539
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			100			100	100	100	94	100	93
cM capacity (veh/h)	620			821			76	39	774	96	40	482

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	32	566	566	539	539	20	41
Volume Left	32	0	0	0	0	0	5
Volume Right	0	0	0	0	0	20	36
cSH	620	1700	1700	1700	1700	1700	317
Volume to Capacity	0.05	0.33	0.33	0.32	0.32	0.01	0.13
Queue Length 95th (ft)	4	0	0	0	0	0	11
Control Delay (s)	11.1	0.0	0.0	0.0	0.0	0.0	18.0
Lane LOS	B						C
Approach Delay (s)	0.3			0.0			18.0
Approach LOS							C

Intersection Summary		
Average Delay		0.5
Intersection Capacity Utilization	41.4%	ICU Level of Service
Analysis Period (min)		15
		A

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	4	419	3	10	411	1	10	0	10	13	3	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	441	3	11	433	1	11	0	11	14	3	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539										
pX, platoon unblocked												
vC, conflicting volume	434			444			917	906	443	916	907	433
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434			444			917	906	443	916	907	433
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			96	100	98	94	99	98
cM capacity (veh/h)	1115			1105			242	270	611	244	270	618

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	448	444	21	27
Volume Left	4	11	11	14
Volume Right	3	1	11	11
cSH	1115	1105	346	323
Volume to Capacity	0.00	0.01	0.06	0.08
Queue Length 95th (ft)	0	1	5	7
Control Delay (s)	0.1	0.3	16.1	17.2
Lane LOS	A	A	C	C
Approach Delay (s)	0.1	0.3	16.1	17.2
Approach LOS			C	C















Intersection Summary			
Average Delay		1.1	
Intersection Capacity Utilization		39.6%	ICU Level of Service
Analysis Period (min)		15	A

2016 Alternative 2

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative2
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	74	0	0
Lane Group Flow (vph)	118	64	643	41	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.3	9.3	18.7	18.7	18.0	40.7
Effective Green, g (s)	11.3	11.3	20.7	20.7	20.0	42.7
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.34	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	311	294	1204	539	551	2484
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.53	0.08	0.59	0.30
Uniform Delay, d1	20.3	19.6	14.8	12.3	15.7	2.6
Progression Factor	0.45	1.22	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.4	1.7	0.3	4.7	0.3
Delay (s)	10.0	24.4	16.5	12.6	20.3	2.9
Level of Service	A	C	B	B	C	A
Approach Delay (s)	20.6		15.9			8.2
Approach LOS	C		B			A
Intersection Summary						
HCM Average Control Delay			13.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative2
AM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	434	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.74			0.93	1.00		0.98			0.78	
Satd. Flow (perm)		2474			3125	1509		1532			1358	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	457	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	3	0	0	0	17	0	30	0	0	9	0
Lane Group Flow (vph)	0	358	0	0	486	30	0	16	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		34.9			34.9	34.9		15.1			15.1	
Effective Green, g (s)		36.9			36.9	36.9		17.1			17.1	
Actuated g/C Ratio		0.64			0.64	0.64		0.29			0.29	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1574			1988	960		452			400	
v/s Ratio Prot												
v/s Ratio Perm		0.14			0.16	0.02		0.01			0.16	
v/c Ratio		0.23			0.24	0.03		0.04			0.55	
Uniform Delay, d1		4.5			4.5	3.9		14.6			17.2	
Progression Factor		0.60			1.28	1.54		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		3.0			6.1	6.1		14.6			18.7	
Level of Service		A			A	A		B			B	
Approach Delay (s)		3.0			6.1	6.1		14.6			18.7	
Approach LOS		A			A	A		B			B	

Intersection Summary

HCM Average Control Delay	7.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			




















Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative2
 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↘↗	↑↑					↘	↖	↗
Volume (vph)	0	374	74	564	324	0	0	0	0	229	9	183
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (prot)		3374	1509	3100	3374					1518	1612	1509
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (perm)		3374	1509	3100	3374					1518	1612	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	394	78	594	341	0	0	0	0	241	9	193
RTOR Reduction (vph)	0	0	54	0	0	0	0	0	0	0	0	133
Lane Group Flow (vph)	0	394	24	594	341	0	0	0	0	125	125	60
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		16.0	16.0	14.0	34.0					16.0	16.0	16.0
Effective Green, g (s)		18.0	18.0	16.0	36.0					18.0	18.0	18.0
Actuated g/C Ratio		0.31	0.31	0.28	0.62					0.31	0.31	0.31
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1047	468	855	2094					471	500	468
v/s Ratio Prot		c0.12		c0.19	0.10					c0.08	0.08	
v/s Ratio Perm			0.02									0.04
v/c Ratio		0.38	0.05	0.69	0.16					0.27	0.25	0.13
Uniform Delay, d1		15.6	14.0	18.8	4.6					15.0	15.0	14.4
Progression Factor		0.92	1.23	0.51	0.21					1.00	1.00	1.00
Incremental Delay, d2		1.0	0.2	2.3	0.2					0.3	0.3	0.1
Delay (s)		15.3	17.5	11.9	1.1					15.3	15.2	14.5
Level of Service		B	B	B	A					B	B	B
Approach Delay (s)		15.7			8.0			0.0			14.9	
Approach LOS		B			A			A			B	
Intersection Summary												
HCM Average Control Delay			11.6		HCM Level of Service					B		
HCM Volume to Capacity ratio			0.42									
Actuated Cycle Length (s)			58.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			50.1%		ICU Level of Service					A		
Analysis Period (min)			15									
c Critical Lane Group												























Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2016 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	490	0	0	814	431	74	0	368	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3100	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3100	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	516	0	0	857	454	78	0	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	189	0	159	158	0	0	0
Lane Group Flow (vph)	119	516	0	0	857	265	78	35	35	0	0	0
Turn Type	Prot				Perm		Prot	Perm				
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	5.6	41.4			31.8	31.8	8.6	8.6	8.6			
Effective Green, g (s)	7.6	43.4			33.8	33.8	10.6	10.6	10.6			
Actuated g/C Ratio	0.13	0.75			0.58	0.58	0.18	0.18	0.18			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	406	2525			1966	879	292	262	248			
v/s Ratio Prot	c0.04	0.15			c0.25		c0.05	0.02				
v/s Ratio Perm						0.18			0.03			
v/c Ratio	0.29	0.20			0.44	0.30	0.27	0.14	0.14			
Uniform Delay, d1	22.8	2.2			6.8	6.1	20.4	19.9	19.9			
Progression Factor	0.39	0.07			0.39	0.92	1.00	1.00	1.00			
Incremental Delay, d2	0.4	0.2			0.6	0.7	0.5	0.2	0.3			
Delay (s)	9.2	0.3			3.2	6.3	20.9	20.1	20.2			
Level of Service	A	A			A	A	C	C	C			
Approach Delay (s)		2.0			4.3			20.2			0.0	
Approach LOS		A			A			C			A	
Intersection Summary												
HCM Average Control Delay			6.8		HCM Level of Service				A			
HCM Volume to Capacity ratio			0.37									
Actuated Cycle Length (s)			58.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			50.1%		ICU Level of Service				A			
Analysis Period (min)			15									
c	Critical Lane Group											















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	549	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1746	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1625	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	578	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	88	0	6	0	0	0	28	0	0	121
Lane Group Flow (vph)	104	578	133	44	790	0	413	14	28	0	55	22
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	5.6	21.0	30.8	4.2	19.6		9.8	20.8	25.0		7.0	7.0
Effective Green, g (s)	7.6	23.0	34.8	6.2	21.6		11.8	22.8	29.0		9.0	9.0
Actuated g/C Ratio	0.13	0.40	0.60	0.11	0.37		0.20	0.39	0.50		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	209	1338	957	331	1247		631	698	807		252	234
v/s Ratio Prot	c0.07	0.17	0.03	0.01	c0.24		c0.13	0.01	0.00			
v/s Ratio Perm			0.06						0.01		c0.03	0.01
v/c Ratio	0.50	0.43	0.14	0.13	0.63		0.65	0.02	0.03		0.22	0.09
Uniform Delay, d1	23.4	12.7	5.1	23.5	14.9		21.2	10.8	7.4		21.4	21.0
Progression Factor	1.11	0.57	1.24	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.8	1.0	0.1	0.2	2.5		2.4	0.0	0.0		0.4	0.2
Delay (s)	27.8	8.2	6.3	23.6	17.4		23.7	10.8	7.4		21.9	21.2
Level of Service	C	A	A	C	B		C	B	A		C	C
Approach Delay (s)		10.0			17.7			21.4			21.4	
Approach LOS		A			B			C			C	
Intersection Summary												
HCM Average Control Delay			15.9			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			58.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			55.4%			ICU Level of Service			B			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative2
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	233	0	164	0	0
Lane Group Flow (vph)	303	67	1158	101	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	10.0	10.0	20.0	20.0	16.0	40.0
Effective Green, g (s)	12.0	12.0	22.0	22.0	18.0	42.0
Actuated g/C Ratio	0.21	0.21	0.38	0.38	0.31	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	321	1317	589	510	2513
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.21	0.88	0.17	0.93	0.37
Uniform Delay, d1	22.4	19.1	16.8	11.9	19.4	3.0
Progression Factor	0.73	0.76	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5	0.3	8.6	0.6	25.7	0.4
Delay (s)	39.9	14.9	25.4	12.6	45.1	3.4
Level of Service	D	B	C	B	D	A
Approach Delay (s)	27.5		23.0			17.6
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			21.6		HCM Level of Service	C
HCM Volume to Capacity ratio			0.87			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative2
PM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	596	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.91			0.90	1.00		1.00			0.82	
Satd. Flow (perm)		3166			3124	1553		1580			1468	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	627	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	5	0	88	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	662	18	0	19	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		42.2			42.2	42.2		7.8			7.8	
Effective Green, g (s)		44.2			44.2	44.2		9.8			9.8	
Actuated g/C Ratio		0.76			0.76	0.76		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2413			2381	1183		267			248	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.01			c0.03	
v/c Ratio		0.33			0.28	0.01		0.07			0.17	
Uniform Delay, d1		2.2			2.1	1.7		20.3			20.6	
Progression Factor		0.68			2.08	2.44		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.0		0.1			0.3	
Delay (s)		1.8			4.6	4.1		20.4			20.9	
Level of Service		A			A	A		C			C	
Approach Delay (s)		1.8			4.6			20.4			20.9	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	4.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			























Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative2
 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑	↑	↑
Volume (vph)	0	677	183	436	448	0	0	0	0	296	4	204
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3471	1553	3190	3471					1562	1655	1553
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3471	1553	3190	3471					1562	1655	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	713	193	459	472	0	0	0	0	312	4	215
RTOR Reduction (vph)	0	0	126	0	0	0	0	0	0	0	0	148
Lane Group Flow (vph)	0	713	67	459	472	0	0	0	0	159	157	67
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		18.0	18.0	12.0	34.0					16.0	16.0	16.0
Effective Green, g (s)		20.0	20.0	14.0	36.0					18.0	18.0	18.0
Actuated g/C Ratio		0.34	0.34	0.24	0.62					0.31	0.31	0.31
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1197	536	770	2154					485	514	482
v/s Ratio Prot		c0.21		c0.14	0.14					c0.10	0.09	
v/s Ratio Perm			0.04									0.04
v/c Ratio		0.60	0.12	0.60	0.22					0.33	0.31	0.14
Uniform Delay, d1		15.7	13.0	19.5	4.8					15.4	15.2	14.4
Progression Factor		0.50	0.14	0.54	0.47					1.00	1.00	1.00
Incremental Delay, d2		2.1	0.5	1.2	0.2					0.4	0.3	0.1
Delay (s)		9.9	2.3	11.7	2.5					15.8	15.6	14.5
Level of Service		A	A	B	A					B	B	B
Approach Delay (s)		8.3			7.0			0.0			15.2	
Approach LOS		A			A			A			B	
Intersection Summary												
HCM Average Control Delay			9.3		HCM Level of Service					A		
HCM Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			58.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			50.1%		ICU Level of Service					A		
Analysis Period (min)			15									
c Critical Lane Group												























Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2016 Alternative2
PM Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 	 			 								
Volume (vph)	159	813	0	0	797	390	86	0	468	0	0	0	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0				
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95				
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85				
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (prot)	3190	3471			3471	1553	1644	1475	1398				
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (perm)	3190	3471			3471	1553	1644	1475	1398				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	167	856	0	0	839	411	91	0	493	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	183	0	141	141	0	0	0	
Lane Group Flow (vph)	167	856	0	0	839	228	91	106	105	0	0	0	
Turn Type	Prot				Perm		Prot		Perm				
Protected Phases	5	2			6		3		8				
Permitted Phases						6						8	
Actuated Green, G (s)	5.6	39.8			30.2	30.2	10.2	10.2	10.2				
Effective Green, g (s)	7.6	41.8			32.2	32.2	12.2	12.2	12.2				
Actuated g/C Ratio	0.13	0.72			0.56	0.56	0.21	0.21	0.21				
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)	418	2502			1927	862	346	310	294				
v/s Ratio Prot	0.05	c0.25			c0.24		0.06	0.07					
v/s Ratio Perm						0.15			c0.07				
v/c Ratio	0.40	0.34			0.44	0.26	0.26	0.34	0.36				
Uniform Delay, d1	23.1	3.0			7.6	6.7	19.1	19.5	19.5				
Progression Factor	0.45	0.10			0.56	0.78	1.00	1.00	1.00				
Incremental Delay, d2	0.5	0.3			0.6	0.6	0.4	0.7	0.7				
Delay (s)	11.1	0.6			4.8	5.9	19.6	20.1	20.3				
Level of Service	B	A			A	A	B	C	C				
Approach Delay (s)		2.3			5.2			20.1			0.0		
Approach LOS		A			A			C			A		
Intersection Summary													
HCM Average Control Delay			7.2		HCM Level of Service				A				
HCM Volume to Capacity ratio			0.39										
Actuated Cycle Length (s)			58.0		Sum of lost time (s)				4.0				
Intersection Capacity Utilization			50.1%		ICU Level of Service				A				
Analysis Period (min)			15										
c	Critical Lane Group												

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative2
PM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3460		3190	1827	1553		1790	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3460		3190	1827	1553		1670	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	160	0	2	0	0	0	17	0	0	24
Lane Group Flow (vph)	32	962	195	138	955	0	284	34	119	0	12	4
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	2.8	19.9	27.8	7.2	24.3		7.9	18.9	26.1		7.0	7.0
Effective Green, g (s)	4.8	21.9	31.8	9.2	26.3		9.9	20.9	30.1		9.0	9.0
Actuated g/C Ratio	0.08	0.38	0.55	0.16	0.45		0.17	0.36	0.52		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	136	1311	905	506	1569		545	658	860		259	241
v/s Ratio Prot	0.02	c0.28	0.04	0.04	c0.28		c0.09	0.02	c0.02			
v/s Ratio Perm			0.09						0.05		0.01	0.00
v/c Ratio	0.24	0.73	0.22	0.27	0.61		0.52	0.05	0.14		0.05	0.02
Uniform Delay, d1	24.9	15.5	6.7	21.5	12.0		21.9	12.1	7.2		20.8	20.8
Progression Factor	1.01	0.72	0.72	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	3.5	0.1	0.3	1.8		0.9	0.0	0.1		0.1	0.0
Delay (s)	26.0	14.7	4.9	21.8	13.7		22.8	12.1	7.3		20.9	20.8
Level of Service	C	B	A	C	B		C	B	A		C	C
Approach Delay (s)		12.4			14.7			17.4			20.8	
Approach LOS		B			B			B			C	
Intersection Summary												
HCM Average Control Delay			14.1			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			58.0			Sum of lost time (s)			4.0			
Intersection Capacity Utilization			55.9%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

2016 Alternative 3

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative3
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	69	0	0
Lane Group Flow (vph)	118	64	643	46	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.3	9.3	21.2	21.2	15.5	40.7
Effective Green, g (s)	11.3	11.3	23.2	23.2	17.5	42.7
Actuated g/C Ratio	0.19	0.19	0.40	0.40	0.30	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	311	294	1350	604	482	2484
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.48	0.08	0.68	0.30
Uniform Delay, d1	20.3	19.6	12.9	10.8	17.8	2.6
Progression Factor	0.55	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.4	1.2	0.2	3.8	0.3
Delay (s)	11.9	20.2	14.1	11.0	21.6	2.9
Level of Service	B	C	B	B	C	A
Approach Delay (s)	18.0		13.6			8.5
Approach LOS	B		B			A
Intersection Summary						
HCM Average Control Delay			12.1		HCM Level of Service	B
HCM Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative3
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	438	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.74			0.93	1.00		0.98			0.78	
Satd. Flow (perm)		2471			3126	1509		1532			1358	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	461	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	3	0	0	0	17	0	30	0	0	9	0
Lane Group Flow (vph)	0	358	0	0	490	30	0	16	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		34.9			34.9	34.9		15.1			15.1	
Effective Green, g (s)		36.9			36.9	36.9		17.1			17.1	
Actuated g/C Ratio		0.64			0.64	0.64		0.29			0.29	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1572			1989	960		452			400	
v/s Ratio Prot												
v/s Ratio Perm		0.14			c0.16	0.02		0.01			c0.16	
v/c Ratio		0.23			0.25	0.03		0.04			0.55	
Uniform Delay, d1		4.5			4.6	3.9		14.6			17.2	
Progression Factor		0.41			0.47	0.44		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		2.2			2.4	1.8		14.6			18.7	
Level of Service		A			A	A		B			B	
Approach Delay (s)		2.2			2.4			14.6			18.7	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	6.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative3
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	74	374	324	564	233	187
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	394	341	594	245	197
RTOR Reduction (vph)	0	0	0	121	37	86
Lane Group Flow (vph)	78	394	341	473	267	52
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	4.2	30.0	21.8	41.8	20.0	20.0
Effective Green, g (s)	6.2	32.0	23.8	45.8	22.0	22.0
Actuated g/C Ratio	0.11	0.55	0.41	0.79	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	331	1862	1385	1244	1155	521
v/s Ratio Prot	0.03	c0.12	0.10	c0.14	0.09	
v/s Ratio Perm				0.17		0.04
v/c Ratio	0.24	0.21	0.25	0.38	0.23	0.10
Uniform Delay, d1	23.7	6.6	11.2	1.8	12.2	11.6
Progression Factor	0.74	0.50	0.65	0.34	1.00	1.00
Incremental Delay, d2	0.4	0.3	0.4	0.8	0.5	0.4
Delay (s)	18.0	3.5	7.7	1.5	12.7	12.0
Level of Service	B	A	A	A	B	B
Approach Delay (s)		5.9	3.7		12.5	
Approach LOS		A	A		B	

Intersection Summary

HCM Average Control Delay	6.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2016 Alternative3
AM Peak



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↖↗	↑↑	↖	↖↗
Volume (vph)	495	113	431	814	74	368
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3374	1509	3100	3374	1598	2656
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3374	1509	3100	3374	1598	2656
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	521	119	454	857	78	387
RTOR Reduction (vph)	0	49	0	0	0	172
Lane Group Flow (vph)	521	70	454	857	78	215
Turn Type		pm+ov	Prot		pm+ov	
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	21.0	30.0	16.0	41.0	9.0	25.0
Effective Green, g (s)	23.0	34.0	18.0	43.0	11.0	29.0
Actuated g/C Ratio	0.40	0.59	0.31	0.74	0.19	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1338	937	962	2501	303	1420
v/s Ratio Prot	c0.15	0.01	c0.15	0.25	c0.05	0.05
v/s Ratio Perm		0.03				0.03
v/c Ratio	0.39	0.07	0.47	0.34	0.26	0.15
Uniform Delay, d1	12.5	5.2	16.2	2.6	20.0	7.8
Progression Factor	0.95	0.91	0.47	0.19	1.00	1.00
Incremental Delay, d2	0.8	0.2	0.3	0.3	2.0	0.0
Delay (s)	12.7	4.9	7.8	0.8	22.1	7.9
Level of Service	B	A	A	A	C	A
Approach Delay (s)	11.3			3.2	10.3	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative3
AM Peak

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	554	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1746	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1625	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	583	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	88	0	6	0	0	0	28	0	0	121
Lane Group Flow (vph)	104	583	133	44	790	0	413	14	28	0	55	22
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	6.4	21.0	30.8	4.2	18.8		9.8	20.8	25.0		7.0	7.0
Effective Green, g (s)	8.4	23.0	34.8	6.2	20.8		11.8	22.8	29.0		9.0	9.0
Actuated g/C Ratio	0.14	0.40	0.60	0.11	0.36		0.20	0.39	0.50		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	231	1338	957	331	1201		631	698	807		252	234
v/s Ratio Prot	c0.07	c0.17	0.03	0.01	c0.24		c0.13	0.01	0.00			
v/s Ratio Perm			0.06						0.01		c0.03	0.01
v/c Ratio	0.45	0.44	0.14	0.13	0.66		0.65	0.02	0.03		0.22	0.09
Uniform Delay, d1	22.7	12.8	5.1	23.5	15.6		21.2	10.8	7.4		21.4	21.0
Progression Factor	0.76	0.52	0.30	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.3	1.0	0.1	0.2	2.8		2.4	0.0	0.0		0.4	0.2
Delay (s)	18.7	7.6	1.6	23.6	18.4		23.7	10.8	7.4		21.9	21.2
Level of Service	B	A	A	C	B		C	B	A		C	C
Approach Delay (s)		7.4			18.7			21.4			21.4	
Approach LOS		A			B			C			C	

Intersection Summary

HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative3
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	233	0	164	0	0
Lane Group Flow (vph)	303	67	1158	101	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	10.0	10.0	20.0	20.0	16.0	40.0
Effective Green, g (s)	12.0	12.0	22.0	22.0	18.0	42.0
Actuated g/C Ratio	0.21	0.21	0.38	0.38	0.31	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	321	1317	589	510	2513
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.21	0.88	0.17	0.93	0.37
Uniform Delay, d1	22.4	19.1	16.8	11.9	19.4	3.0
Progression Factor	0.66	0.59	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5	0.3	8.6	0.6	23.4	0.4
Delay (s)	38.3	11.5	25.4	12.6	42.7	3.4
Level of Service	D	B	C	B	D	A
Approach Delay (s)	25.0		23.0			16.8
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			20.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.87			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative3
PM Peak



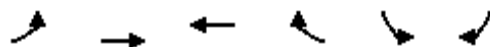
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	598	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.91			0.90	1.00		1.00			0.82	
Satd. Flow (perm)		3166			3124	1553		1580			1468	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	629	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	5	0	88	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	664	18	0	19	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		42.2			42.2	42.2		7.8			7.8	
Effective Green, g (s)		44.2			44.2	44.2		9.8			9.8	
Actuated g/C Ratio		0.76			0.76	0.76		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2413			2381	1183		267			248	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.01			c0.03	
v/c Ratio		0.33			0.28	0.01		0.07			0.17	
Uniform Delay, d1		2.2			2.1	1.7		20.3			20.6	
Progression Factor		0.40			0.36	0.30		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.0		0.1			0.3	
Delay (s)		1.1			1.0	0.5		20.4			20.9	
Level of Service		A			A	A		C			C	
Approach Delay (s)		1.1			1.0			20.4			20.9	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	2.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative3
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	183	677	448	436	298	205
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	193	713	472	459	314	216
RTOR Reduction (vph)	0	0	0	70	23	113
Lane Group Flow (vph)	193	713	472	389	343	51
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	8.0	34.0	22.0	38.0	16.0	16.0
Effective Green, g (s)	10.0	36.0	24.0	42.0	18.0	18.0
Actuated g/C Ratio	0.17	0.62	0.41	0.72	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	550	2154	1436	1178	978	439
v/s Ratio Prot	0.06	c0.21	0.14	c0.10	c0.11	
v/s Ratio Perm				0.15		0.04
v/c Ratio	0.35	0.33	0.33	0.33	0.35	0.12
Uniform Delay, d1	21.1	5.3	11.5	2.9	15.5	14.3
Progression Factor	0.56	0.39	0.50	0.08	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.6	0.7	1.0	0.5
Delay (s)	12.2	2.5	6.3	1.0	16.5	14.8
Level of Service	B	A	A	A	B	B
Approach Delay (s)		4.5	3.7		16.0	
Approach LOS		A	A		B	

Intersection Summary

HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↖↗	↑↑	↖	↖↗
Volume (vph)	816	159	390	797	86	468
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3471	1553	3190	3471	1644	2733
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3471	1553	3190	3471	1644	2733
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	859	167	411	839	91	493
RTOR Reduction (vph)	0	49	0	0	0	107
Lane Group Flow (vph)	859	118	411	839	91	386
Turn Type		pm+ov	Prot		pm+ov	
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	26.0	33.0	13.0	43.0	7.0	20.0
Effective Green, g (s)	28.0	37.0	15.0	45.0	9.0	24.0
Actuated g/C Ratio	0.48	0.64	0.26	0.78	0.16	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1676	1044	825	2693	255	1225
v/s Ratio Prot	c0.25	0.02	c0.13	0.24	0.06	c0.08
v/s Ratio Perm		0.06				0.06
v/c Ratio	0.51	0.11	0.50	0.31	0.36	0.32
Uniform Delay, d1	10.3	4.1	18.3	1.9	21.9	11.5
Progression Factor	0.92	1.49	0.89	0.05	1.00	1.00
Incremental Delay, d2	1.1	0.2	0.4	0.3	3.9	0.1
Delay (s)	10.6	6.3	16.7	0.4	25.8	11.6
Level of Service	B	A	B	A	C	B
Approach Delay (s)	9.9			5.7	13.8	
Approach LOS	A			A	B	

Intersection Summary

HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative3
PM Peak













Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3460		3190	1827	1553		1790	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3460		3190	1827	1553		1670	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	151	0	2	0	0	0	18	0	0	24
Lane Group Flow (vph)	32	962	204	138	955	0	284	34	118	0	12	4
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	2.8	21.5	29.4	5.6	24.3		7.9	18.9	24.5		7.0	7.0
Effective Green, g (s)	4.8	23.5	33.4	7.6	26.3		9.9	20.9	28.5		9.0	9.0
Actuated g/C Ratio	0.08	0.41	0.58	0.13	0.45		0.17	0.36	0.49		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	136	1406	894	418	1569		545	658	817		259	241
v/s Ratio Prot	0.02	c0.28	0.04	0.04	c0.28		c0.09	0.02	c0.02			
v/s Ratio Perm			0.09						0.06		0.01	0.00
v/c Ratio	0.24	0.68	0.23	0.33	0.61		0.52	0.05	0.14		0.05	0.02
Uniform Delay, d1	24.9	14.2	6.0	22.9	12.0		21.9	12.1	8.1		20.8	20.8
Progression Factor	0.87	0.84	0.44	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	2.5	0.1	0.5	1.8		0.9	0.0	0.1		0.1	0.0
Delay (s)	22.4	14.4	2.8	23.4	13.7		22.8	12.1	8.2		20.9	20.8
Level of Service	C	B	A	C	B		C	B	A		C	C
Approach Delay (s)		11.5			14.9			17.6			20.8	
Approach LOS		B			B			B			C	
Intersection Summary												
HCM Average Control Delay			13.9			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			58.0			Sum of lost time (s)			6.0			
Intersection Capacity Utilization			55.9%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

2016 Alternative 4

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Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2016 Alternative4
 AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	70	0	0
Lane Group Flow (vph)	118	64	643	45	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	7.4	7.4	16.9	16.9	11.7	32.6
Effective Green, g (s)	9.4	9.4	18.9	18.9	13.7	34.6
Actuated g/C Ratio	0.20	0.20	0.39	0.39	0.29	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	313	296	1329	594	456	2432
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.48	0.08	0.72	0.31
Uniform Delay, d1	16.8	16.2	10.9	9.1	15.4	2.4
Progression Factor	0.52	2.39	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	1.3	0.2	5.3	0.3
Delay (s)	9.5	39.1	12.2	9.3	20.7	2.7
Level of Service	A	D	B	A	C	A
Approach Delay (s)	31.3		11.7			8.2
Approach LOS	C		B			A
Intersection Summary						
HCM Average Control Delay			13.9		HCM Level of Service	B
HCM Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			48.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative4
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	438	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.75			0.93	1.00		0.98			0.73	
Satd. Flow (perm)		2508			3130	1509		1531			1282	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	461	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	4	0	0	0	19	0	29	0	0	10	0
Lane Group Flow (vph)	0	357	0	0	490	28	0	17	0	0	218	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		26.9			26.9	26.9		13.1			13.1	
Effective Green, g (s)		28.9			28.9	28.9		15.1			15.1	
Actuated g/C Ratio		0.60			0.60	0.60		0.31			0.31	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1510			1885	909		482			403	
v/s Ratio Prot												
v/s Ratio Perm		0.14			0.16	0.02		0.01			0.17	
v/c Ratio		0.24			0.26	0.03		0.04			0.54	
Uniform Delay, d1		4.4			4.5	3.9		11.4			13.6	
Progression Factor		0.21			0.60	0.37		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		1.2			3.0	1.5		11.4			15.1	
Level of Service		A			A	A		B			B	
Approach Delay (s)		1.2			2.9			11.4			15.1	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	48.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative4
 AM Peak



























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	74	374	324	564	233	187
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3215	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3215	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	394	341	594	245	197
RTOR Reduction (vph)	0	0	0	69	23	65
Lane Group Flow (vph)	78	394	341	525	282	73
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	6.5	39.0	28.5	77.5	49.0	49.0
Effective Green, g (s)	8.5	41.0	30.5	81.5	51.0	51.0
Actuated g/C Ratio	0.09	0.43	0.32	0.85	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	274	1441	1072	1313	1708	730
v/s Ratio Prot	c0.03	0.12	0.10	c0.21	0.09	
v/s Ratio Perm				0.14		0.05
v/c Ratio	0.28	0.27	0.32	0.40	0.16	0.10
Uniform Delay, d1	40.9	17.8	24.9	1.7	11.6	11.1
Progression Factor	1.03	0.89	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.5	0.8	0.9	0.2	0.3
Delay (s)	42.9	16.3	25.6	2.6	11.8	11.4
Level of Service	D	B	C	A	B	B
Approach Delay (s)		20.7	11.0		11.7	
Approach LOS		C	B		B	

Intersection Summary

HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2016 Alternative4
AM Peak













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	82	315	210	42	561	316	253	145	35	258	110	74
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3374	1509	3100	3275		3100	1669	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3374	1509	3100	3275		3100	1669	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	86	332	221	44	591	333	266	153	37	272	116	78
RTOR Reduction (vph)	0	0	109	0	0	150	0	30	0	0	40	0
Lane Group Flow (vph)	86	332	112	44	591	183	266	160	0	272	154	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	3.6	15.1	23.3	3.7	15.2	25.5	8.2	8.6		10.3	10.7	
Effective Green, g (s)	5.6	17.1	27.3	5.7	17.2	29.5	10.2	10.6		12.3	12.7	
Actuated g/C Ratio	0.10	0.32	0.51	0.11	0.32	0.55	0.19	0.20		0.23	0.24	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	167	1074	823	329	1081	829	589	646		710	395	
v/s Ratio Prot	c0.05	0.10	0.03	0.01	c0.18	0.05	0.09	0.05		c0.09	c0.09	
v/s Ratio Perm			0.05			0.07						
v/c Ratio	0.51	0.31	0.14	0.13	0.55	0.22	0.45	0.25		0.38	0.39	
Uniform Delay, d1	22.8	13.8	7.0	21.8	15.0	6.2	19.3	18.2		17.5	17.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.7	0.2	0.1	0.2	0.6	0.1	0.6	0.2		0.3	0.6	
Delay (s)	25.4	14.0	7.0	21.9	15.6	6.3	19.8	18.4		17.8	17.9	
Level of Service	C	B	A	C	B	A	B	B		B	B	
Approach Delay (s)		13.1			12.7			19.2			17.9	
Approach LOS		B			B			B			B	

Intersection Summary

HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	53.7	Sum of lost time (s)	6.0
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative4
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	158	0	158	0	0
Lane Group Flow (vph)	303	142	1158	107	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.9	15.9	32.7	32.7	25.4	62.1
Effective Green, g (s)	17.9	17.9	34.7	34.7	27.4	64.1
Actuated g/C Ratio	0.21	0.21	0.40	0.40	0.32	0.75
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	342	323	1401	627	524	2587
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.09		0.07		
v/c Ratio	0.89	0.44	0.83	0.17	0.90	0.36
Uniform Delay, d1	33.1	29.7	23.0	16.4	28.0	3.8
Progression Factor	0.53	0.38	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.3	0.9	5.7	0.6	19.0	0.4
Delay (s)	39.9	12.3	28.7	17.0	47.0	4.2
Level of Service	D	B	C	B	D	A
Approach Delay (s)	26.1		26.5			18.7
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			23.3		HCM Level of Service	C
HCM Volume to Capacity ratio			0.85			
Actuated Cycle Length (s)			86.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative4
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	598	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.92			0.90	1.00		1.00			0.83	
Satd. Flow (perm)		3179			3141	1553		1580			1489	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	629	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	7	0	83	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	664	16	0	24	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		27.5			27.5	27.5		7.5			7.5	
Effective Green, g (s)		29.5			29.5	29.5		9.5			9.5	
Actuated g/C Ratio		0.69			0.69	0.69		0.22			0.22	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2181			2155	1065		349			329	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.02			c0.03	
v/c Ratio		0.37			0.31	0.01		0.07			0.13	
Uniform Delay, d1		2.8			2.7	2.1		13.3			13.4	
Progression Factor		0.63			1.05	0.35		1.00			1.00	
Incremental Delay, d2		0.4			0.4	0.0		0.1			0.2	
Delay (s)		2.1			3.2	0.8		13.3			13.6	
Level of Service		A			A	A		B			B	
Approach Delay (s)		2.1			3.1			13.3			13.6	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	3.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	43.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2016 Alternative4
PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	183	677	448	436	298	205
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3326	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3326	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	193	713	472	459	314	216
RTOR Reduction (vph)	0	0	0	72	16	101
Lane Group Flow (vph)	193	713	472	387	350	63
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	14.0	47.0	29.0	60.0	31.0	31.0
Effective Green, g (s)	16.0	49.0	31.0	64.0	33.0	33.0
Actuated g/C Ratio	0.19	0.57	0.36	0.74	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	593	1978	1251	1192	1276	542
v/s Ratio Prot	0.06	c0.21	c0.14	c0.12	0.11	
v/s Ratio Perm				0.12		0.04
v/c Ratio	0.33	0.36	0.38	0.32	0.27	0.12
Uniform Delay, d1	30.3	10.0	20.4	3.7	18.3	17.1
Progression Factor	0.94	0.68	0.50	0.54	1.00	1.00
Incremental Delay, d2	0.3	0.5	0.8	0.7	0.5	0.4
Delay (s)	28.9	7.3	10.9	2.7	18.8	17.5
Level of Service	C	A	B	A	B	B
Approach Delay (s)		11.9	6.9		18.4	
Approach LOS		B	A		B	

Intersection Summary

HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2016 Alternative4
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	518	337	131	621	294	176	135	85	327	140	86
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3471	1553	3190	3271		3190	1722	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3471	1553	3190	3271		3190	1722	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	126	545	355	138	654	309	185	142	89	344	147	91
RTOR Reduction (vph)	0	0	142	0	0	116	0	77	0	0	28	0
Lane Group Flow (vph)	126	545	213	138	654	193	185	154	0	344	210	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.9	38.4	47.7	7.0	34.5	49.7	9.3	9.4		15.2	15.3	
Effective Green, g (s)	12.9	40.4	51.7	9.0	36.5	53.7	11.3	11.4		17.2	17.3	
Actuated g/C Ratio	0.15	0.47	0.60	0.10	0.42	0.62	0.13	0.13		0.20	0.20	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	247	1631	934	334	1473	970	419	434		638	346	
v/s Ratio Prot	c0.08	0.16	0.03	0.04	c0.19	0.04	c0.06	0.05		0.11	c0.12	
v/s Ratio Perm			0.11			0.08						
v/c Ratio	0.51	0.33	0.23	0.41	0.44	0.20	0.44	0.35		0.54	0.61	
Uniform Delay, d1	33.6	14.3	7.9	36.0	17.6	6.9	34.4	34.0		30.8	31.3	
Progression Factor	0.99	0.72	0.24	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.7	0.5	0.1	0.8	1.0	0.1	0.7	0.5		0.9	3.0	
Delay (s)	34.9	10.8	2.0	36.9	18.5	7.0	35.2	34.5		31.7	34.3	
Level of Service	C	B	A	D	B	A	D	C		C	C	
Approach Delay (s)		10.7			17.6			34.8			32.8	
Approach LOS		B			B			C			C	

Intersection Summary















HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

2016 Alternative 5

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative5
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	70	0	0
Lane Group Flow (vph)	118	64	643	45	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	7.4	7.4	16.9	16.9	11.7	32.6
Effective Green, g (s)	9.4	9.4	18.9	18.9	13.7	34.6
Actuated g/C Ratio	0.20	0.20	0.39	0.39	0.29	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	313	296	1329	594	456	2432
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.48	0.08	0.72	0.31
Uniform Delay, d1	16.8	16.2	10.9	9.1	15.4	2.4
Progression Factor	0.71	2.05	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	1.3	0.2	5.3	0.3
Delay (s)	12.6	33.6	12.2	9.3	20.7	2.7
Level of Service	B	C	B	A	C	A
Approach Delay (s)	28.1		11.7			8.2
Approach LOS	C		B			A
Intersection Summary						
HCM Average Control Delay			13.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			48.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative5
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	438	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.75			0.93	1.00		0.98			0.73	
Satd. Flow (perm)		2508			3130	1509		1531			1282	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	461	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	4	0	0	0	19	0	29	0	0	10	0
Lane Group Flow (vph)	0	357	0	0	490	28	0	17	0	0	218	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		26.9			26.9	26.9		13.1			13.1	
Effective Green, g (s)		28.9			28.9	28.9		15.1			15.1	
Actuated g/C Ratio		0.60			0.60	0.60		0.31			0.31	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1510			1885	909		482			403	
v/s Ratio Prot												
v/s Ratio Perm		0.14			c0.16	0.02		0.01			c0.17	
v/c Ratio		0.24			0.26	0.03		0.04			0.54	
Uniform Delay, d1		4.4			4.5	3.9		11.4			13.6	
Progression Factor		0.40			0.78	0.91		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		2.1			3.8	3.6		11.4			15.1	
Level of Service		A			A	A		B			B	
Approach Delay (s)		2.1			3.8			11.4			15.1	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	5.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	48.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			























Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2016 Alternative5
AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	261	74	564	250	431	74	0	368	233	0	187
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1603	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1603	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	275	78	594	263	454	78	0	387	245	0	197
RTOR Reduction (vph)	0	0	56	0	0	225	0	0	222	0	0	157
Lane Group Flow (vph)	119	275	22	594	263	229	0	78	165	122	123	40
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	8.4	25.4	25.4	29.4	46.4	46.4		7.6	37.0	17.6	17.6	17.6
Effective Green, g (s)	10.4	27.4	27.4	31.4	48.4	48.4		9.6	41.0	19.6	19.6	19.6
Actuated g/C Ratio	0.11	0.29	0.29	0.33	0.50	0.50		0.10	0.43	0.20	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	336	963	431	1014	1701	761		169	1134	310	327	308
v/s Ratio Prot	0.04	0.08		c0.19	0.08			c0.05	0.05	c0.08	0.08	
v/s Ratio Perm			0.01			c0.15			0.01			0.03
v/c Ratio	0.35	0.29	0.05	0.59	0.15	0.30		0.46	0.15	0.39	0.38	0.13
Uniform Delay, d1	39.7	26.7	24.9	26.9	12.8	13.9		40.8	16.8	33.1	32.9	31.2
Progression Factor	0.89	1.06	1.43	0.64	0.49	0.19		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.7	0.2	0.8	0.2	0.9		2.0	0.1	3.7	3.3	0.9
Delay (s)	36.1	28.9	35.7	17.9	6.4	3.6		42.8	16.9	36.8	36.2	32.1
Level of Service	D	C	D	B	A	A		D	B	D	D	C
Approach Delay (s)		31.9			10.6			21.2			34.5	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM Average Control Delay			20.1				HCM Level of Service		C			
HCM Volume to Capacity ratio			0.43									
Actuated Cycle Length (s)			96.0				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			48.4%				ICU Level of Service		A			
Analysis Period (min)			15									
c	Critical Lane Group											













Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative5
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	549	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1746	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1622	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	578	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	61	0	4	0	0	0	32	0	0	127
Lane Group Flow (vph)	104	578	160	44	792	0	413	14	23	0	55	16
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	10.4	47.7	65.4	5.7	43.0		17.7	30.6	36.3		8.9	8.9
Effective Green, g (s)	12.4	49.7	69.4	7.7	45.0		19.7	32.6	40.3		10.9	10.9
Actuated g/C Ratio	0.13	0.52	0.72	0.08	0.47		0.21	0.34	0.42		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	206	1747	1091	249	1569		636	603	665		184	171
v/s Ratio Prot	c0.07	0.17	0.03	0.01	c0.24		c0.13	0.01	0.00			
v/s Ratio Perm			0.08						0.01		c0.03	0.01
v/c Ratio	0.50	0.33	0.15	0.18	0.50		0.65	0.02	0.03		0.30	0.09
Uniform Delay, d1	38.9	13.5	4.1	41.2	17.7		35.0	21.1	16.4		39.0	38.1
Progression Factor	0.69	0.52	0.20	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.9	0.5	0.1	0.3	1.2		2.3	0.0	0.0		0.9	0.2
Delay (s)	28.6	7.4	0.9	41.5	18.9		37.3	21.1	16.4		40.0	38.4
Level of Service	C	A	A	D	B		D	C	B		D	D
Approach Delay (s)		8.3			20.1			34.4			38.8	
Approach LOS		A			C			C			D	
Intersection Summary												
HCM Average Control Delay			20.1			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			96.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			55.4%			ICU Level of Service			B			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative5
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	233	0	164	0	0
Lane Group Flow (vph)	303	67	1158	101	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	10.0	10.0	20.0	20.0	16.0	40.0
Effective Green, g (s)	12.0	12.0	22.0	22.0	18.0	42.0
Actuated g/C Ratio	0.21	0.21	0.38	0.38	0.31	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	321	1317	589	510	2513
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.21	0.88	0.17	0.93	0.37
Uniform Delay, d1	22.4	19.1	16.8	11.9	19.4	3.0
Progression Factor	0.82	1.16	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5	0.3	8.6	0.6	23.4	0.4
Delay (s)	41.8	22.3	25.4	12.6	42.7	3.4
Level of Service	D	C	C	B	D	A
Approach Delay (s)	32.1		23.0			16.8
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			22.0		HCM Level of Service	C
HCM Volume to Capacity ratio			0.87			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative5
PM Peak


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	598	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.91			0.90	1.00		1.00			0.82	
Satd. Flow (perm)		3166			3124	1553		1580			1468	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	629	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	5	0	88	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	664	18	0	19	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		42.2			42.2	42.2		7.8			7.8	
Effective Green, g (s)		44.2			44.2	44.2		9.8			9.8	
Actuated g/C Ratio		0.76			0.76	0.76		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2413			2381	1183		267			248	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.01			c0.03	
v/c Ratio		0.33			0.28	0.01		0.07			0.17	
Uniform Delay, d1		2.2			2.1	1.7		20.3			20.6	
Progression Factor		0.36			1.53	1.85		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.0		0.1			0.3	
Delay (s)		1.1			3.5	3.1		20.4			20.9	
Level of Service		A			A	A		C			C	
Approach Delay (s)		1.1			3.5			20.4			20.9	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	3.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2016 Alternative5
PM Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	159	518	183	436	362	390	86	0	468	298	0	205	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00	
Satd. Flow (prot)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1649	1553	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00	
Satd. Flow (perm)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1649	1553	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	167	545	193	459	381	411	91	0	493	314	0	216	
RTOR Reduction (vph)	0	0	124	0	0	235	0	0	142	0	0	179	
Lane Group Flow (vph)	167	545	69	459	381	176	0	91	351	157	157	37	
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm	
Protected Phases	5	2		1	6		8	8	1	4	4		
Permitted Phases			2			6			8			4	
Actuated Green, G (s)	5.6	18.6	18.6	9.8	22.8	22.8		5.6	15.4	8.0	8.0	8.0	
Effective Green, g (s)	7.6	20.6	20.6	11.8	24.8	24.8		7.6	19.4	10.0	10.0	10.0	
Actuated g/C Ratio	0.13	0.36	0.36	0.20	0.43	0.43		0.13	0.33	0.17	0.17	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	418	1233	552	649	1484	664		227	914	269	284	268	
v/s Ratio Prot	0.05	c0.16		c0.14	0.11			c0.05	0.08	c0.10	0.10		
v/s Ratio Perm			0.04			0.11			0.05			0.02	
v/c Ratio	0.40	0.44	0.12	0.71	0.26	0.26		0.40	0.38	0.58	0.55	0.14	
Uniform Delay, d1	23.1	14.3	12.6	21.5	10.7	10.7		23.1	14.7	22.1	22.0	20.3	
Progression Factor	0.95	0.46	0.15	0.62	0.40	0.42		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	1.1	0.4	3.0	0.4	0.8		1.2	0.3	9.0	7.6	1.1	
Delay (s)	22.6	7.6	2.4	16.4	4.6	5.3		24.3	15.0	31.0	29.5	21.4	
Level of Service	C	A	A	B	A	A		C	B	C	C	C	
Approach Delay (s)		9.3			9.2			16.4			26.7		
Approach LOS		A			A			B			C		
Intersection Summary													
HCM Average Control Delay			13.3		HCM Level of Service					B			
HCM Volume to Capacity ratio			0.51										
Actuated Cycle Length (s)			58.0		Sum of lost time (s)					8.0			
Intersection Capacity Utilization			52.8%		ICU Level of Service					A			
Analysis Period (min)			15										
c	Critical Lane Group												

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative5
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3460		3190	1827	1553		1790	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3460		3190	1827	1553		1670	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	160	0	2	0	0	0	17	0	0	24
Lane Group Flow (vph)	32	962	195	138	955	0	284	34	119	0	12	4
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	2.8	19.9	27.8	7.2	24.3		7.9	18.9	26.1		7.0	7.0
Effective Green, g (s)	4.8	21.9	31.8	9.2	26.3		9.9	20.9	30.1		9.0	9.0
Actuated g/C Ratio	0.08	0.38	0.55	0.16	0.45		0.17	0.36	0.52		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	136	1311	905	506	1569		545	658	860		259	241
v/s Ratio Prot	0.02	c0.28	0.04	c0.04	c0.28		c0.09	0.02	c0.02			
v/s Ratio Perm			0.09						0.05		0.01	0.00
v/c Ratio	0.24	0.73	0.22	0.27	0.61		0.52	0.05	0.14		0.05	0.02
Uniform Delay, d1	24.9	15.5	6.7	21.5	12.0		21.9	12.1	7.2		20.8	20.8
Progression Factor	1.14	0.94	1.51	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	3.3	0.1	0.3	1.8		0.9	0.0	0.1		0.1	0.0
Delay (s)	29.2	17.8	10.3	21.8	13.7		22.8	12.1	7.3		20.9	20.8
Level of Service	C	B	B	C	B		C	B	A		C	C
Approach Delay (s)		16.1			14.7			17.4			20.8	
Approach LOS		B			B			B			C	

Intersection Summary

HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

2016 Alternative 6

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HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative6 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↷	↕	↷	↶	↕
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	264	0	70	0	0
Lane Group Flow (vph)	118	65	643	45	327	755
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	8.4	8.4	18.8	18.8	13.8	36.6
Effective Green, g (s)	10.4	10.4	20.8	20.8	15.8	38.6
Actuated g/C Ratio	0.20	0.20	0.39	0.39	0.30	0.73
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	314	305	1362	592	476	2528
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.21	0.47	0.08	0.69	0.30
Uniform Delay, d1	18.5	17.9	12.0	10.1	16.4	2.5
Progression Factor	0.80	1.10	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	1.2	0.3	4.1	0.3
Delay (s)	15.5	20.0	13.2	10.3	20.5	2.8
Level of Service	B	C	B	B	C	A
Approach Delay (s)	18.8		12.7			8.2
Approach LOS	B		B			A

Intersection Summary

HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	114	250	477	46	196	21
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1598	1776	3374	1509	1589	
Flt Permitted	0.45	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	761	1776	3374	1509	1589	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	263	502	48	206	22
RTOR Reduction (vph)	0	0	0	17	8	0
Lane Group Flow (vph)	120	263	502	31	220	0
Turn Type	Perm		Perm			
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	32.7	32.7	32.7	32.7	12.3	
Effective Green, g (s)	34.7	34.7	34.7	34.7	14.3	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.27	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	498	1163	2209	988	429	
v/s Ratio Prot		0.15	0.15			
v/s Ratio Perm	c0.16			0.02	c0.14	
v/c Ratio	0.24	0.23	0.23	0.03	0.51	
Uniform Delay, d1	3.8	3.7	3.7	3.2	16.4	
Progression Factor	0.75	0.74	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.4	0.2	0.1	1.0	
Delay (s)	3.8	3.1	4.0	3.3	17.4	
Level of Service	A	A	A	A	B	
Approach Delay (s)		3.4	3.9		17.4	
Approach LOS		A	A		B	




















Intersection Summary

HCM Average Control Delay	6.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	74	354	17	0	323	564	0	0	20	233	0	196
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	0.99			1.00	0.85			0.86	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1598	3351			3374	1509			1536	3100		1509
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1598	3351			3374	1509			1536	3100		1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	373	18	0	340	594	0	0	21	245	0	206
RTOR Reduction (vph)	0	4	0	0	0	232	0	0	17	0	0	158
Lane Group Flow (vph)	78	387	0	0	340	362	0	0	4	245	0	48
Turn Type	Prot					Perm			custom	Prot		custom
Protected Phases	5	2			6					4		
Permitted Phases						6			8			4
Actuated Green, G (s)	5.6	60.0			50.4	50.4			18.0	18.0		18.0
Effective Green, g (s)	7.6	62.0			52.4	52.4			18.0	20.0		20.0
Actuated g/C Ratio	0.09	0.72			0.61	0.61			0.21	0.23		0.23
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	141	2416			2056	919			321	721		351
v/s Ratio Prot	c0.05	0.12			0.10					c0.08		
v/s Ratio Perm						c0.24			0.00			0.03
v/c Ratio	0.55	0.16			0.17	0.39			0.01	0.34		0.14
Uniform Delay, d1	37.6	3.8			7.3	8.6			27.0	27.5		26.2
Progression Factor	1.00	1.00			1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	4.6	0.1			0.2	1.3			0.0	1.3		0.8
Delay (s)	42.2	3.9			7.5	9.9			27.0	28.8		27.0
Level of Service	D	A			A	A			C	C		C
Approach Delay (s)		10.3			9.0			27.0			27.9	
Approach LOS		B			A			C			C	
Intersection Summary												
HCM Average Control Delay			14.1				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			86.0				Sum of lost time (s)			6.0		
Intersection Capacity Utilization			47.4%				ICU Level of Service			A		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	341	101	136	457	287	408
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.91	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3077	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3100	1509	1598	3374	3077	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	106	143	481	302	429
RTOR Reduction (vph)	0	71	0	0	273	0
Lane Group Flow (vph)	359	35	143	481	458	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	9.0	31.0	18.0	
Effective Green, g (s)	18.0	18.0	11.0	33.0	20.0	
Actuated g/C Ratio	0.33	0.33	0.20	0.60	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	1015	494	320	2024	1119	
v/s Ratio Prot	c0.12		c0.09	0.14	c0.15	
v/s Ratio Perm		0.02				
v/c Ratio	0.35	0.07	0.45	0.24	0.41	
Uniform Delay, d1	14.1	12.7	19.3	5.1	13.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.3	4.5	0.3	1.1	
Delay (s)	15.0	13.0	23.8	5.4	14.2	
Level of Service	B	B	C	A	B	
Approach Delay (s)	14.6			9.6	14.2	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	287	221	473	286	39	466	13	319	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.86	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3313		3100	1454	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3313		3100	1454	1434	1598	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	302	233	498	301	41	491	14	336	19	36	143
RTOR Reduction (vph)	0	0	122	0	16	0	0	100	109	0	121	0
Lane Group Flow (vph)	104	302	111	498	326	0	491	75	66	19	58	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	6.1	10.8	27.0	14.3	19.0		16.2	22.7	22.7	1.3	7.8	
Effective Green, g (s)	8.1	12.8	31.0	16.3	21.0		18.2	24.7	24.7	3.3	9.8	
Actuated g/C Ratio	0.12	0.20	0.48	0.25	0.32		0.28	0.38	0.38	0.05	0.15	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	199	663	765	776	1069		867	552	544	81	235	
v/s Ratio Prot	c0.07	c0.09	0.04	c0.16	0.10		c0.16	0.05		0.01	c0.04	
v/s Ratio Perm			0.03						0.05			
v/c Ratio	0.52	0.46	0.15	0.64	0.30		0.57	0.14	0.12	0.23	0.24	
Uniform Delay, d1	26.7	23.1	9.6	21.8	16.6		20.1	13.2	13.1	29.7	24.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	0.5	0.1	1.8	0.7		0.9	0.1	0.1	1.5	0.5	
Delay (s)	29.2	23.6	9.7	23.6	17.3		20.9	13.3	13.2	31.2	24.9	
Level of Service	C	C	A	C	B		C	B	B	C	C	
Approach Delay (s)		19.4			21.0			17.7			25.5	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM Average Control Delay			19.9				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			65.1				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			59.7%				ICU Level of Service		B			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	18	324	8	58	365	10	12	1	38	16	1	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	341	8	61	384	11	13	1	40	17	1	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	395			349			906	900	345	935	899	389
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	395			349			906	900	345	935	899	389
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			95			95	100	94	92	100	98
cM capacity (veh/h)	1137			1182			234	255	686	214	255	648

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	368	456	54	28
Volume Left	19	61	13	17
Volume Right	8	11	40	11
cSH	1137	1182	462	287
Volume to Capacity	0.02	0.05	0.12	0.10
Queue Length 95th (ft)	1	4	10	8
Control Delay (s)	0.6	1.6	13.8	18.9
Lane LOS	A	A	B	C
Approach Delay (s)	0.6	1.6	13.8	18.9
Approach LOS			B	C

Intersection Summary			
Average Delay		2.4	
Intersection Capacity Utilization		50.8%	ICU Level of Service
Analysis Period (min)		15	A

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative6 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	238	0	170	0	0
Lane Group Flow (vph)	303	62	1158	95	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.0	9.0	17.0	17.0	15.0	36.0
Effective Green, g (s)	11.0	11.0	19.0	19.0	17.0	38.0
Actuated g/C Ratio	0.21	0.21	0.36	0.36	0.32	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	341	322	1244	557	527	2489
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.19	0.93	0.17	0.90	0.37
Uniform Delay, d1	20.4	17.3	16.4	11.6	17.2	2.9
Progression Factor	0.88	1.22	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.1	0.3	13.6	0.7	18.0	0.4
Delay (s)	41.1	21.5	29.9	12.3	35.2	3.3
Level of Service	D	C	C	B	D	A
Approach Delay (s)	31.4		26.6			14.1
Approach LOS	C		C			B

Intersection Summary

HCM Average Control Delay	22.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak






















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	35	774	636	22	39	6
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1644	1827	3471	1553	1630	
Flt Permitted	0.38	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	665	1827	3471	1553	1630	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	815	669	23	41	6
RTOR Reduction (vph)	0	0	0	6	5	0
Lane Group Flow (vph)	37	815	669	17	42	0
Turn Type	Perm		Perm			
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	37.5	37.5	37.5	37.5	7.5	
Effective Green, g (s)	39.5	39.5	39.5	39.5	9.5	
Actuated g/C Ratio	0.75	0.75	0.75	0.75	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	496	1362	2587	1157	292	
v/s Ratio Prot		c0.45	0.19			
v/s Ratio Perm	0.06			0.01	c0.03	
v/c Ratio	0.07	0.60	0.26	0.01	0.14	
Uniform Delay, d1	1.8	3.1	2.1	1.7	18.3	
Progression Factor	0.64	0.52	0.77	0.39	1.00	
Incremental Delay, d2	0.3	1.8	0.2	0.0	0.2	
Delay (s)	1.5	3.5	1.9	0.7	18.6	
Level of Service	A	A	A	A	B	
Approach Delay (s)		3.4	1.8		18.6	
Approach LOS		A	A		B	

Intersection Summary				
HCM Average Control Delay		3.2	HCM Level of Service	A
HCM Volume to Capacity ratio		0.50		
Actuated Cycle Length (s)		53.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization		53.2%	ICU Level of Service	A
Analysis Period (min)		15		
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	182	626	5	0	448	436	0	0	50	298	0	209
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1644	3467			3471	1553			1580	3190		1553
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1644	3467			3471	1553			1580	3190		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	192	659	5	0	472	459	0	0	53	314	0	220
RTOR Reduction (vph)	0	0	0	0	0	240	0	0	50	0	0	178
Lane Group Flow (vph)	192	664	0	0	472	219	0	0	3	314	0	42
Turn Type	Prot				Perm				custom	Prot		custom
Protected Phases	5	2			6					4		
Permitted Phases						6			8			4
Actuated Green, G (s)	17.9	70.4			48.5	48.5			5.6	18.0		18.0
Effective Green, g (s)	19.9	72.4			50.5	50.5			5.6	20.0		20.0
Actuated g/C Ratio	0.19	0.68			0.48	0.48			0.05	0.19		0.19
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	309	2368			1654	740			83	602		293
v/s Ratio Prot	c0.12	0.19			0.14					c0.10		
v/s Ratio Perm						c0.14			c0.00			0.03
v/c Ratio	0.62	0.28			0.29	0.30			0.03	0.52		0.14
Uniform Delay, d1	39.6	6.6			16.8	16.9			47.6	38.7		35.8
Progression Factor	0.90	0.58			1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	3.2	0.2			0.4	1.0			0.2	3.2		1.0
Delay (s)	39.0	4.1			17.2	17.9			47.8	41.9		36.9
Level of Service	D	A			B	B			D	D		D
Approach Delay (s)		11.9			17.6			47.8			39.8	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM Average Control Delay			21.2				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			106.0				Sum of lost time (s)			10.0		
Intersection Capacity Utilization			44.3%				ICU Level of Service			A		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	428	126	89	431	431	460
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.92	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3202	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3202	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	451	133	94	454	454	484
RTOR Reduction (vph)	0	89	0	0	290	0
Lane Group Flow (vph)	451	44	94	454	648	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	7.0	31.0	20.0	
Effective Green, g (s)	18.0	18.0	9.0	33.0	22.0	
Actuated g/C Ratio	0.33	0.33	0.16	0.60	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	1044	508	269	2083	1281	
v/s Ratio Prot	c0.14		c0.06	0.13	c0.20	
v/s Ratio Perm		0.03				
v/c Ratio	0.43	0.09	0.35	0.22	0.51	
Uniform Delay, d1	14.5	12.8	20.4	5.1	12.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	0.3	3.6	0.2	1.4	
Delay (s)	15.8	13.1	24.0	5.3	13.8	
Level of Service	B	B	C	A	B	
Approach Delay (s)	15.2			8.5	13.8	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement

2016 Alternative6 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	573	370	521	500	19	356	32	470	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3452		3190	1508	1475	1644	1608	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3452		3190	1508	1475	1644	1608	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	603	389	548	526	20	375	34	495	5	7	28
RTOR Reduction (vph)	0	0	191	0	4	0	0	152	171	0	24	0
Lane Group Flow (vph)	32	603	198	548	542	0	375	115	91	5	11	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	2.6	14.2	28.7	12.5	24.1		14.5	20.4	20.4	1.3	7.2	
Effective Green, g (s)	4.6	16.2	32.7	14.5	26.1		16.5	22.4	22.4	3.3	9.2	
Actuated g/C Ratio	0.07	0.25	0.51	0.23	0.41		0.26	0.35	0.35	0.05	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	117	873	837	718	1399		817	525	513	84	230	
v/s Ratio Prot	0.02	c0.17	0.06	c0.17	0.16		c0.12	c0.08		c0.00	0.01	
v/s Ratio Perm			0.07						0.06			
v/c Ratio	0.27	0.69	0.24	0.76	0.39		0.46	0.22	0.18	0.06	0.05	
Uniform Delay, d1	28.3	21.8	8.9	23.3	13.5		20.2	14.8	14.6	29.1	23.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	2.4	0.1	4.8	0.8		0.4	0.2	0.2	0.3	0.1	
Delay (s)	29.6	24.2	9.0	28.2	14.3		20.6	15.0	14.8	29.4	23.9	
Level of Service	C	C	A	C	B		C	B	B	C	C	
Approach Delay (s)		18.6			21.3			17.3			24.6	
Approach LOS		B			C			B			C	

Intersection Summary

HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	4	419	3	47	411	1	11	0	60	13	3	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	441	3	49	433	1	12	0	63	14	3	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	434			444			995	984	443	1046	985	433
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434			444			995	984	443	1046	985	433
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			94	100	90	92	99	98
cM capacity (veh/h)	1115			1105			208	235	611	177	234	618

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	448	483	75	27
Volume Left	4	49	12	14
Volume Right	3	1	63	11
cSH	1115	1105	470	253
Volume to Capacity	0.00	0.04	0.16	0.11
Queue Length 95th (ft)	0	4	14	9
Control Delay (s)	0.1	1.3	14.1	20.9
Lane LOS	A	A	B	C
Approach Delay (s)	0.1	1.3	14.1	20.9
Approach LOS			B	C

Intersection Summary			
Average Delay		2.2	
Intersection Capacity Utilization		61.2%	ICU Level of Service
Analysis Period (min)		15	B

2016 Alternative 7

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HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative7 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	264	0	77	0	0
Lane Group Flow (vph)	118	65	643	38	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.4	9.4	17.0	17.0	19.0	40.0
Effective Green, g (s)	11.4	11.4	19.0	19.0	21.0	42.0
Actuated g/C Ratio	0.20	0.20	0.33	0.33	0.37	0.73
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	317	300	1117	499	585	2469
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.37	0.22	0.58	0.08	0.56	0.31
Uniform Delay, d1	19.9	19.3	15.9	13.2	14.5	2.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	2.2	0.3	3.8	0.3
Delay (s)	20.6	19.6	18.0	13.5	18.3	3.0
Level of Service	C	B	B	B	B	A
Approach Delay (s)	19.9		17.3			7.6
Approach LOS	B		B			A

Intersection Summary

HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	6.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕↕	↗	↘↘	
Volume (vph)	114	234	475	56	196	21
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)		2.0	2.0	2.0	2.0	
Lane Util. Factor		1.00	0.95	1.00	1.00	
Frt		1.00	1.00	0.85	0.99	
Flt Protected		0.98	1.00	1.00	0.96	
Satd. Flow (prot)		1747	3374	1509	1589	
Flt Permitted		0.74	1.00	1.00	0.96	
Satd. Flow (perm)		1312	3374	1509	1589	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	246	500	59	206	22
RTOR Reduction (vph)	0	0	0	16	5	0
Lane Group Flow (vph)	0	366	500	43	223	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)		59.9	59.9	59.9	17.1	
Effective Green, g (s)		61.9	61.9	61.9	19.1	
Actuated g/C Ratio		0.73	0.73	0.73	0.22	
Clearance Time (s)		4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		955	2457	1099	357	
v/s Ratio Prot			0.15			
v/s Ratio Perm		c0.28		0.03	c0.14	
v/c Ratio		0.38	0.20	0.04	0.62	
Uniform Delay, d1		4.4	3.7	3.2	29.7	
Progression Factor		1.00	0.86	0.71	1.00	
Incremental Delay, d2		1.2	0.2	0.1	3.4	
Delay (s)		5.5	3.4	2.4	33.1	
Level of Service		A	A	A	C	
Approach Delay (s)		5.5	3.3		33.1	
Approach LOS		A	A		C	




















Intersection Summary

HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps






















Barton Rd Interchange Improvement
2016 Alternative 7 AM Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	74	346	8	0	335	564	0	0	28	229	0	192	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00	
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85	
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (prot)	1682	3363			3374	1509			1536	3100		1509	
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (perm)	1682	3363			3374	1509			1536	3100		1509	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	78	364	8	0	353	594	0	0	29	241	0	202	
RTOR Reduction (vph)	0	1	0	0	0	159	0	0	27	0	0	113	
Lane Group Flow (vph)	78	371	0	0	353	435	0	0	2	241	0	89	
Turn Type	Prot				pm+ov				custom	Prot		custom	
Protected Phases	5	2			6	7				7		5	
Permitted Phases						6			8			4	
Actuated Green, G (s)	8.0	56.8			44.8	58.2			2.8	13.4		28.2	
Effective Green, g (s)	10.0	58.8			46.8	62.2			4.8	15.4		32.2	
Actuated g/C Ratio	0.12	0.69			0.55	0.73			0.06	0.18		0.38	
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	198	2326			1858	1140			87	562		607	
v/s Ratio Prot	c0.05	0.11			0.10	c0.07				c0.08		c0.02	
v/s Ratio Perm						0.22			0.00			0.04	
v/c Ratio	0.39	0.16			0.19	0.38			0.02	0.43		0.15	
Uniform Delay, d1	34.7	4.5			9.6	4.2			37.9	30.9		17.4	
Progression Factor	0.87	0.52			0.20	1.98			1.00	1.00		1.00	
Incremental Delay, d2	1.2	0.1			0.2	0.2			0.1	0.5		0.1	
Delay (s)	31.2	2.5			2.1	8.6			38.0	31.4		17.5	
Level of Service	C	A			A	A			D	C		B	
Approach Delay (s)		7.5			6.2			38.0			25.1		
Approach LOS		A			A			D			C		
Intersection Summary													
HCM Average Control Delay			11.5									HCM Level of Service	B
HCM Volume to Capacity ratio			0.37										
Actuated Cycle Length (s)			85.0									Sum of lost time (s)	4.0
Intersection Capacity Utilization			47.4%									ICU Level of Service	A
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	113	490	0	0	814	431	74	0	368	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1598	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1598	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	516	0	0	857	454	78	0	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	196	0	167	166	0	0	0
Lane Group Flow (vph)	119	516	0	0	857	258	78	27	27	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	5	2			6		3		8			
Permitted Phases						6						8
Actuated Green, G (s)	17.0	67.3			46.3	46.3	9.7	9.7	9.7			
Effective Green, g (s)	19.0	69.3			48.3	48.3	11.7	11.7	11.7			
Actuated g/C Ratio	0.22	0.82			0.57	0.57	0.14	0.14	0.14			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	357	2751			1917	857	220	197	187			
v/s Ratio Prot	c0.07	0.15			c0.25		c0.05	0.02				
v/s Ratio Perm						0.17			0.02			
v/c Ratio	0.33	0.19			0.45	0.30	0.35	0.14	0.14			
Uniform Delay, d1	27.7	1.7			10.6	9.6	33.2	32.2	32.2			
Progression Factor	1.04	0.51			0.30	0.50	1.00	1.00	1.00			
Incremental Delay, d2	2.5	0.1			0.6	0.8	1.0	0.3	0.4			
Delay (s)	31.3	1.0			3.8	5.6	34.2	32.5	32.6			
Level of Service	C	A			A	A	C	C	C			
Approach Delay (s)		6.7			4.4			32.8			0.0	
Approach LOS		A			A			C			A	
Intersection Summary												
HCM Average Control Delay			10.5				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			85.0				Sum of lost time (s)				6.0	
Intersection Capacity Utilization			50.9%				ICU Level of Service				A	
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak


























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↗↘	↑	↗	↘
Volume (vph)	114	63	189	97	114	343
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.95		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3194		3273	1776	1687	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3194		3273	1776	1687	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	66	199	102	120	361
RTOR Reduction (vph)	59	0	0	0	0	212
Lane Group Flow (vph)	127	0	199	102	120	149
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	8.9		29.1	42.0	35.0	35.0
Effective Green, g (s)	8.9		29.1	42.0	35.0	35.0
Actuated g/C Ratio	0.10		0.34	0.49	0.41	0.41
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	334		1121	878	695	621
v/s Ratio Prot	c0.04		c0.06	0.06	0.07	
v/s Ratio Perm						c0.10
v/c Ratio	0.38		0.18	0.12	0.17	0.24
Uniform Delay, d1	35.5		19.6	11.5	15.8	16.3
Progression Factor	1.00		0.97	0.86	1.00	1.00
Incremental Delay, d2	0.7		0.3	0.3	0.5	0.9
Delay (s)	36.2		19.3	10.2	16.4	17.2
Level of Service	D		B	B	B	B
Approach Delay (s)	36.2			16.2	17.0	
Approach LOS	D			B	B	

Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	549	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.91	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	1598	3348		3100	1535	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.73	1.00	
Satd. Flow (perm)	1598	3374	1509	1598	3348		3100	1535	1434	1233	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	578	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	64	0	4	0	0	14	22	0	125	0
Lane Group Flow (vph)	104	578	157	44	792	0	413	21	12	19	54	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	10.9	41.0	56.3	4.2	34.3		15.3	27.8	27.8	8.5	8.5	
Effective Green, g (s)	12.9	43.0	60.3	6.2	36.3		17.3	29.8	29.8	10.5	10.5	
Actuated g/C Ratio	0.15	0.51	0.71	0.07	0.43		0.20	0.35	0.35	0.12	0.12	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	243	1707	1106	117	1430		631	538	503	152	193	
v/s Ratio Prot	c0.07	c0.17	0.03	0.03	c0.24		c0.13	0.01			c0.03	
v/s Ratio Perm			0.08						0.01	0.02		
v/c Ratio	0.43	0.34	0.14	0.38	0.55		0.65	0.04	0.02	0.12	0.28	
Uniform Delay, d1	32.7	12.5	4.0	37.6	18.3		31.1	18.2	18.1	33.2	33.8	
Progression Factor	0.99	0.94	1.22	1.00	1.00		0.87	0.63	0.49	1.00	1.00	
Incremental Delay, d2	1.2	0.5	0.1	2.0	1.6		2.3	0.0	0.0	0.4	0.8	
Delay (s)	33.4	12.3	4.9	39.6	19.8		29.3	11.5	8.9	33.5	34.6	
Level of Service	C	B	A	D	B		C	B	A	C	C	
Approach Delay (s)		12.9			20.9			26.6			34.5	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM Average Control Delay	20.2	HCM Level of Service C
HCM Volume to Capacity ratio	0.50	
Actuated Cycle Length (s)	85.0	Sum of lost time (s) 6.0
Intersection Capacity Utilization	62.2%	ICU Level of Service B
Analysis Period (min)	15	
c Critical Lane Group		

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	18	324	8	50	365	10	12	1	18	16	2	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	341	8	53	384	11	13	1	19	17	2	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	395			349			889	883	345	897	882	389
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	395			349			889	883	345	897	882	389
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			96			95	100	97	93	99	98
cM capacity (veh/h)	1137			1182			241	262	686	236	263	648

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	368	447	33	29
Volume Left	19	53	13	17
Volume Right	8	11	19	11
cSH	1137	1182	388	308
Volume to Capacity	0.02	0.04	0.08	0.10
Queue Length 95th (ft)	1	3	7	8
Control Delay (s)	0.6	1.4	15.1	17.9
Lane LOS	A	A	C	C
Approach Delay (s)	0.6	1.4	15.1	17.9
Approach LOS			C	C

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		47.6%	ICU Level of Service
Analysis Period (min)		15	A

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative7 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	159	0	162	0	0
Lane Group Flow (vph)	303	141	1158	103	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.9	15.9	31.0	31.0	26.1	61.1
Effective Green, g (s)	17.9	17.9	33.0	33.0	28.1	63.1
Actuated g/C Ratio	0.21	0.21	0.39	0.39	0.33	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	346	327	1348	603	543	2577
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.09		0.07		
v/c Ratio	0.88	0.43	0.86	0.17	0.87	0.36
Uniform Delay, d1	32.5	29.1	23.9	17.0	26.8	3.8
Progression Factor	0.72	0.49	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.0	0.9	7.3	0.6	17.4	0.4
Delay (s)	44.5	15.1	31.2	17.6	44.2	4.2
Level of Service	D	B	C	B	D	A
Approach Delay (s)	29.9		28.6			17.8
Approach LOS	C		C			B

Intersection Summary

HCM Average Control Delay	24.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative7 PM Peak






















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕↕	↕	↕↕	
Volume (vph)	35	766	634	32	39	6
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)		2.0	2.0	2.0	2.0	
Lane Util. Factor		1.00	0.95	1.00	1.00	
Frt		1.00	1.00	0.85	0.98	
Flt Protected		1.00	1.00	1.00	0.96	
Satd. Flow (prot)		1823	3471	1553	1630	
Flt Permitted		0.96	1.00	1.00	0.96	
Satd. Flow (perm)		1748	3471	1553	1630	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	806	667	34	41	6
RTOR Reduction (vph)	0	0	0	5	5	0
Lane Group Flow (vph)	0	843	667	29	42	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)		70.0	70.0	70.0	7.0	
Effective Green, g (s)		72.0	72.0	72.0	9.0	
Actuated g/C Ratio		0.85	0.85	0.85	0.11	
Clearance Time (s)		4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1481	2940	1315	173	
v/s Ratio Prot			0.19			
v/s Ratio Perm		c0.48		0.02	c0.03	
v/c Ratio		0.57	0.23	0.02	0.24	
Uniform Delay, d1		1.9	1.2	1.0	34.9	
Progression Factor		0.49	0.62	0.20	1.00	
Incremental Delay, d2		1.5	0.2	0.0	0.7	
Delay (s)		2.5	0.9	0.2	35.6	
Level of Service		A	A	A	D	
Approach Delay (s)		2.5	0.9		35.6	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	2.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative7 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	183	616	2	0	458	436	0	0	61	296	0	208
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1731	3470			3471	1553			1580	3190		1553
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1731	3470			3471	1553			1580	3190		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	193	648	2	0	482	459	0	0	64	312	0	219
RTOR Reduction (vph)	0	0	0	0	0	174	0	0	58	0	0	45
Lane Group Flow (vph)	193	650	0	0	482	285	0	0	6	312	0	174
Turn Type	Prot				pm+ov				custom	Prot		custom
Protected Phases	5	2			6	7				7		5
Permitted Phases						6			8			4
Actuated Green, G (s)	14.7	52.7			34.0	48.7			5.6	14.7		39.0
Effective Green, g (s)	16.7	54.7			36.0	52.7			7.6	16.7		43.0
Actuated g/C Ratio	0.20	0.64			0.42	0.62			0.09	0.20		0.51
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	340	2233			1470	963			141	627		822
v/s Ratio Prot	c0.11	0.19			c0.14	0.06				c0.10		c0.04
v/s Ratio Perm						0.13			0.00			0.07
v/c Ratio	0.57	0.29			0.33	0.30			0.04	0.50		0.21
Uniform Delay, d1	30.9	6.6			16.4	7.5			35.4	30.4		11.6
Progression Factor	0.83	0.70			0.51	2.03			1.00	1.00		1.00
Incremental Delay, d2	1.8	0.3			0.6	0.2			0.1	0.6		0.1
Delay (s)	27.3	5.0			9.0	15.4			35.5	31.0		11.7
Level of Service	C	A			A	B			D	C		B
Approach Delay (s)		10.1			12.1			35.5			23.1	
Approach LOS		B			B			D			C	
Intersection Summary												
HCM Average Control Delay			14.5		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			85.0		Sum of lost time (s)			8.0				
Intersection Capacity Utilization			44.4%		ICU Level of Service			A				
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative 7 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	159	813	0	0	797	390	86	0	468	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1644	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1644	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	167	856	0	0	839	411	91	0	493	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	188	0	185	185	0	0	0
Lane Group Flow (vph)	167	856	0	0	839	223	91	62	61	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	18.0	66.1			44.1	44.1	10.9	10.9	10.9			
Effective Green, g (s)	20.0	68.1			46.1	46.1	12.9	12.9	12.9			
Actuated g/C Ratio	0.24	0.80			0.54	0.54	0.15	0.15	0.15			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	387	2781			1883	842	250	224	212			
v/s Ratio Prot	c0.10	0.25			c0.24		c0.06	0.04				
v/s Ratio Perm						0.14			0.04			
v/c Ratio	0.43	0.31			0.45	0.26	0.36	0.28	0.29			
Uniform Delay, d1	27.7	2.2			11.7	10.4	32.4	31.9	32.0			
Progression Factor	1.21	1.63			0.49	0.39	1.00	1.00	1.00			
Incremental Delay, d2	0.7	0.3			0.7	0.7	0.9	0.7	0.8			
Delay (s)	34.2	3.9			6.4	4.7	33.3	32.6	32.7			
Level of Service	C	A			A	A	C	C	C			
Approach Delay (s)		8.9			5.9			32.8			0.0	
Approach LOS		A			A			C			A	
Intersection Summary												
HCM Average Control Delay			12.4				HCM Level of Service		B			
HCM Volume to Capacity ratio			0.42									
Actuated Cycle Length (s)			85.0				Sum of lost time (s)		6.0			
Intersection Capacity Utilization			53.1%				ICU Level of Service		A			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2016 Alternative7 PM Peak


























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑	↖	↗
Volume (vph)	108	117	351	124	108	323
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.92		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3201		3367	1827	1736	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3201		3367	1827	1736	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	114	123	369	131	114	340
RTOR Reduction (vph)	110	0	0	0	0	220
Lane Group Flow (vph)	127	0	369	131	114	120
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	8.9		34.1	47.0	30.0	30.0
Effective Green, g (s)	8.9		34.1	47.0	30.0	30.0
Actuated g/C Ratio	0.10		0.40	0.55	0.35	0.35
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	335		1351	1010	613	548
v/s Ratio Prot	c0.04		c0.11	0.07	0.07	
v/s Ratio Perm						c0.08
v/c Ratio	0.38		0.27	0.13	0.19	0.22
Uniform Delay, d1	35.5		17.1	9.2	19.0	19.3
Progression Factor	1.00		0.94	1.03	1.00	1.00
Incremental Delay, d2	0.7		0.5	0.3	0.7	0.9
Delay (s)	36.2		16.5	9.7	19.7	20.2
Level of Service	D		B	A	B	C
Approach Delay (s)	36.2			14.7	20.1	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	33.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative 7 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	1.5	1.5	1.0	1.5	1.0		1.0	1.0	1.0	1.5	1.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.91	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3460		3190	1577	1475	1644	1608	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.53	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3460		3190	1577	1475	911	1608	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	115	0	2	0	0	38	59	0	25	0
Lane Group Flow (vph)	32	962	240	138	955	0	284	49	24	5	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	4.5	41.3	53.4	11.0	48.3		12.1	22.7	22.7	7.1	7.1	
Effective Green, g (s)	6.5	43.3	57.4	13.0	50.3		14.1	24.7	24.7	9.1	9.1	
Actuated g/C Ratio	0.08	0.51	0.68	0.15	0.59		0.17	0.29	0.29	0.11	0.11	
Clearance Time (s)	3.5	3.5	3.0	3.5	3.0		3.0	3.0	3.0	3.5	3.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	126	1768	1049	251	2048		529	458	429	98	172	
v/s Ratio Prot	0.02	c0.28	0.04	c0.08	0.28		c0.09	c0.03			0.01	
v/s Ratio Perm			0.12						0.02	0.01		
v/c Ratio	0.25	0.54	0.23	0.55	0.47		0.54	0.11	0.06	0.05	0.06	
Uniform Delay, d1	37.0	14.2	5.3	33.3	9.8		32.5	22.1	21.7	34.1	34.1	
Progression Factor	0.78	0.62	1.73	1.00	1.00		0.85	0.63	0.39	1.00	1.00	
Incremental Delay, d2	1.0	1.1	0.1	2.5	0.8		1.0	0.1	0.1	0.2	0.1	
Delay (s)	29.7	9.9	9.3	35.8	10.5		28.6	14.0	8.5	34.3	34.2	
Level of Service	C	A	A	D	B		C	B	A	C	C	
Approach Delay (s)		10.2			13.7			22.1			34.2	
Approach LOS		B			B			C			C	

Intersection Summary

HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative7 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	4	419	3	19	411	1	11	0	10	13	3	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	441	3	20	433	1	12	0	11	14	3	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	434			444			936	925	443	935	926	433
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434			444			936	925	443	935	926	433
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			95	100	98	94	99	98
cM capacity (veh/h)	1115			1105			233	261	611	236	261	618

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	448	454	22	27
Volume Left	4	20	12	14
Volume Right	3	1	11	11
cSH	1115	1105	330	314
Volume to Capacity	0.00	0.02	0.07	0.09
Queue Length 95th (ft)	0	1	5	7
Control Delay (s)	0.1	0.6	16.7	17.6
Lane LOS	A	A	C	C
Approach Delay (s)	0.1	0.6	16.7	17.6
Approach LOS			C	C

Intersection Summary			
Average Delay		1.2	
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

2040 Intersection LOS















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2040 Alternative 1

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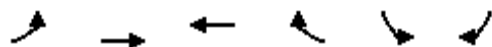
Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative1
AM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	347	0	191	0	0
Lane Group Flow (vph)	291	238	1083	87	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.4	15.4	23.0	23.0	29.6	56.6
Effective Green, g (s)	17.4	17.4	25.0	25.0	31.6	58.6
Actuated g/C Ratio	0.22	0.22	0.31	0.31	0.40	0.73
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	358	338	1085	485	649	2543
v/s Ratio Prot	c0.18		c0.31		c0.40	0.45
v/s Ratio Perm		0.15		0.06		
v/c Ratio	0.81	0.70	1.00	0.18	1.01	0.62
Uniform Delay, d1	29.8	28.9	27.5	20.0	24.2	5.2
Progression Factor	0.74	0.72	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.8	6.3	26.9	0.8	36.9	1.1
Delay (s)	34.7	27.0	54.4	20.8	61.1	6.4
Level of Service	C	C	D	C	E	A
Approach Delay (s)	29.5		47.5			22.4
Approach LOS	C		D			C
Intersection Summary						
HCM Average Control Delay			31.4		HCM Level of Service	C
HCM Volume to Capacity ratio			0.94			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative1
AM PEAK



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↗	↘	
Volume (veh/h)	178	672	808	75	190	24
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	187	707	851	79	200	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.84				0.84	0.84
vC, conflicting volume	929				1933	851
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	820				2016	726
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	72				0	93
cM capacity (veh/h)	671				38	353

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	895	851	79	225
Volume Left	187	0	0	200
Volume Right	0	0	79	25
cSH	671	1700	1700	43
Volume to Capacity	0.28	0.50	0.05	5.28
Queue Length 95th (ft)	29	0	0	Err
Control Delay (s)	7.3	0.0	0.0	Err
Lane LOS	A			F
Approach Delay (s)	7.3	0.0		Err
Approach LOS				F

Intersection Summary			
Average Delay		1102.2	
Intersection Capacity Utilization		115.3%	ICU Level of Service H
Analysis Period (min)		15	

Barton Road Interchange Improvement Project
3: Barton Rd & La Crosse Ave

2040 Alternative1
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	858	3	21	570	0	7	0	17	0	22	306
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	903	3	22	600	0	7	0	18	0	23	322
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.82						0.82	0.82		0.82	0.82	0.82
vC, conflicting volume	600			906			1883	1549	905	1567	1551	600
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	398			906			1969	1560	905	1582	1562	398
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			36	100	95	100	74	39
cM capacity (veh/h)	939			743			12	88	332	66	88	529
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	906	622	25	345								
Volume Left	0	22	7	0								
Volume Right	3	0	18	322								
cSH	1700	743	36	395								
Volume to Capacity	0.53	0.03	0.69	0.87								
Queue Length 95th (ft)	0	2	61	217								
Control Delay (s)	0.0	0.8	223.4	51.9								
Lane LOS		A	F	F								
Approach Delay (s)	0.0	0.8	223.4	51.9								
Approach LOS			F	F								
Intersection Summary												
Average Delay			12.7									
Intersection Capacity Utilization			77.5%		ICU Level of Service				D			
Analysis Period (min)			15									

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative1
AM PEAK





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	754	119	907	591	11	0	0	0	382	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.98		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1790		1644	1822						1736	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1790		1644	1822						1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2	794	125	955	622	12	0	0	0	402	0	0
RTOR Reduction (vph)	0	7	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	912	0	955	633	0	0	0	0	0	402	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	24.8		27.2	51.2						16.0	
Effective Green, g (s)	2.8	26.8		29.2	53.2						18.0	
Actuated g/C Ratio	0.03	0.34		0.36	0.67						0.22	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	58	600		600	1212						391	
v/s Ratio Prot	0.00	c0.51		c0.58	0.35						c0.23	
v/s Ratio Perm												
v/c Ratio	0.03	1.52		1.59	0.52						1.03	
Uniform Delay, d1	37.3	26.6		25.4	6.9						31.0	
Progression Factor	1.30	0.54		0.61	0.12						1.00	
Incremental Delay, d2	0.2	240.4		267.0	0.0						52.9	
Delay (s)	48.8	254.6		282.6	0.9						83.9	
Level of Service	D	F		F	A						F	
Approach Delay (s)		254.2			170.2			0.0			83.9	
Approach LOS		F			F			A			F	

Intersection Summary

HCM Average Control Delay	184.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	132.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative1
AM PEAK

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	227	909	0	0	1377	868	132	0	574	0	0	0	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0				
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00				
Frt	1.00	1.00			1.00	0.85		1.00	0.85				
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00				
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553				
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00				
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	239	957	0	0	1449	914	139	0	604	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	312	0	0	143	0	0	0	
Lane Group Flow (vph)	239	957	0	0	1449	602	0	139	461	0	0	0	
Turn Type	Prot						Perm	Split	Perm				
Protected Phases	5	2					6	8	8				
Permitted Phases							6						8
Actuated Green, G (s)	8.0	55.0					43.0	43.0	17.0	17.0			
Effective Green, g (s)	10.0	57.0					45.0	45.0	19.0	19.0			
Actuated g/C Ratio	0.12	0.71					0.56	0.56	0.24	0.24			
Clearance Time (s)	4.0	4.0					4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	206	1302					1028	874	412	369			
v/s Ratio Prot	c0.15	0.52					c0.79		0.08				
v/s Ratio Perm								0.39					c0.30
v/c Ratio	1.16	0.74					1.41	0.69	0.34	1.25			
Uniform Delay, d1	35.0	6.9					17.5	12.5	25.3	30.5			
Progression Factor	1.35	0.17					0.83	0.39	1.00	1.00			
Incremental Delay, d2	77.4	0.3					185.6	1.0	2.2	132.5			
Delay (s)	124.6	1.5					200.2	5.9	27.5	163.0			
Level of Service	F	A					F	A	C	F			
Approach Delay (s)	26.1						125.0					137.6	0.0
Approach LOS	C						F					F	A
Intersection Summary													
HCM Average Control Delay					99.7	HCM Level of Service				F			
HCM Volume to Capacity ratio					1.31								
Actuated Cycle Length (s)					80.0	Sum of lost time (s)				6.0			
Intersection Capacity Utilization					103.5%	ICU Level of Service				G			
Analysis Period (min)					15								
c	Critical Lane Group												

Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

2040 Alternative1
AM PEAK




















Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	↵
Volume (vph)	1003	480	173	1350	896	183
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.95		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3303		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3303		1644	3471	1644	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1056	505	182	1421	943	193
RTOR Reduction (vph)	72	0	0	0	0	101
Lane Group Flow (vph)	1490	0	182	1421	943	92
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	26.0		7.0	37.0	35.0	35.0
Effective Green, g (s)	28.0		9.0	39.0	37.0	37.0
Actuated g/C Ratio	0.35		0.11	0.49	0.46	0.46
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1156		185	1692	760	718
v/s Ratio Prot	c0.45		c0.11	0.41	c0.57	
v/s Ratio Perm						0.06
v/c Ratio	1.29		0.98	0.84	1.24	0.13
Uniform Delay, d1	26.0		35.4	17.8	21.5	12.3
Progression Factor	1.10		1.00	1.00	1.00	1.00
Incremental Delay, d2	132.6		61.0	5.2	119.4	0.4
Delay (s)	161.2		96.5	23.0	140.9	12.7
Level of Service	F		F	C	F	B
Approach Delay (s)	161.2			31.3	119.1	
Approach LOS	F			C	F	

Intersection Summary

HCM Average Control Delay	101.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	115.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative1
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	155	1031	0	0	1358	65	0	0	0	21	0	165
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	163	1085	0	0	1429	68	0	0	0	22	0	174
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.69			0.69	0.69	0.69	0.69	0.69	
vC, conflicting volume	1498			1085			2300	2909	543	2298	2841	715
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1498			219			1983	2869	0	1981	2769	715
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	62			100			100	100	100	0	100	53
cM capacity (veh/h)	434			918			9	7	742	17	8	369
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	163	543	543	715	715	68	196					
Volume Left	163	0	0	0	0	0	22					
Volume Right	0	0	0	0	0	68	174					
cSH	434	1700	1700	1700	1700	1700	112					
Volume to Capacity	0.38	0.32	0.32	0.42	0.42	0.04	1.74					
Queue Length 95th (ft)	43	0	0	0	0	0	381					
Control Delay (s)	18.2	0.0	0.0	0.0	0.0	0.0	434.9					
Lane LOS	C						F					
Approach Delay (s)	2.4			0.0			434.9					
Approach LOS							F					
Intersection Summary												
Average Delay			30.0									
Intersection Capacity Utilization			70.7%		ICU Level of Service				C			
Analysis Period (min)			15									

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative1
PM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	293	0	150	0	0
Lane Group Flow (vph)	359	413	2497	247	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	16.0	16.0	34.0	34.0	18.0	56.0
Effective Green, g (s)	18.0	18.0	36.0	36.0	20.0	58.0
Actuated g/C Ratio	0.22	0.22	0.45	0.45	0.25	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	370	349	1562	699	411	2516
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.27		0.16		
v/c Ratio	0.97	1.18	1.60	0.35	1.75	0.83
Uniform Delay, d1	30.7	31.0	22.0	14.4	30.0	7.6
Progression Factor	0.61	0.74	1.00	1.00	1.00	1.00
Incremental Delay, d2	36.7	106.1	272.4	1.4	346.1	3.3
Delay (s)	55.6	129.2	294.4	15.8	376.1	10.9
Level of Service	E	F	F	B	F	B
Approach Delay (s)	104.4		256.2			104.4
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			169.3		HCM Level of Service	F
HCM Volume to Capacity ratio			1.51			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative1
PM PEAK



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↗	↘	
Volume (veh/h)	52	1420	1111	26	38	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	55	1495	1169	27	40	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.66				0.66	0.66
vC, conflicting volume	1197				2774	1169
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1041				3430	999
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	87				0	98
cM capacity (veh/h)	436				4	193

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	1549	1169	27	43
Volume Left	55	0	0	40
Volume Right	0	0	27	3
cSH	436	1700	1700	5
Volume to Capacity	0.13	0.69	0.02	9.04
Queue Length 95th (ft)	11	0	0	Err
Control Delay (s)	14.4	0.0	0.0	Err
Lane LOS	B			F
Approach Delay (s)	14.4	0.0		Err
Approach LOS				F

Intersection Summary			
Average Delay		162.7	
Intersection Capacity Utilization		133.3%	ICU Level of Service H
Analysis Period (min)		15	


















Barton Road Interchange Improvement Project
 3: Barton Rd & La Crosse Ave

2040 Alternative1
 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1455	3	7	769	0	8	0	63	0	6	360
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	1532	3	7	809	0	8	0	66	0	6	379
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.69						0.69	0.69		0.69	0.69	0.69
vC, conflicting volume	809			1535			2739	2357	1533	2424	2359	809
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	495			1535			3303	2747	1533	2844	2750	495
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			0	100	53	100	52	3
cM capacity (veh/h)	727			428			0	13	142	4	13	392
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	1535	817	75	385								
Volume Left	0	7	8	0								
Volume Right	3	0	66	379								
cSH	1700	428	1	266								
Volume to Capacity	0.90	0.02	122.68	1.45								
Queue Length 95th (ft)	0	1	Err	539								
Control Delay (s)	0.0	0.6	Err	256.2								
Lane LOS		A	F	F								
Approach Delay (s)	0.0	0.6	Err	256.2								
Approach LOS			F	F								
Intersection Summary												
Average Delay			301.1									
Intersection Capacity Utilization			111.5%		ICU Level of Service				H			
Analysis Period (min)			15									



















Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative1
 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1255	258	615	776	10	0	0	0	523	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1780		1644	1823						1736	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1780		1644	1823						1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	1321	272	647	817	11	0	0	0	551	0	0
RTOR Reduction (vph)	0	10	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	5	1583	0	647	827	0	0	0	0	0	551	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	33.8		16.2	49.2						18.0	
Effective Green, g (s)	2.8	35.8		18.2	51.2						20.0	
Actuated g/C Ratio	0.03	0.45		0.23	0.64						0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	58	797		374	1167						434	
v/s Ratio Prot	0.00	c0.89		c0.39	0.45						c0.32	
v/s Ratio Perm												
v/c Ratio	0.09	1.99		1.73	0.71						1.27	
Uniform Delay, d1	37.4	22.1		30.9	9.5						30.0	
Progression Factor	0.93	0.64		0.50	0.49						1.00	
Incremental Delay, d2	0.3	445.9		329.5	0.2						138.4	
Delay (s)	34.9	460.1		344.9	4.9						168.4	
Level of Service	C	F		F	A						F	
Approach Delay (s)		458.8		154.0				0.0			168.4	
Approach LOS		F		F				A			F	
Intersection Summary												
HCM Average Control Delay	290.6			HCM Level of Service				F				
HCM Volume to Capacity ratio	1.70											
Actuated Cycle Length (s)	80.0			Sum of lost time (s)				6.0				
Intersection Capacity Utilization	158.3%			ICU Level of Service				H				
Analysis Period (min)	15											
c Critical Lane Group												

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative1
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	267	1512	0	0	1367	655	34	0	901	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	1592	0	0	1439	689	36	0	948	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	237	0	0	20	0	0	0
Lane Group Flow (vph)	281	1592	0	0	1439	452	0	36	929	0	0	0
Turn Type	Prot				Perm		Split		Perm			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			8			
Actuated Green, G (s)	8.0	46.0			34.0	34.0		26.0	26.0			
Effective Green, g (s)	10.0	48.0			36.0	36.0		28.0	28.0			
Actuated g/C Ratio	0.12	0.60			0.45	0.45		0.35	0.35			
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	206	1096			822	699		608	544			
v/s Ratio Prot	0.17	c0.87			c0.79			0.02				
v/s Ratio Perm						0.29			c0.60			
v/c Ratio	1.36	1.45			1.75	0.65		0.06	1.71			
Uniform Delay, d1	35.0	16.0			22.0	17.1		17.3	26.0			
Progression Factor	0.80	0.56			0.85	0.48		1.00	1.00			
Incremental Delay, d2	166.7	204.1			340.6	2.6		0.2	325.9			
Delay (s)	194.6	213.1			359.3	10.8		17.4	351.9			
Level of Service	F	F			F	B		B	F			
Approach Delay (s)		210.3			246.5			339.6			0.0	
Approach LOS		F			F			F			A	

Intersection Summary

HCM Average Control Delay	251.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	142.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			





















Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

2040 Alternative1
PM PEAK

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	↗
Volume (vph)	1796	616	259	1506	516	364
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3338		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3338		1644	3471	1644	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1891	648	273	1585	543	383
RTOR Reduction (vph)	42	0	0	0	0	152
Lane Group Flow (vph)	2497	0	273	1585	543	231
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	39.0		9.0	52.0	20.0	20.0
Effective Green, g (s)	41.0		11.0	54.0	22.0	22.0
Actuated g/C Ratio	0.51		0.14	0.68	0.28	0.28
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1711		226	2343	452	427
v/s Ratio Prot	c0.75		c0.17	0.46	c0.33	
v/s Ratio Perm						0.15
v/c Ratio	1.46		1.21	0.68	1.20	0.54
Uniform Delay, d1	19.5		34.5	7.8	29.0	24.7
Progression Factor	1.03		1.00	1.00	1.00	1.00
Incremental Delay, d2	206.9		127.5	1.6	110.1	4.8
Delay (s)	227.0		162.0	9.4	139.1	29.5
Level of Service	F		F	A	F	C
Approach Delay (s)	227.0			31.8	93.8	
Approach LOS	F			C	F	
Intersection Summary						
HCM Average Control Delay			135.7		HCM Level of Service	F
HCM Volume to Capacity ratio			1.32			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			124.7%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative1
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	45	2115	0	0	1732	23	0	0	0	3	0	33
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	47	2226	0	0	1823	24	0	0	0	3	0	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.50			0.50	0.50	0.50	0.50	0.50	
vC, conflicting volume	1847			2226			3267	4168	1113	3031	4144	912
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1847			1455			3534	5334	0	3062	5285	912
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	85			100			100	100	100	0	100	87
cM capacity (veh/h)	317			226			1	0	540	2	0	273
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	47	1113	1113	912	912	24	38					
Volume Left	47	0	0	0	0	0	3					
Volume Right	0	0	0	0	0	24	35					
cSH	317	1700	1700	1700	1700	1700	25					
Volume to Capacity	0.15	0.65	0.65	0.54	0.54	0.01	1.52					
Queue Length 95th (ft)	13	0	0	0	0	0	117					
Control Delay (s)	18.4	0.0	0.0	0.0	0.0	0.0	603.7					
Lane LOS	C						F					
Approach Delay (s)	0.4			0.0			603.7					
Approach LOS							F					
Intersection Summary												
Average Delay			5.7									
Intersection Capacity Utilization			71.7%		ICU Level of Service				C			
Analysis Period (min)			15									

2040 Alternative 2

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative2
AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	306	0	188	0	0
Lane Group Flow (vph)	291	279	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	16.0	16.0	27.0	27.0	35.0	66.0
Effective Green, g (s)	18.0	18.0	29.0	29.0	37.0	68.0
Actuated g/C Ratio	0.20	0.20	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	320	302	1087	486	657	2549
v/s Ratio Prot	0.18		c0.32		c0.41	0.47
v/s Ratio Perm		c0.19		0.06		
v/c Ratio	0.91	0.93	1.00	0.18	0.99	0.62
Uniform Delay, d1	35.2	35.3	30.4	22.0	26.4	5.1
Progression Factor	0.71	0.85	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.7	31.1	26.4	0.8	33.7	1.1
Delay (s)	51.6	61.2	56.9	22.8	60.1	6.2
Level of Service	D	E	E	C	E	A
Approach Delay (s)	58.0		49.9			22.0
Approach LOS	E		D			C

Intersection Summary

HCM Average Control Delay	37.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative2
AM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.96			0.73	
Satd. Flow (perm)		2104			2874	1509		1522			1270	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	23	0	32	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	56	0	22	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		61.9			61.9	61.9		20.1			20.1	
Effective Green, g (s)		63.9			63.9	63.9		22.1			22.1	
Actuated g/C Ratio		0.71			0.71	0.71		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1494			2041	1071		374			312	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.42	0.05		0.06			0.70	
Uniform Delay, d1		6.5			5.4	3.9		26.0			30.9	
Progression Factor		0.20			1.52	2.27		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			7.0	
Delay (s)		2.2			8.9	9.0		26.1			37.9	
Level of Service		A			A	A		C			D	
Approach Delay (s)		2.2			8.9	9.0		26.1			37.9	
Approach LOS		A			A	A		C			D	

Intersection Summary

HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			




















Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑	↑	↑
Volume (vph)	0	754	119	907	591	0	0	0	0	382	22	306
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (prot)		3374	1509	3100	3374					1518	1615	1509
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (perm)		3374	1509	3100	3374					1518	1615	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	794	125	955	622	0	0	0	0	402	23	322
RTOR Reduction (vph)	0	0	83	0	0	0	0	0	0	0	0	254
Lane Group Flow (vph)	0	794	42	955	622	0	0	0	0	213	212	68
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		28.0	28.0	33.0	65.0					17.0	17.0	17.0
Effective Green, g (s)		30.0	30.0	35.0	67.0					19.0	19.0	19.0
Actuated g/C Ratio		0.33	0.33	0.39	0.74					0.21	0.21	0.21
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1125	503	1206	2512					320	341	319
v/s Ratio Prot		c0.24		c0.31	0.18					c0.14	0.13	
v/s Ratio Perm			0.03									0.05
v/c Ratio		0.71	0.08	0.79	0.25					0.67	0.62	0.21
Uniform Delay, d1		26.2	20.6	24.3	3.6					32.6	32.2	29.3
Progression Factor		0.69	0.40	0.57	0.14					1.00	1.00	1.00
Incremental Delay, d2		3.2	0.3	2.8	0.2					5.2	3.5	0.3
Delay (s)		21.2	8.5	16.7	0.7					37.7	35.7	29.7
Level of Service		C	A	B	A					D	D	C
Approach Delay (s)		19.4			10.4			0.0			33.7	
Approach LOS		B			B			A			C	
Intersection Summary												
HCM Average Control Delay			18.3		HCM Level of Service					B		
HCM Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			82.4%		ICU Level of Service					E		
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	909	0	0	1366	868	132	0	574	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3100	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3100	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	957	0	0	1438	914	139	0	604	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	280	0	158	158	0	0	0
Lane Group Flow (vph)	239	957	0	0	1438	634	139	144	144	0	0	0
Turn Type	Prot				Perm		Prot	Perm				
Protected Phases	5	2			6		3	8				
Permitted Phases					6				8			
Actuated Green, G (s)	8.0	67.9			55.9	55.9	14.1	14.1	14.1			
Effective Green, g (s)	10.0	69.9			57.9	57.9	16.1	16.1	16.1			
Actuated g/C Ratio	0.11	0.78			0.64	0.64	0.18	0.18	0.18			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	344	2620			2171	971	286	257	243			
v/s Ratio Prot	c0.08	0.28			c0.43		0.09	0.10				
v/s Ratio Perm					0.42				c0.11			
v/c Ratio	0.69	0.37			0.66	0.65	0.49	0.56	0.59			
Uniform Delay, d1	38.5	3.1			10.0	9.9	33.2	33.7	33.9			
Progression Factor	0.76	0.00			0.57	0.43	1.00	1.00	1.00			
Incremental Delay, d2	4.3	0.3			0.5	1.0	1.3	2.8	3.9			
Delay (s)	33.5	0.3			6.2	5.2	34.5	36.5	37.8			
Level of Service	C	A			A	A	C	D	D			
Approach Delay (s)	6.9				5.8		36.7				0.0	
Approach LOS	A				A		D				A	
Intersection Summary												
HCM Average Control Delay			11.5		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			82.4%		ICU Level of Service				E			
Analysis Period (min)			15									
c	Critical Lane Group											















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative2
AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1742	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.89	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1572	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	117	0	4	0	0	0	26	0	0	122
Lane Group Flow (vph)	163	893	388	182	1335	0	943	43	128	0	57	18
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	7.0	34.1	59.1	7.9	35.0		25.0	36.0	43.9		7.0	7.0
Effective Green, g (s)	9.0	36.1	63.1	9.9	37.0		27.0	38.0	47.9		9.0	9.0
Actuated g/C Ratio	0.10	0.40	0.70	0.11	0.41		0.30	0.42	0.53		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	160	1353	1058	341	1376		930	750	837		157	151
v/s Ratio Prot	c0.10	0.26	0.11	0.06	c0.40		c0.30	0.02	0.02		c0.04	0.01
v/s Ratio Perm			0.15						0.07			
v/c Ratio	1.02	0.66	0.37	0.53	0.97		1.01	0.06	0.15		0.36	0.12
Uniform Delay, d1	40.5	22.0	5.4	37.9	26.0		31.5	15.4	10.7		37.8	36.9
Progression Factor	0.78	0.65	0.85	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	72.4	2.3	0.2	1.6	18.1		33.0	0.0	0.1		1.4	0.3
Delay (s)	104.1	16.6	4.8	39.5	44.1		64.5	15.4	10.8		39.3	37.2
Level of Service	F	B	A	D	D		E	B	B		D	D
Approach Delay (s)		21.9			43.5			55.4			37.8	
Approach LOS		C			D			E			D	
Intersection Summary												
HCM Average Control Delay			38.7			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)		8.0				
Intersection Capacity Utilization			88.1%			ICU Level of Service		E				
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2040 Alternative2
 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.74	1.11	1.00	1.00	1.00	1.00
Incremental Delay, d2	199.9	321.8	200.6	1.2	267.4	1.9
Delay (s)	228.1	364.1	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	318.2		194.5			81.5
Approach LOS	F		F			F

Intersection Summary

HCM Average Control Delay	167.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative2
PM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.55	
Satd. Flow (perm)		2953			2727	1553		1580			996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	61	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	141	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		68.9			68.9	68.9		13.1			13.1	
Effective Green, g (s)		70.9			70.9	70.9		15.1			15.1	
Actuated g/C Ratio		0.79			0.79	0.79		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2326			2148	1223		265			167	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.09			0.04	
v/c Ratio		0.62			0.54	0.02		0.53			0.24	
Uniform Delay, d1		3.9			3.5	2.1		34.2			32.5	
Progression Factor		0.52			0.18	0.01		1.00			1.00	
Incremental Delay, d2		0.5			0.9	0.0		2.1			0.8	
Delay (s)		2.6			1.6	0.1		36.3			33.2	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.6			1.5			36.3			33.2	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			




















Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative2
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑	↑	↑
Volume (vph)	0	1255	258	615	776	0	0	0	0	523	6	360
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3471	1553	3190	3471					1562	1655	1553
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3471	1553	3190	3471					1562	1655	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1321	272	647	817	0	0	0	0	551	6	379
RTOR Reduction (vph)	0	0	151	0	0	0	0	0	0	0	0	192
Lane Group Flow (vph)	0	1321	121	647	817	0	0	0	0	281	276	187
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		38.0	38.0	21.0	63.0					19.0	19.0	19.0
Effective Green, g (s)		40.0	40.0	23.0	65.0					21.0	21.0	21.0
Actuated g/C Ratio		0.44	0.44	0.26	0.72					0.23	0.23	0.23
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1543	690	815	2507					364	386	362
v/s Ratio Prot		c0.38		c0.20	0.24					c0.18	0.17	
v/s Ratio Perm			0.08									0.12
v/c Ratio		0.86	0.18	0.79	0.33					0.77	0.72	0.52
Uniform Delay, d1		22.4	15.1	31.3	4.5					32.3	31.7	30.1
Progression Factor		0.78	0.61	0.42	0.48					1.00	1.00	1.00
Incremental Delay, d2		5.2	0.5	2.8	0.2					9.8	6.2	1.3
Delay (s)		22.7	9.6	15.9	2.3					42.0	37.9	31.3
Level of Service		C	A	B	A					D	D	C
Approach Delay (s)		20.5			8.3			0.0			36.5	
Approach LOS		C			A			A			D	
Intersection Summary												
HCM Average Control Delay			19.8		HCM Level of Service					B		
HCM Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			87.7%		ICU Level of Service					E		
Analysis Period (min)			15									
c Critical Lane Group												























Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative2
PM Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	267	1512	0	0	1357	655	34	0	901	0	0	0	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0				
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95				
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85				
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (prot)	3190	3471			3471	1553	1644	1475	1398				
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (perm)	3190	3471			3471	1553	1644	1475	1398				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	281	1592	0	0	1428	689	36	0	948	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	360	0	18	18	0	0	0	
Lane Group Flow (vph)	281	1592	0	0	1428	329	36	456	456	0	0	0	
Turn Type	Prot				Perm		Prot		Perm				
Protected Phases	5	2			6		3		8				
Permitted Phases						6						8	
Actuated Green, G (s)	7.0	52.0			41.0	41.0	30.0	30.0	30.0				
Effective Green, g (s)	9.0	54.0			43.0	43.0	32.0	32.0	32.0				
Actuated g/C Ratio	0.10	0.60			0.48	0.48	0.36	0.36	0.36				
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)	319	2083			1658	742	585	524	497				
v/s Ratio Prot	0.09	c0.46			c0.41		0.02	0.31					
v/s Ratio Perm						0.21			c0.33				
v/c Ratio	0.88	0.76			0.86	0.44	0.06	0.87	0.92				
Uniform Delay, d1	40.0	13.3			20.9	15.6	19.1	27.1	27.7				
Progression Factor	0.71	0.21			0.58	0.95	1.00	1.00	1.00				
Incremental Delay, d2	14.4	1.5			3.5	1.1	0.0	14.6	21.7				
Delay (s)	42.9	4.3			15.7	15.9	19.2	41.6	49.5				
Level of Service	D	A			B	B	B	D	D				
Approach Delay (s)		10.1			15.8			44.6			0.0		
Approach LOS		B			B			D			A		
Intersection Summary													
HCM Average Control Delay			19.3		HCM Level of Service				B				
HCM Volume to Capacity ratio			0.86										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				4.0				
Intersection Capacity Utilization			87.7%		ICU Level of Service				E				
Analysis Period (min)			15										
c	Critical Lane Group												

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative2
PM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.99	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3463		3190	1827	1553		1800	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3463		3190	1827	1553		1684	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	148	0	1	0	0	0	5	0	0	24
Lane Group Flow (vph)	47	1843	500	273	1569	0	543	103	301	0	10	3
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	4.2	46.0	60.0	7.0	48.8		14.0	25.0	32.0		7.0	7.0
Effective Green, g (s)	6.2	48.0	64.0	9.0	50.8		16.0	27.0	36.0		9.0	9.0
Actuated g/C Ratio	0.07	0.53	0.71	0.10	0.56		0.18	0.30	0.40		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	113	1851	1104	319	1955		567	548	656		168	155
v/s Ratio Prot	0.03	c0.53	0.08	c0.09	0.45		c0.17	0.06	c0.05			
v/s Ratio Perm			0.24						0.15		0.01	0.00
v/c Ratio	0.42	1.00	0.45	0.86	0.80		0.96	0.19	0.46		0.06	0.02
Uniform Delay, d1	40.2	20.9	5.5	39.9	15.6		36.7	23.4	19.8		36.7	36.5
Progression Factor	0.92	0.81	1.43	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	14.8	0.2	19.6	3.6		27.2	0.2	0.5		0.1	0.0
Delay (s)	38.3	31.7	8.1	59.4	19.2		63.9	23.5	20.3		36.8	36.6
Level of Service	D	C	A	E	B		E	C	C		D	D
Approach Delay (s)		25.8			25.2			45.5			36.6	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay			29.2			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			88.4%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2040 Alternative 3

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative3
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	344	0	188	0	0
Lane Group Flow (vph)	291	241	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.0	13.0	24.0	24.0	31.0	59.0
Effective Green, g (s)	15.0	15.0	26.0	26.0	33.0	61.0
Actuated g/C Ratio	0.19	0.19	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	300	283	1097	490	659	2573
v/s Ratio Prot	c0.18		c0.32		c0.41	0.47
v/s Ratio Perm		0.16		0.06		
v/c Ratio	0.97	0.85	0.99	0.18	0.99	0.61
Uniform Delay, d1	32.3	31.4	26.8	19.4	23.4	4.2
Progression Factor	0.59	1.28	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.4	20.0	24.3	0.8	32.6	1.1
Delay (s)	60.4	60.1	51.1	20.2	56.0	5.3
Level of Service	E	E	D	C	E	A
Approach Delay (s)	60.2		44.8			20.2
Approach LOS	E		D			C
Intersection Summary						
HCM Average Control Delay			35.5		HCM Level of Service	D
HCM Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative3
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.63			0.86	1.00		0.96			0.74	
Satd. Flow (perm)		2134			2893	1509		1522			1297	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	24	0	31	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	55	0	23	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		53.9			53.9	53.9		18.1			18.1	
Effective Green, g (s)		55.9			55.9	55.9		20.1			20.1	
Actuated g/C Ratio		0.70			0.70	0.70		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1491			2021	1054		382			326	
v/s Ratio Prot												
v/s Ratio Perm		c0.41			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.43	0.05		0.06			0.67	
Uniform Delay, d1		6.2			5.2	3.8		22.8			27.0	
Progression Factor		0.29			0.39	0.00		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			5.4	
Delay (s)		2.7			2.6	0.1		22.8			32.3	
Level of Service		A			A	A		C			C	
Approach Delay (s)		2.7			2.4			22.8			32.3	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	44	27	104
Lane Group Flow (vph)	125	794	622	911	472	121
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	5.6	31.0	21.4	62.4	41.0	41.0
Effective Green, g (s)	7.6	33.0	23.4	66.4	43.0	43.0
Actuated g/C Ratio	0.09	0.41	0.29	0.83	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	295	1392	987	1290	1637	739
v/s Ratio Prot	0.04	c0.24	0.18	c0.38	0.15	
v/s Ratio Perm				0.22		0.09
v/c Ratio	0.42	0.57	0.63	0.71	0.29	0.16
Uniform Delay, d1	34.1	18.1	24.5	2.8	10.1	9.4
Progression Factor	0.86	1.00	0.73	1.82	1.00	1.00
Incremental Delay, d2	0.8	1.4	2.6	2.8	0.4	0.5
Delay (s)	30.1	19.5	20.5	7.9	10.6	9.9
Level of Service	C	B	C	A	B	A
Approach Delay (s)		20.9	12.9		10.3	
Approach LOS		C	B		B	

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative3
AM Peak



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑	↑↓
Volume (vph)	909	227	868	1366	132	574
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3374	1509	3100	3374	1598	2656
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3374	1509	3100	3374	1598	2656
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	957	239	914	1438	139	604
RTOR Reduction (vph)	0	18	0	0	0	32
Lane Group Flow (vph)	957	221	914	1438	139	572
Turn Type		pm+ov	Prot		pm+ov	
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	29.0	40.0	28.0	61.0	11.0	39.0
Effective Green, g (s)	31.0	44.0	30.0	63.0	13.0	43.0
Actuated g/C Ratio	0.39	0.55	0.38	0.79	0.16	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1307	868	1163	2657	260	1494
v/s Ratio Prot	c0.28	0.04	c0.29	0.43	c0.09	0.14
v/s Ratio Perm		0.10				0.07
v/c Ratio	0.73	0.25	0.79	0.54	0.53	0.38
Uniform Delay, d1	21.0	9.4	22.2	3.1	30.7	10.8
Progression Factor	0.67	0.32	0.54	0.04	1.00	1.00
Incremental Delay, d2	3.3	0.6	0.3	0.1	7.7	0.2
Delay (s)	17.3	3.6	12.2	0.2	38.4	10.9
Level of Service	B	A	B	A	D	B
Approach Delay (s)	14.6			4.9	16.1	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative3
AM Peak

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1742	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.89	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1577	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	140	0	5	0	0	0	23	0	0	123
Lane Group Flow (vph)	163	893	365	182	1334	0	943	43	131	0	57	16
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	7.0	29.0	50.0	7.0	29.0		21.0	32.0	39.0		7.0	7.0
Effective Green, g (s)	9.0	31.0	54.0	9.0	31.0		23.0	34.0	43.0		9.0	9.0
Actuated g/C Ratio	0.11	0.39	0.68	0.11	0.39		0.29	0.42	0.54		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	180	1307	1019	349	1297		891	755	849		177	170
v/s Ratio Prot	c0.10	0.26	0.10	0.06	c0.40		c0.30	0.02	0.02			
v/s Ratio Perm			0.14						0.07		c0.04	0.01
v/c Ratio	0.91	0.68	0.36	0.52	1.03		1.06	0.06	0.15		0.32	0.09
Uniform Delay, d1	35.1	20.4	5.6	33.5	24.5		28.5	13.6	9.3		32.7	31.8
Progression Factor	0.79	0.65	5.51	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	35.2	2.3	0.2	1.4	32.6		46.8	0.0	0.1		1.1	0.2
Delay (s)	62.9	15.7	30.9	34.9	57.1		75.3	13.6	9.4		33.7	32.1
Level of Service	E	B	C	C	E		E	B	A		C	C
Approach Delay (s)		25.5			54.4			64.1			32.6	
Approach LOS		C			D			E			C	

Intersection Summary

HCM Average Control Delay	45.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative3
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	321	0	150	0	0
Lane Group Flow (vph)	359	385	2497	247	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	11.0	11.0	37.0	37.0	20.0	61.0
Effective Green, g (s)	13.0	13.0	39.0	39.0	22.0	63.0
Actuated g/C Ratio	0.16	0.16	0.49	0.49	0.28	0.79
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	267	252	1692	757	452	2733
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.25		0.16		
v/c Ratio	1.34	1.53	1.48	0.33	1.59	0.76
Uniform Delay, d1	33.5	33.5	20.5	12.5	29.0	4.5
Progression Factor	0.59	1.12	1.00	1.00	1.00	1.00
Incremental Delay, d2	174.8	254.3	217.3	1.1	275.2	2.1
Delay (s)	194.7	291.9	237.8	13.6	304.2	6.6
Level of Service	F	F	F	B	F	A
Approach Delay (s)	259.1		207.1			82.8
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			163.7		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative3
PM Peak



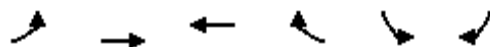
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.86			0.80	1.00		0.99			0.61	
Satd. Flow (perm)		2974			2760	1553		1580			1100	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	56	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	146	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		59.5			59.5	59.5		12.5			12.5	
Effective Green, g (s)		61.5			61.5	61.5		14.5			14.5	
Actuated g/C Ratio		0.77			0.77	0.77		0.18			0.18	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2286			2122	1194		286			199	
v/s Ratio Prot												
v/s Ratio Perm		c0.48			0.42	0.01		c0.09			0.04	
v/c Ratio		0.63			0.55	0.02		0.51			0.20	
Uniform Delay, d1		4.1			3.7	2.2		29.5			27.8	
Progression Factor		0.59			0.68	0.17		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.4			0.5	
Delay (s)		3.0			3.4	0.4		31.0			28.4	
Level of Service		A			A	A		C			C	
Approach Delay (s)		3.0			3.3			31.0			28.4	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 PM Peak



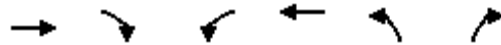
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	50	17	180
Lane Group Flow (vph)	272	1321	817	597	625	108
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	14.0	44.0	26.0	54.0	28.0	28.0
Effective Green, g (s)	16.0	46.0	28.0	58.0	30.0	30.0
Actuated g/C Ratio	0.20	0.58	0.35	0.72	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	638	1996	1215	1165	1182	530
v/s Ratio Prot	0.09	c0.38	c0.24	0.19	c0.20	
v/s Ratio Perm				0.19		0.08
v/c Ratio	0.43	0.66	0.67	0.51	0.53	0.20
Uniform Delay, d1	28.0	11.7	22.1	4.8	19.5	16.9
Progression Factor	0.73	0.49	0.78	0.10	1.00	1.00
Incremental Delay, d2	0.4	1.4	2.7	1.4	1.7	0.9
Delay (s)	20.9	7.1	19.9	1.9	21.2	17.8
Level of Service	C	A	B	A	C	B
Approach Delay (s)		9.5	12.0		20.1	
Approach LOS		A	B		C	

Intersection Summary

HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative3
PM Peak

























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑	↑↓
Volume (vph)	1512	267	655	1357	34	901
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3471	1553	3190	3471	1644	2733
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3471	1553	3190	3471	1644	2733
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1592	281	689	1428	36	948
RTOR Reduction (vph)	0	13	0	0	0	21
Lane Group Flow (vph)	1592	268	689	1428	36	927
Turn Type		pm+ov	Prot			pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	41.0	48.0	20.0	65.0	7.0	27.0
Effective Green, g (s)	43.0	52.0	22.0	67.0	9.0	31.0
Actuated g/C Ratio	0.54	0.65	0.28	0.84	0.11	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1866	1048	877	2907	185	1127
v/s Ratio Prot	c0.46	0.03	0.22	0.41	0.02	c0.23
v/s Ratio Perm		0.14				0.11
v/c Ratio	0.85	0.26	0.79	0.49	0.19	0.82
Uniform Delay, d1	15.8	5.9	26.8	1.8	32.2	22.0
Progression Factor	0.72	0.77	0.68	0.18	1.00	1.00
Incremental Delay, d2	4.1	0.5	2.4	0.3	2.3	5.0
Delay (s)	15.6	5.0	20.7	0.6	34.5	27.0
Level of Service	B	A	C	A	C	C
Approach Delay (s)	14.0			7.1	27.3	
Approach LOS	B			A	C	

Intersection Summary

HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative3
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.99	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3463		3190	1827	1553		1800	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3463		3190	1827	1553		1686	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	181	0	1	0	0	0	5	0	0	24
Lane Group Flow (vph)	47	1843	467	273	1569	0	543	103	301	0	10	3
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	4.2	37.4	48.4	8.6	41.8		11.0	22.0	30.6		7.0	7.0
Effective Green, g (s)	6.2	39.4	52.4	10.6	43.8		13.0	24.0	34.6		9.0	9.0
Actuated g/C Ratio	0.08	0.49	0.65	0.13	0.55		0.16	0.30	0.43		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	127	1709	1056	423	1896		518	548	710		190	175
v/s Ratio Prot	0.03	c0.53	0.07	c0.09	c0.45		c0.17	0.06	c0.06			
v/s Ratio Perm			0.23						0.14		0.01	0.00
v/c Ratio	0.37	1.08	0.44	0.65	0.83		1.05	0.19	0.42		0.05	0.02
Uniform Delay, d1	35.0	20.3	6.7	32.9	15.0		33.5	20.8	15.8		31.7	31.6
Progression Factor	0.99	0.84	0.72	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	41.5	0.2	3.4	4.3		52.8	0.2	0.4		0.1	0.0
Delay (s)	35.5	58.7	5.0	36.3	19.3		86.3	20.9	16.2		31.8	31.6
Level of Service	D	E	A	D	B		F	C	B		C	C
Approach Delay (s)		44.5			21.8			56.7			31.7	
Approach LOS		D			C			E			C	
Intersection Summary												
HCM Average Control Delay			38.8			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)			4.0			
Intersection Capacity Utilization			88.4%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2040 Alternative 4

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative4
AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	344	0	188	0	0
Lane Group Flow (vph)	291	241	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.0	13.0	24.0	24.0	31.0	59.0
Effective Green, g (s)	15.0	15.0	26.0	26.0	33.0	61.0
Actuated g/C Ratio	0.19	0.19	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	300	283	1097	490	659	2573
v/s Ratio Prot	c0.18		c0.32		c0.41	0.47
v/s Ratio Perm		0.16		0.06		
v/c Ratio	0.97	0.85	0.99	0.18	0.99	0.61
Uniform Delay, d1	32.3	31.4	26.8	19.4	23.4	4.2
Progression Factor	0.51	1.18	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.4	20.0	24.3	0.8	32.6	1.1
Delay (s)	58.0	57.0	51.1	20.2	56.0	5.3
Level of Service	E	E	D	C	E	A
Approach Delay (s)	57.3		44.8			20.2
Approach LOS	E		D			C

Intersection Summary			
HCM Average Control Delay	35.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative4
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.63			0.86	1.00		0.96			0.74	
Satd. Flow (perm)		2134			2893	1509		1522			1297	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	24	0	31	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	55	0	23	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		53.9			53.9	53.9		18.1			18.1	
Effective Green, g (s)		55.9			55.9	55.9		20.1			20.1	
Actuated g/C Ratio		0.70			0.70	0.70		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1491			2021	1054		382			326	
v/s Ratio Prot												
v/s Ratio Perm		c0.41			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.43	0.05		0.06			0.67	
Uniform Delay, d1		6.2			5.2	3.8		22.8			27.0	
Progression Factor		0.35			0.38	0.00		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			5.4	
Delay (s)		3.1			2.6	0.1		22.8			32.3	
Level of Service		A			A	A		C			C	
Approach Delay (s)		3.1			2.4			22.8			32.3	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	6.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 AM Peak

























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3215	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3215	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	44	27	104
Lane Group Flow (vph)	125	794	622	911	472	121
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	5.6	31.0	21.4	62.4	41.0	41.0
Effective Green, g (s)	7.6	33.0	23.4	66.4	43.0	43.0
Actuated g/C Ratio	0.09	0.41	0.29	0.83	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	295	1392	987	1290	1728	739
v/s Ratio Prot	0.04	c0.24	0.18	c0.38	0.15	
v/s Ratio Perm				0.22		0.09
v/c Ratio	0.42	0.57	0.63	0.71	0.27	0.16
Uniform Delay, d1	34.1	18.1	24.5	2.8	10.0	9.4
Progression Factor	1.12	1.22	0.50	2.43	1.00	1.00
Incremental Delay, d2	0.8	1.4	1.7	1.9	0.4	0.5
Delay (s)	39.0	23.5	14.0	8.7	10.4	9.9
Level of Service	D	C	B	A	B	A
Approach Delay (s)		25.6	10.8		10.2	
Approach LOS		C	B		B	

Intersection Summary

HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			















Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2040 Alternative4
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	146	909	480	173	837	561	529	387	92	402	172	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3374	1509	3100	3276		3100	1660	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3374	1509	3100	3276		3100	1660	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	154	957	505	182	881	591	557	407	97	423	181	139
RTOR Reduction (vph)	0	0	125	0	0	87	0	26	0	0	35	0
Lane Group Flow (vph)	154	957	380	182	881	504	557	478	0	423	285	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	9.0	26.6	41.8	7.0	24.6	36.6	15.2	18.4		12.0	15.2	
Effective Green, g (s)	11.0	28.6	45.8	9.0	26.6	40.6	17.2	20.4		14.0	17.2	
Actuated g/C Ratio	0.14	0.36	0.57	0.11	0.33	0.51	0.21	0.25		0.18	0.21	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	220	1206	902	349	1122	766	667	835		543	357	
v/s Ratio Prot	c0.10	c0.28	0.09	0.06	0.26	0.12	c0.18	0.15		0.14	c0.17	
v/s Ratio Perm			0.16			0.22						
v/c Ratio	0.70	0.79	0.42	0.52	0.79	0.66	0.84	0.57		0.78	0.80	
Uniform Delay, d1	32.9	23.1	9.6	33.5	24.1	14.6	30.0	26.0		31.5	29.7	
Progression Factor	0.95	0.76	0.16	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.9	5.2	0.3	1.4	5.5	2.1	8.9	1.0		7.0	11.7	
Delay (s)	40.3	22.8	1.8	34.9	29.7	16.6	38.9	26.9		38.5	41.5	
Level of Service	D	C	A	C	C	B	D	C		D	D	
Approach Delay (s)		17.9			25.6			33.2			39.8	
Approach LOS		B			C			C			D	
Intersection Summary												
HCM Average Control Delay			26.8				HCM Level of Service				C	
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			6.0		
Intersection Capacity Utilization			78.1%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative4
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.62	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	199.9	321.8	200.6	1.2	267.4	1.9
Delay (s)	223.4	360.3	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	314.1		194.5			81.5
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			166.5		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative4
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.55	
Satd. Flow (perm)		2953			2727	1553		1580			996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	61	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	141	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		68.9			68.9	68.9		13.1			13.1	
Effective Green, g (s)		70.9			70.9	70.9		15.1			15.1	
Actuated g/C Ratio		0.79			0.79	0.79		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2326			2148	1223		265			167	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.09			0.04	
v/c Ratio		0.62			0.54	0.02		0.53			0.24	
Uniform Delay, d1		3.9			3.5	2.1		34.2			32.5	
Progression Factor		0.62			0.60	0.11		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		2.1			0.8	
Delay (s)		2.9			2.9	0.3		36.3			33.2	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.9			2.9			36.3			33.2	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	5.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 PM Peak



























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3326	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3326	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	49	15	179
Lane Group Flow (vph)	272	1321	817	598	627	109
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	16.0	50.0	30.0	62.0	32.0	32.0
Effective Green, g (s)	18.0	52.0	32.0	66.0	34.0	34.0
Actuated g/C Ratio	0.20	0.58	0.36	0.73	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	638	2005	1234	1173	1256	534
v/s Ratio Prot	0.09	c0.38	c0.24	c0.19	0.19	
v/s Ratio Perm				0.19		0.08
v/c Ratio	0.43	0.66	0.66	0.51	0.50	0.20
Uniform Delay, d1	31.5	13.0	24.4	5.1	21.5	18.9
Progression Factor	0.86	0.60	0.35	0.13	1.00	1.00
Incremental Delay, d2	0.4	1.4	1.5	0.9	1.4	0.9
Delay (s)	27.5	9.2	10.0	1.6	22.9	19.7
Level of Service	C	A	B	A	C	B
Approach Delay (s)		12.3	6.3		21.9	
Approach LOS		B	A		C	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2040 Alternative4
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	191	1512	616	259	997	469	360	261	197	631	270	34
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	0.95	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	1.00	1.00	0.98	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3471	1553	3190	3248	3248	3190	1796	1796
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3471	1553	3190	3248	3248	3190	1796	1796
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	201	1592	648	273	1049	494	379	275	207	664	284	36
RTOR Reduction (vph)	0	0	76	0	0	80	0	121	0	0	5	0
Lane Group Flow (vph)	201	1592	572	273	1049	414	379	361	0	664	315	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	11.8	36.0	47.0	7.0	31.2	48.3	11.0	13.9		17.1	20.0	
Effective Green, g (s)	13.8	38.0	51.0	9.0	33.2	52.3	13.0	15.9		19.1	22.0	
Actuated g/C Ratio	0.15	0.42	0.57	0.10	0.37	0.58	0.14	0.18		0.21	0.24	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	252	1466	880	319	1280	902	461	574		677	439	
v/s Ratio Prot	0.12	c0.46	0.09	0.09	c0.30	0.10	c0.12	c0.11		c0.21	0.18	
v/s Ratio Perm			0.27			0.17						
v/c Ratio	0.80	1.09	0.65	0.86	0.82	0.46	0.82	0.63		0.98	0.72	
Uniform Delay, d1	36.8	26.0	13.4	39.9	25.7	10.8	37.4	34.3		35.3	31.1	
Progression Factor	1.12	0.72	0.68	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.5	49.5	1.6	19.6	6.0	0.4	11.3	2.2		29.7	5.5	
Delay (s)	55.8	68.3	10.7	59.4	31.6	11.1	48.6	36.5		64.9	36.7	
Level of Service	E	E	B	E	C	B	D	D		E	D	
Approach Delay (s)		52.0			30.2			41.8			55.7	
Approach LOS		D			C			D			E	

Intersection Summary















HCM Average Control Delay	44.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

2040 Alternative 5

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative5
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	344	0	188	0	0
Lane Group Flow (vph)	291	241	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.0	13.0	24.0	24.0	31.0	59.0
Effective Green, g (s)	15.0	15.0	26.0	26.0	33.0	61.0
Actuated g/C Ratio	0.19	0.19	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	300	283	1097	490	659	2573
v/s Ratio Prot	c0.18		c0.32		c0.41	0.47
v/s Ratio Perm		0.16		0.06		
v/c Ratio	0.97	0.85	0.99	0.18	0.99	0.61
Uniform Delay, d1	32.3	31.4	26.8	19.4	23.4	4.2
Progression Factor	0.76	0.95	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.4	20.0	24.3	0.8	32.6	1.1
Delay (s)	65.9	49.7	51.1	20.2	56.0	5.3
Level of Service	E	D	D	C	E	A
Approach Delay (s)	55.1		44.8			20.2
Approach LOS	E		D			C
Intersection Summary						
HCM Average Control Delay			34.5		HCM Level of Service	C
HCM Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative5
AM Peak


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.63			0.86	1.00		0.96			0.74	
Satd. Flow (perm)		2134			2893	1509		1522			1297	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	24	0	31	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	55	0	23	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		53.9			53.9	53.9		18.1			18.1	
Effective Green, g (s)		55.9			55.9	55.9		20.1			20.1	
Actuated g/C Ratio		0.70			0.70	0.70		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1491			2021	1054		382			326	
v/s Ratio Prot												
v/s Ratio Perm		c0.41			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.43	0.05		0.06			0.67	
Uniform Delay, d1		6.2			5.2	3.8		22.8			27.0	
Progression Factor		0.22			1.00	1.44		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			5.4	
Delay (s)		2.3			5.8	5.5		22.8			32.3	
Level of Service		A			A	A		C			C	
Approach Delay (s)		2.3			5.8			22.8			32.3	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			























Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2040 Alternative5
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	527	119	907	459	868	132	0	574	382	22	306
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1615	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1615	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	555	125	955	483	914	139	0	604	402	23	322
RTOR Reduction (vph)	0	0	94	0	0	423	0	0	56	0	0	262
Lane Group Flow (vph)	239	555	31	955	483	491	0	139	548	213	212	60
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	7.0	18.0	18.0	26.0	37.0	37.0		7.0	33.0	13.0	13.0	13.0
Effective Green, g (s)	9.0	20.0	20.0	28.0	39.0	39.0		9.0	37.0	15.0	15.0	15.0
Actuated g/C Ratio	0.11	0.25	0.25	0.35	0.49	0.49		0.11	0.46	0.19	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	349	844	377	1085	1645	736		190	1228	285	303	283
v/s Ratio Prot	c0.08	c0.16		c0.31	0.14			c0.08	0.16	c0.14	0.13	
v/s Ratio Perm			0.02			0.33			0.05			0.04
v/c Ratio	0.68	0.66	0.08	0.88	0.29	0.67		0.73	0.45	0.75	0.70	0.21
Uniform Delay, d1	34.1	26.9	23.0	24.4	12.3	15.6		34.3	14.6	30.7	30.4	27.5
Progression Factor	0.88	0.82	0.58	0.59	0.38	1.94		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	3.4	0.4	0.9	0.0	0.4		13.5	0.3	16.3	12.7	1.7
Delay (s)	34.6	25.5	13.8	15.2	4.7	30.7		47.8	14.8	47.0	43.0	29.2
Level of Service	C	C	B	B	A	C		D	B	D	D	C
Approach Delay (s)		26.3			19.1			21.0			38.2	
Approach LOS		C			B			C			D	
Intersection Summary												
HCM Average Control Delay			23.8				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			78.3%				ICU Level of Service		D			
Analysis Period (min)			15									
c	Critical Lane Group											















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative5
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1742	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.89	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1577	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	140	0	5	0	0	0	23	0	0	123
Lane Group Flow (vph)	163	893	365	182	1334	0	943	43	131	0	57	16
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	7.0	29.0	50.0	7.0	29.0		21.0	32.0	39.0		7.0	7.0
Effective Green, g (s)	9.0	31.0	54.0	9.0	31.0		23.0	34.0	43.0		9.0	9.0
Actuated g/C Ratio	0.11	0.39	0.68	0.11	0.39		0.29	0.42	0.54		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	180	1307	1019	349	1297		891	755	849		177	170
v/s Ratio Prot	c0.10	0.26	0.10	0.06	c0.40		c0.30	0.02	0.02			
v/s Ratio Perm			0.14						0.07		c0.04	0.01
v/c Ratio	0.91	0.68	0.36	0.52	1.03		1.06	0.06	0.15		0.32	0.09
Uniform Delay, d1	35.1	20.4	5.6	33.5	24.5		28.5	13.6	9.3		32.7	31.8
Progression Factor	0.99	0.74	0.91	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	35.2	2.3	0.2	1.4	32.6		46.8	0.0	0.1		1.1	0.2
Delay (s)	70.1	17.5	5.3	34.9	57.1		75.3	13.6	9.4		33.7	32.1
Level of Service	E	B	A	C	E		E	B	A		C	C
Approach Delay (s)		19.0			54.4			64.1			32.6	
Approach LOS		B			D			E			C	
Intersection Summary												
HCM Average Control Delay			43.4			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			88.1%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative5
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.72	1.09	1.00	1.00	1.00	1.00
Incremental Delay, d2	199.9	321.8	200.6	1.2	267.4	1.9
Delay (s)	227.4	363.2	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	317.5		194.5			81.5
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			167.0		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative5
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕			↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.55	
Satd. Flow (perm)		2953			2727	1553		1580			996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	61	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	141	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		68.9			68.9	68.9		13.1			13.1	
Effective Green, g (s)		70.9			70.9	70.9		15.1			15.1	
Actuated g/C Ratio		0.79			0.79	0.79		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2326			2148	1223		265			167	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.09			0.04	
v/c Ratio		0.62			0.54	0.02		0.53			0.24	
Uniform Delay, d1		3.9			3.5	2.1		34.2			32.5	
Progression Factor		0.57			0.75	0.27		1.00			1.00	
Incremental Delay, d2		0.5			0.9	0.0		2.1			0.8	
Delay (s)		2.8			3.5	0.6		36.3			33.2	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.8			3.5			36.3			33.2	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			























Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2040 Alternative5
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	267	988	258	615	742	655	34	0	901	523	6	360
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1655	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1655	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	1040	272	647	781	689	36	0	948	551	6	379
RTOR Reduction (vph)	0	0	170	0	0	346	0	0	24	0	0	303
Lane Group Flow (vph)	281	1040	102	647	781	343	0	36	924	281	276	76
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	11.0	31.8	31.8	22.0	42.8	42.8		4.2	26.2	16.0	16.0	16.0
Effective Green, g (s)	13.0	33.8	33.8	24.0	44.8	44.8		6.2	30.2	18.0	18.0	18.0
Actuated g/C Ratio	0.14	0.38	0.38	0.27	0.50	0.50		0.07	0.34	0.20	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	461	1304	583	851	1728	773		120	917	312	331	311
v/s Ratio Prot	0.09	c0.30		0.20	0.22			0.02	c0.27	c0.18	0.17	
v/s Ratio Perm			0.07			0.22			0.07			0.05
v/c Ratio	0.61	0.80	0.18	0.76	0.45	0.44		0.30	1.01	0.90	0.83	0.24
Uniform Delay, d1	36.1	25.0	18.8	30.4	14.6	14.6		39.8	29.9	35.1	34.6	30.3
Progression Factor	0.94	0.64	0.45	0.74	0.87	1.22		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	4.2	0.5	2.3	0.5	1.0		1.4	31.6	30.9	21.3	1.9
Delay (s)	35.9	20.3	9.0	24.8	13.2	18.8		41.2	61.5	66.0	55.8	32.1
Level of Service	D	C	A	C	B	B		D	E	E	E	C
Approach Delay (s)		21.1			18.6			60.8			49.3	
Approach LOS		C			B			E			D	
Intersection Summary												
HCM Average Control Delay			31.8				HCM Level of Service		C			
HCM Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			84.1%				ICU Level of Service		E			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative5
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.99	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3463		3190	1827	1553		1800	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3463		3190	1827	1553		1684	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	157	0	1	0	0	0	5	0	0	24
Lane Group Flow (vph)	47	1843	491	273	1569	0	543	103	301	0	10	3
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	4.2	44.4	58.4	8.6	48.8		14.0	25.0	33.6		7.0	7.0
Effective Green, g (s)	6.2	46.4	62.4	10.6	50.8		16.0	27.0	37.6		9.0	9.0
Actuated g/C Ratio	0.07	0.52	0.69	0.12	0.56		0.18	0.30	0.42		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	113	1789	1077	376	1955		567	548	683		168	155
v/s Ratio Prot	0.03	c0.53	0.08	0.09	c0.45		c0.17	0.06	c0.05			
v/s Ratio Perm			0.23						0.14		0.01	0.00
v/c Ratio	0.42	1.03	0.46	0.73	0.80		0.96	0.19	0.44		0.06	0.02
Uniform Delay, d1	40.2	21.8	6.2	38.3	15.6		36.7	23.4	18.7		36.7	36.5
Progression Factor	1.02	0.98	1.05	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.1	22.6	0.1	6.8	3.6		27.2	0.2	0.5		0.1	0.0
Delay (s)	42.1	44.0	6.7	45.1	19.2		63.9	23.5	19.1		36.8	36.6
Level of Service	D	D	A	D	B		E	C	B		D	D
Approach Delay (s)		34.5			23.0			45.1			36.6	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay			32.4			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)		4.0				
Intersection Capacity Utilization			88.4%			ICU Level of Service		E				
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative6
AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	275	0	183	0	0
Lane Group Flow (vph)	291	310	1083	95	653	1578
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	17.0	17.0	32.0	32.0	39.0	75.0
Effective Green, g (s)	19.0	19.0	34.0	34.0	41.0	77.0
Actuated g/C Ratio	0.19	0.19	0.34	0.34	0.41	0.77
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	304	295	1180	513	655	2673
v/s Ratio Prot	0.18		c0.31		c0.41	0.45
v/s Ratio Perm		c0.20		0.06		
v/c Ratio	0.96	1.05	0.92	0.18	1.00	0.59
Uniform Delay, d1	40.1	40.5	31.7	23.2	29.4	4.8
Progression Factor	0.58	0.53	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.1	64.1	12.7	0.8	34.1	1.0
Delay (s)	61.4	85.5	44.3	24.0	63.6	5.8
Level of Service	E	F	D	C	E	A
Approach Delay (s)	77.5		40.2			22.7
Approach LOS	E		D			C

Intersection Summary

HCM Average Control Delay	38.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.96			0.71	
Satd. Flow (perm)		2081			2856	1509		1522			1250	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	22	0	32	0	0	5	0
Lane Group Flow (vph)	0	874	0	0	866	57	0	22	0	0	220	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.2			70.2	70.2		21.8			21.8	
Effective Green, g (s)		72.2			72.2	72.2		23.8			23.8	
Actuated g/C Ratio		0.72			0.72	0.72		0.24			0.24	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1502			2062	1089		362			298	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.18	
v/c Ratio		0.58			0.42	0.05		0.06			0.74	
Uniform Delay, d1		6.7			5.5	4.0		29.5			35.2	
Progression Factor		0.19			0.41	0.01		1.00			1.00	
Incremental Delay, d2		0.9			0.5	0.1		0.1			9.2	
Delay (s)		2.1			2.8	0.1		29.5			44.4	
Level of Service		A			A	A		C			D	
Approach Delay (s)		2.1			2.6			29.5			44.4	
Approach LOS		A			A			C			D	

Intersection Summary

HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative6
AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1598	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1598	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	69	22	106
Lane Group Flow (vph)	125	794	622	886	477	119
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	12.0	41.0	25.0	76.0	51.0	51.0
Effective Green, g (s)	14.0	43.0	27.0	80.0	53.0	53.0
Actuated g/C Ratio	0.14	0.43	0.27	0.80	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	224	1451	911	1237	1614	728
v/s Ratio Prot	0.08	c0.24	0.18	c0.38	0.16	
v/s Ratio Perm				0.21		0.09
v/c Ratio	0.56	0.55	0.68	0.72	0.30	0.16
Uniform Delay, d1	40.1	21.2	32.7	4.7	13.1	12.1
Progression Factor	0.93	0.93	0.91	2.70	1.00	1.00
Incremental Delay, d2	2.5	1.2	1.8	1.6	0.5	0.5
Delay (s)	40.0	20.9	31.5	14.2	13.6	12.6
Level of Service	D	C	C	B	B	B
Approach Delay (s)		23.5	21.0		13.3	
Approach LOS		C	C		B	

Intersection Summary

HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	499	207	348	1083	794	747
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3129	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3100	1509	1598	3374	3129	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	525	218	366	1140	836	786
RTOR Reduction (vph)	0	121	0	0	170	0
Lane Group Flow (vph)	525	97	366	1140	1453	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	24.0	76.0	48.0	
Effective Green, g (s)	18.0	18.0	26.0	78.0	50.0	
Actuated g/C Ratio	0.18	0.18	0.26	0.78	0.50	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	558	272	415	2632	1565	
v/s Ratio Prot	c0.17		c0.23	0.34	c0.46	
v/s Ratio Perm		0.06				
v/c Ratio	0.94	0.36	0.88	0.43	0.93	
Uniform Delay, d1	40.5	35.9	35.5	3.7	23.3	
Progression Factor	1.00	1.00	1.00	1.00	0.34	
Incremental Delay, d2	26.0	3.6	22.7	0.5	4.9	
Delay (s)	66.4	39.5	58.2	4.2	12.8	
Level of Service	E	D	E	A	B	
Approach Delay (s)	58.5			17.3	12.8	
Approach LOS	E			B	B	
























Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	482	499	1042	338	65	1028	41	513	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	507	525	1097	356	68	1082	43	540	22	35	139
RTOR Reduction (vph)	0	0	64	0	16	0	0	156	176	0	126	0
Lane Group Flow (vph)	163	507	461	1097	408	0	1082	141	110	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	14.3	15.9	48.3	28.7	30.3		32.4	36.6	36.6	2.8	7.0	
Effective Green, g (s)	16.3	17.9	52.3	30.7	32.3		34.4	38.6	38.6	4.8	9.0	
Actuated g/C Ratio	0.16	0.18	0.52	0.31	0.32		0.34	0.39	0.39	0.05	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	260	604	819	952	1064		1066	568	554	77	141	
v/s Ratio Prot	0.10	c0.15	0.19	c0.35	0.12		c0.35	0.10		0.01	c0.03	
v/s Ratio Perm			0.11						0.08			
v/c Ratio	0.63	0.84	0.56	1.15	0.38		1.02	0.25	0.20	0.29	0.34	
Uniform Delay, d1	39.0	39.7	16.1	34.6	26.2		32.8	20.8	20.4	45.9	42.7	
Progression Factor	0.75	0.73	0.30	1.00	1.00		0.72	0.14	0.02	1.00	1.00	
Incremental Delay, d2	4.2	9.1	0.8	80.7	1.0		28.6	0.2	0.1	2.0	1.4	
Delay (s)	33.4	37.9	5.6	115.3	27.2		52.2	3.1	0.6	48.0	44.1	
Level of Service	C	D	A	F	C		D	A	A	D	D	
Approach Delay (s)		23.1			90.8			34.6			44.6	
Approach LOS		C			F			C			D	
Intersection Summary												
HCM Average Control Delay			50.7			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.93									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			98.9%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative6
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.78	0.78	1.00	1.00	1.00	1.00
Incremental Delay, d2	200.1	321.9	200.6	1.2	267.4	1.9
Delay (s)	229.5	351.8	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	310.6		194.5			81.5
Approach LOS	F		F			F

Intersection Summary

HCM Average Control Delay	165.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.50	
Satd. Flow (perm)		2953			2728	1553		1579			900	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	5	0	79	0	0	3	0
Lane Group Flow (vph)	0	1437	0	0	1167	22	0	123	0	0	40	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.1			70.1	70.1		11.9			11.9	
Effective Green, g (s)		72.1			72.1	72.1		13.9			13.9	
Actuated g/C Ratio		0.80			0.80	0.80		0.15			0.15	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2366			2185	1244		244			139	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.08			0.04	
v/c Ratio		0.61			0.53	0.02		0.50			0.29	
Uniform Delay, d1		3.5			3.1	1.8		34.9			33.7	
Progression Factor		0.79			1.68	1.38		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.6			1.2	
Delay (s)		3.2			6.0	2.5		36.5			34.9	
Level of Service		A			A	A		D			C	
Approach Delay (s)		3.2			5.9			36.5			34.9	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1644	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1644	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	92	15	205
Lane Group Flow (vph)	272	1321	817	555	627	83
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	19.1	58.0	34.9	58.9	24.0	24.0
Effective Green, g (s)	21.1	60.0	36.9	62.9	26.0	26.0
Actuated g/C Ratio	0.23	0.67	0.41	0.70	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	385	2314	1423	1120	910	408
v/s Ratio Prot	c0.17	c0.38	0.24	0.14	c0.20	
v/s Ratio Perm				0.21		0.06
v/c Ratio	0.71	0.57	0.57	0.50	0.69	0.20
Uniform Delay, d1	31.6	8.1	20.5	6.2	28.4	24.2
Progression Factor	1.11	0.45	0.68	1.65	1.00	1.00
Incremental Delay, d2	4.8	0.8	1.3	1.2	4.3	1.1
Delay (s)	39.8	4.4	15.2	11.5	32.7	25.3
Level of Service	D	A	B	B	C	C
Approach Delay (s)		10.5	13.6		30.4	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
PM Peak


























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	700	235	168	905	809	754
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3220	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3220	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	737	247	177	953	852	794
RTOR Reduction (vph)	0	110	0	0	185	0
Lane Group Flow (vph)	737	137	177	953	1461	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	21.8	21.8	10.8	60.2	45.4	
Effective Green, g (s)	23.8	23.8	12.8	62.2	47.4	
Actuated g/C Ratio	0.26	0.26	0.14	0.69	0.53	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	844	411	234	2399	1696	
v/s Ratio Prot	c0.23		c0.11	0.27	c0.45	
v/s Ratio Perm		0.09				
v/c Ratio	0.87	0.33	0.76	0.40	0.86	
Uniform Delay, d1	31.7	26.7	37.1	5.9	18.5	
Progression Factor	1.00	1.00	1.00	1.00	0.49	
Incremental Delay, d2	9.9	0.5	13.0	0.5	2.9	
Delay (s)	41.6	27.2	50.1	6.4	11.9	
Level of Service	D	C	D	A	B	
Approach Delay (s)	38.0			13.3	11.9	
Approach LOS	D			B	B	

Intersection Summary

HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1085	649	914	814	23	550	98	958	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.88	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1142	683	962	857	24	579	103	1008	3	7	27
RTOR Reduction (vph)	0	0	111	0	2	0	0	160	381	0	23	0
Lane Group Flow (vph)	47	1142	572	962	879	0	579	407	163	3	11	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.2	26.6	42.6	21.0	43.4		16.0	25.0	25.0	1.4	10.4	
Effective Green, g (s)	6.2	28.6	46.6	23.0	45.4		18.0	27.0	27.0	3.4	12.4	
Actuated g/C Ratio	0.07	0.32	0.52	0.26	0.50		0.20	0.30	0.30	0.04	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	113	1103	839	815	1744		638	457	443	62	222	
v/s Ratio Prot	0.03	c0.33	0.14	c0.30	0.25		c0.18	c0.27		0.00	c0.01	
v/s Ratio Perm			0.23						0.11			
v/c Ratio	0.42	1.04	0.68	1.18	0.50		0.91	0.89	0.37	0.05	0.05	
Uniform Delay, d1	40.2	30.7	16.2	33.5	14.8		35.2	30.1	24.8	41.7	33.7	
Progression Factor	0.93	0.88	0.73	1.00	1.00		0.91	0.48	0.74	1.00	1.00	
Incremental Delay, d2	2.0	33.8	1.8	93.7	1.0		13.9	16.1	0.4	0.3	0.1	
Delay (s)	39.2	60.9	13.6	127.2	15.9		45.8	30.6	18.7	42.1	33.8	
Level of Service	D	E	B	F	B		D	C	B	D	C	
Approach Delay (s)		43.1			74.0			32.0			34.4	
Approach LOS		D			E			C			C	

Intersection Summary		
HCM Average Control Delay	50.0	HCM Level of Service D
HCM Volume to Capacity ratio	0.95	
Actuated Cycle Length (s)	90.0	Sum of lost time (s) 6.0
Intersection Capacity Utilization	92.3%	ICU Level of Service F
Analysis Period (min)	15	
c Critical Lane Group		

2040 Alternative 6

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative6
AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	275	0	183	0	0
Lane Group Flow (vph)	291	310	1083	95	653	1578
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	17.0	17.0	32.0	32.0	39.0	75.0
Effective Green, g (s)	19.0	19.0	34.0	34.0	41.0	77.0
Actuated g/C Ratio	0.19	0.19	0.34	0.34	0.41	0.77
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	304	295	1180	513	655	2673
v/s Ratio Prot	0.18		c0.31		c0.41	0.45
v/s Ratio Perm		c0.20		0.06		
v/c Ratio	0.96	1.05	0.92	0.18	1.00	0.59
Uniform Delay, d1	40.1	40.5	31.7	23.2	29.4	4.8
Progression Factor	0.58	0.57	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.1	64.1	12.7	0.8	34.1	1.0
Delay (s)	61.4	87.3	44.3	24.0	63.6	5.8
Level of Service	E	F	D	C	E	A
Approach Delay (s)	78.7		40.2			22.7
Approach LOS	E		D			C

Intersection Summary

HCM Average Control Delay	39.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.96			0.71	
Satd. Flow (perm)		2081			2856	1509		1522			1250	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	22	0	32	0	0	5	0
Lane Group Flow (vph)	0	874	0	0	866	57	0	22	0	0	220	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.2			70.2	70.2		21.8			21.8	
Effective Green, g (s)		72.2			72.2	72.2		23.8			23.8	
Actuated g/C Ratio		0.72			0.72	0.72		0.24			0.24	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1502			2062	1089		362			298	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.18	
v/c Ratio		0.58			0.42	0.05		0.06			0.74	
Uniform Delay, d1		6.7			5.5	4.0		29.5			35.2	
Progression Factor		0.19			0.38	0.00		1.00			1.00	
Incremental Delay, d2		0.9			0.5	0.1		0.1			9.2	
Delay (s)		2.1			2.7	0.1		29.5			44.4	
Level of Service		A			A	A		C			D	
Approach Delay (s)		2.1			2.5			29.5			44.4	
Approach LOS		A			A			C			D	

Intersection Summary

HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1598	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1598	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	69	22	106
Lane Group Flow (vph)	125	794	622	886	477	119
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	12.0	41.0	25.0	76.0	51.0	51.0
Effective Green, g (s)	14.0	43.0	27.0	80.0	53.0	53.0
Actuated g/C Ratio	0.14	0.43	0.27	0.80	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	224	1451	911	1237	1614	728
v/s Ratio Prot	0.08	c0.24	0.18	c0.38	0.16	
v/s Ratio Perm				0.21		0.09
v/c Ratio	0.56	0.55	0.68	0.72	0.30	0.16
Uniform Delay, d1	40.1	21.2	32.7	4.7	13.1	12.1
Progression Factor	0.96	0.98	0.91	2.70	1.00	1.00
Incremental Delay, d2	2.5	1.2	1.8	1.6	0.5	0.5
Delay (s)	41.0	22.0	31.5	14.2	13.6	12.6
Level of Service	D	C	C	B	B	B
Approach Delay (s)		24.6	21.0		13.3	
Approach LOS		C	C		B	

Intersection Summary

HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	499	207	348	1083	794	747
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3129	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3100	1509	1598	3374	3129	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	525	218	366	1140	836	786
RTOR Reduction (vph)	0	121	0	0	170	0
Lane Group Flow (vph)	525	97	366	1140	1453	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	24.0	76.0	48.0	
Effective Green, g (s)	18.0	18.0	26.0	78.0	50.0	
Actuated g/C Ratio	0.18	0.18	0.26	0.78	0.50	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	558	272	415	2632	1565	
v/s Ratio Prot	c0.17		c0.23	0.34	c0.46	
v/s Ratio Perm		0.06				
v/c Ratio	0.94	0.36	0.88	0.43	0.93	
Uniform Delay, d1	40.5	35.9	35.5	3.7	23.3	
Progression Factor	1.00	1.00	1.00	1.00	0.34	
Incremental Delay, d2	26.0	3.6	22.7	0.5	4.9	
Delay (s)	66.4	39.5	58.2	4.2	12.8	
Level of Service	E	D	E	A	B	
Approach Delay (s)	58.5			17.3	12.8	
Approach LOS	E			B	B	
























Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group













Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	482	499	1042	338	65	1028	41	513	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	507	525	1097	356	68	1082	43	540	22	35	139
RTOR Reduction (vph)	0	0	64	0	16	0	0	156	176	0	126	0
Lane Group Flow (vph)	163	507	461	1097	408	0	1082	141	110	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	14.3	15.9	48.3	28.7	30.3		32.4	36.6	36.6	2.8	7.0	
Effective Green, g (s)	16.3	17.9	52.3	30.7	32.3		34.4	38.6	38.6	4.8	9.0	
Actuated g/C Ratio	0.16	0.18	0.52	0.31	0.32		0.34	0.39	0.39	0.05	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	260	604	819	952	1064		1066	568	554	77	141	
v/s Ratio Prot	0.10	c0.15	0.19	c0.35	0.12		c0.35	0.10		0.01	c0.03	
v/s Ratio Perm			0.11						0.08			
v/c Ratio	0.63	0.84	0.56	1.15	0.38		1.02	0.25	0.20	0.29	0.34	
Uniform Delay, d1	39.0	39.7	16.1	34.6	26.2		32.8	20.8	20.4	45.9	42.7	
Progression Factor	0.75	0.73	0.30	1.00	1.00		0.72	0.14	0.02	1.00	1.00	
Incremental Delay, d2	4.2	9.1	0.8	80.7	1.0		28.6	0.2	0.1	2.0	1.4	
Delay (s)	33.4	37.9	5.6	115.3	27.2		52.2	3.1	0.6	48.0	44.1	
Level of Service	C	D	A	F	C		D	A	A	D	D	
Approach Delay (s)		23.1			90.8			34.6			44.6	
Approach LOS		C			F			C			D	
Intersection Summary												
HCM Average Control Delay			50.7			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.93									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			98.9%			ICU Level of Service			F			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative6
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.81	0.71	1.00	1.00	1.00	1.00
Incremental Delay, d2	200.1	321.9	200.6	1.2	267.4	1.9
Delay (s)	230.8	349.1	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	309.2		194.5			81.5
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			165.7		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
PM Peak



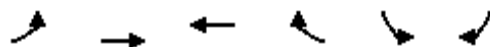
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.50	
Satd. Flow (perm)		2953			2728	1553		1579			900	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	5	0	79	0	0	3	0
Lane Group Flow (vph)	0	1437	0	0	1167	22	0	123	0	0	40	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.1			70.1	70.1		11.9			11.9	
Effective Green, g (s)		72.1			72.1	72.1		13.9			13.9	
Actuated g/C Ratio		0.80			0.80	0.80		0.15			0.15	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2366			2185	1244		244			139	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.08			0.04	
v/c Ratio		0.61			0.53	0.02		0.50			0.29	
Uniform Delay, d1		3.5			3.1	1.8		34.9			33.7	
Progression Factor		0.59			1.30	0.88		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.6			1.2	
Delay (s)		2.5			4.8	1.6		36.5			34.9	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.5			4.8			36.5			34.9	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1644	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1644	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	92	15	205
Lane Group Flow (vph)	272	1321	817	555	627	83
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	19.1	58.0	34.9	58.9	24.0	24.0
Effective Green, g (s)	21.1	60.0	36.9	62.9	26.0	26.0
Actuated g/C Ratio	0.23	0.67	0.41	0.70	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	385	2314	1423	1120	910	408
v/s Ratio Prot	c0.17	c0.38	0.24	0.14	c0.20	
v/s Ratio Perm				0.21		0.06
v/c Ratio	0.71	0.57	0.57	0.50	0.69	0.20
Uniform Delay, d1	31.6	8.1	20.5	6.2	28.4	24.2
Progression Factor	1.07	0.49	0.68	1.65	1.00	1.00
Incremental Delay, d2	4.8	0.8	1.3	1.2	4.3	1.1
Delay (s)	38.6	4.8	15.2	11.5	32.7	25.3
Level of Service	D	A	B	B	C	C
Approach Delay (s)		10.6	13.6		30.4	
Approach LOS		B	B		C	

Intersection Summary

HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	700	235	168	905	809	754
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3220	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3220	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	737	247	177	953	852	794
RTOR Reduction (vph)	0	110	0	0	185	0
Lane Group Flow (vph)	737	137	177	953	1461	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	21.8	21.8	10.8	60.2	45.4	
Effective Green, g (s)	23.8	23.8	12.8	62.2	47.4	
Actuated g/C Ratio	0.26	0.26	0.14	0.69	0.53	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	844	411	234	2399	1696	
v/s Ratio Prot	c0.23		c0.11	0.27	c0.45	
v/s Ratio Perm		0.09				
v/c Ratio	0.87	0.33	0.76	0.40	0.86	
Uniform Delay, d1	31.7	26.7	37.1	5.9	18.5	
Progression Factor	1.00	1.00	1.00	1.00	0.49	
Incremental Delay, d2	9.9	0.5	13.0	0.5	2.9	
Delay (s)	41.6	27.2	50.1	6.4	11.9	
Level of Service	D	C	D	A	B	
Approach Delay (s)	38.0			13.3	11.9	
Approach LOS	D			B	B	

Intersection Summary

HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1085	649	914	814	23	550	98	958	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.88	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1142	683	962	857	24	579	103	1008	3	7	27
RTOR Reduction (vph)	0	0	111	0	2	0	0	160	381	0	23	0
Lane Group Flow (vph)	47	1142	572	962	879	0	579	407	163	3	11	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.2	26.6	42.6	21.0	43.4		16.0	25.0	25.0	1.4	10.4	
Effective Green, g (s)	6.2	28.6	46.6	23.0	45.4		18.0	27.0	27.0	3.4	12.4	
Actuated g/C Ratio	0.07	0.32	0.52	0.26	0.50		0.20	0.30	0.30	0.04	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	113	1103	839	815	1744		638	457	443	62	222	
v/s Ratio Prot	0.03	c0.33	0.14	c0.30	0.25		c0.18	c0.27		0.00	c0.01	
v/s Ratio Perm			0.23						0.11			
v/c Ratio	0.42	1.04	0.68	1.18	0.50		0.91	0.89	0.37	0.05	0.05	
Uniform Delay, d1	40.2	30.7	16.2	33.5	14.8		35.2	30.1	24.8	41.7	33.7	
Progression Factor	0.89	0.86	0.68	1.00	1.00		0.91	0.48	0.74	1.00	1.00	
Incremental Delay, d2	2.0	33.8	1.8	93.7	1.0		13.9	16.1	0.4	0.3	0.1	
Delay (s)	37.6	60.1	12.8	127.2	15.9		45.8	30.6	18.7	42.1	33.8	
Level of Service	D	E	B	F	B		D	C	B	D	C	
Approach Delay (s)		42.3			74.0			32.0			34.4	
Approach LOS		D			E			C			C	

Intersection Summary















HCM Average Control Delay	49.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

2040 Alternative 7

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative7
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	290	0	187	0	0
Lane Group Flow (vph)	291	295	1083	91	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	17.0	17.0	29.0	29.0	37.0	70.0
Effective Green, g (s)	19.0	19.0	31.0	31.0	39.0	72.0
Actuated g/C Ratio	0.20	0.20	0.33	0.33	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	320	302	1101	492	656	2557
v/s Ratio Prot	0.18		c0.32		c0.41	0.47
v/s Ratio Perm		c0.20		0.06		
v/c Ratio	0.91	0.98	0.98	0.18	1.00	0.62
Uniform Delay, d1	37.2	37.8	31.7	22.9	27.9	5.2
Progression Factor	1.00	1.27	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.7	43.5	23.5	0.8	34.0	1.1
Delay (s)	63.9	91.6	55.2	23.8	62.0	6.4
Level of Service	E	F	E	C	E	A
Approach Delay (s)	82.4		48.8			22.6
Approach LOS	F		D			C
Intersection Summary						
HCM Average Control Delay			42.3		HCM Level of Service	D
HCM Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			95.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative7
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		4.0			4.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.95			0.76	
Satd. Flow (perm)		2093			2865	1509		1515			1336	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	22	0	33	0	0	5	0
Lane Group Flow (vph)	0	874	0	0	866	57	0	21	0	0	220	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		66.2			66.2	66.2		20.8			20.8	
Effective Green, g (s)		68.2			68.2	68.2		20.8			20.8	
Actuated g/C Ratio		0.72			0.72	0.72		0.22			0.22	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1503			2057	1083		332			293	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.16	
v/c Ratio		0.58			0.42	0.05		0.06			0.75	
Uniform Delay, d1		6.5			5.4	3.9		29.4			34.7	
Progression Factor		0.70			0.94	0.42		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			10.0	
Delay (s)		5.4			5.7	1.7		29.5			44.7	
Level of Service		A			A	A		C			D	
Approach Delay (s)		5.4			5.4			29.5			44.7	
Approach LOS		A			A			C			D	

Intersection Summary

HCM Average Control Delay	10.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative7
AM Peak

























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1682	3374	3374	1509	3046	1374
Flt Permitted	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1682	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	67	31	26
Lane Group Flow (vph)	125	794	622	888	468	199
Turn Type	Prot			pm+ov		custom
Protected Phases	5	2	6	7	7	5
Permitted Phases				6		4
Actuated Green, G (s)	11.0	55.3	40.3	72.0	31.7	42.7
Effective Green, g (s)	13.0	57.3	42.3	76.0	33.7	46.7
Actuated g/C Ratio	0.14	0.60	0.45	0.80	0.35	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	230	2035	1502	1239	1081	704
v/s Ratio Prot	c0.07	0.24	0.18	c0.25	0.15	0.04
v/s Ratio Perm				0.33		0.11
v/c Ratio	0.54	0.39	0.41	0.72	0.43	0.28
Uniform Delay, d1	38.2	9.8	17.9	4.5	23.4	14.3
Progression Factor	1.03	0.94	0.33	2.41	1.00	1.00
Incremental Delay, d2	2.2	0.5	0.6	1.3	0.3	0.2
Delay (s)	41.6	9.6	6.5	12.0	23.6	14.5
Level of Service	D	A	A	B	C	B
Approach Delay (s)		14.0	9.9		20.8	
Approach LOS		B	A		C	

Intersection Summary

HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative7
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Volume (vph)	227	909	0	0	1366	868	132	0	574	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1598	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1598	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	957	0	0	1438	914	139	0	604	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	265	0	180	180	0	0	0
Lane Group Flow (vph)	239	957	0	0	1438	649	139	122	122	0	0	0
Turn Type	Prot			Perm			Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	19.0	74.0			51.0	51.0	13.0	13.0	13.0			
Effective Green, g (s)	21.0	76.0			53.0	53.0	15.0	15.0	15.0			
Actuated g/C Ratio	0.22	0.80			0.56	0.56	0.16	0.16	0.16			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	353	2699			1882	842	252	226	214			
v/s Ratio Prot	c0.15	0.28			0.43		0.09	0.08				
v/s Ratio Perm						c0.43			c0.09			
v/c Ratio	0.68	0.35			0.76	0.77	0.55	0.54	0.57			
Uniform Delay, d1	33.9	2.7			16.2	16.3	36.9	36.8	37.0			
Progression Factor	0.90	0.70			0.30	0.73	1.00	1.00	1.00			
Incremental Delay, d2	9.5	0.3			0.3	0.6	2.6	2.5	3.4			
Delay (s)	40.0	2.2			5.1	12.5	39.5	39.3	40.5			
Level of Service	D	A			A	B	D	D	D			
Approach Delay (s)		9.7			8.0			39.8			0.0	
Approach LOS		A			A			D			A	

Intersection Summary

HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Commerce Way & Michigan Ave

2040 Alternative7
AM Peak


























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑	↖	↗
Volume (vph)	274	163	490	196	270	809
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.94		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3185		3273	1776	1687	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3185		3273	1776	1687	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	288	172	516	206	284	852
RTOR Reduction (vph)	93	0	0	0	0	357
Lane Group Flow (vph)	367	0	516	206	284	495
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	16.0		22.0	42.0	45.0	45.0
Effective Green, g (s)	16.0		22.0	42.0	45.0	45.0
Actuated g/C Ratio	0.17		0.23	0.44	0.47	0.47
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	536		758	785	799	715
v/s Ratio Prot	c0.12		c0.16	0.12	0.17	
v/s Ratio Perm						c0.33
v/c Ratio	0.68		0.68	0.26	0.36	0.69
Uniform Delay, d1	37.1		33.3	16.7	15.8	19.6
Progression Factor	1.00		0.70	0.76	1.00	1.00
Incremental Delay, d2	3.6		4.2	0.7	1.2	5.4
Delay (s)	40.7		27.4	13.3	17.1	25.0
Level of Service	D		C	B	B	C
Approach Delay (s)	40.7			23.4	23.0	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative7
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.91	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	1598	3348		3100	1541	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.56	1.00	
Satd. Flow (perm)	1598	3374	1509	1598	3348		3100	1541	1434	949	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	125	0	4	0	0	35	57	0	126	0
Lane Group Flow (vph)	163	893	380	182	1335	0	943	67	38	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	13.5	35.3	60.3	11.7	33.5		25.0	36.0	36.0	7.0	7.0	
Effective Green, g (s)	15.5	37.3	64.3	13.7	35.5		27.0	38.0	38.0	9.0	9.0	
Actuated g/C Ratio	0.16	0.39	0.68	0.14	0.37		0.28	0.40	0.40	0.09	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	261	1325	1021	230	1251		881	616	574	90	148	
v/s Ratio Prot	0.10	c0.26	0.11	0.11	c0.40		c0.30	0.04			c0.03	
v/s Ratio Perm			0.15						0.03	0.02		
v/c Ratio	0.62	0.67	0.37	0.79	1.07		1.07	0.11	0.07	0.24	0.33	
Uniform Delay, d1	37.0	23.8	6.6	39.3	29.8		34.0	17.9	17.6	39.8	40.2	
Progression Factor	1.04	1.04	1.50	1.00	1.00		0.89	0.78	0.83	1.00	1.00	
Incremental Delay, d2	4.1	2.5	0.2	16.8	45.5		44.9	0.0	0.0	1.4	1.3	
Delay (s)	42.6	27.2	10.1	56.0	75.2		75.0	13.9	14.5	41.3	41.5	
Level of Service	D	C	B	E	E		E	B	B	D	D	
Approach Delay (s)		23.3			72.9			64.5			41.4	
Approach LOS		C			E			E			D	
Intersection Summary												
HCM Average Control Delay			51.8			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			95.0			Sum of lost time (s)			6.0			
Intersection Capacity Utilization			94.7%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative7
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.86	1.50	1.00	1.00	1.00	1.00
Incremental Delay, d2	200.1	321.9	200.6	1.2	267.4	1.9
Delay (s)	232.9	378.8	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	329.6		194.5			81.5
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			168.9		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative7
PM Peak



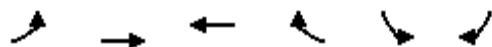
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.50	
Satd. Flow (perm)		2953			2728	1553		1579			900	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	5	0	79	0	0	3	0
Lane Group Flow (vph)	0	1437	0	0	1167	22	0	123	0	0	40	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.1			70.1	70.1		11.9			11.9	
Effective Green, g (s)		72.1			72.1	72.1		13.9			13.9	
Actuated g/C Ratio		0.80			0.80	0.80		0.15			0.15	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2366			2185	1244		244			139	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.08			0.04	
v/c Ratio		0.61			0.53	0.02		0.50			0.29	
Uniform Delay, d1		3.5			3.1	1.8		34.9			33.7	
Progression Factor		0.63			0.57	0.28		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.6			1.2	
Delay (s)		2.7			2.5	0.5		36.5			34.9	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.7			2.5	0.5		36.5			34.9	
Approach LOS		A			A	A		D			C	

Intersection Summary

HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative7
PM Peak
























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1731	3471	3471	1553	3151	1413
Flt Permitted	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1731	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	97	16	203
Lane Group Flow (vph)	272	1321	817	550	626	85
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	7	7	
Permitted Phases				6		7
Actuated Green, G (s)	22.0	57.5	31.5	56.0	24.5	24.5
Effective Green, g (s)	24.0	59.5	33.5	60.0	26.5	26.5
Actuated g/C Ratio	0.27	0.66	0.37	0.67	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	462	2295	1292	1070	928	416
v/s Ratio Prot	0.16	c0.38	c0.24	0.15	c0.20	
v/s Ratio Perm				0.20		0.06
v/c Ratio	0.59	0.58	0.63	0.51	0.68	0.20
Uniform Delay, d1	28.7	8.3	23.2	7.6	28.0	23.8
Progression Factor	0.69	0.47	0.10	0.83	1.00	1.00
Incremental Delay, d2	1.6	0.9	0.8	0.1	2.0	0.2
Delay (s)	21.5	4.8	3.1	6.5	29.9	24.1
Level of Service	C	A	A	A	C	C
Approach Delay (s)		7.6	4.6		28.1	
Approach LOS		A	A		C	

Intersection Summary

HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative7
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	267	1512	0	0	1357	655	34	0	901	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1644	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1644	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	1592	0	0	1428	689	36	0	948	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	227	0	27	27	0	0	0
Lane Group Flow (vph)	281	1592	0	0	1428	462	36	447	447	0	0	0
Turn Type	Prot				Perm		Prot	Perm				
Protected Phases	5	2			6		3	8				
Permitted Phases					6				8			
Actuated Green, G (s)	16.0	56.0			36.0	36.0	26.0	26.0	26.0			
Effective Green, g (s)	18.0	58.0			38.0	38.0	28.0	28.0	28.0			
Actuated g/C Ratio	0.20	0.64			0.42	0.42	0.31	0.31	0.31			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	329	2237			1466	656	511	459	435			
v/s Ratio Prot	c0.17	0.46			c0.41		0.02	0.30				
v/s Ratio Perm					0.30				c0.32			
v/c Ratio	0.85	0.71			0.97	0.70	0.07	0.97	1.03			
Uniform Delay, d1	34.7	10.5			25.5	21.4	21.8	30.6	31.0			
Progression Factor	1.00	0.98			0.59	0.55	1.00	1.00	1.00			
Incremental Delay, d2	19.8	1.6			11.0	2.9	0.1	35.1	50.5			
Delay (s)	54.5	11.8			26.0	14.6	21.9	65.7	81.5			
Level of Service	D	B			C	B	C	E	F			
Approach Delay (s)	18.2				22.3		71.7				0.0	
Approach LOS	B				C		E				A	
Intersection Summary												
HCM Average Control Delay			30.5		HCM Level of Service				C			
HCM Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			87.7%		ICU Level of Service				E			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
6: Commerce Way & Michigan Ave

2040 Alternative7
PM Peak



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑	↖	↗
Volume (vph)	245	219	657	225	220	660
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.93		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3225		3367	1827	1736	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3225		3367	1827	1736	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	258	231	692	237	232	695
RTOR Reduction (vph)	188	0	0	0	0	425
Lane Group Flow (vph)	301	0	692	237	232	270
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	13.1		29.9	47.0	35.0	35.0
Effective Green, g (s)	13.1		29.9	47.0	35.0	35.0
Actuated g/C Ratio	0.15		0.33	0.52	0.39	0.39
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	469		1119	954	675	604
v/s Ratio Prot	c0.09		c0.21	0.13	0.13	
v/s Ratio Perm						c0.17
v/c Ratio	0.64		0.62	0.25	0.34	0.45
Uniform Delay, d1	36.2		25.3	11.8	19.4	20.3
Progression Factor	1.00		0.67	0.64	1.00	1.00
Incremental Delay, d2	3.0		1.8	0.4	1.4	2.4
Delay (s)	39.2		18.7	8.0	20.8	22.7
Level of Service	D		B	A	C	C
Approach Delay (s)	39.2			16.0	22.2	
Approach LOS	D			B	C	

Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative7
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3463		3190	1601	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.44	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3463		3190	1601	1475	769	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	155	0	1	0	0	43	142	0	24	0
Lane Group Flow (vph)	47	1843	493	273	1569	0	543	170	54	3	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	8.1	42.4	54.4	12.6	46.9		12.0	23.0	23.0	7.0	7.0	
Effective Green, g (s)	10.1	44.4	58.4	14.6	48.9		14.0	25.0	25.0	9.0	9.0	
Actuated g/C Ratio	0.11	0.49	0.65	0.16	0.54		0.16	0.28	0.28	0.10	0.10	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	184	1712	1042	267	1882		496	445	410	77	161	
v/s Ratio Prot	0.03	c0.53	0.07	c0.17	c0.45		c0.17	c0.11			0.01	
v/s Ratio Perm			0.24						0.04	0.00		
v/c Ratio	0.26	1.08	0.47	1.02	0.83		1.09	0.38	0.13	0.04	0.06	
Uniform Delay, d1	36.5	22.8	8.0	37.7	17.2		38.0	26.3	24.4	36.6	36.7	
Progression Factor	0.92	0.74	0.46	1.00	1.00		1.04	1.08	1.55	1.00	1.00	
Incremental Delay, d2	0.4	41.2	0.2	61.0	4.5		63.4	0.4	0.1	0.2	0.2	
Delay (s)	33.8	58.0	3.9	98.7	21.7		102.8	28.8	38.0	36.8	36.8	
Level of Service	C	E	A	F	C		F	C	D	D	D	
Approach Delay (s)		43.7			33.1			72.9			36.8	
Approach LOS		D			C			E			D	
Intersection Summary												
HCM Average Control Delay			45.2			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			6.0			
Intersection Capacity Utilization			95.8%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

2040 Alternative 6 (Without Bi-County)

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HCM Signalized Intersection Capacity Analysis
1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt6 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	294	594	1099	282	662	1601
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	309	625	1157	297	697	1685
RTOR Reduction (vph)	0	307	0	198	0	0
Lane Group Flow (vph)	309	318	1157	99	697	1685
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.0	15.0	28.0	28.0	35.0	67.0
Effective Green, g (s)	17.0	17.0	30.0	30.0	37.0	69.0
Actuated g/C Ratio	0.19	0.19	0.33	0.33	0.41	0.77
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	302	293	1157	503	657	2661
v/s Ratio Prot	0.19		c0.33		c0.44	0.49
v/s Ratio Perm		c0.20		0.07		
v/c Ratio	1.02	1.08	1.00	0.20	1.06	0.63
Uniform Delay, d1	36.5	36.5	30.0	21.4	26.5	4.8
Progression Factor	0.94	0.99	1.00	1.00	1.00	1.00
Incremental Delay, d2	54.7	73.7	26.5	0.9	52.4	1.2
Delay (s)	89.1	109.8	56.5	22.3	78.9	5.9
Level of Service	F	F	E	C	E	A
Approach Delay (s)	102.9		49.5			27.3
Approach LOS	F		D			C

Intersection Summary

HCM Average Control Delay	48.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	178	660	928	981	190	24
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1598	1776	3374	1509	1586	
Flt Permitted	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	1598	1776	3374	1509	1586	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	695	977	1033	200	25
RTOR Reduction (vph)	0	0	0	293	5	0
Lane Group Flow (vph)	187	695	977	740	220	0
Turn Type	Prot		Perm			
Protected Phases	7	4	8			
Permitted Phases				8	1	
Actuated Green, G (s)	11.7	67.1	51.4	51.4	14.9	
Effective Green, g (s)	13.7	69.1	53.4	53.4	16.9	
Actuated g/C Ratio	0.15	0.77	0.59	0.59	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	243	1364	2002	895	298	
v/s Ratio Prot	c0.12	0.39	0.29			
v/s Ratio Perm				c0.49	c0.14	
v/c Ratio	0.77	0.51	0.49	0.83	0.74	
Uniform Delay, d1	36.6	4.0	10.5	14.6	34.5	
Progression Factor	0.88	0.19	0.58	0.86	1.00	
Incremental Delay, d2	6.7	0.6	0.8	8.4	9.2	
Delay (s)	38.8	1.4	6.9	20.9	43.7	
Level of Service	D	A	A	C	D	
Approach Delay (s)		9.3	14.1		43.7	
Approach LOS		A	B		D	

Intersection Summary

HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Alignment) Alt6 AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	106	732	11	0	721	803	0	0	22	382	0	326	
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00	
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85	
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (prot)	1598	3366			3374	1509			1536	3100		1509	
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (perm)	1598	3366			3374	1509			1536	3100		1509	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	112	771	12	0	759	845	0	0	23	402	0	343	
RTOR Reduction (vph)	0	1	0	0	0	520	0	0	22	0	0	171	
Lane Group Flow (vph)	112	782	0	0	759	325	0	0	1	402	0	172	
Turn Type	Prot					Perm			custom	Prot		custom	
Protected Phases	7	4			8					1			
Permitted Phases						8			2			6	
Actuated Green, G (s)	9.0	45.6			32.6	32.6			2.8	29.6		36.4	
Effective Green, g (s)	11.0	47.6			34.6	34.6			2.8	31.6		38.4	
Actuated g/C Ratio	0.12	0.53			0.38	0.38			0.03	0.35		0.43	
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	195	1780			1297	580			48	1088		644	
v/s Ratio Prot	c0.07	0.23			c0.22					c0.13			
v/s Ratio Perm						0.22			0.00			c0.11	
v/c Ratio	0.57	0.44			0.59	0.56			0.01	0.37		0.27	
Uniform Delay, d1	37.3	13.0			22.0	21.7			42.3	21.8		16.7	
Progression Factor	0.76	0.58			1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	10.0	0.7			1.9	3.9			0.1	1.0		1.0	
Delay (s)	38.4	8.2			23.9	25.6			42.4	22.7		17.7	
Level of Service	D	A			C	C			D	C		B	
Approach Delay (s)		11.9			24.8			42.4			20.4		
Approach LOS		B			C			D			C		
Intersection Summary													
HCM Average Control Delay			20.4									HCM Level of Service	C
HCM Volume to Capacity ratio			0.47										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			62.6%									ICU Level of Service	B
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
 2040 (3+1 No Alignmt) Alt6 AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	611	238	365	1114	803	751
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3129	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	3100	1509	137	3374	3129	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	643	251	384	1173	845	791
RTOR Reduction (vph)	0	195	0	0	172	0
Lane Group Flow (vph)	643	56	384	1173	1464	0
Turn Type		Perm	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	20.0	20.0	70.0	70.0	45.0	
Effective Green, g (s)	22.0	22.0	72.0	72.0	47.0	
Actuated g/C Ratio	0.22	0.22	0.73	0.73	0.48	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	696	339	444	2479	1501	
v/s Ratio Prot	c0.21		c0.20	0.35	c0.47	
v/s Ratio Perm		0.04	0.43			
v/c Ratio	0.92	0.17	0.86	0.47	0.98	
Uniform Delay, d1	37.2	30.6	29.0	5.3	24.9	
Progression Factor	1.00	1.00	1.00	1.00	0.35	
Incremental Delay, d2	18.0	0.2	19.6	0.7	9.7	
Delay (s)	55.1	30.8	48.6	5.9	18.3	
Level of Service	E	C	D	A	B	
Approach Delay (s)	48.3			16.5	18.3	
Approach LOS	D			B	B	
























Intersection Summary

HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	98.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	491	490	1065	306	65	1086	35	603	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	1.6	1.9	1.6	1.9	1.6		1.6	2.0	1.9	1.9	1.9	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3286		3100	1461	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3286		3100	1461	1434	919	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	517	516	1121	322	68	1143	37	635	22	35	139
RTOR Reduction (vph)	0	0	72	0	21	0	0	165	2	0	126	0
Lane Group Flow (vph)	163	517	444	1121	369	0	1143	177	328	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov		Perm	
Protected Phases	7	4	5	3	8		5	2	3		6	
Permitted Phases			4						2		6	
Actuated Green, G (s)	28.4	12.1	44.5	31.1	15.4		32.4	43.0	74.1	7.1	7.1	
Effective Green, g (s)	30.4	14.1	48.5	33.1	17.4		34.4	45.0	78.1	9.1	9.1	
Actuated g/C Ratio	0.31	0.14	0.49	0.34	0.18		0.35	0.46	0.80	0.09	0.09	
Clearance Time (s)	3.6	3.9	3.6	3.9	3.6		3.6	4.0	3.9	3.9	3.9	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0		2.0	3.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	496	485	747	1047	583		1088	671	1143	85	145	
v/s Ratio Prot	0.10	c0.15	0.21	c0.36	0.11		c0.37	0.12	c0.10		0.03	
v/s Ratio Perm			0.09						0.13	0.02		
v/c Ratio	0.33	1.07	0.59	1.07	0.63		1.05	0.26	0.29	0.26	0.33	
Uniform Delay, d1	26.0	42.0	17.7	32.5	37.3		31.8	16.3	2.6	41.3	41.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.70	0.11	0.85	1.00	1.00	
Incremental Delay, d2	0.1	59.6	0.9	48.8	1.7		38.5	0.2	0.0	7.2	6.0	
Delay (s)	26.1	101.5	18.6	81.2	39.0		60.7	1.9	2.3	48.6	47.6	
Level of Service	C	F	B	F	D		E	A	A	D	D	
Approach Delay (s)		55.5			70.3			39.0			47.7	
Approach LOS		E			E			D			D	
Intersection Summary												
HCM Average Control Delay			53.6				HCM Level of Service				D	
HCM Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			98.0				Sum of lost time (s)			5.4		
Intersection Capacity Utilization			101.5%				ICU Level of Service			G		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2040 (3+1 No Aligmnt) Alt6 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	344	677	2392	380	688	2000
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	362	713	2518	400	724	2105
RTOR Reduction (vph)	0	405	0	226	0	0
Lane Group Flow (vph)	362	308	2518	174	724	2105
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.0	9.0	17.0	17.0	15.0	36.0
Effective Green, g (s)	11.0	11.0	19.0	19.0	17.0	38.0
Actuated g/C Ratio	0.21	0.21	0.36	0.36	0.32	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	341	322	1244	557	527	2489
v/s Ratio Prot	c0.22		c0.73		c0.44	0.61
v/s Ratio Perm		0.20		0.11		
v/c Ratio	1.06	0.96	2.02	0.31	1.37	0.85
Uniform Delay, d1	21.0	20.8	17.0	12.3	18.0	5.4
Progression Factor	1.14	3.22	1.00	1.00	1.00	1.00
Incremental Delay, d2	63.3	35.8	463.7	1.5	180.0	3.8
Delay (s)	87.3	102.8	480.7	13.7	198.0	9.2
Level of Service	F	F	F	B	F	A
Approach Delay (s)	97.5		416.7			57.5
Approach LOS	F		F			E

Intersection Summary				
HCM Average Control Delay		217.4	HCM Level of Service	F
HCM Volume to Capacity ratio		1.52		
Actuated Cycle Length (s)		53.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization		136.5%	ICU Level of Service	H
Analysis Period (min)		15		
c	Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	140	1293	1170	32	38	3
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1644	1827	3471	1553	1638	
Flt Permitted	0.20	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	338	1827	3471	1553	1638	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	147	1361	1232	34	40	3
RTOR Reduction (vph)	0	0	0	9	2	0
Lane Group Flow (vph)	147	1361	1232	25	41	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	37.5	37.5	37.5	37.5	7.5	
Effective Green, g (s)	39.5	39.5	39.5	39.5	9.5	
Actuated g/C Ratio	0.75	0.75	0.75	0.75	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	252	1362	2587	1157	294	
v/s Ratio Prot		c0.74	0.35			
v/s Ratio Perm	0.44			0.02	c0.02	
v/c Ratio	0.58	1.00	0.48	0.02	0.14	
Uniform Delay, d1	3.0	6.7	2.7	1.7	18.3	
Progression Factor	0.68	0.99	0.92	0.40	1.00	
Incremental Delay, d2	5.6	18.4	0.5	0.0	0.2	
Delay (s)	7.7	25.1	3.0	0.7	18.5	
Level of Service	A	C	A	A	B	
Approach Delay (s)		23.4	2.9		18.5	
Approach LOS		C	A		B	

Intersection Summary				
HCM Average Control Delay		14.1	HCM Level of Service	B
HCM Volume to Capacity ratio		0.82		
Actuated Cycle Length (s)		53.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization		80.6%	ICU Level of Service	D
Analysis Period (min)		15		
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	239	1167	13	0	819	570	0	0	88	523	0	366
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1644	3465			3471	1553			1580	3190		1553
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1644	3465			3471	1553			1580	3190		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	252	1228	14	0	862	600	0	0	93	551	0	385
RTOR Reduction (vph)	0	1	0	0	0	340	0	0	51	0	0	312
Lane Group Flow (vph)	252	1241	0	0	862	260	0	0	42	551	0	73
Turn Type	Prot				Perm				custom	Prot		custom
Protected Phases	5	2			6					4		
Permitted Phases						6			8			4
Actuated Green, G (s)	20.5	68.4			43.9	43.9			7.6	18.0		18.0
Effective Green, g (s)	22.5	70.4			45.9	45.9			7.6	20.0		20.0
Actuated g/C Ratio	0.21	0.66			0.43	0.43			0.07	0.19		0.19
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	349	2301			1503	672			113	602		293
v/s Ratio Prot	c0.15	0.36			c0.25					c0.17		
v/s Ratio Perm						0.17			c0.03			0.05
v/c Ratio	0.72	0.54			0.57	0.39			0.37	0.92		0.25
Uniform Delay, d1	38.8	9.3			22.7	20.5			46.9	42.2		36.6
Progression Factor	0.91	0.79			1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	2.9	0.4			1.6	1.7			2.1	20.9		2.0
Delay (s)	38.4	7.7			24.3	22.1			49.0	63.0		38.6
Level of Service	D	A			C	C			D	E		D
Approach Delay (s)		12.9			23.4			49.0			53.0	
Approach LOS		B			C			D			D	
Intersection Summary												
HCM Average Control Delay			27.0				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			106.0				Sum of lost time (s)			10.0		
Intersection Capacity Utilization			64.3%				ICU Level of Service			C		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	647	227	179	902	823	840
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.92	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3208	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3208	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	681	239	188	949	866	884
RTOR Reduction (vph)	0	181	0	0	203	0
Lane Group Flow (vph)	681	58	188	949	1547	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	19.8	19.8	10.9	62.2	47.3	
Effective Green, g (s)	21.8	21.8	12.9	64.2	49.3	
Actuated g/C Ratio	0.24	0.24	0.14	0.71	0.55	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	773	376	236	2476	1757	
v/s Ratio Prot	c0.21		c0.11	0.27	c0.48	
v/s Ratio Perm		0.04				
v/c Ratio	0.88	0.15	0.80	0.38	0.88	
Uniform Delay, d1	32.9	26.8	37.3	5.1	17.8	
Progression Factor	1.00	1.00	1.00	1.00	0.32	
Incremental Delay, d2	11.5	0.2	16.8	0.5	2.3	
Delay (s)	44.3	27.0	54.1	5.5	8.0	
Level of Service	D	C	D	A	A	
Approach Delay (s)	39.8			13.6	8.0	
Approach LOS	D			B	A	
























Intersection Summary

HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1049	682	982	817	23	545	99	905	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	1.5	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.88	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3457		3190	1526	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3457		3190	1526	1475	1644	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1104	718	1034	860	24	574	104	953	3	7	27
RTOR Reduction (vph)	0	0	126	0	2	0	0	144	362	0	24	0
Lane Group Flow (vph)	47	1104	592	1034	882	0	574	389	162	3	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.2	22.2	42.0	25.0	43.0		19.8	25.9	25.9	1.4	7.0	
Effective Green, g (s)	6.2	24.2	46.0	27.0	45.0		21.8	27.9	27.9	3.4	9.0	
Actuated g/C Ratio	0.07	0.27	0.51	0.30	0.50		0.24	0.31	0.31	0.04	0.10	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	3.5	4.0	
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0		2.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	113	933	794	957	1729		773	473	457	62	161	
v/s Ratio Prot	0.03	c0.32	0.18	c0.32	0.26		0.18	c0.25		0.00	c0.01	
v/s Ratio Perm			0.20						0.11			
v/c Ratio	0.42	1.18	0.75	1.08	0.51		0.74	0.82	0.36	0.05	0.06	
Uniform Delay, d1	40.2	32.9	17.4	31.5	15.1		31.5	28.8	24.1	41.7	36.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.70	0.39	0.49	1.00	1.00	
Incremental Delay, d2	2.5	93.5	3.4	53.3	1.1		2.8	9.1	0.4	0.3	0.2	
Delay (s)	42.6	126.4	20.7	84.8	16.2		24.8	20.5	12.1	42.1	36.8	
Level of Service	D	F	C	F	B		C	C	B	D	D	
Approach Delay (s)		83.7			53.2			19.3			37.3	
Approach LOS		F			D			B			D	
Intersection Summary												
HCM Average Control Delay			53.4				HCM Level of Service			D		
HCM Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			92.3%				ICU Level of Service		F			
Analysis Period (min)			15									
c Critical Lane Group												

2040 Alternative 7 (Without Bi-County)

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HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2040 (3+1 No Alignmt) Alt7 AM PEAK



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	294	594	1099	282	662	1601
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	309	625	1157	297	697	1685
RTOR Reduction (vph)	0	445	0	203	0	0
Lane Group Flow (vph)	309	180	1157	94	697	1685
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	11.9	11.9	17.0	17.0	19.0	40.0
Effective Green, g (s)	13.9	13.9	19.0	19.0	21.0	42.0
Actuated g/C Ratio	0.23	0.23	0.32	0.32	0.35	0.70
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	371	350	1070	479	560	2366
v/s Ratio Prot	c0.19		c0.34		c0.44	0.50
v/s Ratio Perm		0.12		0.06		
v/c Ratio	0.83	0.52	1.08	0.20	1.24	0.71
Uniform Delay, d1	21.9	20.1	20.4	14.9	19.4	5.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.7	1.3	52.3	0.9	124.5	1.9
Delay (s)	36.6	21.3	72.7	15.8	144.0	7.2
Level of Service	D	C	E	B	F	A
Approach Delay (s)	26.4		61.1			47.2
Approach LOS	C		E			D

Intersection Summary

HCM Average Control Delay	47.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	59.9	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt7 AM PEAK



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	178	660	981	79	190	24
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1598	1776	3374	1509	1586	
Flt Permitted	0.24	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	407	1776	3374	1509	1586	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	695	1033	83	200	25
RTOR Reduction (vph)	0	0	0	22	6	0
Lane Group Flow (vph)	187	695	1033	61	219	0
Turn Type	Perm		Perm			
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	60.1	60.1	60.1	60.1	16.9	
Effective Green, g (s)	62.1	62.1	62.1	62.1	18.9	
Actuated g/C Ratio	0.73	0.73	0.73	0.73	0.22	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	297	1298	2465	1102	353	
v/s Ratio Prot		0.39	0.31			
v/s Ratio Perm	c0.46			0.04	c0.14	
v/c Ratio	0.63	0.54	0.42	0.06	0.62	
Uniform Delay, d1	5.7	5.1	4.4	3.2	29.8	
Progression Factor	1.00	1.00	0.33	0.05	1.00	
Incremental Delay, d2	9.7	1.6	0.5	0.1	3.2	
Delay (s)	15.4	6.7	2.0	0.2	33.0	
Level of Service	B	A	A	A	C	
Approach Delay (s)		8.5	1.8		33.0	
Approach LOS		A	A		C	























Intersection Summary

HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis






















4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 AM PEAK

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 					 			
Volume (vph)	106	732	11	0	721	803	0	0	22	382	0	326	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00	
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85	
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (prot)	1682	3366			3374	1509			1536	3100		1509	
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (perm)	1682	3366			3374	1509			1536	3100		1509	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	112	771	12	0	759	845	0	0	23	402	0	343	
RTOR Reduction (vph)	0	1	0	0	0	223	0	0	22	0	0	11	
Lane Group Flow (vph)	112	782	0	0	759	622	0	0	1	402	0	332	
Turn Type	Prot				pm+ov				custom	Prot		custom	
Protected Phases	5	2			6	7				7		5	
Permitted Phases						6			8			4	
Actuated Green, G (s)	8.0	49.9			37.9	58.2			2.8	20.3		35.1	
Effective Green, g (s)	10.0	51.9			39.9	62.2			4.8	22.3		39.1	
Actuated g/C Ratio	0.12	0.61			0.47	0.73			0.06	0.26		0.46	
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	198	2055			1584	1140			87	813		730	
v/s Ratio Prot	c0.07	0.23			0.22	c0.14				0.13		c0.05	
v/s Ratio Perm						0.27			0.00			0.17	
v/c Ratio	0.57	0.38			0.48	0.55			0.01	0.49		0.46	
Uniform Delay, d1	35.4	8.4			15.4	5.1			37.9	26.6		15.7	
Progression Factor	0.91	0.88			0.33	9.52			1.00	1.00		1.00	
Incremental Delay, d2	3.2	0.5			0.6	0.3			0.1	0.5		0.5	
Delay (s)	35.5	7.9			5.6	48.7			37.9	27.0		16.1	
Level of Service	D	A			A	D			D	C		B	
Approach Delay (s)		11.3			28.3			37.9			22.0		
Approach LOS		B			C			D			C		
Intersection Summary													
HCM Average Control Delay			22.3									HCM Level of Service	C
HCM Volume to Capacity ratio			0.53										
Actuated Cycle Length (s)			85.0									Sum of lost time (s)	4.0
Intersection Capacity Utilization			62.6%									ICU Level of Service	B
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	231	908	0	0	1366	885	159	0	690	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1598	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1598	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	243	956	0	0	1438	932	167	0	726	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	302	0	146	146	0	0	0
Lane Group Flow (vph)	243	956	0	0	1438	630	167	217	217	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	17.0	61.0			40.0	40.0	16.0	16.0	16.0			
Effective Green, g (s)	19.0	63.0			42.0	42.0	18.0	18.0	18.0			
Actuated g/C Ratio	0.22	0.74			0.49	0.49	0.21	0.21	0.21			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	357	2501			1667	746	338	304	288			
v/s Ratio Prot	c0.15	0.28			c0.43		0.10	0.15				
v/s Ratio Perm						0.42			c0.16			
v/c Ratio	0.68	0.38			0.86	0.84	0.49	0.71	0.75			
Uniform Delay, d1	30.2	4.0			19.0	18.7	29.5	31.1	31.4			
Progression Factor	0.96	0.79			1.00	1.00	1.00	1.00	1.00			
Incremental Delay, d2	9.5	0.4			6.2	11.3	1.1	7.7	10.7			
Delay (s)	38.5	3.6			25.1	29.9	30.6	38.9	42.1			
Level of Service	D	A			C	C	C	D	D			
Approach Delay (s)		10.6			27.0			38.6			0.0	
Approach LOS		B			C			D			A	
Intersection Summary												
HCM Average Control Delay			24.9		HCM Level of Service				C			
HCM Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			85.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			92.5%		ICU Level of Service				F			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt7 AM PEAK



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑↑	↑	↑	↑
Volume (vph)	277	169	507	202	279	838
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.94		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3182		3273	1776	1687	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3182		3273	1776	1687	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	292	178	534	213	294	882
RTOR Reduction (vph)	98	0	0	0	0	357
Lane Group Flow (vph)	372	0	534	213	294	525
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	16.0		22.0	42.0	45.0	45.0
Effective Green, g (s)	16.0		22.0	42.0	45.0	45.0
Actuated g/C Ratio	0.17		0.23	0.44	0.47	0.47
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	536		758	785	799	715
v/s Ratio Prot	c0.12		c0.16	0.12	0.17	
v/s Ratio Perm						c0.35
v/c Ratio	0.69		0.70	0.27	0.37	0.73
Uniform Delay, d1	37.2		33.5	16.8	15.9	20.2
Progression Factor	1.00		0.80	0.83	1.00	1.00
Incremental Delay, d2	3.9		4.6	0.7	1.3	6.6
Delay (s)	41.1		31.5	14.7	17.2	26.8
Level of Service	D		C	B	B	C
Approach Delay (s)	41.1			26.7	24.4	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt7 AM PEAK

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	947	497	180	1192	65	927	35	152	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	1598	3348		3100	1527	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.57	1.00	
Satd. Flow (perm)	1598	3374	1509	1598	3348		3100	1527	1434	955	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	997	523	189	1255	68	976	37	160	22	35	139
RTOR Reduction (vph)	0	0	123	0	4	0	0	38	58	0	126	0
Lane Group Flow (vph)	163	997	400	189	1319	0	976	63	38	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	13.5	35.1	60.1	11.9	33.5		25.0	36.0	36.0	7.0	7.0	
Effective Green, g (s)	15.5	37.1	64.1	13.9	35.5		27.0	38.0	38.0	9.0	9.0	
Actuated g/C Ratio	0.16	0.39	0.67	0.15	0.37		0.28	0.40	0.40	0.09	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	261	1318	1018	234	1251		881	611	574	90	148	
v/s Ratio Prot	0.10	c0.30	0.11	0.12	c0.39		c0.31	0.04			c0.03	
v/s Ratio Perm			0.15						0.03	0.02		
v/c Ratio	0.62	0.76	0.39	0.81	1.05		1.11	0.10	0.07	0.24	0.33	
Uniform Delay, d1	37.0	25.0	6.8	39.3	29.8		34.0	17.8	17.6	39.8	40.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.90	0.82	0.88	1.00	1.00	
Incremental Delay, d2	4.6	4.1	0.3	18.2	41.0		58.4	0.0	0.0	1.4	1.3	
Delay (s)	41.6	29.1	7.1	57.4	70.7		88.9	14.7	15.4	41.3	41.5	
Level of Service	D	C	A	E	E		F	B	B	D	D	
Approach Delay (s)		23.5			69.1			76.5			41.4	
Approach LOS		C			E			E			D	
Intersection Summary												
HCM Average Control Delay			53.0			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.92									
Actuated Cycle Length (s)			95.0			Sum of lost time (s)			6.0			
Intersection Capacity Utilization			95.2%			ICU Level of Service			F			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2040 (3+1 No Alignment) Alt7 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	344	677	2392	380	688	2000
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	362	713	2518	400	724	2105
RTOR Reduction (vph)	0	317	0	141	0	0
Lane Group Flow (vph)	362	396	2518	259	724	2105
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	16.0	16.0	31.0	31.0	26.0	61.0
Effective Green, g (s)	18.0	18.0	33.0	33.0	28.0	63.0
Actuated g/C Ratio	0.21	0.21	0.39	0.39	0.33	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	348	329	1348	603	542	2573
v/s Ratio Prot	0.22		c0.73		c0.44	0.61
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.04	1.20	1.87	0.43	1.34	0.82
Uniform Delay, d1	33.5	33.5	26.0	19.1	28.5	7.2
Progression Factor	0.65	0.84	1.00	1.00	1.00	1.00
Incremental Delay, d2	57.2	115.5	393.4	2.2	163.3	3.0
Delay (s)	79.0	143.7	419.4	21.3	191.8	10.3
Level of Service	E	F	F	C	F	B
Approach Delay (s)	121.9		364.9			56.7
Approach LOS	F		F			E

Intersection Summary

HCM Average Control Delay	198.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.50		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	136.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Alignment) Alt7 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	52	1381	1170	32	38	3
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1644	1827	3471	1553	1638	
Flt Permitted	0.21	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	364	1827	3471	1553	1638	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1454	1232	34	40	3
RTOR Reduction (vph)	0	0	0	5	3	0
Lane Group Flow (vph)	55	1454	1232	29	40	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	70.0	70.0	70.0	70.0	7.0	
Effective Green, g (s)	72.0	72.0	72.0	72.0	9.0	
Actuated g/C Ratio	0.85	0.85	0.85	0.85	0.11	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	308	1548	2940	1315	173	
v/s Ratio Prot		c0.80	0.35			
v/s Ratio Perm	0.15			0.02	c0.02	
v/c Ratio	0.18	0.94	0.42	0.02	0.23	
Uniform Delay, d1	1.2	4.9	1.5	1.0	34.8	
Progression Factor	0.76	2.11	0.51	0.00	1.00	
Incremental Delay, d2	0.8	8.2	0.4	0.0	0.7	
Delay (s)	1.7	18.5	1.2	0.0	35.5	
Level of Service	A	B	A	A	D	
Approach Delay (s)		17.9	1.1		35.5	
Approach LOS		B	A		D	

Intersection Summary

HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps
























Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	239	1167	13	0	760	570	0	0	88	523	0	366
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1731	3465			3471	1553			1580	3190		1553
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1731	3465			3471	1553			1580	3190		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	252	1228	14	0	800	600	0	0	93	551	0	385
RTOR Reduction (vph)	0	1	0	0	0	247	0	0	35	0	0	6
Lane Group Flow (vph)	252	1241	0	0	800	353	0	0	58	551	0	379
Turn Type	Prot				pm+ov				custom	Prot		custom
Protected Phases	5	2			6	7				7		5
Permitted Phases						6			8			4
Actuated Green, G (s)	15.4	45.3			25.9	46.0			7.6	20.1		47.1
Effective Green, g (s)	17.4	47.3			27.9	50.0			9.6	22.1		51.1
Actuated g/C Ratio	0.20	0.56			0.33	0.59			0.11	0.26		0.60
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	354	1928			1139	914			178	829		970
v/s Ratio Prot	c0.15	c0.36			0.23	0.10				c0.17		c0.08
v/s Ratio Perm						0.13			0.04			0.16
v/c Ratio	0.71	0.64			0.70	0.39			0.33	0.66		0.39
Uniform Delay, d1	31.5	13.0			24.9	9.3			34.7	28.1		8.8
Progression Factor	0.89	1.16			1.07	7.92			1.00	1.00		1.00
Incremental Delay, d2	2.6	0.6			1.4	0.1			1.1	2.0		0.3
Delay (s)	30.5	15.8			28.0	73.9			35.8	30.2		9.1
Level of Service	C	B			C	E			D	C		A
Approach Delay (s)		18.2			47.7			35.8			21.5	
Approach LOS		B			D			D			C	
Intersection Summary												
HCM Average Control Delay			29.9		HCM Level of Service				C			
HCM Volume to Capacity ratio			0.62									
Actuated Cycle Length (s)			85.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			64.3%		ICU Level of Service				C			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Alignmnt) Alt7 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Volume (vph)	295	1481	0	0	1357	724	32	0	842	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1644	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1644	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	311	1559	0	0	1428	762	34	0	886	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	266	0	40	40	0	0	0
Lane Group Flow (vph)	311	1559	0	0	1428	496	34	403	403	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	18.0	57.0			35.0	35.0	20.0	20.0	20.0			
Effective Green, g (s)	20.0	59.0			37.0	37.0	22.0	22.0	22.0			
Actuated g/C Ratio	0.24	0.69			0.44	0.44	0.26	0.26	0.26			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	387	2409			1511	676	426	382	362			
v/s Ratio Prot	c0.19	0.45			c0.41		0.02	0.27				
v/s Ratio Perm						0.32			c0.29			
v/c Ratio	0.80	0.65			0.95	0.73	0.08	1.05	1.11			
Uniform Delay, d1	30.6	7.2			23.0	19.9	23.8	31.5	31.5			
Progression Factor	1.20	1.53			1.00	1.00	1.00	1.00	1.00			
Incremental Delay, d2	9.2	1.1			13.3	6.9	0.1	61.2	81.5			
Delay (s)	45.9	12.1			36.3	26.9	23.9	92.7	113.0			
Level of Service	D	B			D	C	C	F	F			
Approach Delay (s)		17.7			33.0			100.0			0.0	
Approach LOS		B			C			F			A	
Intersection Summary												
HCM Average Control Delay			39.6				HCM Level of Service		D			
HCM Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			85.0				Sum of lost time (s)		6.0			
Intersection Capacity Utilization			89.5%				ICU Level of Service		E			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 PM Peak


























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑↑	↑	↑	↑
Volume (vph)	246	218	653	224	219	657
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.93		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3227		3367	1827	1736	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3227		3367	1827	1736	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	259	229	687	236	231	692
RTOR Reduction (vph)	193	0	0	0	0	448
Lane Group Flow (vph)	295	0	687	236	231	244
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	13.3		29.7	47.0	30.0	30.0
Effective Green, g (s)	13.3		29.7	47.0	30.0	30.0
Actuated g/C Ratio	0.16		0.35	0.55	0.35	0.35
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	505		1176	1010	613	548
v/s Ratio Prot	c0.09		c0.20	0.13	0.13	
v/s Ratio Perm						c0.16
v/c Ratio	0.58		0.58	0.23	0.38	0.45
Uniform Delay, d1	33.3		22.6	9.8	20.5	21.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7		2.1	0.5	1.8	2.6
Delay (s)	35.0		24.7	10.3	22.3	23.7
Level of Service	D		C	B	C	C
Approach Delay (s)	35.0			21.0	23.4	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	24.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1664	613	258	1541	23	513	99	290	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	1.5	1.5	1.0	1.5	1.0		1.0	1.0	1.0	1.5	1.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3464		3190	1602	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.44	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3464		3190	1602	1475	761	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1752	645	272	1622	24	540	104	305	3	7	27
RTOR Reduction (vph)	0	0	138	0	1	0	0	40	138	0	24	0
Lane Group Flow (vph)	47	1752	507	272	1645	0	540	174	57	3	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	4.5	45.5	60.9	13.5	55.0		15.4	26.0	26.0	7.1	7.1	
Effective Green, g (s)	6.5	47.5	64.9	15.5	57.0		17.4	28.0	28.0	9.1	9.1	
Actuated g/C Ratio	0.07	0.50	0.68	0.16	0.60		0.18	0.29	0.29	0.10	0.10	
Clearance Time (s)	3.5	3.5	3.0	3.5	3.0		3.0	3.0	3.0	3.5	3.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	112	1736	1061	268	2078		584	472	435	73	154	
v/s Ratio Prot	0.03	c0.50	0.09	c0.17	0.47		c0.17	c0.11			0.01	
v/s Ratio Perm			0.24						0.04	0.00		
v/c Ratio	0.42	1.01	0.48	1.01	0.79		0.92	0.37	0.13	0.04	0.06	
Uniform Delay, d1	42.4	23.8	7.1	39.8	14.5		38.2	26.5	24.6	39.0	39.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	23.9	0.3	58.8	3.2		20.5	0.5	0.1	0.2	0.2	
Delay (s)	45.0	47.6	7.4	98.6	17.7		58.7	27.0	24.7	39.2	39.2	
Level of Service	D	D	A	F	B		E	C	C	D	D	
Approach Delay (s)		37.0			29.1			44.6			39.2	
Approach LOS		D			C			D			D	
Intersection Summary												
HCM Average Control Delay			35.5			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			95.0			Sum of lost time (s)			5.0			
Intersection Capacity Utilization			93.2%			ICU Level of Service			F			
Analysis Period (min)			15									
c	Critical Lane Group											

Existing Queuing Analysis

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Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 AM PEAK



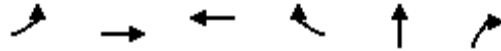
Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	10	394	426	343	234
v/c Ratio	0.07	0.58	0.80	0.27	0.67
Control Delay	47.1	13.8	22.5	1.3	39.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	13.8	22.5	1.3	39.5
Queue Length 50th (ft)	4	57	137	8	106
Queue Length 95th (ft)	m16	120	213	24	180
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	138	678	599	1286	381
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.07	0.58	0.71	0.27	0.61

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

Existing
 AM PEAK



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	81	453	688	317	66	327
v/c Ratio	0.41	0.35	0.64	0.31	0.17	0.55
Control Delay	47.8	6.8	10.9	0.9	26.5	7.3
Queue Delay	0.0	1.0	0.0	0.0	0.0	0.0
Total Delay	47.8	7.8	11.0	0.9	26.5	7.3
Queue Length 50th (ft)	45	102	177	3	27	0
Queue Length 95th (ft)	m76	143	230	3	59	64
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	200	1288	1074	1038	380	593
Starvation Cap Reductn	0	570	11	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.63	0.65	0.31	0.17	0.55

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 PM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	3	716	327	415	301
v/c Ratio	0.02	0.85	0.83	0.32	0.79
Control Delay	39.3	24.0	37.8	1.6	46.6
Queue Delay	0.0	0.0	0.0	0.2	0.0
Total Delay	39.3	24.0	37.8	1.8	46.6
Queue Length 50th (ft)	2	146	173	16	142
Queue Length 95th (ft)	m7	#507	#297	27	#261
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	129	838	411	1299	392
Starvation Cap Reductn	0	0	0	340	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	0.85	0.80	0.43	0.77

Intersection Summary

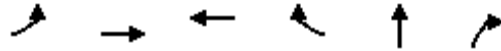
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

Existing
 PM PEAK



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	132	712	661	302	57	313
v/c Ratio	0.53	0.54	0.63	0.30	0.15	0.53
Control Delay	35.4	3.6	12.7	1.1	26.1	7.5
Queue Delay	0.0	1.5	0.1	0.0	0.0	0.0
Total Delay	35.4	5.1	12.8	1.1	26.1	7.5
Queue Length 50th (ft)	72	120	177	0	23	3
Queue Length 95th (ft)	m89	m92	243	13	53	66
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	267	1325	1051	1021	391	586
Starvation Cap Reductn	0	405	24	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.77	0.64	0.30	0.15	0.53

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

2016 Queuing Analysis

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Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative1 AM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	2	472	594	353	241
v/c Ratio	0.02	0.81	0.93	0.27	0.73
Control Delay	37.5	39.0	31.7	2.0	46.2
Queue Delay	0.0	0.0	2.3	0.0	0.0
Total Delay	37.5	39.0	34.1	2.0	46.2
Queue Length 50th (ft)	1	232	228	14	121
Queue Length 95th (ft)	8	#404	m#478	m73	#215
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	121	586	654	1307	353
Starvation Cap Reductn	0	0	19	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	0.81	0.94	0.27	0.68

Intersection Summary

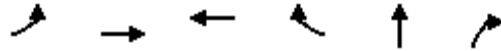
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues

5: Barton Rd & I-215 NB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	119	516	868	454	78	387
v/c Ratio	0.71	0.39	0.79	0.41	0.22	0.62
Control Delay	54.3	4.9	15.1	1.4	30.2	8.3
Queue Delay	0.0	1.5	1.2	0.0	0.0	0.0
Total Delay	54.3	6.4	16.2	1.4	30.2	8.3
Queue Length 50th (ft)	52	94	192	8	35	0
Queue Length 95th (ft)	m77	m124	571	8	74	75
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	167	1322	1095	1104	353	622
Starvation Cap Reductn	0	596	0	0	0	0
Spillback Cap Reductn	0	0	80	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.71	0.86	0.41	0.22	0.62

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative1 PM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	5	906	459	483	312
v/c Ratio	0.03	1.25	0.97	0.39	0.77
Control Delay	30.0	149.4	37.4	4.5	42.1
Queue Delay	0.0	38.6	0.0	0.3	0.0
Total Delay	30.0	188.0	37.4	4.7	42.1
Queue Length 50th (ft)	2	~588	230	20	143
Queue Length 95th (ft)	11	#813	m231	m97	#253
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	184	724	473	1263	434
Starvation Cap Reductn	0	0	0	287	0
Spillback Cap Reductn	0	47	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.03	1.34	0.97	0.49	0.72

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

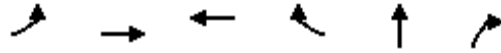
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
5: Barton Rd & I-215 NB Ramps



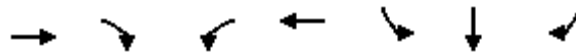
Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	167	856	849	411	91	493
v/c Ratio	0.81	0.78	1.03	0.44	0.15	0.76
Control Delay	37.0	9.5	61.3	1.9	18.7	23.8
Queue Delay	0.0	62.1	0.0	0.0	0.0	0.0
Total Delay	37.0	71.6	61.3	1.9	18.7	23.8
Queue Length 50th (ft)	93	185	~468	6	31	142
Queue Length 95th (ft)	m91	m139	#692	9	63	#277
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	206	1096	822	925	608	652
Starvation Cap Reductn	0	338	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.81	1.13	1.03	0.44	0.15	0.76

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative2
 AM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	394	78	594	341	125	125	193
v/c Ratio	0.38	0.15	0.69	0.16	0.27	0.25	0.32
Control Delay	15.6	6.2	14.1	1.1	16.9	16.6	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.6	6.2	14.1	1.1	16.9	16.6	4.5
Queue Length 50th (ft)	68	6	82	1	33	33	0
Queue Length 95th (ft)	66	20	126	6	71	71	37
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1047	522	855	2094	471	501	601
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.15	0.69	0.16	0.27	0.25	0.32

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2016 Alternative2
 AM Peak

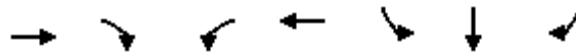


Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	119	516	857	454	78	194	193
v/c Ratio	0.25	0.20	0.43	0.42	0.27	0.34	0.35
Control Delay	9.7	0.3	3.5	1.9	22.2	1.6	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.7	0.3	3.5	1.9	22.2	1.6	1.7
Queue Length 50th (ft)	9	1	7	0	24	0	0
Queue Length 95th (ft)	19	1	62	13	52	0	0
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	481	2525	2013	1083	496	702	679
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.20	0.43	0.42	0.16	0.28	0.28

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative2
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	713	193	459	472	159	157	215
v/c Ratio	0.60	0.29	0.60	0.22	0.33	0.31	0.34
Control Delay	10.0	1.5	13.9	2.5	17.7	17.3	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.0	1.5	13.9	2.5	17.7	17.3	4.4
Queue Length 50th (ft)	37	1	80	7	44	43	0
Queue Length 95th (ft)	64	0	38	26	88	86	39
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1197	662	770	2154	485	514	630
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.29	0.60	0.22	0.33	0.31	0.34

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2016 Alternative2
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	167	856	839	411	91	247	246
v/c Ratio	0.34	0.34	0.43	0.39	0.26	0.55	0.56
Control Delay	11.7	0.7	5.5	2.1	19.7	10.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.7	0.7	5.5	2.1	19.7	10.9	11.4
Queue Length 50th (ft)	15	4	61	0	28	22	21
Queue Length 95th (ft)	m27	5	55	12	52	67	67
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	495	2500	1974	1060	510	581	557
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.34	0.43	0.39	0.18	0.43	0.44

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative3
 AM Peak

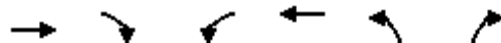


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	78	394	341	594	304	138
v/c Ratio	0.16	0.21	0.23	0.43	0.26	0.23
Control Delay	16.7	3.6	8.0	1.0	10.5	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.7	3.6	8.0	1.0	10.5	3.8
Queue Length 50th (ft)	10	15	27	0	28	0
Queue Length 95th (ft)	20	24	51	0	52	30
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	481	1862	1478	1383	1192	607
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.21	0.23	0.43	0.26	0.23

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2016 Alternative3
 AM Peak



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	521	119	454	857	78	387
v/c Ratio	0.39	0.12	0.47	0.34	0.26	0.24
Control Delay	12.9	1.3	9.0	0.8	22.7	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.9	1.3	9.0	0.8	22.7	1.8
Queue Length 50th (ft)	65	1	38	7	23	3
Queue Length 95th (ft)	95	12	58	7	55	21
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1338	982	962	2501	303	1580
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.12	0.47	0.34	0.26	0.24
Intersection Summary						

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

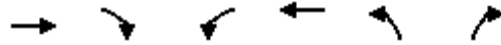
2016 Alternative3
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	193	713	472	459	366	164
v/c Ratio	0.35	0.33	0.33	0.37	0.37	0.30
Control Delay	13.7	2.5	6.4	0.9	15.3	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.7	2.5	6.4	0.9	15.3	4.7
Queue Length 50th (ft)	19	21	43	2	45	0
Queue Length 95th (ft)	41	24	45	0	75	38
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	550	2154	1436	1239	1002	552
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.33	0.33	0.37	0.37	0.30
Intersection Summary						

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2016 Alternative3
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	859	167	411	839	91	493
v/c Ratio	0.51	0.15	0.50	0.31	0.36	0.37
Control Delay	10.8	2.0	18.4	0.4	26.4	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.8	2.0	18.4	0.4	26.4	7.4
Queue Length 50th (ft)	82	0	68	1	29	35
Queue Length 95th (ft)	118	8	125	3	66	66
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1676	1088	825	2693	255	1326
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.15	0.50	0.31	0.36	0.37

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative4
 AM Peak

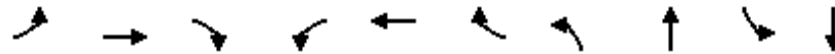


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	78	394	341	594	304	138
v/c Ratio	0.24	0.27	0.31	0.43	0.18	0.17
Control Delay	42.7	16.4	26.3	1.3	10.0	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.7	16.4	26.3	1.3	10.0	2.6
Queue Length 50th (ft)	23	71	84	8	38	0
Queue Length 95th (ft)	45	101	125	24	60	29
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	355	1441	1101	1385	1730	795
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.27	0.31	0.43	0.18	0.17

Intersection Summary

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2016 Alternative4
 AM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	86	332	221	44	591	333	266	190	272	194
v/c Ratio	0.29	0.30	0.23	0.07	0.55	0.33	0.43	0.27	0.37	0.43
Control Delay	26.1	16.1	2.7	20.4	18.1	1.5	24.0	17.8	20.4	17.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.1	16.1	2.7	20.4	18.1	1.5	24.0	17.8	20.4	17.3
Queue Length 50th (ft)	26	30	0	6	86	0	41	23	40	41
Queue Length 95th (ft)	70	90	33	19	149	15	85	52	77	96
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	295	1478	952	657	1384	1010	636	1233	760	649
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.22	0.23	0.07	0.43	0.33	0.42	0.15	0.36	0.30

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative4
 PM Peak

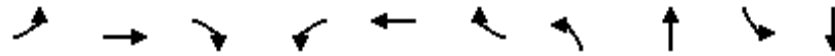


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	193	713	472	459	366	164
v/c Ratio	0.33	0.36	0.38	0.36	0.28	0.26
Control Delay	30.2	7.4	11.1	1.4	17.7	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	7.4	11.1	1.4	17.7	4.1
Queue Length 50th (ft)	53	82	94	8	63	0
Queue Length 95th (ft)	78	113	74	20	96	40
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	593	1978	1251	1258	1293	643
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.36	0.38	0.36	0.28	0.26

Intersection Summary

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2016 Alternative4
 PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	126	545	355	138	654	309	185	231	344	238
v/c Ratio	0.51	0.33	0.33	0.41	0.44	0.28	0.44	0.45	0.54	0.63
Control Delay	40.1	11.6	0.9	40.1	20.3	1.2	37.8	23.4	33.8	34.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.1	11.6	0.9	40.1	20.3	1.2	37.8	23.4	33.8	34.0
Queue Length 50th (ft)	54	57	0	36	133	0	47	37	85	100
Queue Length 95th (ft)	87	98	0	64	200	13	79	68	124	165
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	274	1631	1085	334	1473	1096	445	755	665	467
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.33	0.33	0.41	0.44	0.28	0.42	0.31	0.52	0.51

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 Ramps

2016 Alternative5
 AM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	119	275	78	594	263	454	78	387	122	123	197
v/c Ratio	0.35	0.28	0.16	0.59	0.15	0.46	0.40	0.29	0.39	0.38	0.42
Control Delay	38.3	29.8	10.3	19.5	6.7	1.6	45.7	1.4	37.8	37.2	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	29.8	10.3	19.5	6.7	1.6	45.7	1.4	37.8	37.2	8.0
Queue Length 50th (ft)	31	71	5	164	13	0	44	0	68	69	0
Queue Length 95th (ft)	60	104	37	167	32	0	89	13	126	127	57
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	355	991	498	1033	1729	995	211	1361	310	327	465
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.28	0.16	0.58	0.15	0.46	0.37	0.28	0.39	0.38	0.42

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 Ramps

2016 Alternative5
 PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	167	545	193	459	381	411	91	493	157	157	216
v/c Ratio	0.34	0.41	0.27	0.76	0.24	0.44	0.34	0.49	0.58	0.55	0.48
Control Delay	22.9	7.4	1.3	22.9	5.0	2.1	25.9	6.4	32.4	30.3	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.9	7.4	1.3	22.9	5.0	2.1	25.9	6.4	32.4	30.3	7.9
Queue Length 50th (ft)	19	27	1	82	32	0	29	22	53	53	0
Queue Length 95th (ft)	38	50	0	#130	28	12	65	42	#120	#108	48
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	495	1329	714	605	1580	931	269	1005	269	284	447
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.41	0.27	0.76	0.24	0.44	0.34	0.49	0.58	0.55	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Queues
4: Barton Rd & I-215 SB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	78	391	340	594	21	245	206
v/c Ratio	0.47	0.16	0.16	0.51	0.03	0.34	0.40
Control Delay	46.1	3.8	7.7	2.5	0.1	29.1	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	3.8	7.7	2.5	0.1	29.1	6.9
Queue Length 50th (ft)	40	27	40	0	0	57	0
Queue Length 95th (ft)	85	41	59	40	0	90	53
Internal Link Dist (ft)		270	1430				
Turn Bay Length (ft)	250			185			630
Base Capacity (vph)	167	2419	2087	1160	766	721	509
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.16	0.16	0.51	0.03	0.34	0.40

Intersection Summary

Queues
5: I-215 NB Ramps & Vivienda Av



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	359	106	143	481	731
v/c Ratio	0.35	0.19	0.45	0.24	0.53
Control Delay	15.3	4.5	24.5	5.5	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	15.3	4.5	24.5	5.5	6.9
Queue Length 50th (ft)	44	0	42	32	35
Queue Length 95th (ft)	74	26	87	51	72
Internal Link Dist (ft)	423			334	2145
Turn Bay Length (ft)		240	410		
Base Capacity (vph)	1015	565	320	2024	1392
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.19	0.45	0.24	0.53

Intersection Summary

Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative6 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	192	664	472	459	53	314	220
v/c Ratio	0.62	0.28	0.28	0.46	0.17	0.52	0.47
Control Delay	42.8	4.1	18.4	3.6	1.2	42.3	8.6
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Total Delay	42.8	4.5	18.4	3.6	1.2	42.3	8.6
Queue Length 50th (ft)	108	57	101	0	0	100	0
Queue Length 95th (ft)	183	78	154	61	0	144	63
Internal Link Dist (ft)		270	1430				
Turn Bay Length (ft)	250			185			630
Base Capacity (vph)	319	2395	1681	989	425	602	472
Starvation Cap Reductn	0	1123	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.52	0.28	0.46	0.12	0.52	0.47

Intersection Summary

Queues
5: I-215 NB Ramps & Vivienda Av



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	451	133	94	454	938
v/c Ratio	0.43	0.22	0.35	0.22	0.60
Control Delay	16.1	4.3	24.6	5.4	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	16.1	4.3	24.6	5.4	7.7
Queue Length 50th (ft)	58	0	28	30	52
Queue Length 95th (ft)	92	29	64	48	98
Internal Link Dist (ft)	423			334	2145
Turn Bay Length (ft)		240	410		
Base Capacity (vph)	1044	598	269	2083	1572
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.22	0.35	0.22	0.60

Intersection Summary

Queues
4: Barton Rd & I-215 SB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	78	372	353	594	29	241	202
v/c Ratio	0.39	0.15	0.18	0.45	0.06	0.43	0.30
Control Delay	36.1	2.8	2.2	1.9	0.2	32.6	4.0
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	36.1	2.8	2.2	2.0	0.2	32.6	4.0
Queue Length 50th (ft)	42	11	2	8	0	59	7
Queue Length 95th (ft)	78	33	16	40	0	87	38
Internal Link Dist (ft)		435	455				
Turn Bay Length (ft)	250						500
Base Capacity (vph)	198	2425	1955	1311	618	985	678
Starvation Cap Reductn	0	0	0	99	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.15	0.18	0.49	0.05	0.24	0.30

Intersection Summary

Queues
5: Barton Rd & I-215 NB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	119	516	857	454	78	194	193
v/c Ratio	0.33	0.19	0.45	0.43	0.35	0.34	0.35
Control Delay	32.0	1.1	4.0	1.7	37.0	1.7	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.0	1.1	4.0	1.7	37.0	1.7	1.7
Queue Length 50th (ft)	59	7	15	0	38	0	0
Queue Length 95th (ft)	114	25	44	0	77	0	0
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	357	2749	1916	1053	395	674	656
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.19	0.45	0.43	0.20	0.29	0.29

Intersection Summary

Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative7 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	193	650	482	459	64	312	219
v/c Ratio	0.57	0.29	0.32	0.40	0.19	0.50	0.26
Control Delay	30.4	5.5	10.2	2.2	1.3	32.6	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	5.5	10.2	2.2	1.3	32.6	5.2
Queue Length 50th (ft)	76	51	33	1	0	77	32
Queue Length 95th (ft)	129	107	68	24	0	107	44
Internal Link Dist (ft)		435	455				
Turn Bay Length (ft)	250						500
Base Capacity (vph)	389	2266	1502	1189	484	733	893
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.29	0.32	0.39	0.13	0.43	0.25

Intersection Summary

Queues
5: Barton Rd & I-215 NB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	167	856	839	411	91	247	246
v/c Ratio	0.43	0.31	0.45	0.40	0.37	0.60	0.62
Control Delay	37.6	4.5	6.9	1.6	35.3	13.1	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.6	4.5	6.9	1.6	35.3	13.1	13.7
Queue Length 50th (ft)	79	36	53	0	45	14	13
Queue Length 95th (ft)	141	197	108	21	81	77	78
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	387	2781	1883	1030	426	543	523
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.31	0.45	0.40	0.21	0.45	0.47

Intersection Summary

2040 Queuing Analysis

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Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative1
 AM PEAK



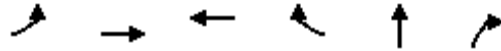
Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	2	919	955	634	402
v/c Ratio	0.02	1.36	1.79	0.49	1.03
Control Delay	45.0	186.3	375.4	0.9	86.4
Queue Delay	0.0	0.0	0.0	1.2	0.0
Total Delay	45.0	186.3	375.4	2.1	86.4
Queue Length 50th (ft)	1	~595	~740	3	~218
Queue Length 95th (ft)	m3	m#697	m#491	m9	#386
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	123	678	534	1285	391
Starvation Cap Reductn	0	0	0	412	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	1.36	1.79	0.73	1.03

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative1
 AM PEAK



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	239	957	1449	914	139	604
v/c Ratio	1.16	0.74	1.41	0.77	0.34	1.18
Control Delay	120.4	1.6	205.3	2.3	28.1	122.0
Queue Delay	0.0	2.3	0.0	0.5	0.0	0.0
Total Delay	120.4	3.9	205.3	2.8	28.1	122.0
Queue Length 50th (ft)	~145	4	~1016	15	58	~290
Queue Length 95th (ft)	m102	m3	m#1020	m21	108	#490
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	206	1302	1028	1186	412	512
Starvation Cap Reductn	0	216	0	56	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.16	0.88	1.41	0.81	0.34	1.18

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative1
 PM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	5	1593	647	828	551
v/c Ratio	0.03	1.82	2.10	0.67	1.27
Control Delay	31.4	389.2	514.9	4.6	167.6
Queue Delay	0.0	15.2	0.0	2.8	174.0
Total Delay	31.4	404.4	514.9	7.4	341.6
Queue Length 50th (ft)	3	~1254	~548	8	~353
Queue Length 95th (ft)	m6	m#1062	m#252	m28	#541
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	151	876	308	1241	434
Starvation Cap Reductn	0	0	0	293	0
Spillback Cap Reductn	0	16	0	0	102
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.03	1.85	2.10	0.87	1.66

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

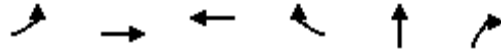
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative1
 PM PEAK



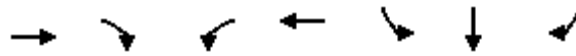
Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	281	1592	1439	689	36	948
v/c Ratio	1.36	1.45	1.75	0.74	0.06	1.68
Control Delay	194.5	221.2	361.4	6.2	17.7	338.5
Queue Delay	0.0	150.2	0.0	0.2	0.0	0.0
Total Delay	194.5	371.4	361.4	6.4	17.7	338.5
Queue Length 50th (ft)	~197	~1157	~1112	31	12	~704
Queue Length 95th (ft)	m89	m246	m#1235	m62	31	#932
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	206	1096	822	936	608	563
Starvation Cap Reductn	0	205	0	21	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.36	1.79	1.75	0.75	0.06	1.68

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative2
 AM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	794	125	955	622	213	212	322
v/c Ratio	0.71	0.21	0.79	0.25	0.67	0.62	0.56
Control Delay	21.4	2.4	18.3	0.7	44.1	41.3	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.4	2.4	18.3	0.7	44.1	41.3	7.9
Queue Length 50th (ft)	163	2	211	8	117	115	0
Queue Length 95th (ft)	236	m11	298	6	#212	194	69
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1125	586	1206	2512	320	341	573
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.21	0.79	0.25	0.67	0.62	0.56

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative2
 AM Peak



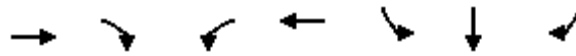
Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	239	957	1438	914	139	302	302
v/c Ratio	0.69	0.36	0.66	0.73	0.49	0.73	0.76
Control Delay	38.0	0.3	6.9	2.0	38.0	23.4	25.2
Queue Delay	0.0	0.0	0.2	1.1	0.0	0.0	0.0
Total Delay	38.0	0.3	7.1	3.2	38.0	23.4	25.2
Queue Length 50th (ft)	76	0	88	22	72	60	60
Queue Length 95th (ft)	m#111	0	m165	m29	121	148	152
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	344	2622	2172	1252	373	482	464
Starvation Cap Reductn	0	0	176	148	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.36	0.72	0.83	0.37	0.63	0.65

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative2
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1321	272	647	817	281	276	379
v/c Ratio	0.86	0.32	0.79	0.33	0.77	0.72	0.68
Control Delay	23.4	2.1	17.9	2.4	48.3	43.6	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	2.1	17.9	2.4	48.3	43.6	18.0
Queue Length 50th (ft)	382	5	106	20	157	152	62
Queue Length 95th (ft)	474	14	m156	m50	#286	#265	165
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1543	841	815	2507	364	386	554
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.32	0.79	0.33	0.77	0.72	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative2
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	281	1592	1428	689	36	474	474
v/c Ratio	0.88	0.76	0.86	0.63	0.06	0.87	0.92
Control Delay	48.1	4.4	16.7	2.8	18.9	44.1	51.8
Queue Delay	0.0	0.9	0.0	0.8	0.0	0.1	0.2
Total Delay	48.1	5.3	16.7	3.6	18.9	44.2	52.0
Queue Length 50th (ft)	85	148	261	30	13	243	250
Queue Length 95th (ft)	m#114	143	m385	m53	33	#432	#451
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	319	2083	1659	1102	603	559	530
Starvation Cap Reductn	0	0	0	170	0	0	0
Spillback Cap Reductn	0	234	0	0	0	2	2
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.88	0.86	0.86	0.74	0.06	0.85	0.90

Intersection Summary

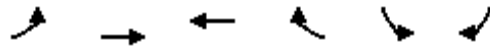
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 AM Peak



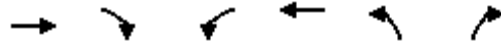
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.36	0.57	0.61	0.71	0.30	0.27
Control Delay	30.9	19.8	20.6	6.4	9.5	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.9	19.8	20.6	6.4	9.5	2.3
Queue Length 50th (ft)	29	161	129	132	57	0
Queue Length 95th (ft)	m53	246	186	2	85	32
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	349	1392	1021	1347	1664	843
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.57	0.61	0.71	0.30	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative3
 AM Peak



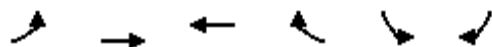
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	957	239	914	1438	139	604
v/c Ratio	0.73	0.27	0.79	0.54	0.53	0.40
Control Delay	17.6	3.0	12.7	0.2	39.2	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.6	3.0	12.7	0.2	39.2	9.5
Queue Length 50th (ft)	217	9	159	4	64	77
Queue Length 95th (ft)	300	30	m156	m2	121	114
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1307	885	1163	2657	260	1524
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.27	0.79	0.54	0.53	0.40

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.43	0.66	0.67	0.53	0.54	0.41
Control Delay	22.5	7.3	20.2	1.8	20.7	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.5	7.3	20.2	1.8	20.7	4.2
Queue Length 50th (ft)	59	136	187	1	121	0
Queue Length 95th (ft)	85	106	240	0	171	52
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	638	1996	1215	1211	1199	710
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.66	0.67	0.53	0.54	0.41

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative3
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1592	281	689	1428	36	948
v/c Ratio	0.85	0.27	0.79	0.49	0.19	0.83
Control Delay	16.2	4.0	22.5	0.6	35.1	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.2	4.0	22.5	0.6	35.1	27.9
Queue Length 50th (ft)	252	34	160	1	17	225
Queue Length 95th (ft)	427	70	m181	m1	44	#321
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1866	1060	877	2907	185	1147
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.27	0.79	0.49	0.19	0.83

Intersection Summary

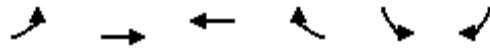
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 AM Peak



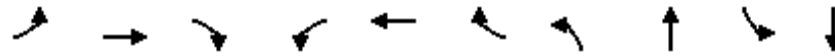
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.36	0.57	0.61	0.71	0.28	0.27
Control Delay	39.6	23.9	14.0	6.7	9.3	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.6	23.9	14.0	6.7	9.3	2.3
Queue Length 50th (ft)	34	198	100	79	56	0
Queue Length 95th (ft)	m51	231	m148	m412	84	32
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	349	1392	1021	1347	1755	843
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.57	0.61	0.71	0.28	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2040 Alternative4
 AM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	154	957	505	182	881	591	557	504	423	320
v/c Ratio	0.70	0.79	0.50	0.52	0.78	0.69	0.84	0.59	0.78	0.82
Control Delay	49.6	23.5	2.2	39.4	30.5	10.4	43.3	27.2	43.1	43.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.6	23.5	2.2	39.4	30.5	10.4	43.3	27.2	43.1	43.6
Queue Length 50th (ft)	80	227	0	44	208	78	138	106	105	130
Queue Length 95th (ft)	#165	294	23	76	282	147	#220	155	#170	#258
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	220	1207	1019	349	1123	853	665	886	543	408
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.79	0.50	0.52	0.78	0.69	0.84	0.57	0.78	0.78

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 PM Peak



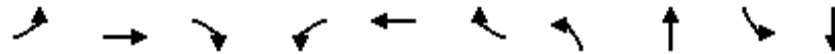
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.43	0.66	0.66	0.53	0.50	0.40
Control Delay	29.1	9.4	10.1	1.3	22.3	4.3
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	29.1	9.6	10.1	1.3	22.3	4.3
Queue Length 50th (ft)	77	158	152	0	136	0
Queue Length 95th (ft)	110	196	m177	m0	187	54
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	638	2005	1234	1218	1272	713
Starvation Cap Reductn	0	125	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.70	0.66	0.53	0.50	0.40

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2040 Alternative4
 PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	201	1592	648	273	1049	494	379	482	664	320
v/c Ratio	0.80	1.09	0.68	0.86	0.82	0.50	0.82	0.69	0.98	0.72
Control Delay	63.1	70.6	7.3	65.6	32.3	5.4	53.6	29.2	68.2	41.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.1	70.6	7.3	65.6	32.3	5.4	53.6	29.2	68.2	41.1
Queue Length 50th (ft)	106	~540	58	80	280	39	109	92	~211	164
Queue Length 95th (ft)	m#215	#671	99	#148	363	75	#180	143	#331	#275
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	256	1466	956	319	1281	982	461	767	677	444
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	1.09	0.68	0.86	0.82	0.50	0.82	0.63	0.98	0.72

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 Ramps

2040 Alternative5
 AM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	239	555	125	955	483	914	139	604	213	212	322
v/c Ratio	0.68	0.66	0.27	0.88	0.29	0.79	0.73	0.47	0.75	0.70	0.59
Control Delay	39.8	25.8	4.2	16.7	4.8	5.3	58.4	7.4	48.9	44.5	8.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.8	25.8	4.2	16.7	4.8	5.3	58.4	7.4	48.9	44.5	8.6
Queue Length 50th (ft)	55	119	5	188	38	50	68	43	107	105	0
Queue Length 95th (ft)	#104	178	m23	m183	m40	m43	#155	65	#216	#205	67
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	349	844	471	1085	1645	1158	190	1284	285	303	545
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.66	0.27	0.88	0.29	0.79	0.73	0.47	0.75	0.70	0.59

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 Ramps

2040 Alternative5
 PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	281	1040	272	647	781	689	36	948	281	276	379
v/c Ratio	0.61	0.76	0.35	0.76	0.44	0.61	0.21	1.03	0.90	0.83	0.62
Control Delay	39.3	20.1	2.3	26.5	13.2	3.1	40.5	62.3	68.1	57.5	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.3	20.1	2.3	26.5	13.2	3.1	40.5	62.3	68.1	57.5	8.4
Queue Length 50th (ft)	81	196	0	154	121	28	19	182	165	160	0
Queue Length 95th (ft)	120	#394	13	m202	m142	m50	48	#323	#318	#300	77
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	461	1366	776	851	1790	1134	174	917	312	331	614
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.76	0.35	0.76	0.44	0.61	0.21	1.03	0.90	0.83	0.62

Intersection Summary

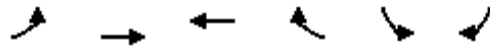
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 AM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.56	0.55	0.68	0.74	0.31	0.27
Control Delay	47.4	22.3	31.9	8.7	12.4	2.5
Queue Delay	0.0	1.3	0.0	0.0	0.0	0.0
Total Delay	47.4	23.6	31.9	8.7	12.4	2.5
Queue Length 50th (ft)	68	179	207	142	78	0
Queue Length 95th (ft)	130	215	m222	m136	110	37
Internal Link Dist (ft)		270	1430		1233	
Turn Bay Length (ft)	225			185		630
Base Capacity (vph)	224	1451	911	1299	1635	834
Starvation Cap Reductn	0	425	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.77	0.68	0.74	0.31	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
 AM Peak



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	525	218	366	1140	1622
v/c Ratio	0.94	0.55	0.88	0.43	0.94
Control Delay	67.5	19.1	59.6	4.2	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	67.5	19.1	59.6	4.2	12.4
Queue Length 50th (ft)	172	39	224	101	86
Queue Length 95th (ft)	#273	114	#390	128	m101
Internal Link Dist (ft)	423			439	2145
Turn Bay Length (ft)		80	410		
Base Capacity (vph)	558	393	415	2632	1734
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.94	0.55	0.88	0.43	0.94

Intersection Summary

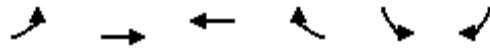
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.70	0.57	0.57	0.54	0.69	0.47
Control Delay	41.8	4.9	16.0	6.7	32.1	6.0
Queue Delay	0.2	0.4	0.0	0.0	0.0	0.0
Total Delay	42.0	5.3	16.0	6.7	32.1	6.0
Queue Length 50th (ft)	127	81	152	130	161	0
Queue Length 95th (ft)	191	102	m184	m161	221	63
Internal Link Dist (ft)		270	1430		1233	
Turn Bay Length (ft)	225			185		630
Base Capacity (vph)	457	2314	1421	1205	926	613
Starvation Cap Reductn	12	463	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.71	0.57	0.54	0.69	0.47

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
 PM Peak



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	737	247	177	953	1646
v/c Ratio	0.87	0.47	0.76	0.40	0.87
Control Delay	44.4	14.6	59.2	6.5	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	44.4	14.6	59.2	6.5	10.5
Queue Length 50th (ft)	205	44	98	105	107
Queue Length 95th (ft)	#303	113	#198	137	m130
Internal Link Dist (ft)	423			439	2145
Turn Bay Length (ft)		80	410		
Base Capacity (vph)	851	523	237	2397	1882
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.87	0.47	0.75	0.40	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative7
 AM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.54	0.39	0.41	0.74	0.45	0.31
Control Delay	47.7	12.0	7.6	8.6	21.0	9.5
Queue Delay	0.0	0.0	0.0	0.3	0.0	0.0
Total Delay	47.7	12.0	7.6	8.9	21.0	9.5
Queue Length 50th (ft)	80	145	62	135	106	61
Queue Length 95th (ft)	124	242	197	211	106	67
Internal Link Dist (ft)		435	455		1273	
Turn Bay Length (ft)	300					500
Base Capacity (vph)	230	2036	1503	1299	1625	730
Starvation Cap Reductn	0	0	0	59	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.39	0.41	0.77	0.31	0.31

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative7
 AM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	239	957	1438	914	139	302	302
v/c Ratio	0.68	0.35	0.76	0.83	0.55	0.74	0.76
Control Delay	40.9	2.4	5.4	5.9	44.8	23.6	25.3
Queue Delay	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Total Delay	40.9	2.4	5.4	6.6	44.8	23.6	25.3
Queue Length 50th (ft)	140	19	159	52	78	50	50
Queue Length 95th (ft)	#211	106	m192	m62	134	147	150
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	353	2700	1883	1107	303	445	431
Starvation Cap Reductn	0	0	0	42	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.35	0.76	0.86	0.46	0.68	0.70

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative7
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.59	0.58	0.63	0.56	0.68	0.47
Control Delay	24.9	5.0	3.2	3.7	31.0	5.7
Queue Delay	0.0	0.2	0.0	0.1	0.1	0.0
Total Delay	24.9	5.2	3.2	3.8	31.1	5.7
Queue Length 50th (ft)	119	104	13	0	155	0
Queue Length 95th (ft)	195	100	m15	m1	213	61
Internal Link Dist (ft)		435	455		1273	
Turn Bay Length (ft)	300					500
Base Capacity (vph)	462	2296	1293	1158	996	638
Starvation Cap Reductn	0	267	0	68	0	0
Spillback Cap Reductn	0	0	0	0	34	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.65	0.63	0.59	0.67	0.45

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative7
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	281	1592	1428	689	36	474	474
v/c Ratio	0.85	0.71	0.97	0.78	0.07	0.98	1.03
Control Delay	56.3	12.1	27.9	8.7	22.4	65.4	79.0
Queue Delay	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Total Delay	56.3	12.7	27.9	8.7	22.4	65.4	79.0
Queue Length 50th (ft)	164	285	295	73	14	260	~288
Queue Length 95th (ft)	#296	359	m#506	m102	36	#474	#490
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	329	2237	1466	883	511	486	462
Starvation Cap Reductn	0	271	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.81	0.97	0.78	0.07	0.98	1.03

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

APPENDIX E
Freeway Ramp & Mainline
LOS Calculation Worksheets

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**Existing Barton Road Interchange
Ramp LOS**

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Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5736	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	462	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	289	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5736	462	289	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1509	122	76	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6249	503	315	pcph

----- Estimation of V12 Merge Areas -----

L = 1139.53 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3714 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6752	7050	No
FO			
v	4217	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.4$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.544
S
Space mean speed in ramp influence area, S = 52.5 mph
R
Space mean speed in outer lanes, S = 57.1 mph
0
Space mean speed for all vehicles, S = 54.1 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6069	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	333	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	492	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6069	333	492	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1597	88	129	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6612	363	536	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.578 Using Equation 5
FD
v = v + (v - v) P = 3975 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	6612	7050	No
Fi F			
v	3975	4400	No
12			
v = v - v	6249	7050	No
FO F R			
v	363	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 36.0 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence E

----- Speed Estimation -----

Intermediate speed variable, D = 0.461
S
Space mean speed in ramp influence area, S = 54.4 mph
R
Space mean speed in outer lanes, S = 64.9 mph
0
Space mean speed for all vehicles, S = 58.2 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4511	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	370	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	342	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4511	370	342	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1187	97	90	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4915	403	373	pcph

----- Estimation of V12 Merge Areas -----

L = 832.65 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2921 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5318	7050	No
FO			
v	3324	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.5$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable, M = 0.387
S
Space mean speed in ramp influence area, S = 56.1 mph
R
Space mean speed in outer lanes, S = 59.6 mph
0
Space mean speed for all vehicles, S = 57.4 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4876	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	365	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	450	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4876	365	450	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1283	96	118	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5312	398	490	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.609 Using Equation 5
FD
v = v + (v - v) P = 3390 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5312	7050	No
Fi F			
v	3390	4400	No
12			
v = v - v	4914	7050	No
FO F R			
v	398	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 31.0 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.464
S
Space mean speed in ramp influence area, S = 54.3 mph
R
Space mean speed in outer lanes, S = 67.7 mph
0
Space mean speed for all vehicles, S = 58.5 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4915	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	431	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	366	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4915	431	366	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1293	113	96	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5277	463	393	pcph

----- Estimation of V12 Merge Areas -----

L = 922.96 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3136 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5740	7050	No
FO			
v	3599	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.422
S
Space mean speed in ramp influence area, S = 55.3 mph
R
Space mean speed in outer lanes, S = 59.1 mph
0
Space mean speed for all vehicles, S = 56.7 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5276	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	361	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	363	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5276	361	363	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1388	95	96	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5665	388	390	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.601 Using Equation 5
FD
v = v + (v - v) P = 3557 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5665	7050	No
Fi F			
v	3557	4400	No
12			
v = v - v	5277	7050	No
FO F R			
v	388	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 32.4 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.463
S
Space mean speed in ramp influence area, S = 54.4 mph
R
Space mean speed in outer lanes, S = 67.0 mph
0
Space mean speed for all vehicles, S = 58.5 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5271	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	406	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	441	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5271	406	441	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1387	107	116	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5659	436	473	pcph

----- Estimation of V12 Merge Areas -----

L = 998.93 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3363 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6095	7050	No
FO			
v	3799	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 31.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.453
S
Space mean speed in ramp influence area, S = 54.6 mph
R
Space mean speed in outer lanes, S = 58.5 mph
0
Space mean speed for all vehicles, S = 56.0 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5685	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	414	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	379	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5685	414	379	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1496	109	100	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6104	445	407	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.587 Using Equation 5
FD
v = v + (v - v) P = 3766 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	6104	7050	No
Fi F			
v	3766	4400	No
12			
v = v - v	5659	7050	No
FO F R			
v	445	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 34.2 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.468
S
Space mean speed in ramp influence area, S = 54.2 mph
R
Space mean speed in outer lanes, S = 66.1 mph
0
Space mean speed for all vehicles, S = 58.2 mph

**Existing Adjacent Interchange
Ramp LOS**

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Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5456	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	613	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1013	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5456	613	1013	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1436	161	267	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5944	668	1104	pcph

----- Estimation of V12 Merge Areas -----

L = 1109.57 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3533 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6612	7050	No
FO			
v	4201	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.2$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.539
S
Space mean speed in ramp influence area, S = 52.6 mph
R
Space mean speed in outer lanes, S = 57.8 mph
0
Space mean speed for all vehicles, S = 54.4 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6474	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1018	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	600	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6474	1018	600	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1704	268	158	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7053	1109	654	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.533 Using Equation 5
FD
v = v + (v - v) P = 4275 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	7053	7050	Yes
Fi F			
v	4275	4400	No
12			
v = v - v	5944	7050	No
FO F R			
v	1109	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 38.6 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable, D = 0.528
S
Space mean speed in ramp influence area, S = 52.9 mph
R
Space mean speed in outer lanes, S = 64.4 mph
0
Space mean speed for all vehicles, S = 56.9 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 6010 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 354 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 652 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6010	354	652	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1582	93	172	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6548	386	710	pcph

Estimation of V12 Merge Areas

L = 1178.48 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3891 pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	6934	7050	No
FO			
v	4277	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.9$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.560
S
Space mean speed in ramp influence area, S = 52.1 mph
R
Space mean speed in outer lanes, S = 56.3 mph
0
Space mean speed for all vehicles, S = 53.7 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6198	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	188	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	332	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6198	188	332	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1631	49	87	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6753	205	362	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.582 Using Equation 5
FD
v = v + (v - v) P = 4014 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	6753	7050	No
Fi F			
v	4014	4400	No
12			
v = v - v	6548	7050	No
FO F R			
v	205	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 36.3 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence E

----- Speed Estimation -----

Intermediate speed variable, D = 0.446
S
Space mean speed in ramp influence area, S = 54.7 mph
R
Space mean speed in outer lanes, S = 64.5 mph
0
Space mean speed for all vehicles, S = 58.3 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4511	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	663	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	739	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4511	663	739	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1187	174	194	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4915	722	805	pcph

----- Estimation of V12 Merge Areas -----

L = 900.92 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2921 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5637	7050	No
FO			
v	3643	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.8$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.428
S
Space mean speed in ramp influence area, S = 55.2 mph
R
Space mean speed in outer lanes, S = 59.6 mph
0
Space mean speed for all vehicles, S = 56.7 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4881	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	847	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	532	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4881	847	532	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1284	223	140	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	%	0.00	%
Length	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5318	923	580	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.585 Using Equation 5
FD
v = v + (v - v) P = 3492 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5318	7050	No
Fi F			
v	3492	4400	No
12			
v = v - v	4395	7050	No
FO F R			
v	923	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 31.9 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.511
S
Space mean speed in ramp influence area, S = 53.2 mph
R
Space mean speed in outer lanes, S = 68.1 mph
0
Space mean speed for all vehicles, S = 57.6 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3872	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1004	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	217	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3872	1004	217	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1019	264	57	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4218	1094	236	pcph

----- Estimation of V12 Merge Areas -----

L = 831.37 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2507 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5312	7050	No
FO			
v	3601	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.3$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.422
S
Space mean speed in ramp influence area, S = 55.3 mph
R
Space mean speed in outer lanes, S = 60.6 mph
0
Space mean speed for all vehicles, S = 56.9 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4113	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	241	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	782	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4113	241	782	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1082	63	206	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4481	263	852	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.636 Using Equation 5
FD
v = v + (v - v) P = 2945 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	4481	7050	No
Fi F			
v	2945	4400	No
12			
v = v - v	4218	7050	No
FO F R			
v	263	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 27.1 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable, D = 0.452
S
Space mean speed in ramp influence area, S = 54.6 mph
R
Space mean speed in outer lanes, S = 69.2 mph
0
Space mean speed for all vehicles, S = 58.9 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4303	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	973	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1188	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4303	973	1188	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1132	256	313	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4620	1045	1276	pcph

----- Estimation of V12 Merge Areas -----

L = 906.91 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2746 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5665	7050	No
FO			
v	3791	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 30.8$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.452
S
Space mean speed in ramp influence area, S = 54.6 mph
R
Space mean speed in outer lanes, S = 60.1 mph
0
Space mean speed for all vehicles, S = 56.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5619	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1316	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	786	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5619	1316	786	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1479	346	207	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6033	1413	844	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.544 Using Equation 5
FD
v = v + (v - v) P = 3927 pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	6033	7050	No
Fi F			
v	3927	4400	No
12			
v = v - v	4620	7050	No
FO F R			
v	1413	2000	No
R			

Level of Service Determination (if not F)

Density, D = 4.252 + 0.0086 v - 0.009 L = 35.6 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, D = 0.555
S
Space mean speed in ramp influence area, S = 52.2 mph
R
Space mean speed in outer lanes, S = 67.0 mph
0
Space mean speed for all vehicles, S = 56.6 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5055 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 285 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 863 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5055	285	863	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1330	75	227	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	5427	306	927
			pcph

Estimation of V12 Merge Areas

L = 921.46 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3225 pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5733	7050	No
FO			
v	3531	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.412
S
Space mean speed in ramp influence area, S = 55.5 mph
R
Space mean speed in outer lanes, S = 58.9 mph
0
Space mean speed for all vehicles, S = 56.8 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5346	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	291	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	353	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5346	291	353	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1407	77	93	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5740	312	379	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.602 Using Equation 5
FD
v = v + (v - v) P = 3580 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5740	7050	No
Fi F			
v	3580	4400	No
12			
v = v - v	5428	7050	No
FO F R			
v	312	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 32.6 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.456
S
Space mean speed in ramp influence area, S = 54.5 mph
R
Space mean speed in outer lanes, S = 66.8 mph
0
Space mean speed for all vehicles, S = 58.6 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5271	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	653	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	572	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5271	653	572	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1387	172	151	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5659	701	614	pcph

----- Estimation of V12 Merge Areas -----

L = 1055.64 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3363 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6360	7050	No
FO			
v	4064	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 33.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.506
S
Space mean speed in ramp influence area, S = 53.4 mph
R
Space mean speed in outer lanes, S = 58.5 mph
0
Space mean speed for all vehicles, S = 55.1 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5677	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	826	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	475	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5677	826	475	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1494	217	125	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6095	887	510	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.567 Using Equation 5
FD
v = v + (v - v) P = 3839 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	6095	7050	No
Fi F			
v	3839	4400	No
12			
v = v - v	5208	7050	No
FO F R			
v	887	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 34.8 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable,	D = 0.508	
	S	
Space mean speed in ramp influence area,	S = 53.3	mph
	R	
Space mean speed in outer lanes,	S = 66.4	mph
	0	
Space mean speed for all vehicles,	S = 57.5	mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4701	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	285	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	249	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4701	285	249	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1237	75	66	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5047	306	267	pcph

----- Estimation of V12 Merge Areas -----

L = 840.14 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2999 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5353	7050	No
FO			
v	3305	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, D = 5.475 + 0.00734 v_R + 0.0078 v₁₂ - 0.00627 L_A = 27.4 pc/mi/ln
Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable, M = 0.385
S
Space mean speed in ramp influence area, S = 56.1 mph
R
Space mean speed in outer lanes, S = 59.4 mph
0
Space mean speed for all vehicles, S = 57.4 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4992	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	291	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	969	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4992	291	969	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1314	77	255	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5360	312	1040	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.612 Using Equation 5
FD
v = v + (v - v) P = 3400 pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	5360	7050	No
Fi F			
v	3400	4400	No
12			
v = v - v	5048	7050	No
FO F R			
v	312	2000	No
R			

Level of Service Determination (if not F)

Density, D = 4.252 + 0.0086 v - 0.009 L = 31.1 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D = 0.456	
	S	
Space mean speed in ramp influence area,	S = 54.5	mph
	R	
Space mean speed in outer lanes,	S = 67.6	mph
	0	
Space mean speed for all vehicles,	S = 58.7	mph

Existing Freeway Mainline LOS

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Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4881	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1284	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1773	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1773	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.7	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company:
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4511	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1187	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1638	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1638	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	27.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	4876	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1283	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1771	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	1771	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington Ave to Barton
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6069	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1597	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2204	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2204	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	53.9	mi/h
Number of lanes, N	3	
Density, D	40.9	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5736	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1509	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2083	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2083	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	3	
Density, D	36.8	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	6198	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1631	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2251	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	2251	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	52.6	mi/h
Number of lanes, N	3	
Density, D	42.8	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington to Barton Rd
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5276	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1388	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1888	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1888	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	3	
Density, D	31.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5346	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1407	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1913	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1913	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.9	mi/h
Number of lanes, N	3	
Density, D	32.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4915	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1293	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1759	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1759	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5685	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1496	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2035	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2035	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	57.4	mi/h
Number of lanes, N	3	
Density, D	35.4	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

2009 NB Barton to Washington PM.txt

HCS+: Basic Freeway Segments Release 5.3

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5677	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1494	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2032	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2032	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	57.5	mi/h
Number of lanes, N	3	
Density, D	35.4	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5271	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1387	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1886	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1886	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	3	
Density, D	31.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

**2016 Barton Road Interchange
Ramp LOS**

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2016 AM NB Barton Off_Alt1.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: **2016 No Project**
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5250	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	442	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	544	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5250	442	544	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1382	116	143	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM NB Barton Off_Alt1.txt
Flow rate, vp 5720 482 593 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P = 0.595$ Using Equation 5
 $FD =$
 $v_{12} = v_R + (v_F - v_R) P = 3598$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{F0}$	5720	7050	No
$v = v_F - v_{R0}$	5238	7050	No
v_R	482	2000	No
$v_{3 or av34}$	2122 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 or av34} > 2700$ pc/h?		No	
Is $v_{3 or av34} > 1.5 v_{12}$		No	
If yes, $v_{12A} = 3598$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3598	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 32.8$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D_S = 0.471$
Space mean speed in ramp influence area,	$S_R = 54.2$ mph
Space mean speed in outer lanes,	$S_O = 66.9$ mph
Space mean speed for all vehicles,	$S = 58.3$ mph

2016 PM NB Barton Off_Alt1.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: **2016 No Project**
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6098	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	553	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	549	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6098	553	549	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1605	146	144	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Barton Off_Alt1.txt
Flow rate, vp 6547 594 589 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P = 0.569$ Using Equation 5
 $FD =$
 $v_{12} = v_R + (v_F - v_R) P = 3981$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{EO}$	6547	7050	No
$v = v_{FO}$	5953	7050	No
$v = v_R$	594	2000	No
$v = v_{3 or av34}$	2566 pc/h	(Equation 25-15 or 25-16)	
Is $v > 2700$ pc/h?		No	
Is $v > 1.5 v_{12}$?		No	
If yes, $v_{12A} = 3981$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3981	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 36.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$D_S = 0.481$
Space mean speed in ramp influence area,	$S_R = 53.9$ mph
Space mean speed in outer lanes,	$S_O = 65.2$ mph
Space mean speed for all vehicles,	$S = 57.8$ mph

2016 AM NB Barton Off.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5250	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	442	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	544	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5250	442	544	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1382	116	143	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM NB Barton Off.txt
Flow rate, vp 5720 482 593 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.260 \text{ Using Equation 0}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 1844 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	5720	9400	No
$v_{Fi} = v_{F - v_{R}}$	5238	9400	No
$v_{FO} = v_{F - v_{R}}$	482	3800	No
v_R	1938 pc/h	(Equation 25-15 or 25-16)	
$v_{3 \text{ or } av34}$	> 2700 pc/h?	No	
$v_{3 \text{ or } av34}$	> 1.5 v / 2	Yes	
If yes, $v_{12A} = 2288$	12	(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12A}	Actual 2288	Max Desirable 4400	Violation? No
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Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{D12} = 14.6 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.471$
Space mean speed in ramp influence area, $S = 54.2 \text{ mph}$
Space mean speed in outer lanes, $S = 68.5 \text{ mph}$
Space mean speed for all vehicles, $S = 61.9 \text{ mph}$

2016 AM NB Barton On.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4764 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 544 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 442 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4764	544	442	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1254	143	116	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM NB Barton On.txt
Flow rate, vp 5190 593 482 pcph

Estimation of V12 Merge Areas

L_{EO} = 932.16 (Equation 25-2 or 25-3)
P_{FM} = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3084 pc/h

Capacity Checks

v_{FO} Actual 5783 Maximum 7050 LOS F? No
v₃ v_{av34} 2106 pc/h (Equation 25-4 or 25-5)
Is v₃ v_{av34} > 2700 pc/h? No
Is v₃ v_{av34} > 1.5 v₁₂ /2 No
If yes, v_{12A} = 3084 (Equation 25-8)

Flow Entering Merge Influence Area

v_{R12} Actual 3084 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_R + 0.0078 v_A - 0.00627 L_A = 30.1 pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M_S = 0.433
Space mean speed in ramp influence area, S = 55.0 mph
Space mean speed in outer lanes, R_S = 59.2 mph
Space mean speed for all vehicles, O_S = 56.5 mph

2016 AM SB Barton Off.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5990	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	421	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	639	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5990	421	639	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1576	111	168	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM SB Barton Off.txt
Flow rate, vp 6526 459 696 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P_{FD} = 0.576$ Using Equation 5
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 3952$ pc/h

Capacity Checks

$v_{Fi} = v_{F0}$	Actual	Maximum	LOS F?
	6526	7050	No
$v_{FO} = v_{FR}$	6067	7050	No
v_R	459	2000	No
$v_{3 or av34}$	2574 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 or av34} > 2700$ pc/h?		No	
Is $v_{3 or av34} > 1.5 v_{12}$		No	
If yes, $v_{12A} = 3952$		(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12}	Actual	Max Desirable	Violation?
	3952	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 35.8$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$D = 0.469$	
Space mean speed in ramp influence area,	$S = 54.2$	mph
Space mean speed in outer lanes,	$S = 65.2$	mph
Space mean speed for all vehicles,	$S = 58.1$	mph

2016 AM SB Barton On.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5502	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	639	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	421	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5502	639	421	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1448	168	111	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM SB Barton On.txt
Flow rate, vp 5994 696 459 pcph

Estimation of V12 Merge Areas

$L_{EO} = 1126.26$ (Equation 25-2 or 25-3)
 $P_{FM} = 0.594$ Using Equation 1
 $v_{12} = v_{FM} (P_{FM}) = 3562$ pc/h

Capacity Checks

v_{FO}	Actual	Maximum	LOS F?
	6690	7050	No
$v_{3 \text{ or } av34}$	2432 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?			No
Is $v_{3 \text{ or } av34} > 1.5 v_{12}$?			No
If yes, $v_{12A} = 3562$		(Equation 25-8)	

Flow Entering Merge Influence Area

v_{R12}	Actual	Max Desirable	Violation?
	3562	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_{R12} + 0.0078 v_{A12} - 0.00627 L_{A12} = 34.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$M_S = 0.555$
Space mean speed in ramp influence area,	$S_R = 52.2$ mph
Space mean speed in outer lanes,	$S_O = 57.7$ mph
Space mean speed for all vehicles,	$S = 54.1$ mph

2016 PM NB Barton Off.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6098	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	553	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	549	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6098	553	549	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1605	146	144	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Barton Off.txt
Flow rate, vp 6547 594 589 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.260 \text{ Using Equation 0}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 2142 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{EO}$	6547	9400	No
$v = v_{FO}$	5953	9400	No
$v = v_R$	594	3800	No
$v = v_{3 \text{ or } av34}$	2202 pc/h	(Equation 25-15 or 25-16)	
Is $v > 2700 \text{ pc/h?}$		No	
Is $v > 1.5 v_{12}$		Yes	
If yes, $v_{12A} = 2618$		(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12A}	Actual 2618	Max Desirable 4400	Violation? No
-----------	----------------	-----------------------	------------------

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 17.4 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.481$

Space mean speed in ramp influence area, $S = 53.9 \text{ mph}$

Space mean speed in outer lanes, $S = 67.5 \text{ mph}$

Space mean speed for all vehicles, $S = 61.3 \text{ mph}$

2016 PM NB Barton On.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5552	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	549	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	553	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5552	549	553	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1461	144	146	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Barton On.txt
Flow rate, vp 5961 589 594 pcph

Estimation of V12 Merge Areas

$L_{EO} = 1096.30$ (Equation 25-2 or 25-3)
 $P = 0.594$ Using Equation 1
 $v_{12} = v_F(P_{FM}) = 3543$ pc/h

Capacity Checks

v_{FO}	Actual	Maximum	LOS F?
	6550	7050	No
$v_{3 \text{ or } av34}$	2418 pc/h	(Equation 25-4 or 25-5)	
$I_s v_{3 \text{ or } av34} > 2700$ pc/h?			No
$I_s v_{3 \text{ or } av34} > 1.5 v_{12}$			No
If yes, $v_{12A} = 3543$		(Equation 25-8)	

Flow Entering Merge Influence Area

v_{R12}	Actual	Max Desirable	Violation?
	3543	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_{R12} + 0.0078 v_A - 0.00627 L_A = 33.7$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$M_S = 0.522$
Space mean speed in ramp influence area,	$S_R = 53.0$ mph
Space mean speed in outer lanes,	$S_O = 57.8$ mph
Space mean speed for all vehicles,	$S = 54.7$ mph

2016 PM SB Barton Off.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5577	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	503	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	618	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5577	503	618	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1468	132	163	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Barton Off.txt
Flow rate, vp 5988 540 664 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.585 \text{ Using Equation 5}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 3730 \text{ pc/h}$$

Capacity Checks

v_{12}	Actual	Maximum	LOS F?
	5988	7050	No
v_{Fi}			
v_{FO}	5448	7050	No
v_R	540	2000	No
$v_{3 \text{ or } av34}$	2258 pc/h		(Equation 25-15 or 25-16)
$v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
$v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
$v_{12A} = 3730$			(Equation 25-18)

Flow Entering Diverge Influence Area

v_{12}	Actual	Max Desirable	Violation?
	3730	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{D12} = 33.9 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D_S = 0.477$

Space mean speed in ramp influence area, $S_R = 54.0 \text{ mph}$

Space mean speed in outer lanes, $S_O = 66.4 \text{ mph}$

Space mean speed for all vehicles, $S = 58.1 \text{ mph}$

2016 PM SB Barton On.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4960 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 618 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 503 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4960	618	503	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1305	163	132	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Barton On.txt
Flow rate, vp 5325 664 540 pcph

Estimation of V12 Merge Areas

L_{EO} = 976.25 (Equation 25-2 or 25-3)
P = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3165 pc/h

Capacity Checks

v_{FO} Actual 5989 Maximum 7050 LOS F? No
v₃ v_{av34} 2160 pc/h (Equation 25-4 or 25-5)
Is v₃ v_{av34} > 2700 pc/h? No
Is v₃ v_{av34} > 1.5 v₁₂ /2 No
If yes, v_{12A} = 3165 (Equation 25-8)

Flow Entering Merge Influence Area

v_{R12} Actual 3165 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_R + 0.0078 v_A - 0.00627 L_A = 31.3 pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.458
Space mean speed in ramp influence area, S = 54.5 mph
Space mean speed in outer lanes, R = 59.0 mph
Space mean speed for all vehicles, S_O = 56.0 mph

**2016 Adjacent Interchange
Ramp LOS**

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2016 AM NB Iowa Off. txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-Flow speed on freeway	65.0	mph
Volume on freeway	4474	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	349	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1074	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4474	349	1074	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1177	92	283	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

2016 AM NB Iowa Off. txt
Flow rate, vp 4874 380 1170 pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.621 Using Equation 5
FD
 $v = v + (v - v) P = 3169$ pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	4874	7050	No
$F_i = v$			
$v = v - v$	4494	7050	No
$F_0 = v - v$			
v	380	2000	No
v			
R	1705 pc/h	(Equation 25-15 or 25-16)	
v			
3 or $av34$			
Is v	> 2700 pc/h?	No	
3 or $av34$			
Is v	> 1.5 v /2	No	
3 or $av34$			
If yes, v	= 3169	(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	3169	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 29.1$ pc/mi /ln
R 12 D
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D = 0.462$
Space mean speed in ramp influence area,	$S = 54.4$ mph
Space mean speed in outer lanes,	$S = 68.6$ mph
Space mean speed for all vehicles,	$S = 58.6$ mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4177 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 1074 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 349 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4177	1074	349	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1099	283	92	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Merge Areas

L = 918.89 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 2705$ pc/h
12 F FM

Capacity Checks

v F0 Actual 5721 Maximum 7050 LOS F? No
v 3 or av34 1846 pc/h (Equation 25-4 or 25-5)
Is v 3 or av34 > 2700 pc/h? No
Is v 3 or av34 > 1.5 v /2 No
If yes, v 12A = 2705 (Equation 25-8)

Flow Entering Merge Influence Area

v R12 Actual 2705 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 31.4$ pc/mi/ln
R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.467
Space mean speed in ramp influence area, S_R = 54.3 mph
Space mean speed in outer lanes, S_O = 60.2 mph
Space mean speed for all vehicles, S = 56.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis: Diverge
Number of lanes in freeway: 3
Free-Flow speed on freeway: 65.0 mph
Volume on freeway: 5308 vph

Off Ramp Data

Side of freeway: Right
Number of lanes in ramp: 1
Free-Flow speed on ramp: 35.0 mph
Volume on ramp: 1047 vph
Length of first accel/decel lane: 270 ft
Length of second accel/decel lane: ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent ramp: 670 vph
Position of adjacent ramp: Downstream
Type of adjacent ramp: On
Distance to adjacent ramp: 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5308	1047	670	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1397	276	176	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Diverge Areas

$$L = \text{(Equation 25-8 or 25-9)}$$

$$EQ$$

$$P = 0.563 \text{ Using Equation 5}$$

$$FD$$

$$v = v + (v - v) P = 3754 \text{ pc/h}$$

$$12 \quad R \quad F \quad R \quad FD$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	5783	7050	No
$F_i = F$			
$v = v - v$	4642	7050	No
$F_0 = F - R$			
v	1141	2000	No
R			
v	2029 pc/h	(Equation 25-15 or 25-16)	
$3 \text{ or } av34$			
$I_s \quad v = v$	> 2700 pc/h?	No	
$3 \text{ or } av34$			
$I_s \quad v = v$	> 1.5 v /2	No	
$3 \text{ or } av34$			
$I_f \text{ yes, } v = 3754$		(Equation 25-18)	
$12A$			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	3754	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 34.1 \text{ pc/mi/ln}$
 $R \quad 12 \quad D$
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D = 0.531$
Space mean speed in ramp influence area,	$S = 52.8 \text{ mph}$
Space mean speed in outer lanes,	$S = 67.3 \text{ mph}$
Space mean speed for all vehicles,	$S^0 = 57.1 \text{ mph}$

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4287 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 670 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 1047 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4287	670	1047	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1128	176	276	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Merge Areas

L = 850.41 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 2776$ pc/h
12 F FM

Capacity Checks

Actual Maximum LOS F?
v F0 5401 7050 No
v 3 or v av34 1895 pc/h (Equation 25-4 or 25-5)
Is v 3 or v av34 > 2700 pc/h? No
Is v 3 or v av34 > 1.5 v /2 No
If yes, v 12A = 2776 (Equation 25-8)

Flow Entering Merge Influence Area

Actual Max Desirable Violation?
v R12 2776 4600 No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 28.7$ pc/mi/ln
R R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.409
Space mean speed in ramp influence area, S_R = 55.6 mph
Space mean speed in outer lanes, S_O = 60.0 mph
Space mean speed for all vehicles, S = 57.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis: Diverge
Number of lanes in freeway: 3
Free-Flow speed on freeway: 65.0 mph
Volume on freeway: 6140 vph

Off Ramp Data

Side of freeway: Right
Number of lanes in ramp: 1
Free-Flow speed on ramp: 35.0 mph
Volume on ramp: 410 vph
Length of first accel/decel lane: 270 ft
Length of second accel/decel lane: ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent ramp: 531 vph
Position of adjacent ramp: Downstream
Type of adjacent ramp: On
Distance to adjacent ramp: 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6140	410	531	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1616	108	140	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Diverge Areas

$$L = \text{(Equation 25-8 or 25-9)}$$

$$EQ$$

$$P = 0.572 \text{ Using Equation 5}$$

$$FD$$

$$v = v + (v - v) P = 4019 \text{ pc/h}$$

$$12 \quad R \quad F \quad R \quad FD$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	6689	7050	No
$F_i = F$			
$v = v - v$	6242	7050	No
$F_0 = F - R$			
v	447	2000	No
R			
v	2670 pc/h	(Equation 25-15 or 25-16)	
$3 \text{ or } av34$			
$I_s \quad v \quad v$	> 2700 pc/h?	No	
$3 \text{ or } av34$			
$I_s \quad v \quad v$	> 1.5 v /2	No	
$3 \text{ or } av34$			
$I_f \text{ yes, } v = 4019$		(Equation 25-18)	
$12A$			

Flow Entering Diverge Influence Area

v	Actual	Max Desirable	Violation?
12	4019	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 36.4 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$D = 0.468$
Space mean speed in ramp influence area,	$S = 54.2 \text{ mph}$
Space mean speed in outer lanes,	$S = 64.8 \text{ mph}$
Space mean speed for all vehicles,	$S = 58.0 \text{ mph}$

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5724 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 531 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 410 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5724	531	410	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1506	140	108	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Merge Areas

L = 1153.01 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 3706$ pc/h
12 F FM

Capacity Checks

v F0 Actual 6815 Maximum 7050 LOS F? No
v 3 or v av34 2530 pc/h (Equation 25-4 or 25-5)
Is v 3 or v av34 > 2700 pc/h? No
Is v 3 or v av34 > 1.5 v /2 No
If yes, v 12A = 3706 (Equation 25-8)

Flow Entering Merge Influence Area

v R12 Actual 3706 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 34.9$ pc/mi/ln
R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.562
Space mean speed in ramp influence area, S_R = 52.1 mph
Space mean speed in outer lanes, S_O = 57.1 mph
Space mean speed for all vehicles, S = 53.8 mph

2016 AM SB Washington Off. txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis: Diverge
Number of lanes in freeway: 3
Free-Flow speed on freeway: 65.0 mph
Volume on freeway: 6207 vph

Off Ramp Data

Side of freeway: Right
Number of lanes in ramp: 1
Free-Flow speed on ramp: 35.0 mph
Volume on ramp: 1062 vph
Length of first accel/decel lane: 270 ft
Length of second accel/decel lane: ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent ramp: 686 vph
Position of adjacent ramp: Downstream
Type of adjacent ramp: On
Distance to adjacent ramp: 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6207	1062	686	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1633	279	181	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Flow rate, vp 2016 AM SB Washington Off. txt
6762 1157 747 pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.538 Using Equation 5
FD
 $v = v + (v - v) P = 4171$ pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	6762	7050	No
$F_i = v$			
$v = v - v$	5605	7050	No
$F_0 = v - v$			
v	1157	2000	No
R			
v	2591 pc/h	(Equation 25-15 or 25-16)	
$3 \text{ or } v$			
$av34$			
Is $v > 2700$ pc/h?		No	
$3 \text{ or } v$			
$av34$			
Is $v > 1.5 v / 2$		No	
$3 \text{ or } v$			
$av34$			
If yes, $v = 4171$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

v	Actual	Max Desirable	Violation?
12	4171	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 37.7$ pc/mi/ln
12 R D

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, $D = 0.532$
Space mean speed in ramp influence area, $S = 52.8$ mph
Space mean speed in outer lanes, $S = 65.1$ mph
Space mean speed for all vehicles, $S = 56.9$ mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5305 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 686 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 1062 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5305	686	1062	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1396	181	279	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

2016 AM SB Washington On.txt
Flow rate, vp 5780 747 1157 pcph

Estimation of V12 Merge Areas

L = 1091.38 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 3435$ pc/h
12 F FM

Capacity Checks

Actual Maximum LOS F?
v F0 6527 7050 No
v 3 or v av34 2345 pc/h (Equation 25-4 or 25-5)
Is v 3 or v av34 > 2700 pc/h? No
Is v 3 or v av34 > 1.5 v /2 No
If yes, v 12A = 3435 (Equation 25-8)

Flow Entering Merge Influence Area

Actual Max Desirable Violation?
v R12 3435 4600 No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 34.0$ pc/mi/ln
R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.534
Space mean speed in ramp influence area, S_R = 52.7 mph
Space mean speed in outer lanes, S_O = 58.2 mph
Space mean speed for all vehicles, S = 54.6 mph

2016 PM NB Iowa Off. txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5321	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	380	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1100	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5321	380	1100	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1400	100	289	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Iowa Off. txt
Flow rate, vp 5713 408 1181 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P = 0.598$ Using Equation 5
 $FD =$
 $v_{12} = v_R + (v_F - v_R) \frac{P}{FD} = 3583$ pc/h

Capacity Checks

$v = v_{12}$	Actual	Maximum	LOS F?
$F_i = F$	5713	7050	No
$v = v_F - v_R$	5305	7050	No
$F_0 = F - R$	408	2000	No
v_R	2130 pc/h	(Equation 25-15 or 25-16)	
v_3 or av_{34}			
$I_s v_3$ or $av_{34} > 2700$ pc/h?		No	
$I_s v_3$ or $av_{34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3583$		(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12}	Actual	Max Desirable	Violation?
	3583	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 \frac{L_D}{D} = 32.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D_S = 0.465$
Space mean speed in ramp influence area,	$S_R = 54.3$ mph
Space mean speed in outer lanes,	$S_0 = 66.9$ mph
Space mean speed for all vehicles,	$S = 58.4$ mph

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Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4998	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1100	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	380	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4998	1100	380	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1315	289	100	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

Flow rate, vp 2016 PM NB Iowa On.txt
5366 1181 408 pcph

Estimation of V12 Merge Areas

$L_{EO} = 1095.66$ (Equation 25-2 or 25-3)
 $P_{FM} = 0.594$ Using Equation 1
 $v_{12} = v_{FM} (P_{FM}) = 3189$ pc/h

Capacity Checks

v_{FO}	Actual	Maximum	LOS F?
	6547	7050	No
$v_{3 \text{ or } av34}$	2177 pc/h	(Equation 25-4 or 25-5)	
$I_s v_{3 \text{ or } av34} > 2700$ pc/h?			No
$I_s v_{3 \text{ or } av34} > 1.5 v_{12}$			No
If yes, $v_{12A} = 3189$		(Equation 25-8)	

Flow Entering Merge Influence Area

v_{R12}	Actual	Max Desirable	Violation?
	3189	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_{R12} + 0.0078 v_{A12} - 0.00627 L_{A12} = 35.3$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$M_S = 0.587$
Space mean speed in ramp influence area,	$S_R = 51.5$ mph
Space mean speed in outer lanes,	$S_O = 59.0$ mph
Space mean speed for all vehicles,	$S = 53.8$ mph

2016 PM NB Mt Vernon Off. txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6101	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	954	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	655	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6101	954	655	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1606	251	172	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Mt Vernon Off. txt
Flow rate, vp 6551 1024 703 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.549 \text{ Using Equation 5}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 4059 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{EO}$	6551	7050	No
$v = v_{FO} - v_{FR}$	5527	7050	No
v_R	1024	2000	No
$v_{3 \text{ or } av34}$	2492 pc/h	(Equation 25-15 or 25-16)	
$I_s v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
$I_s v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
$I_f \text{ yes, } v_{12A} = 4059$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4059	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 36.7 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, $D_S = 0.520$

Space mean speed in ramp influence area, $S_R = 53.0 \text{ mph}$

Space mean speed in outer lanes, $S_O = 65.5 \text{ mph}$

Space mean speed for all vehicles, $S = 57.2 \text{ mph}$

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HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5118 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 655 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 954 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5118	655	954	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1347	172	251	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Mt Vernon On.txt
Flow rate, vp 5495 703 1024 pcph

Estimation of V12 Merge Areas

L_{EO} = 1020.97 (Equation 25-2 or 25-3)
P = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3266 pc/h

Capacity Checks

v_{FO} Actual 6198 Maximum 7050 LOS F? No
v_{3 or av34} 2229 pc/h (Equation 25-4 or 25-5)
Is v_{3 or av34} > 2700 pc/h? No
Is v_{3 or av34} > 1.5 v₁₂ /2 No
If yes, v_{12A} = 3266 (Equation 25-8)

Flow Entering Merge Influence Area

v_{R12} Actual 3266 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_R + 0.0078 v_A - 0.00627 L_A = 32.3 pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.485
Space mean speed in ramp influence area, S = 53.8 mph
Space mean speed in outer lanes, R = 58.8 mph
Space mean speed for all vehicles, S_O = 55.5 mph

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Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5578	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	583	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	438	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5578	583	438	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1468	153	115	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB La Cadena Off. txt
Flow rate, vp 5989 626 470 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.581 \text{ Using Equation 5}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 3744 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{EO}$	5989	7050	No
$v = v_{FO} - v_{FR}$	5363	7050	No
v_R	626	2000	No
$v_{3 \text{ or } av34}$	2245 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3744$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3744	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 \frac{L_D}{12} = 34.0 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D_S = 0.484$
Space mean speed in ramp influence area, $S_R = 53.9 \text{ mph}$
Space mean speed in outer lanes, $S_O = 66.4 \text{ mph}$
Space mean speed for all vehicles, $S = 58.0 \text{ mph}$

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Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5019 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 438 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 583 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5019	438	583	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1321	115	153	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB La Cadena On.txt
Flow rate, vp 5389 470 626 pcph

Estimation of V12 Merge Areas

$L_{EO} = 948.43$ (Equation 25-2 or 25-3)
 $P_{FM} = 0.594$ Using Equation 1
 $v_{12} = v_F(P_{FM}) = 3203$ pc/h

Capacity Checks

$v_{FO} = 5859$ Maximum 7050 LOS F? No
 $v_{3 \text{ or } av34} = 2186$ pc/h (Equation 25-4 or 25-5)
Is $v_{3 \text{ or } av34} > 2700$ pc/h? No
Is $v_{3 \text{ or } av34} > 1.5 v_{12}$? No
If yes, $v_{12A} = 3203$ (Equation 25-8)

Flow Entering Merge Influence Area

$v_{R12} = 3203$ Actual Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_{R12} + 0.0078 v_{A12} - 0.00627 L_{A12} = 30.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $M_S = 0.433$
Space mean speed in ramp influence area, $S_R = 55.1$ mph
Space mean speed in outer lanes, $S_O = 58.9$ mph
Space mean speed for all vehicles, $S = 56.4$ mph

2016 PM SB Washington Off. txt
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Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5703	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1415	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1077	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5703	1415	1077	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1501	372	283	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Washington Off. txt
Flow rate, vp 6123 1519 1156 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P_{FD} = 0.537$ Using Equation 5
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 3992$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{12}	6123	7050	No
$v_{Fi} = v_{F0}$	4604	7050	No
v_{R0}	1519	2000	No
$v_{3 \text{ or } av34}$	2131 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12}$		No	
If yes, $v_{12A} = 3992$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3992	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{12} = 36.2$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$D_S = 0.565$
Space mean speed in ramp influence area,	$S_R = 52.0$ mph
Space mean speed in outer lanes,	$S_0 = 66.9$ mph
Space mean speed for all vehicles,	$S = 56.4$ mph

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Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4501	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1077	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1415	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4501	1077	1415	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1184	283	372	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Washington On.txt
Flow rate, vp 4833 1156 1519 pcph

Estimation of V12 Merge Areas

$L_{EO} = 976.25$ (Equation 25-2 or 25-3)
 $P_{FM} = 0.594$ Using Equation 1
 $v_{12} = v_{FM} (P_{FM}) = 2872$ pc/h

Capacity Checks

v_{FO}	Actual	Maximum	LOS F?
	5989	7050	No
$v_{3 \text{ or } av34}$	1961 pc/h	(Equation 25-4 or 25-5)	
$I_s v_{3 \text{ or } av34} > 2700$ pc/h?			No
$I_s v_{3 \text{ or } av34} > 1.5 v_{12} / 2$			No
If yes, $v_{12A} = 2872$			(Equation 25-8)

Flow Entering Merge Influence Area

v_{R12}	Actual	Max Desirable	Violation?
	2872	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_{R12} + 0.0078 v_{A12} - 0.00627 L_{A12} = 32.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$M_S = 0.498$
Space mean speed in ramp influence area,	$S_R = 53.5$ mph
Space mean speed in outer lanes,	$S_O = 59.7$ mph
Space mean speed for all vehicles,	$S = 55.4$ mph

2016 Weaving LOS

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2016 NB Iowa to Barton AM.txt
HCS+: Freeway Weaving Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Iteris, Inc
Agency/Co.: Iteris, Inc
Date Performed: 4/20/2009
Analysis Time Period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Weaving Location: Iowa Av On to Barton Off
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
Weaving number of lanes, N 4
Weaving segment length, L 1490 ft
Terrain type Level
Grade Length %
Weaving type A mi
Volume ratio, VR 0.25
Weaving ratio, R 0.26

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	V ₀₁	V ₀₂	V _{w1}	V _{w2}	
Volume, V	3825	90	983	352	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v ₁₅	1007	24	259	93	v
Trucks and buses	7	7	7	7	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5*	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.966	0.966	0.966	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4167	98	1070	383	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.92	0.26
Weaving and non-weaving speeds, Si	32.15	54.66
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		1.45
Maximum number of lanes, Nw (max) (Exhibit 24-7)		1.40

2016 NB Iowa to Barton AM.txt
Type of operation is Constrained

Weaving Segment	Speed	Density	Level of Service	and Capacity
Weaving segment speed, S	46.40	mph		
Weaving segment density, D	30.81	pc/mi/ln		
Level of service, LOS	D			
Capacity of base condition, cb	7433	pc/h		
Capacity as a 15-minute flow rate, c	7182	pc/h		
Capacity as a full-hour volume, ch	6823	pc/h		

Limitations on Weaving Segments

Analyzed	If Max Exceeded	See Note	
Weaving flow rate, Vw	1453	2800	a
Average flow rate (pcphpl)	1429	2300	b
Volume ratio, VR	0.25	0.35	c
Weaving ratio, R	0.26	N/A	d
Weaving length (ft)	1490	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2016 NB Iowa to Barton PM.txt
HCS+: Freeway Weaving Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Iteris, Inc
Agency/Co.: Iteris, Inc
Date Performed: 4/20/2009
Analysis Time Period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Weaving Location: Iowa Av On to Barton Off
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
Weaving number of lanes, N 4
Weaving segment length, L 1490 ft
Terrain type Level
Grade Length %
Weaving type A mi
Volume ratio, VR 0.24
Weaving ratio, R 0.31

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	V ₀₁	V ₀₂	V _{w1}	V _{w2}	
Volume, V	4544	100	1000	454	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v ₁₅	1196	26	263	119	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5*	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.980	0.980	0.980	0.980	
Driver population adjustment, f _P	1.00	1.00	1.00	1.00	
Flow rate, v	4878	107	1073	487	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, W _i	2.12	0.30
Weaving and non-weaving speeds, S _i	31.00	53.60
Number of lanes required for unconstrained operation, N _w (Exhibit 24-7)		1.42
Maximum number of lanes, N _w (max) (Exhibit 24-7)		1.40

2016 NB Iowa to Barton PM.txt
Type of operation is Constrained

Weaving Segment	Speed	Density	Level of Service	Capacity
Weaving segment speed, S	45.66	mph		
Weaving segment density, D	35.83	pc/mi/ln		
Level of service, LOS	E			
Capacity of base condition, c _b	7537	pc/h		
Capacity as a 15-minute flow rate, c	7389	pc/h		
Capacity as a full-hour volume, c _h	7020	pc/h		

Limitations on Weaving Segments

	Analyzed	If Max Exceeded	See Note
Weaving flow rate, V _w	1560	2800	a
Average flow rate (pcphpl)	1636	2300	b
Volume ratio, VR	0.24	0.35	c
Weaving ratio, R	0.31	N/A	d
Weaving length (ft)	1490	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2016 Freeway Mainline LOS

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Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5250	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1382	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1907	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1907	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.0	mi/h
Number of lanes, N	3	
Density, D	32.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6098	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1605	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2182	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2182	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.5	mi/h
Number of lanes, N	3	
Density, D	40.0	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4764	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1254	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1730	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1730	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	3	
Density, D	28.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5552	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1461	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1987	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1987	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.1	mi/h
Number of lanes, N	3	
Density, D	34.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

2016 NB Barton to Washington AM.txt

HCS+: Basic Freeway Segments Release 5.4

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5308	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1397	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1928	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1928	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.8	mi/h
Number of lanes, N	3	
Density, D	32.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

2016 NB Barton to Washington PM.txt

HCS+: Basic Freeway Segments Release 5.4

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6101	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1606	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2184	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2184	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.5	mi/h
Number of lanes, N	3	
Density, D	40.1	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5250	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1382	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1430	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1430	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	23.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5250	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1382	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1907	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1907	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.0	mi/h
Number of lanes, N	3	
Density, D	32.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6098	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1605	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1637	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1637	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	27.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6098	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1605	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2182	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2182	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.5	mi/h
Number of lanes, N	3	
Density, D	40.0	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5502	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1448	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1998	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1998	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.0	mi/h
Number of lanes, N	3	
Density, D	34.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4960	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1305	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1775	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1775	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.7	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6140	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1616	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2230	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2230	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	53.2	mi/h
Number of lanes, N	3	
Density, D	41.9	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5578	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1468	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1996	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1996	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.0	mi/h
Number of lanes, N	3	
Density, D	34.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington Ave to Barton
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5990	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1576	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2175	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2175	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.7	mi/h
Number of lanes, N	3	
Density, D	39.8	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington to Barton Rd
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5577	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1468	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1996	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1996	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.0	mi/h
Number of lanes, N	3	
Density, D	34.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

2040 Freeway Ramp LOS

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Year 2040 Barton Road Freeway Ramp LOS Calculations

I-215 Freeway Ramp	Lanes	Capacity	AM Peak						PM Peak					
			Vol	PCE Vol	PHF Vol	V/C	Density	LOS	Vol	PCE Vol	PHF Vol	V/C	Density	LOS
Northbound														
Barton Rd Off Ramp	2	4600	706	734	773	0.17	6.8	A	935	954	1004	0.22	8.8	A
Barton Rd On Ramp	1	2300	1095	1139	1199	0.52	21.0	C	922	940	990	0.43	17.3	B
Southbound														
Barton Rd Off Ramp	2	4600	703	731	770	0.17	6.7	A	890	908	956	0.21	8.4	A
Barton Rd On Ramp	1	2300	1047	1089	1146	0.50	20.1	C	883	901	948	0.41	16.6	B

Year 2040 Adjacent Interchange Ramp LOS Calculations

I-215 Freeway Ramp	Lanes	Capacity	AM Peak						PM Peak					
			Vol	PCE Vol	PHF Vol	V/C	Density	LOS	Vol	PCE Vol	PHF Vol	V/C	Density	LOS
Northbound														
Iowa Ave Off Ramp	2	4600	720	749	788	0.17	6.9	A	692	706	743	0.16	6.5	A
Iowa Ave On Ramp	1	2300	1312	1364	1436	0.62	25.1	C	1754	1789	1883	0.82	33.0	D
Washington Rd Off Ramp	2	4600	1731	1800	1895	0.41	16.6	B	1391	1419	1493	0.32	13.1	B
Washington Rd On Ramp	1	2300	1678	1745	1837	0.80	32.1	D	1338	1365	1437	0.62	25.1	C
Southbound														
Washington Rd Off Ramp	2	4600	1212	1260	1327	0.29	11.6	B	1755	1790	1884	0.41	16.5	B
Washington Rd On Ramp	1	2300	935	972	1024	0.45	17.9	B	1432	1461	1538	0.67	26.9	C
Iowa Ave Off Ramp	2	4600	1169	1216	1280	0.28	11.2	B	1582	1614	1699	0.37	14.9	B
Iowa Ave On Ramp	1	2300	1136	1181	1244	0.54	21.8	C	964	983	1035	0.45	18.1	B

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2040 Weaving LOS

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2040 NB Iowa to Barton AM_Type B.txt

HCS+: Freeway Weaving Release 5.3

Operational Analysis

Analyst: Iteris, Inc.
 Agency/Co.: Iteris, Inc.
 Date Performed: 7/24/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Dir of Travel: I-215 Northbound
 Weaving Location: Iowa Av On to Barton Off
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
 Weaving number of lanes, N 5
 Weaving segment length, L 2400 ft
 Terrain type Level
 Grade %
 Length mi
 Weaving type B
 Volume ratio, VR 0.21
 Weaving ratio, R 0.33

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	V A-C	V B-D	V A-D	V B-C	
Volume, V	6509	110	1206	596	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v15	1713	29	317	157	v
Trucks and buses	7	7	7	7	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.966	0.966	0.966	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7091	119	1313	649	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.48	0.24
Weaving and non-weaving speeds, Si	48.75	55.33
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		1.07
Maximum number of lanes, Nw (max) (Exhibit 24-7)		3.50
Type of operation is		Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S 53.78 mph
 Weaving segment density, D 34.11 pc/mi/ln
 Level of service, LOS D

2040 NB Iowa to Barton AM_Type B.txt

Capacity of base condition, cb 11210 pc/h
 Capacity as a 15-minute flow rate, c 10831 pc/h
 Capacity as a full-hour volume, ch 10289 pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded	See Note
Weaving flow rate, Vw	1962	4000	a
Average flow rate (pcphpl)	1834	2300	b
Volume ratio, VR	0.21	0.80	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	2400	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2040 NB Iowa to Barton PM_Type B.txt

HCS+: Freeway Weaving Release 5.3

Operational Analysis

Analyst: Iteris, Inc.
 Agency/Co.: Iteris, Inc.
 Date Performed: 7/24/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Dir of Travel: I-215 Northbound
 Weaving Location: Iowa Av On to Barton Off
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
 Weaving number of lanes, N 5
 Weaving segment length, L 2400 ft
 Terrain type Level
 Grade %
 Length mi
 Weaving type B
 Volume ratio, VR 0.24
 Weaving ratio, R 0.33

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	A-C	B-D	A-D	B-C	
Volume, V	7340	166	1588	769	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v15	1932	44	418	202	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.980	0.980	0.980	0.980	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7880	178	1705	825	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.56	0.31
Weaving and non-weaving speeds, Si	47.11	53.09
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		1.22
Maximum number of lanes, Nw (max) (Exhibit 24-7)		3.50
Type of operation is		Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S 51.53 mph
 Weaving segment density, D 41.10 pc/mi/ln
 Level of service, LOS E

2040 NB Iowa to Barton PM_Type B.txt

Capacity of base condition, cb 11009 pc/h
 Capacity as a 15-minute flow rate, c 10793 pc/h
 Capacity as a full-hour volume, ch 10253 pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded	See Note
Weaving flow rate, Vw	2530	4000	a
Average flow rate (pcphpl)	2117	2300	b
Volume ratio, VR	0.24	0.80	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	2400	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2040 Freeway Mainline LOS

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2040 SB Washington to Barton AM.txt

HCS+: Basic Freeway Segments Release 5.21

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington Ave to Barton
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8342	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2195	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1818	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1818	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.6	mi/h
Number of lanes, N	5	
Density, D	30.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8676	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2283	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1890	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1890	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	5	
Density, D	32.0	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	7639	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2010	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2081	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2081	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	4	
Density, D	36.7	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8417	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2215	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1834	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1834	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.5	mi/h
Number of lanes, N	5	
Density, D	30.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

2040 NB Barton to Washington AM.txt

HCS+: Basic Freeway Segments Release 5.21

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8660	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2279	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1887	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1887	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	5	
Density, D	31.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	7711	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2029	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2100	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2100	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.3	mi/h
Number of lanes, N	4	
Density, D	37.3	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	8604	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2264	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1848	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	1848	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.4	mi/h
Number of lanes, N	5	
Density, D	31.1	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	7670	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2018	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2059	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2059	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	4	
Density, D	36.1	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

2040 SB Washington to Barton PM.txt

HCS+: Basic Freeway Segments Release 5.21

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington to Barton Rd
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8560	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2253	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1838	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1838	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.5	mi/h
Number of lanes, N	5	
Density, D	30.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	9863	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2596	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2118	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2118	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	55.9	mi/h
Number of lanes, N	5	
Density, D	37.9	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	9692	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2551	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2081	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2081	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	5	
Density, D	36.7	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8928	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2349	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2396	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2396	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

**APPENDIX F
Traffic Index
Calculation Worksheets**

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 NB Off Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 6/9/11
 6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
ADT	11,688	14,960
%TRUCKS	4.00%	4.00%
#TRUCKS	0	598

20-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 20yr Constant	ONE-WAY 20 Yr. ESAL	Shoulders
2.	468	61.4%	1380	396306	7926
3.	468	15.7%	3680	270349	5407
4.	468	11.4%	5880	314160	6283
5.	468	11.4%	13780	736246	14725
		100%			
TOTAL				1717061	34341
T.I. =				9.60	6.03
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 40yr Constant	ONE-WAY 40 Yr. ESAL	Shoulders
2.	598	61.4%	2760	1014544	20291
3.	598	15.7%	7360	692092	13842
4.	598	11.4%	11760	804250	16085
5.	598	11.4%	27560	1884789	37696
TOTAL				4395675	87914
T.I. =				10.73	6.74
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 NB On Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 6/9/11
 6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
	2040	2060
ADT	11,525	14,752
%TRUCKS	4.00%	4.00%
#TRUCKS	0	461
		590

20-YEAR T.I.

AXLES	1-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	461	x 61.4%	x 1380	390796	7816
3.	461	x 15.7%	x 3680	266590	5332
4.	461	x 11.4%	x 5880	309792	6196
5.	461	x 11.4%	x 13780	726009	14520
		100%			
TOTAL				1693187	33864
T.I. =				9.58	6.02
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	590	x 61.4%	x 2760	1000438	20009
3.	590	x 15.7%	x 7360	682470	13649
4.	590	x 11.4%	x 11760	793068	15861
5.	590	x 11.4%	x 27560	1858583	37172
TOTAL				4334559	86691
T.I. =				10.72	6.73
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 SB Off Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 6/9/11
 6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
	2040	2060
ADT	11,113	14,224
%TRUCKS	4.00%	4.00%
#TRUCKS	0	569

20-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 20yr Constant	ONE-WAY 20 Yr. ESAL	Shoulders
2.	445	61.4%	x 1380	376809	7536
3.	445	15.7%	x 3680	257048	5141
4.	445	11.4%	x 5880	298704	5974
5.	445	11.4%	x 13780	700024	14000
		100%			
TOTAL				1632585	32652
T.I. =				9.54	5.99
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 40yr Constant	ONE-WAY 40 Yr. ESAL	Shoulders
2.	569	61.4%	x 2760	964631	19293
3.	569	15.7%	x 7360	658043	13161
4.	569	11.4%	x 11760	764682	15294
5.	569	11.4%	x 27560	1792061	35841
TOTAL				4179418	83588
T.I. =				10.67	6.70
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 SB On Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 3/3/09

6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
ADT	10,988	14,064
%TRUCKS	4.00%	4.00%
#TRUCKS	0	563

20-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 20yr Constant	ONE-WAY 20 Yr. ESAL	Shoulders
2.	440	61.4%	x 1380	372570	7451
3.	440	15.7%	x 3680	254157	5083
4.	440	11.4%	x 5880	295344	5907
5.	440	11.4%	x 13780	692150	13843
		100%			
TOTAL				1614221	32284
T.I. =				9.53	5.98
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 40yr Constant	ONE-WAY 40 Yr. ESAL	Shoulders
2.	563	61.4%	x 2760	953780	19076
3.	563	15.7%	x 7360	650641	13013
4.	563	11.4%	x 11760	756081	15122
5.	563	11.4%	x 27560	1771903	35438
TOTAL				4132405	82648
T.I. =				10.66	6.69
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 NB Aux Lane
 Construction Yr: 2015

CALC BY: SBG

CHK BY:

DATE: 6/9/11

6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
	2040	2060
ADT	33,238	42,545
%TRUCKS	4.00%	4.00%
#TRUCKS	0	1,702

20-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 20yr Constant	ONE-WAY 20 Yr. ESAL	Shoulders
2.	1,330	61.4%	x 1380	1127053	22541
3.	1,330	15.7%	x 3680	768842	15377
4.	1,330	11.4%	x 5880	893437	17869
5.	1,330	11.4%	x 13780	2093804	41876
		100%			
TOTAL				4883137	97663
T.I. =				10.87	6.82
USE				11.00	7.00

40-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 40yr Constant	ONE-WAY 40 Yr. ESAL	Shoulders
2.	1,702	61.4%	x 2760	2885256	57705
3.	1,702	15.7%	x 7360	1968237	39365
4.	1,702	11.4%	x 11760	2287200	45744
5.	1,702	11.4%	x 27560	5360138	107203
TOTAL				12500831	250017
T.I. =				12.16	7.63
USE				12.00	7.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road CALC BY: SBG

between I-215 on/off ramp CHK BY:

Construction Yr: 2015 DATE: 3/3/09

6/9/11

	MID YR 20 YR TI	MID YR 40 YR TI
YEAR	2040	2060
ADT	55,300	70,784
%TRUCKS	4.00%	4.00%
#TRUCKS	0	2,831

20-YEAR T.I.

AXLES	2-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	2,212	x 61.4%	x 1380	937572	18751
3.	2,212	x 15.7%	x 3680	639584	12792
4.	2,212	x 11.4%	x 5880	743232	14865
5.	2,212	x 11.4%	x 13780	1741792	34836
		100%			
TOTAL				4062180	81244
T.I. =				10.63	6.68
USE				10.50	6.50

40-YEAR T.I.

AXLES	2-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	2,831	x 61.4%	x 2760	2400184	48004
3.	2,831	x 15.7%	x 7360	1637335	32747
4.	2,831	x 11.4%	x 11760	1902674	38053
5.	2,831	x 11.4%	x 27560	4458988	89180
TOTAL				10399181	207984
T.I. =				11.89	7.47
USE				12.00	7.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Commerce Way
 between I-215 NB ramps &
 Construction Yr: 2015

CALC BY: mhc
 CHK BY: sbg
 DATE: 4/27/09
 6/9/11

	MID YR 20 YR TI	MID YR 40 YR TI
YEAR	2040	2060
ADT	29,265	37,459
%TRUCKS	4.00%	4.00%
#TRUCKS	0	1,498

20-YEAR T.I.

AXLES	2-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	1,171	x 61.4%	x 1380	496167	9923
3.	1,171	x 15.7%	x 3680	338471	6769
4.	1,171	x 11.4%	x 5880	393322	7866
5.	1,171	x 11.4%	x 13780	921764	18435
		100%			
TOTAL				2149723	42994
T.I. =				9.86	6.19
USE				10.00	6.00

40-YEAR T.I.

AXLES	2-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	1,498	x 61.4%	x 2760	1270188	25404
3.	1,498	x 15.7%	x 7360	866485	17330
4.	1,498	x 11.4%	x 11760	1006903	20138
5.	1,498	x 11.4%	x 27560	2359716	47194
TOTAL				5503292	110066
T.I. =				11.02	6.92
USE				11.00	7.00

Interstate 215/Barton Road Interchange Improvement Project

08-SBd-215-PM 0.58/1.66

Technical Appendices

Caltrans Project No. 0800000282 (0J0700)

Prepared for:



Under contract to AECOM

Prepared by:

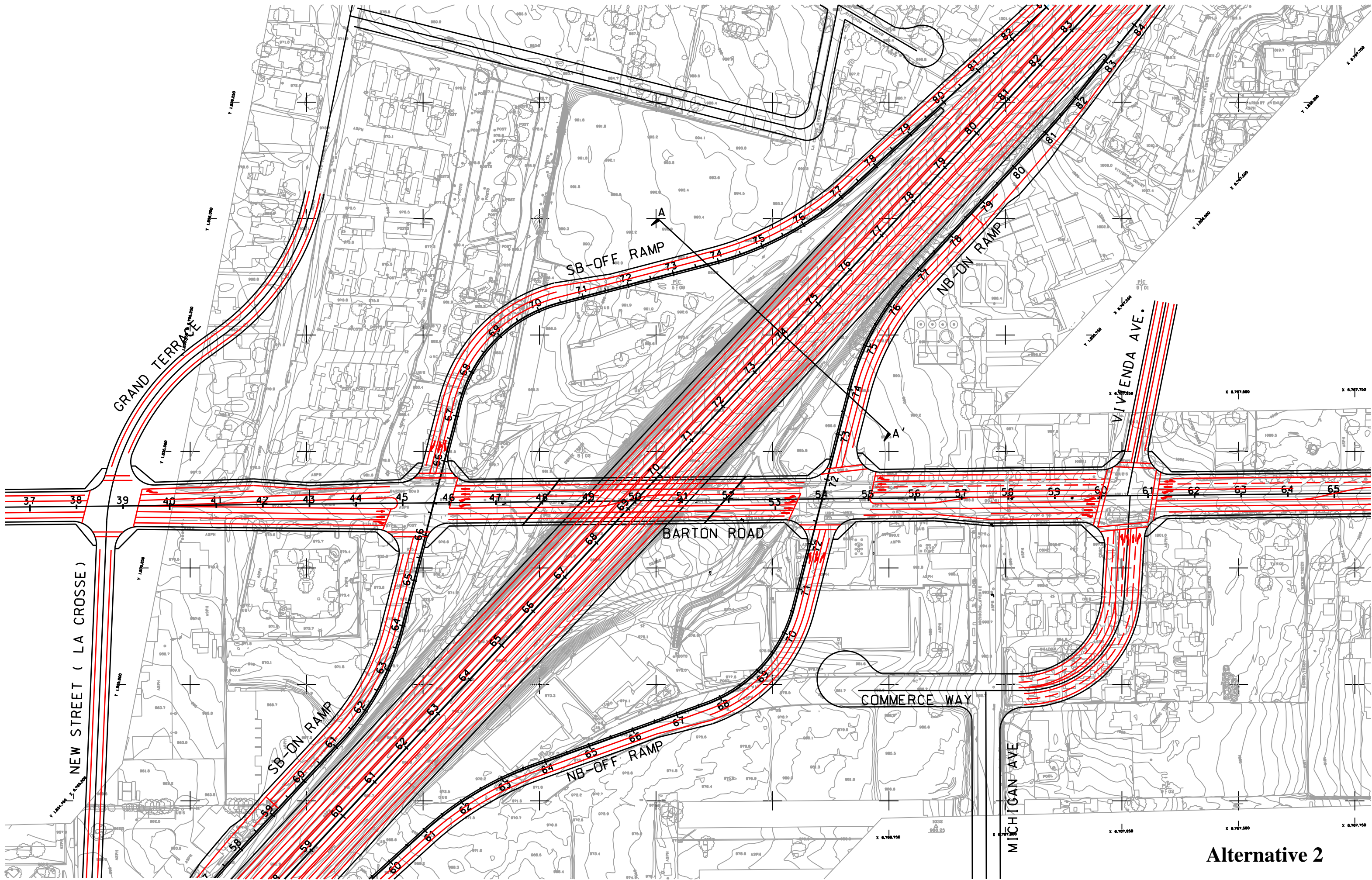


December 21, 2011

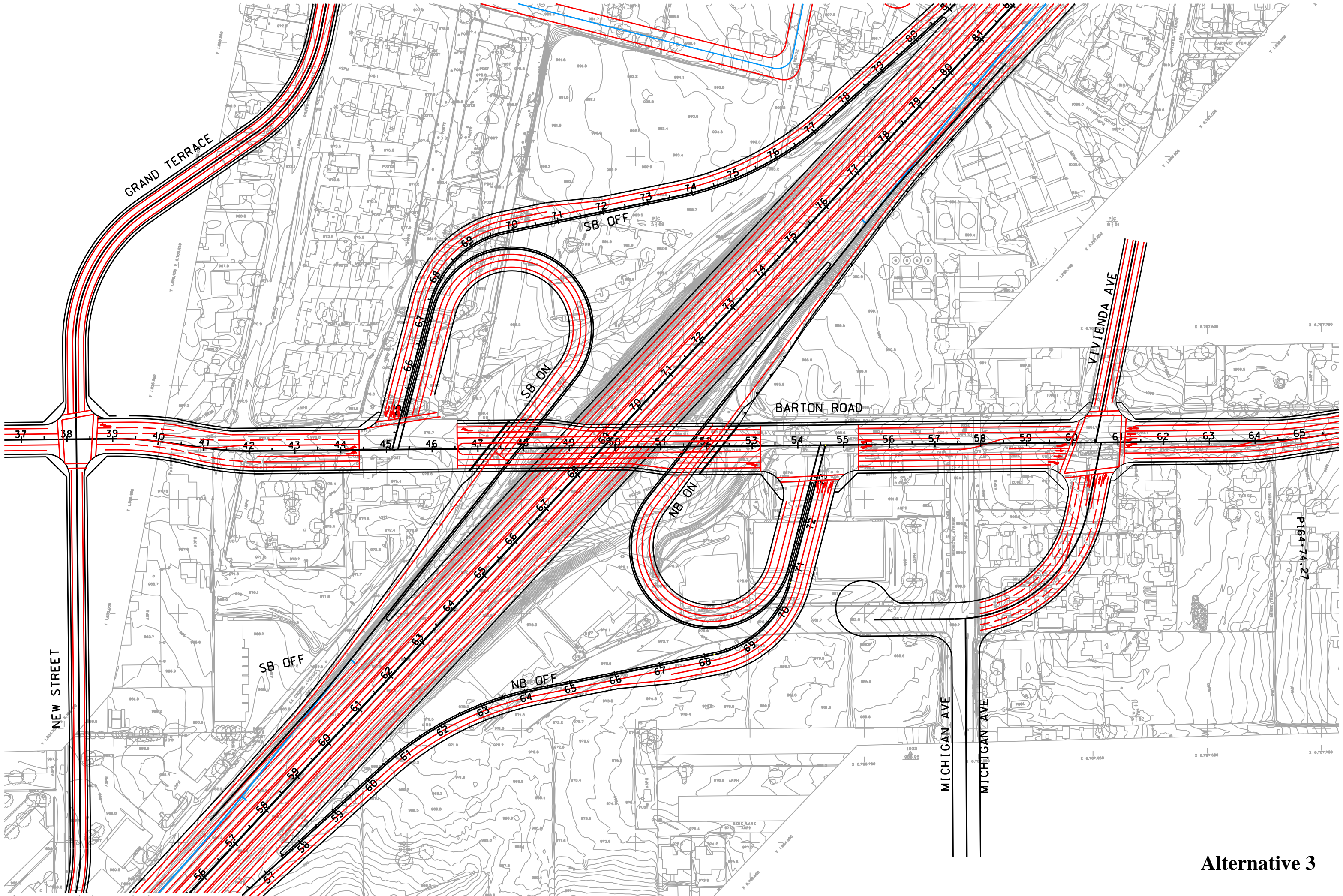
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APPENDIX A
Alternative Design Layouts

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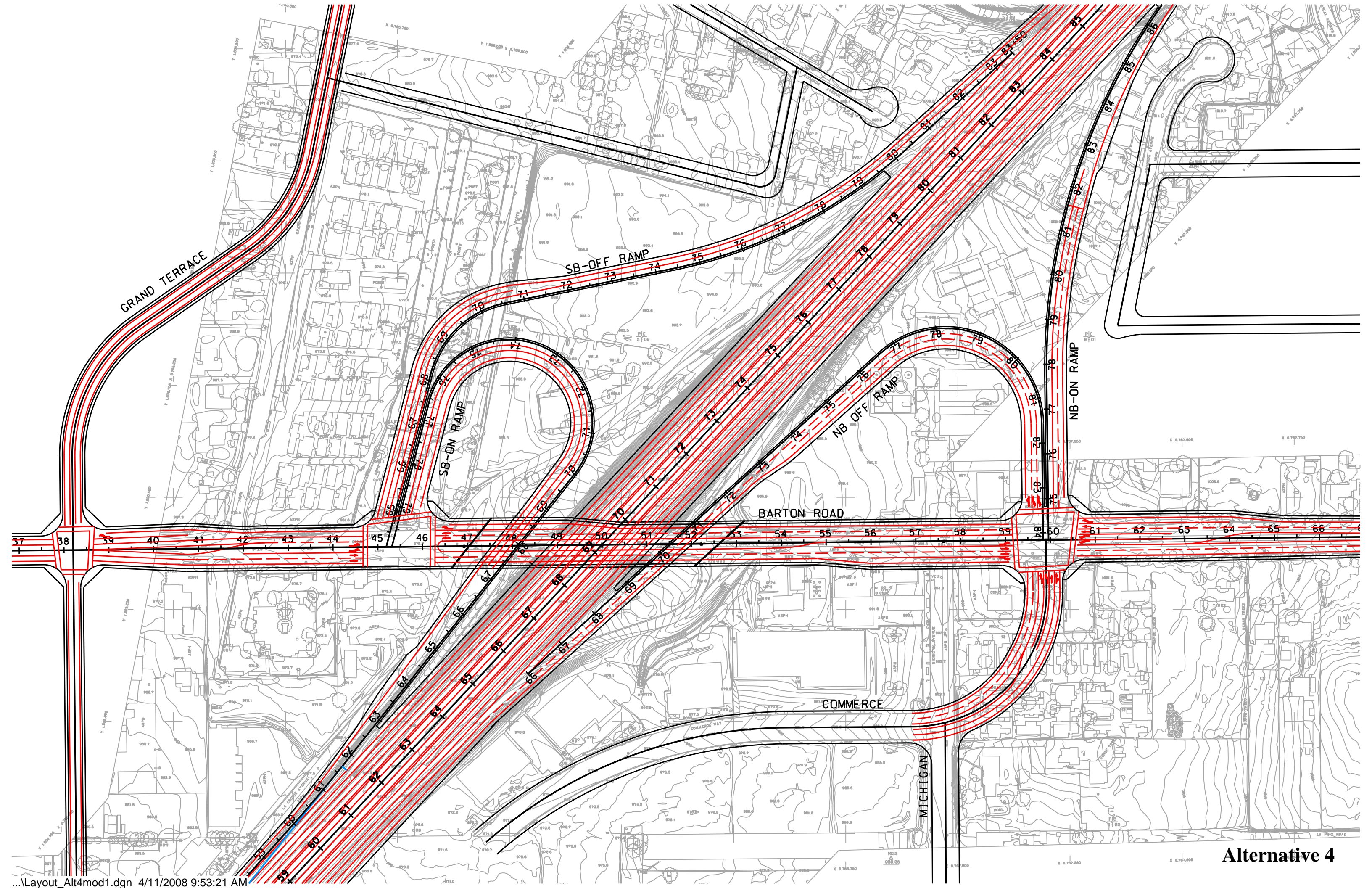


Alternative 2

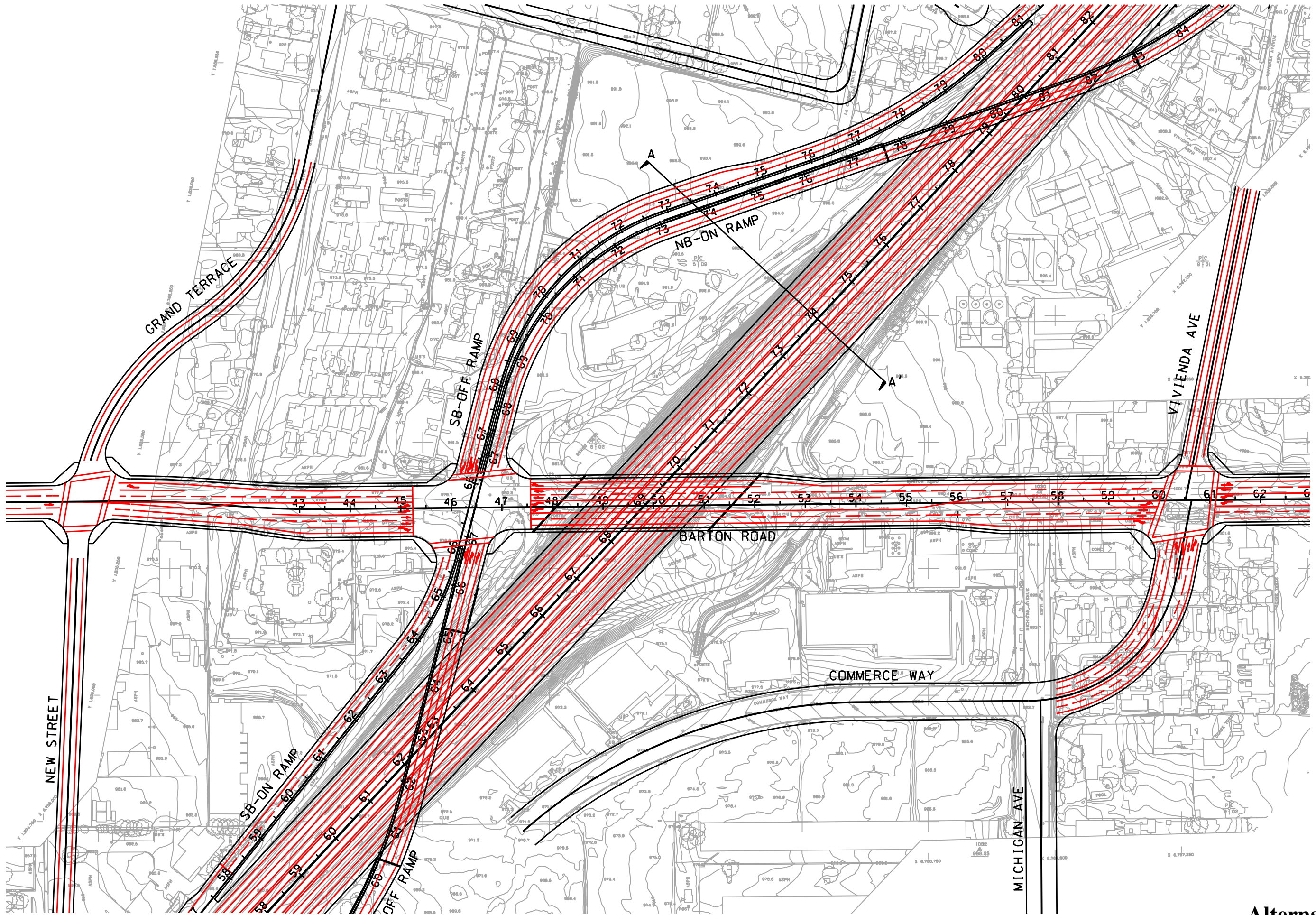


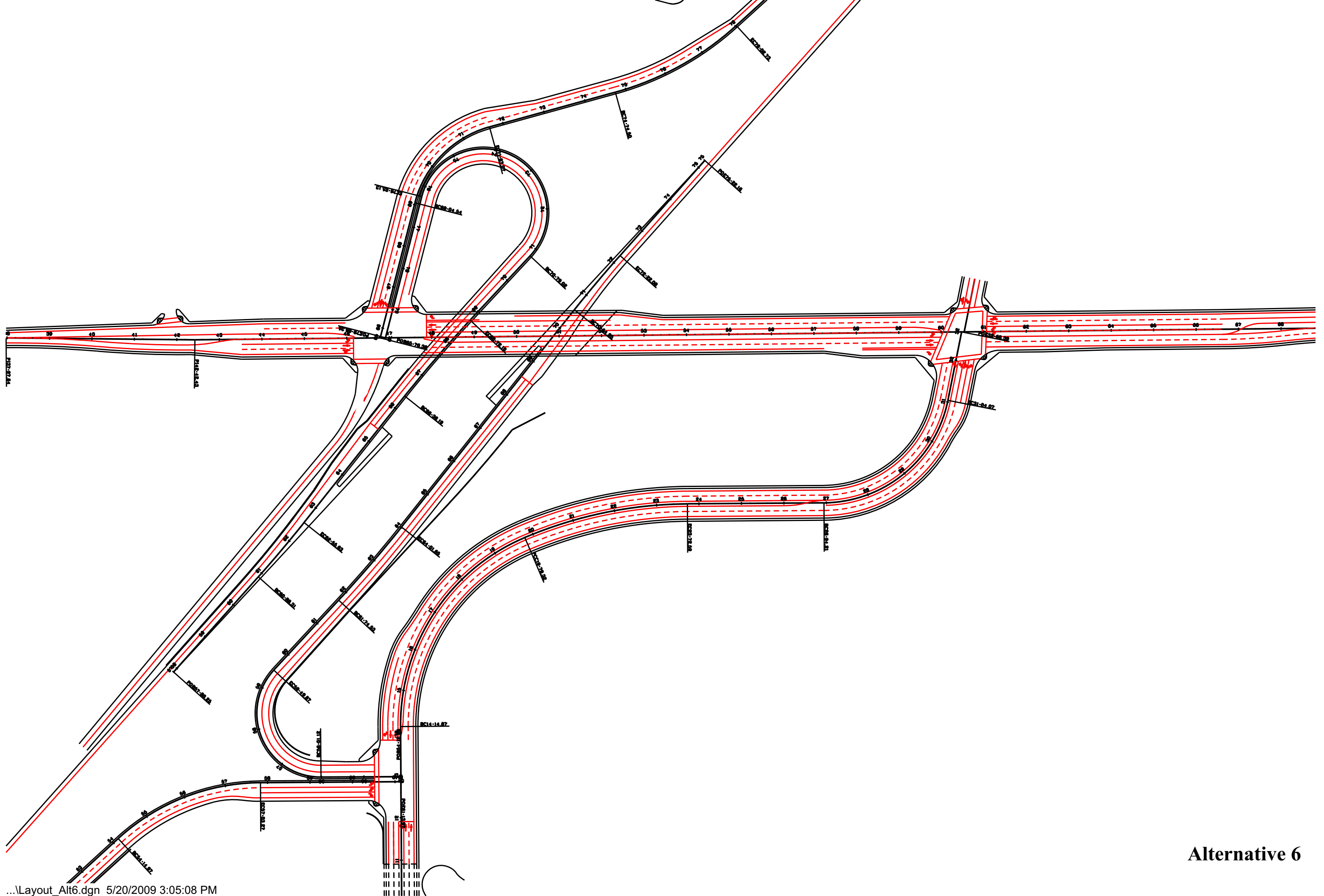
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Alternative 3

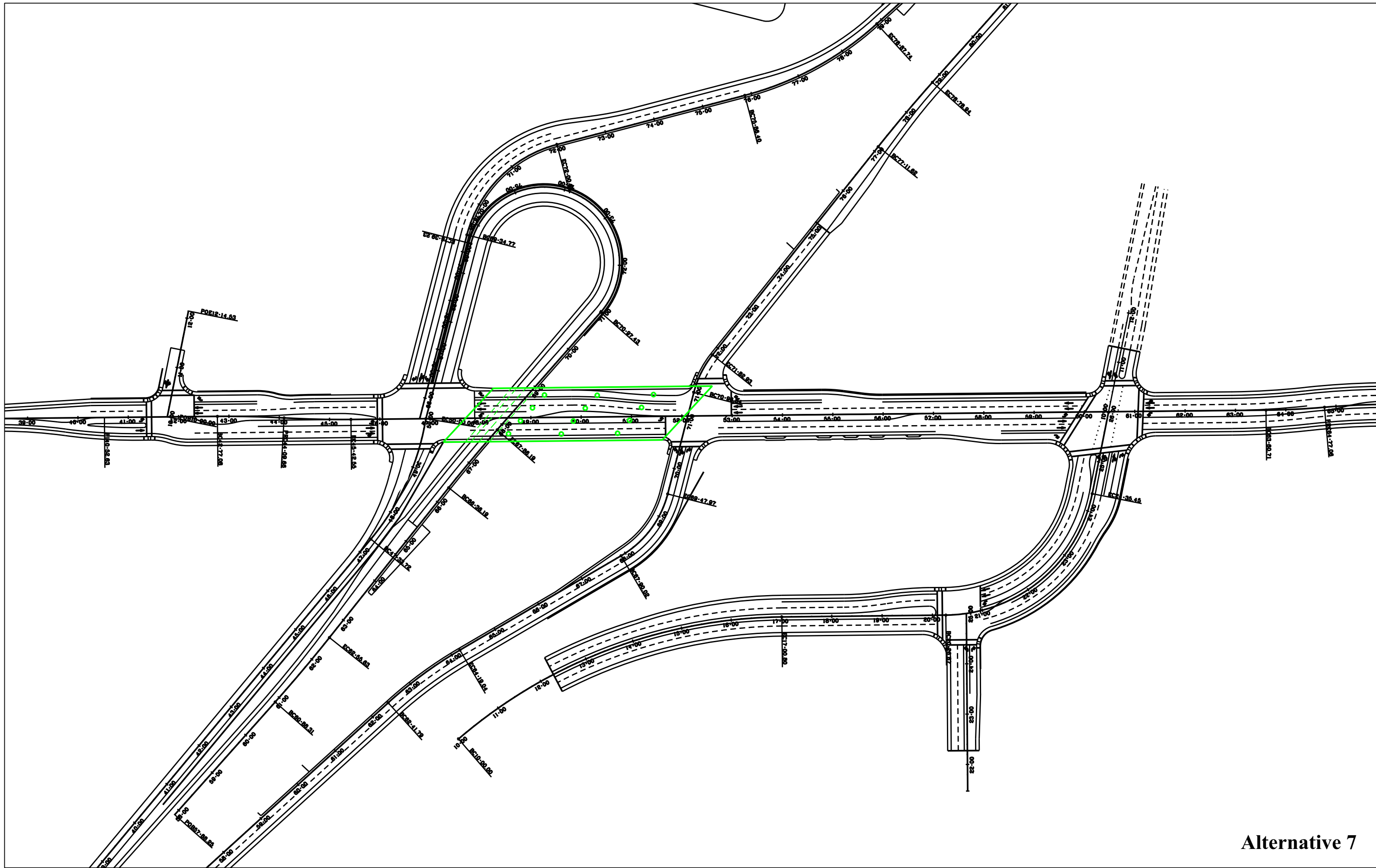


Alternative 4





Alternative 6



Alternative 7

APPENDIX B
Year 2009 Traffic Counts

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City of Grand Terrace
 N/S: La Cadena Drive
 E/W: Barton Road
 Weather: Sunny

File Name : GTRCABAAM
 Site Code : 9054028
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
07:00 AM	42	85	127	20	73	93	124	9	133	353
07:15 AM	54	127	181	23	59	82	114	20	134	397
07:30 AM	56	163	219	11	33	44	99	19	118	381
07:45 AM	68	132	200	25	56	81	95	29	124	405
Total	220	507	727	79	221	300	432	77	509	1536
08:00 AM	42	83	125	18	55	73	83	15	98	296
08:15 AM	32	73	105	15	40	55	56	19	75	235
08:30 AM	30	77	107	14	25	39	65	26	91	237
08:45 AM	31	78	109	19	28	47	84	21	105	261
Total	135	311	446	66	148	214	288	81	369	1029
Grand Total	355	818	1173	145	369	514	720	158	878	2565
Apprch %	30.3	69.7		28.2	71.8		82	18		
Total %	13.8	31.9	45.7	5.7	14.4	20	28.1	6.2	34.2	

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	42	85	127	20	73	93	124	9	133	353
07:15 AM	54	127	181	23	59	82	114	20	134	397
07:30 AM	56	163	219	11	33	44	99	19	118	381
07:45 AM	68	132	200	25	56	81	95	29	124	405
Total Volume	220	507	727	79	221	300	432	77	509	1536
% App. Total	30.3	69.7		26.3	73.7		84.9	15.1		
PHF	.809	.778	.830	.790	.757	.806	.871	.664	.950	.948

City of Grand Terrace
 N/S: La Cadena Drive
 E/W: Barton Road
 Weather: Sunny

File Name : GTRCABAPM
 Site Code : 9054028
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
04:00 PM	64	96	160	31	50	81	102	25	127	368
04:15 PM	72	107	179	30	38	68	141	29	170	417
04:30 PM	59	136	195	35	39	74	154	34	188	457
04:45 PM	68	126	194	44	42	86	155	38	193	473
Total	263	465	728	140	169	309	552	126	678	1715
05:00 PM	71	143	214	32	45	77	180	29	209	500
05:15 PM	68	159	227	47	38	85	173	46	219	531
05:30 PM	65	102	167	51	47	98	157	39	196	461
05:45 PM	63	82	145	31	36	67	131	37	168	380
Total	267	486	753	161	166	327	641	151	792	1872
Grand Total	530	951	1481	301	335	636	1193	277	1470	3587
Apprch %	35.8	64.2		47.3	52.7		81.2	18.8		
Total %	14.8	26.5	41.3	8.4	9.3	17.7	33.3	7.7	41	

Start Time	La Cadena Drive Southbound			Barton Road Westbound			La Cadena Drive Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	68	126	194	44	42	86	155	38	193	473
05:00 PM	71	143	214	32	45	77	180	29	209	500
05:15 PM	68	159	227	47	38	85	173	46	219	531
05:30 PM	65	102	167	51	47	98	157	39	196	461
Total Volume	272	530	802	174	172	346	665	152	817	1965
% App. Total	33.9	66.1		50.3	49.7		81.4	18.6		
PHF	.958	.833	.883	.853	.915	.883	.924	.826	.933	.925

City of Grand Terrace
 N/S: Grand Terrace Road
 E/W: Barton Road
 Weather: Overcast

File Name : GTRGTBAAM
 Site Code : 9054025
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
07:00 AM	2	1	3	111	2	113	3	50	53	169
07:15 AM	5	1	6	79	2	81	1	61	62	149
07:30 AM	4	0	4	66	0	66	1	74	75	145
07:45 AM	5	1	6	91	5	96	2	88	90	192
Total	16	3	19	347	9	356	7	273	280	655
08:00 AM	10	0	10	112	6	118	0	49	49	177
08:15 AM	11	2	13	75	5	80	0	59	59	152
08:30 AM	8	1	9	60	10	70	0	58	58	137
08:45 AM	8	0	8	54	2	56	3	55	58	122
Total	37	3	40	301	23	324	3	221	224	588
Grand Total	53	6	59	648	32	680	10	494	504	1243
Apprch %	89.8	10.2		95.3	4.7		2	98		
Total %	4.3	0.5	4.7	52.1	2.6	54.7	0.8	39.7	40.5	

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
07:30 AM	4	0	4	66	0	66	1	74	75	145
07:45 AM	5	1	6	91	5	96	2	88	90	192
08:00 AM	10	0	10	112	6	118	0	49	49	177
08:15 AM	11	2	13	75	5	80	0	59	59	152
Total Volume	30	3	33	344	16	360	3	270	273	666
% App. Total	90.9	9.1		95.6	4.4		1.1	98.9		
PHF	.682	.375	.635	.768	.667	.763	.375	.767	.758	.867

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

City of Grand Terrace
 N/S: Grand Terrace Road
 E/W: Barton Road
 Weather: Sunny

File Name : GTRGTBAPM
 Site Code : 9054025
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
04:00 PM	4	2	6	81	4	85	3	98	101	192
04:15 PM	7	5	12	70	6	76	3	99	102	190
04:30 PM	5	5	10	74	5	79	4	102	106	195
04:45 PM	4	1	5	74	11	85	3	106	109	199
Total	20	13	33	299	26	325	13	405	418	776
05:00 PM	6	2	8	72	7	79	2	121	123	210
05:15 PM	2	7	9	73	4	77	8	136	144	230
05:30 PM	8	6	14	86	7	93	8	139	147	254
05:45 PM	7	3	10	61	5	66	4	102	106	182
Total	23	18	41	292	23	315	22	498	520	876
Grand Total	43	31	74	591	49	640	35	903	938	1652
Apprch %	58.1	41.9		92.3	7.7		3.7	96.3		
Total %	2.6	1.9	4.5	35.8	3	38.7	2.1	54.7	56.8	

Start Time	Grand Terrace Road Southbound			Barton Road Westbound			Barton Road Eastbound			Int. Total
	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	4	1	5	74	11	85	3	106	109	199
05:00 PM	6	2	8	72	7	79	2	121	123	210
05:15 PM	2	7	9	73	4	77	8	136	144	230
05:30 PM	8	6	14	86	7	93	8	139	147	254
Total Volume	20	16	36	305	29	334	21	502	523	893
% App. Total	55.6	44.4		91.3	8.7		4	96		
PHF	.625	.571	.643	.887	.659	.898	.656	.903	.889	.879

Counts Unlimited Inc.
 25286 Jaclyn Avenue
 Moreno Valley, CA 92557
 951-485-7934

City of Grand Terrace
 N/S: I-215 SB Ramps/La Crosse Av
 E/W: Barton Road
 Weather: Sunny

File Name : GTR215SBAAM
 Site Code : 9054022
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total					
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total						
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	33	2	6	17	58	65	5	97	0	167	0	0	0	0	0	0	0	0	2	2	0	45	3	3	51	278					
07:15 AM	48	1	6	22	77	90	3	69	0	162	0	0	0	0	0	1	0	0	3	4	1	50	6	1	58	301					
07:30 AM	63	1	5	16	85	109	3	51	0	163	0	0	0	0	0	1	0	0	4	5	3	69	16	1	89	342					
07:45 AM	46	2	8	23	79	105	4	86	1	196	0	0	0	0	0	1	0	1	5	7	2	97	7	1	107	389					
Total	190	6	25	78	299	369	15	303	1	688	0	0	0	0	0	3	0	1	14	18	6	261	32	6	305	1310					
08:00 AM	50	1	8	26	85	81	6	87	3	177	0	0	0	0	0	2	0	0	5	7	3	54	7	4	68	337					
08:15 AM	46	4	7	35	92	93	7	64	1	165	0	0	0	0	0	0	0	0	13	13	1	71	9	2	83	353					
08:30 AM	45	4	4	16	69	73	4	53	3	133	0	0	0	0	0	1	0	0	4	5	1	70	8	4	83	290					
08:45 AM	46	1	5	18	70	57	4	47	2	110	0	0	0	0	0	0	0	0	13	13	2	68	11	3	84	277					
Total	187	10	24	95	316	304	21	251	9	585	0	0	0	0	0	3	0	0	35	38	7	263	35	13	318	1257					
Grand Total	377	16	49	173	615	673	36	554	10	1273	0	0	0	0	0	6	0	1	49	56	13	524	67	19	623	2567					
Apprch %	61.3	2.6	8	28.1		52.9	2.8	43.5	0.8		0	0	0	0		10.7	0	1.8	87.5		2.1	84.1	10.8	3							
Total %	14.7	0.6	1.9	6.7	24	26.2	1.4	21.6	0.4	49.6	0	0	0	0	0	0.2	0	0	1.9	2.2	0.5	20.4	2.6	0.7	24.3						

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

07:30 AM	63	1	5	16	85	109	3	51	0	163	0	0	0	0	0	1	0	0	4	5	3	69	16	1	89	342
07:45 AM	46	2	8	23	79	105	4	86	1	196	0	0	0	0	0	1	0	1	5	7	2	97	7	1	107	389
08:00 AM	50	1	8	26	85	81	6	87	3	177	0	0	0	0	0	2	0	0	5	7	3	54	7	4	68	337
08:15 AM	46	4	7	35	92	93	7	64	1	165	0	0	0	0	0	0	0	0	13	13	1	71	9	2	83	353
Total Volume	205	8	28	100	341	388	20	288	5	701	0	0	0	0	0	4	0	1	27	32	9	291	39	8	347	1421
% App. Total	60.1	2.3	8.2	29.3		55.3	2.9	41.1	0.7		0	0	0	0		12.5	0	3.1	84.4		2.6	83.9	11.2	2.3		
PHF	.813	.500	.875	.714	.927	.890	.714	.828	.417	.894	.000	.000	.000	.000	.000	.500	.000	.250	.519	.615	.750	.750	.609	.500	.811	.913

City of Grand Terrace
 N/S: I-215 Southbound Ramos/La Crosse Av
 E/W: Barton Road
 Weather: Sunny

File Name : GTR215SBAPM
 Site Code : 9054022
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total					
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total						
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	82	3	3	27	115	59	5	62	4	130	0	0	0	0	0	0	0	0	13	13	1	111	15	1	128	386					
04:15 PM	48	1	5	15	69	60	1	67	2	130	0	0	0	0	0	1	0	0	11	12	0	104	10	1	115	326					
04:30 PM	43	0	5	14	62	79	5	68	4	156	0	0	0	0	0	1	0	0	10	11	1	114	10	0	125	354					
04:45 PM	67	7	2	27	103	68	1	64	1	134	0	0	0	0	0	0	0	0	5	5	1	111	4	0	116	358					
Total	240	11	15	83	349	266	12	261	11	550	0	0	0	0	0	2	0	0	39	41	3	440	39	2	484	1424					
05:00 PM	64	0	1	17	82	60	1	59	1	121	0	0	0	0	0	1	0	0	30	31	0	144	20	1	165	399					
05:15 PM	63	0	1	26	90	76	2	61	0	139	0	0	0	0	0	0	0	0	14	14	0	137	15	1	153	396					
05:30 PM	72	1	0	21	94	94	1	69	4	168	0	0	0	0	0	0	0	0	12	12	2	135	25	0	162	436					
05:45 PM	70	1	0	15	86	56	0	58	5	119	0	0	0	0	0	0	0	0	7	7	0	125	11	1	137	349					
Total	269	2	2	79	352	286	4	247	10	547	0	0	0	0	0	1	0	0	63	64	2	541	71	3	617	1580					
Grand Total	509	13	17	162	701	552	16	508	21	1097	0	0	0	0	0	3	0	0	102	105	5	981	110	5	1101	3004					
Apprch %	72.6	1.9	2.4	23.1		50.3	1.5	46.3	1.9		0	0	0	0		2.9	0	0	97.1		0.5	89.1	10	0.5							
Total %	16.9	0.4	0.6	5.4	23.3	18.4	0.5	16.9	0.7	36.5	0	0	0	0		0.1	0	0	3.4	3.5	0.2	32.7	3.7	0.2	36.7						

Start Time	La Crosse Avenue/I-215 Southbound Off Ramp Southbound					Barton Road Westbound					I-215 Southbound On Ramp Northbound					La Crosse Avenue Northeastbound					Barton Road Eastbound					Int. Total
	Left	Thru	Bear Right	Right	App. Total	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 04:45 PM

04:45 PM	67	7	2	27	103	68	1	64	1	134	0	0	0	0	0	0	0	0	5	5	1	111	4	0	116	358
05:00 PM	64	0	1	17	82	60	1	59	1	121	0	0	0	0	0	1	0	0	30	31	0	144	20	1	165	399
05:15 PM	63	0	1	26	90	76	2	61	0	139	0	0	0	0	0	0	0	0	14	14	0	137	15	1	153	396
05:30 PM	72	1	0	21	94	94	1	69	4	168	0	0	0	0	0	0	0	0	12	12	2	135	25	0	162	436
Total Volume	266	8	4	91	369	298	5	253	6	562	0	0	0	0	0	1	0	0	61	62	3	527	64	2	596	1589
% App. Total	72.1	2.2	1.1	24.7		53	0.9	45	1.1		0	0	0	0		1.6	0	0	98.4		0.5	88.4	10.7	0.3		
PHF	.924	.286	.500	.843	.896	.793	.625	.917	.375	.836	.000	.000	.000	.000	.000	.250	.000	.000	.508	.500	.375	.915	.640	.500	.903	.911

City of Grand Terrace
 N/S: I-215 Northbound Ramps
 E/W: Barton Road
 Weather: Sunny

File Name : GTR215NBAAM
 Site Code : 9054043
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Passenger Vehicles - Large 2 Axle Vehicles - 3 Axle Vehicles - 4+ Axle Trucks

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
07:00 AM	0	0	0	0	0	169	78	247	10	0	61	71	14	60	0	74	392
07:15 AM	0	0	0	0	0	142	78	220	12	0	74	86	11	92	0	103	409
07:30 AM	0	0	0	0	0	163	82	245	5	0	87	92	27	116	0	143	480
07:45 AM	0	0	0	0	0	171	78	249	17	0	72	89	23	111	0	134	472
Total	0	0	0	0	0	645	316	961	44	0	294	338	75	379	0	454	1753
08:00 AM	0	0	0	0	0	158	57	215	27	0	71	98	14	100	0	114	427
08:15 AM	0	0	0	0	0	144	69	213	12	0	61	73	28	82	0	110	396
08:30 AM	0	0	0	0	0	126	63	189	15	0	60	75	18	99	0	117	381
08:45 AM	0	0	0	0	0	104	63	167	8	1	59	68	17	96	0	113	348
Total	0	0	0	0	0	532	252	784	62	1	251	314	77	377	0	454	1552
Grand Total	0	0	0	0	0	1177	568	1745	106	1	545	652	152	756	0	908	3305
Apprch %	0	0	0	0	0	67.4	32.6	0	16.3	0.2	83.6	0	16.7	83.3	0	0	0
Total %	0	0	0	0	0	35.6	17.2	52.8	3.2	0	16.5	19.7	4.6	22.9	0	27.5	0
Passenger Vehicles	0	0	0	0	0	1151	547	1698	96	1	525	622	129	720	0	849	3169
% Passenger Vehicles	0	0	0	0	0	97.8	96.3	97.3	90.6	100	96.3	95.4	84.9	95.2	0	93.5	95.9
Large 2 Axle Vehicles	0	0	0	0	0	23	18	41	1	0	15	16	9	30	0	39	96
% Large 2 Axle Vehicles																	
3 Axle Vehicles	0	0	0	0	0	2	0	2	0	0	2	2	8	4	0	12	16
% 3 Axle Vehicles	0	0	0	0	0	0.2	0	0.1	0	0	0.4	0.3	5.3	0.5	0	1.3	0.5
4+ Axle Trucks	0	0	0	0	0	1	3	4	9	0	3	12	6	2	0	8	24
% 4+ Axle Trucks	0	0	0	0	0	0.1	0.5	0.2	8.5	0	0.6	1.8	3.9	0.3	0	0.9	0.7

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	0	0	0	0	142	78	220	12	0	74	86	11	92	0	103	409
07:30 AM	0	0	0	0	0	163	82	245	5	0	87	92	27	116	0	143	480
07:45 AM	0	0	0	0	0	171	78	249	17	0	72	89	23	111	0	134	472
08:00 AM	0	0	0	0	0	158	57	215	27	0	71	98	14	100	0	114	427
Total Volume	0	0	0	0	0	634	295	929	61	0	304	365	75	419	0	494	1788
% App. Total	0	0	0	0	0	68.2	31.8	0	16.7	0	83.3	0	15.2	84.8	0	0	0
PHF	.000	.000	.000	.000	.000	.927	.899	.933	.565	.000	.874	.931	.694	.903	.000	.864	.931

City of Grand Terrace
 N/S: I-215 Northbound Ramps
 E/W: Barton Road
 Weather: Sunny

File Name : GTR215NBAPM
 Site Code : 9054043
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Passenger Vehicles - Large 2 Axle Vehicles - 3 Axle Vehicles - 4+ Axle Trucks

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
04:00 PM	0	0	0	0	0	119	75	194	6	0	90	96	31	160	0	191	481
04:15 PM	0	0	0	0	0	129	74	203	9	0	80	89	25	128	0	153	445
04:30 PM	0	0	0	0	0	139	50	189	10	0	87	97	22	138	0	160	446
04:45 PM	0	0	0	0	0	126	61	187	5	0	86	91	31	149	0	180	458
Total	0	0	0	0	0	513	260	773	30	0	343	373	109	575	0	684	1830
05:00 PM	0	0	0	0	0	115	75	190	7	0	98	105	52	156	0	208	503
05:15 PM	0	0	0	0	0	139	57	196	10	0	103	113	41	147	0	188	497
05:30 PM	0	0	0	0	0	151	58	209	7	0	98	105	31	185	0	216	530
05:45 PM	0	0	0	0	0	116	46	162	2	0	105	107	35	154	0	189	458
Total	0	0	0	0	0	521	236	757	26	0	404	430	159	642	0	801	1988
Grand Total	0	0	0	0	0	1034	496	1530	56	0	747	803	268	1217	0	1485	3818
Apprch %	0	0	0	0	0	67.6	32.4		7	0	93		18	82	0		
Total %	0	0	0	0	0	27.1	13	40.1	1.5	0	19.6	21	7	31.9	0	38.9	
Passenger Vehicles	0	0	0	0	0	1023	490	1513	47	0	737	784	243	1204	0	1447	3744
% Passenger Vehicles	0	0	0	0	0	98.9	98.8	98.9	83.9	0	98.7	97.6	90.7	98.9	0	97.4	98.1
Large 2 Axle Vehicles	0	0	0	0	0	7	3	10	3	0	9	12	4	12	0	16	38
% Large 2 Axle Vehicles																	
3 Axle Vehicles	0	0	0	0	0	3	2	5	2	0	1	3	2	1	0	3	11
% 3 Axle Vehicles	0	0	0	0	0	0.3	0.4	0.3	3.6	0	0.1	0.4	0.7	0.1	0	0.2	0.3
4+ Axle Trucks	0	0	0	0	0	1	1	2	4	0	0	4	19	0	0	19	25
% 4+ Axle Trucks	0	0	0	0	0	0.1	0.2	0.1	7.1	0	0	0.5	7.1	0	0	1.3	0.7

Start Time	I-215 Northbound On Ramp Southbound				Barton Road Westbound				I-215 Northbound Off Ramp Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	0	0	0	0	126	61	187	5	0	86	91	31	149	0	180	458
05:00 PM	0	0	0	0	0	115	75	190	7	0	98	105	52	156	0	208	503
05:15 PM	0	0	0	0	0	139	57	196	10	0	103	113	41	147	0	188	497
05:30 PM	0	0	0	0	0	151	58	209	7	0	98	105	31	185	0	216	530
Total Volume	0	0	0	0	0	531	251	782	29	0	385	414	155	637	0	792	1988
% App. Total	0	0	0	0	0	67.9	32.1		7	0	93		19.6	80.4	0		
PHF	.000	.000	.000	.000	.000	.879	.837	.935	.725	.000	.934	.916	.745	.861	.000	.917	.938

City of Grand Terrace
 N/S: Michigan Street
 E/W: Barton Road
 Weather: Sunny

File Name : GTRMIBAAM1
 Site Code : 9054131
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
07:00 AM	11	138	149	89	13	102	73	39	112	363
07:15 AM	6	126	132	82	13	95	105	44	149	376
07:30 AM	5	148	153	83	15	98	145	52	197	448
07:45 AM	11	178	189	54	10	64	122	30	152	405
Total	33	590	623	308	51	359	445	165	610	1592
08:00 AM	13	117	130	66	6	72	105	35	140	342
08:15 AM	18	128	146	59	12	71	121	19	140	357
08:30 AM	23	117	140	53	33	86	118	25	143	369
08:45 AM	27	124	151	41	50	91	114	34	148	390
Total	81	486	567	219	101	320	458	113	571	1458
Grand Total	114	1076	1190	527	152	679	903	278	1181	3050
Apprch %	9.6	90.4		77.6	22.4		76.5	23.5		
Total %	3.7	35.3	39	17.3	5	22.3	29.6	9.1	38.7	

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	11	138	149	89	13	102	73	39	112	363
07:15 AM	6	126	132	82	13	95	105	44	149	376
07:30 AM	5	148	153	83	15	98	145	52	197	448
07:45 AM	11	178	189	54	10	64	122	30	152	405
Total Volume	33	590	623	308	51	359	445	165	610	1592
% App. Total	5.3	94.7		85.8	14.2		73	27		
PHF	.750	.829	.824	.865	.850	.880	.767	.793	.774	.888

City of Grand Terrace
 N/S: Michigan Street
 E/W: Barton Road
 Weather: Sunny

File Name : GTRMIBAPM2
 Site Code : 9054131
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Factor	1.0	1.0		1.0	1.0		1.0	1.0		
04:00 PM	18	113	131	62	31	93	187	26	213	437
04:15 PM	28	106	134	52	30	82	157	23	180	396
04:30 PM	25	110	135	42	22	64	163	39	202	401
04:45 PM	18	113	131	38	17	55	155	39	194	380
Total	89	442	531	194	100	294	662	127	789	1614
05:00 PM	23	138	161	63	22	85	177	49	226	472
05:15 PM	19	123	142	35	29	64	171	62	233	439
05:30 PM	21	155	176	45	26	71	186	58	244	491
05:45 PM	22	106	128	32	27	59	162	49	211	398
Total	85	522	607	175	104	279	696	218	914	1800
Grand Total	174	964	1138	369	204	573	1358	345	1703	3414
Apprch %	15.3	84.7		64.4	35.6		79.7	20.3		
Total %	5.1	28.2	33.3	10.8	6	16.8	39.8	10.1	49.9	

Start Time	Barton Road Westbound			Michigan Street Northbound			Barton Road Eastbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	23	138	161	63	22	85	177	49	226	472
05:15 PM	19	123	142	35	29	64	171	62	233	439
05:30 PM	21	155	176	45	26	71	186	58	244	491
05:45 PM	22	106	128	32	27	59	162	49	211	398
Total Volume	85	522	607	175	104	279	696	218	914	1800
% App. Total	14	86		62.7	37.3		76.1	23.9		
PHF	.924	.842	.862	.694	.897	.821	.935	.879	.936	.916

City of Grand Terrace
 N/S: Vivienda Avenue
 E/W: Barton Road
 Weather: Sunny

File Name : GTRVIBAAM
 Site Code : 9054135
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
07:00 AM	0	0	7	7	0	151	1	152	0	0	0	0	3	87	0	90	249
07:15 AM	0	0	11	11	1	121	4	126	0	0	0	0	3	110	2	115	252
07:30 AM	2	0	6	8	0	143	5	148	2	0	0	2	11	154	1	166	324
07:45 AM	1	0	10	11	0	178	5	183	0	0	1	1	10	131	0	141	336
Total	3	0	34	37	1	593	15	609	2	0	1	3	27	482	3	512	1161
08:00 AM	1	0	8	9	3	128	3	134	1	0	0	1	7	105	0	112	256
08:15 AM	1	0	13	14	2	130	16	148	2	0	0	2	24	104	1	129	293
08:30 AM	5	0	36	41	0	109	15	124	1	0	2	3	58	94	5	157	325
08:45 AM	4	0	33	37	2	105	14	121	1	0	0	1	73	96	3	172	331
Total	11	0	90	101	7	472	48	527	5	0	2	7	162	399	9	570	1205
Grand Total	14	0	124	138	8	1065	63	1136	7	0	3	10	189	881	12	1082	2366
Apprch %	10.1	0	89.9		0.7	93.8	5.5		70	0	30		17.5	81.4	1.1		
Total %	0.6	0	5.2	5.8	0.3	45	2.7	48	0.3	0	0.1	0.4	8	37.2	0.5	45.7	

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	1	0	10	11	0	178	5	183	0	0	1	1	10	131	0	141	336
08:00 AM	1	0	8	9	3	128	3	134	1	0	0	1	7	105	0	112	256
08:15 AM	1	0	13	14	2	130	16	148	2	0	0	2	24	104	1	129	293
08:30 AM	5	0	36	41	0	109	15	124	1	0	2	3	58	94	5	157	325
Total Volume	8	0	67	75	5	545	39	589	4	0	3	7	99	434	6	539	1210
% App. Total	10.7	0	89.3		0.8	92.5	6.6		57.1	0	42.9		18.4	80.5	1.1		
PHF	.400	.000	.465	.457	.417	.765	.609	.805	.500	.000	.375	.583	.427	.828	.300	.858	.900

City of Grand Terrace
 N/S: Vivienda Avenue
 E/W: Barton Road
 Weather: Sunny

File Name : GTRVIBAPM
 Site Code : 9054135
 Start Date : 2/26/2009
 Page No : 1

Groups Printed- Total Volume

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
04:00 PM	2	0	11	13	3	128	2	133	3	0	2	5	10	198	6	214	365
04:15 PM	2	0	22	24	3	131	10	144	0	0	9	9	23	165	3	191	368
04:30 PM	2	0	14	16	2	137	2	141	1	0	2	3	14	179	2	195	355
04:45 PM	2	0	15	17	4	145	5	154	1	0	5	6	6	185	3	194	371
Total	8	0	62	70	12	541	19	572	5	0	18	23	53	727	14	794	1459
05:00 PM	0	0	8	8	1	142	4	147	2	0	1	3	8	196	3	207	365
05:15 PM	1	0	6	7	0	156	5	161	0	0	2	2	9	209	3	221	391
05:30 PM	2	0	5	7	0	171	5	176	0	0	4	4	7	229	1	237	424
05:45 PM	0	1	4	5	1	123	1	125	2	0	1	3	9	205	1	215	348
Total	3	1	23	27	2	592	15	609	4	0	8	12	33	839	8	880	1528
Grand Total	11	1	85	97	14	1133	34	1181	9	0	26	35	86	1566	22	1674	2987
Apprch %	11.3	1	87.6		1.2	95.9	2.9		25.7	0	74.3		5.1	93.5	1.3		
Total %	0.4	0	2.8	3.2	0.5	37.9	1.1	39.5	0.3	0	0.9	1.2	2.9	52.4	0.7	56	

Start Time	Vivienda Avenue Southbound				Barton Road Westbound				Private Driveway Northbound				Barton Road Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	2	0	15	17	4	145	5	154	1	0	5	6	6	185	3	194	371
05:00 PM	0	0	8	8	1	142	4	147	2	0	1	3	8	196	3	207	365
05:15 PM	1	0	6	7	0	156	5	161	0	0	2	2	9	209	3	221	391
05:30 PM	2	0	5	7	0	171	5	176	0	0	4	4	7	229	1	237	424
Total Volume	5	0	34	39	5	614	19	638	3	0	12	15	30	819	10	859	1551
% App. Total	12.8	0	87.2		0.8	96.2	3		20	0	80		3.5	95.3	1.2		
PHF	.625	.000	.567	.574	.313	.898	.950	.906	.375	.000	.600	.625	.833	.894	.833	.906	.915

APPENDIX C
Volume Development
Calculation Worksheets

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2040 Volume Development

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INTERSECTION	AM EXISTING VEHICLE TURNING MOVEMENT COUNTS											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	432	77	0	0	0	220	507	0	79	0	221
2. Barton Rd & Grand Terrace Rd	0	0	0	3	270	0	30	0	3	0	344	16
3. Barton Rd & La Crosse Ave	4	0	28	0	339	8	0	28	100	20	288	0
4. Barton Rd & I-215 SB Ramps	0	0	0	9	292	66	205	8	0	388	308	5
5. Barton Rd & I-215 NB Ramps	61	0	304	75	419	0	0	0	0	0	634	295
6. Barton Rd & Michigan St	308	0	51	0	445	165	0	0	0	33	590	0
7. Barton Rd & Vivienda Ave	4	0	3	99	434	6	8	0	67	5	545	39

INTERSECTION	PM EXISTING VEHICLE TURNING MOVEMENT COUNTS											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	665	152	0	0	0	272	530	0	174	0	172
2. Barton Rd & Grand Terrace Rd	0	0	0	21	502	0	20	0	16	0	305	29
3. Barton Rd & La Crosse Ave	1	0	61	0	594	2	0	4	91	5	253	0
4. Barton Rd & I-215 SB Ramps	0	0	0	3	527	125	266	8	0	298	258	6
5. Barton Rd & I-215 NB Ramps	29	0	385	155	637	0	0	0	0	0	531	251
6. Barton Rd & Michigan St	175	0	104	0	696	218	0	0	0	85	522	0
7. Barton Rd & Vivienda Ave	3	0	12	30	819	10	5	0	34	5	614	19

INTERSECTION	AM EXISTING VEHICLE TURNING MOVEMENT - Adjustments											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave												
4. Barton Rd & I-215 SB Ramps					-1	1						
5. Barton Rd & I-215 NB Ramps					2						6	
6. Barton Rd & Michigan St					115						37	
7. Barton Rd & Vivienda Ave	-4		-3		78	-6				-5	48	

INTERSECTION	PM EXISTING VEHICLE TURNING MOVEMENT - Adjustments											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave											113	
4. Barton Rd & I-215 SB Ramps											113	
5. Barton Rd & I-215 NB Ramps	25		-91	-31	32						90	33
6. Barton Rd & Michigan St					49						208	
7. Barton Rd & Vivienda Ave	-3		-12			-10				-5	167	

INTERSECTION	AM EXISTING VEHICLE TURNING MOVEMENT - BALANCED											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	432	77	0	0	0	220	507	0	79	0	221
2. Barton Rd & Grand Terrace Rd	0	0	0	3	270	0	30	0	3	0	344	16
3. Barton Rd & La Crosse Ave	4	0	28	0	339	8	0	28	100	20	288	0
4. Barton Rd & I-215 SB Ramps	0	0	0	9	291	67	205	8	0	388	308	5
5. Barton Rd & I-215 NB Ramps	61	0	304	75	421	0	0	0	0	0	640	295
6. Barton Rd & Michigan St	308	0	51	0	560	165	0	0	0	33	627	0
7. Barton Rd & Vivienda Ave	0	0	0	99	512	0	8	0	67	0	593	39

INTERSECTION	PM EXISTING VEHICLE TURNING MOVEMENT - BALANCED											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	665	152	0	0	0	272	530	0	174	0	172
2. Barton Rd & Grand Terrace Rd	0	0	0	21	502	0	20	0	16	0	305	29
3. Barton Rd & La Crosse Ave	1	0	61	0	594	2	0	4	91	5	366	0
4. Barton Rd & I-215 SB Ramps	0	0	0	3	527	125	266	8	0	298	371	6
5. Barton Rd & I-215 NB Ramps	54	0	294	124	669	0	0	0	0	0	621	284
6. Barton Rd & Michigan St	175	0	104	0	745	218	0	0	0	85	730	0
7. Barton Rd & Vivienda Ave	0	0	0	30	819	0	5	0	34	0	781	19

INTERSECTION	AM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd	0	0	0	178	672	0	190	0	24	0	808	75
3. Barton Rd & La Crosse Ave	7	0	17	0	858	3	0	22	306	21	570	
4. Barton Rd & I-215 SB Ramps	0	0	0	2	754	119	382	0	0	907	591	11
5. Barton Rd & I-215 NB Ramps	132	0	574	227	909	0	0	0	0	0	1377	868
6. Barton Rd & Michigan St	896	0	183	0	1003	480	0	0	0	173	1350	0
7. Barton Rd & Vivienda Ave	0	0	0	155	1031	0	21	0	165	0	1358	65

INTERSECTION	PM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd	0	0	0	52	1420	0	38	0	3	0	1111	26
3. Barton Rd & La Crosse Ave	8	0	63	0	1455	3	0	6	360	7	769	
4. Barton Rd & I-215 SB Ramps	0	0	0	5	1255	258	523	0	0	615	776	10
5. Barton Rd & I-215 NB Ramps	34	0	901	267	1512	0	0	0	0	0	1367	655
6. Barton Rd & Michigan St	516	0	364	0	1796	616	0	0	0	259	1506	0
7. Barton Rd & Vivienda Ave	0	0	0	45	2115	0	3	0	33	0	1732	23

Volume same as Existing

INTERSECTION	AM Ait2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	0	754	119	382	22	306	907	591	0
5. Barton Rd & I-215 NB Ramps	132	0	574	227	909	0	0	0	0	0	1366	868
7. Barton Rd & Vivienda Ave/Michigan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM Ait2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	0	1255	258	523	6	360	615	776	0
5. Barton Rd & I-215 NB Ramps	34	0	901	267	1512	0	0	0	0	0	1357	655
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

INTERSECTION	AM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	119	754	0	382	0	306	0	591	907
5. Barton Rd & I-215 NB Ramps	132	0	574	0	909	227	0	0	0	868	1366	0
7. Barton Rd & Vivienda Ave/Michagan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	258	1255	0	523	0	360	0	776	615
5. Barton Rd & I-215 NB Ramps	34	0	901	0	1512	267	0	0	0	655	1357	0
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

INTERSECTION	AM A1t5 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 Ramps	132	0	574	227	527	119	382	22	306	907	459	868
7. Barton Rd & Vivienda Ave/Michigan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM A1t5 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 Ramps	34	0	901	267	988	258	523	6	360	615	742	655
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

INTERSECTION	AM Ait6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	119	754	0	382	0	306	0	591	907
5. Vivienda Ave & I-215 NB Ramps	348	1083		499		207		794	747			
7. Barton Rd & Vivienda Ave/Michagan	1028	41	513	155	482	499	21	33	132	1042	338	65

INTERSECTION	PM Ait6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	258	1255	0	523	0	360	0	776	615
5. Vivienda Ave & I-215 NB Ramps	168	905		700		235		809	754			
7. Barton Rd & Vivienda Ave	550	98	958	45	1085	649	3	7	26	914	814	23

INTERSECTION	AM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1029	264	0	0	0	620	1499	0	276	0	556
2. Barton Rd & Grand Terrace Rd & La Crosse Av	8	4	40	178	647	7	186	4	24	50	772	75
4. Barton Rd & I-215 SB Ramps	0	0	0	119	754	0	382	0	306	0	591	907
5. Barton Rd & I-215 NB Ramps	132	0	574	227	909	0	0	0	0	0	1366	868
6. Commerce Way & Michigan Ave	270		809		274	163				490	196	
7. Barton Rd & Vivienda Ave/Michigan	896	41	146	155	848	480	21	33	132	173	1207	65

INTERSECTION	PM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	2372	377	0	0	0	682	1984	0	341	0	671
2. Barton Rd & Grand Terrace Rd & La Crosse Av	11	6	175	52	1305	8	34	4	3	58	1051	26
4. Barton Rd & I-215 SB Ramps	0	0	0	258	1255	0	523	0	360	0	776	615
5. Barton Rd & I-215 NB Ramps	34	0	901	267	1512	0	0	0	0	0	1357	655
7. Barton Rd & Vivienda Ave/Michigan	220		660		245	219				657	225	
7. Barton Rd & Vivienda Ave/Michigan	516	98	291	45	1751	616	3	7	26	259	1469	23

2016 Volume Development

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INTERSECTION	AM Ait2 VEHICLE TURNING MOVEMENT Growth Rate Applied to Arterial Volumes											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave					435							
4. Barton Rd & I-215 SB Ramps					374							
5. Barton Rd & I-215 NB Ramps											814	
6. Barton Rd & Michigan St												
7. Barton Rd & Vivienda Ave												

INTERSECTION	PM Ait2 VEHICLE TURNING MOVEMENT Growth Rate Applied to Arterial Volumes											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr												
2. Barton Rd & Grand Terrace Rd												
3. Barton Rd & La Crosse Ave					763							
4. Barton Rd & I-215 SB Ramps					677							
5. Barton Rd & I-215 NB Ramps											797	
6. Barton Rd & Michigan St												
7. Barton Rd & Vivienda Ave												

INTERSECTION	AM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd	0	0	0	114	234	0	196	0	21	0	446	45
3. Barton Rd & La Crosse Ave	4	0	28	0	422	8	0	9	183	20	304	
4. Barton Rd & I-215 SB Ramps	0	0	0	2	374	74	229	0	0	564	324	11
5. Barton Rd & I-215 NB Ramps	74	0	368	113	490	0	0	0	0	0	825	431
6. Barton Rd & Michigan St	392	0	65	0	648	210	0	0	0	42	864	0
7. Barton Rd & Vivienda Ave	0	0	0	99	614	0	18	0	170	0	736	39

INTERSECTION	PM Ait1 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd	0	0	0	35	766	0	39	0	6	0	625	22
3. Barton Rd & La Crosse Ave	1	0	61	0	803	2	0	4	204	5	443	
4. Barton Rd & I-215 SB Ramps	0	0	0	5	677	183	296	0	0	436	448	10
5. Barton Rd & I-215 NB Ramps	86	0	468	159	813	0	0	0	0	0	807	390
6. Barton Rd & Michigan St	270	0	161	0	944	337	0	0	0	131	927	0
7. Barton Rd & Vivienda Ave	0	0	0	30	1075	0	5	0	34	0	1024	19

INTERSECTION	AM Aft2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av	3	1	40	114	218	11	190	6	21	28	434	45
4. Barton Rd & I-215 SB Ramps	0	0	0	0	374	74	229	9	183	564	324	0
5. Barton Rd & I-215 NB Ramps	74	0	368	113	490	0	0	0	0	0	814	431
7. Barton Rd & Vivienda Ave/Michigan	392	13	52	99	549	210	18	34	136	42	717	39

INTERSECTION	PM Aft2 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av	1	0	101	35	721	3	37	2	6	33	596	22
4. Barton Rd & I-215 SB Ramps	0	0	0	0	677	183	296	4	204	436	448	0
5. Barton Rd & I-215 NB Ramps	86	0	468	159	813	0	0	0	0	0	797	390
7. Barton Rd & Vivienda Ave/Michigan	270	32	129	30	914	337	5	7	27	131	890	19

INTERSECTION	AM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av	3	1	40	114	218	11	190	6	21	28	438	45
4. Barton Rd & I-215 SB Ramps	0	0	0	74	374	0	233	0	187	0	324	564
5. Barton Rd & I-215 NB Ramps	74	0	368	0	495	113	0	0	0	431	814	0
7. Barton Rd & Vivienda Ave/Michagan	392	13	52	99	554	210	18	34	136	42	717	39

INTERSECTION	PM Ait3 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av	1	0	101	35	721	3	37	2	6	33	598	22
4. Barton Rd & I-215 SB Ramps	0	0	0	183	677	0	298	0	205	0	448	436
5. Barton Rd & I-215 NB Ramps	86	0	468	0	816	159	0	0	0	390	797	0
7. Barton Rd & Vivienda Ave	270	32	129	30	914	337	5	7	27	131	890	19

INTERSECTION	AM A15 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av	3	1	40	114	218	11	190	6	21	28	438	45
4. Barton Rd & I-215 Ramps	74	0	368	113	261	74	233		187	564	250	431
7. Barton Rd & Vivienda Ave	392	13	52	99	549	210	18	34	136	42	717	39

INTERSECTION	PM A15 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av	1	0	101	35	721	3	37	2	6	33	598	22
4. Barton Rd & I-215 Ramps	86	0	468	159	518	183	298		205	436	362	390
7. Barton Rd & Vivienda Ave	270	32	129	30	914	337	5	7	27	131	890	19

INTERSECTION	AM AIt6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd				114	230		196		21		440	46
4. Barton Rd & I-215 SB Ramps & La Crosse Av	4	20	20	54	354	17	233	9	187	28	295	564
5. Vivienda Ave & I-215 NB Ramps	136	457		341		101		287	408			
7. Barton Rd & Vivienda Ave/Michagan	466	13	319	99	287	221	18	34	136	473	286	39

INTERSECTION	PM AIt6 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd				35	724		39		6		599	22
4. Barton Rd & I-215 SB Ramps & La Crosse Av	1	50	50	132	626	5	298	4	205	33	415	436
5. Vivienda Ave & I-215 NB Ramps	89	431		428		126		431	460			
7. Barton Rd & Vivienda Ave	356	32	470	30	573	370	5	7	27	521	500	19

INTERSECTION	AM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	611	109	0	0	0	311	717	0	112	0	313
2. Barton Rd & Grand Terrace Rd & La Crosse Av				114	230		196		21		440	46
4. Barton Rd & I-215 SB Ramps	4	20	20	54	354	17	233	9	187	28	295	564
5. Barton Rd & I-215 NB Ramps	74	0	368	113	490	0	0	0	0	0	814	431
6. Commerce Way & Michigan Ave	114		343		114	63				189	97	
7. Barton Rd & Vivienda Ave/Michigan	392	13	52	99	549	210	18	34	136	42	717	39

INTERSECTION	PM Ait7 VEHICLE TURNING MOVEMENT											
	NORTHBOUND			EASTBOUND			SOUTHBOUND			WESTBOUND		
	L	T	R	L	T	R	L	T	R	L	T	R
1. Barton Rd & La Cadena Dr	0	1100	252	0	0	0	450	877	0	288	0	285
2. Barton Rd & Grand Terrace Rd & La Crosse Av				35	724		39		6		599	22
4. Barton Rd & I-215 SB Ramps	1	50	50	132	626	5	298	4	205	33	415	436
5. Barton Rd & I-215 NB Ramps	86	0	468	159	813	0	0	0	0	0	797	390
	108		323		108	117				351	124	
7. Barton Rd & Vivienda Ave/Michigan	270	32	129	30	914	337	5	7	27	131	890	19

APPENDIX D
Intersection LOS Calculation
And Queuing Analysis
Worksheets

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Existing Intersection LOS

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Barton Road Interchange Improvement Project
1: Barton Rd & La Cadena Dr

Existing
AM PEAK



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	79	221	432	77	220	507
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	233	455	81	232	534
RTOR Reduction (vph)	0	200	0	37	0	0
Lane Group Flow (vph)	83	33	455	44	232	534
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.5	9.5	41.7	41.7	16.8	62.5
Effective Green, g (s)	11.5	11.5	43.7	43.7	18.8	64.5
Actuated g/C Ratio	0.14	0.14	0.55	0.55	0.24	0.81
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	230	217	1843	824	376	2720
v/s Ratio Prot	c0.05		c0.13		c0.15	0.16
v/s Ratio Perm		0.02		0.03		
v/c Ratio	0.36	0.15	0.25	0.05	0.62	0.20
Uniform Delay, d1	30.9	30.0	9.5	8.5	27.4	1.8
Progression Factor	0.70	1.07	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.3	0.3	0.1	3.0	0.2
Delay (s)	22.6	32.4	9.8	8.6	30.4	1.9
Level of Service	C	C	A	A	C	A
Approach Delay (s)	29.8		9.7			10.6
Approach LOS	C		A			B

Intersection Summary

HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	39.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

Existing
AM PEAK



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↖	↗	↗	↖	↖
Volume (veh/h)	3	270	344	16	30	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	3	310	395	18	34	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.99				0.99	0.99
vC, conflicting volume	414				713	395
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	403				705	384
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	100				91	99
cM capacity (veh/h)	1118				390	646

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	314	395	18	38
Volume Left	3	0	0	34
Volume Right	0	0	18	3
cSH	1118	1700	1700	405
Volume to Capacity	0.00	0.23	0.01	0.09
Queue Length 95th (ft)	0	0	0	8
Control Delay (s)	0.1	0.0	0.0	14.8
Lane LOS	A			B
Approach Delay (s)	0.1	0.0		14.8
Approach LOS				B

Intersection Summary			
Average Delay		0.8	
Intersection Capacity Utilization		29.1%	ICU Level of Service A
Analysis Period (min)		15	

Barton Road Interchange Improvement Project
3: Barton Rd & La Crosse Ave


















Existing
AM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	339	8	20	288	0	4	0	28	0	28	100
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	373	9	22	316	0	4	0	31	0	31	110
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	316			381			863	737	377	768	742	316
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	222			381			812	676	377	710	681	222
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			98			98	100	95	100	91	85
cM capacity (veh/h)	1220			1150			211	335	659	298	333	746
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	381	338	35	141								
Volume Left	0	22	4	0								
Volume Right	9	0	31	110								
cSH	1700	1150	521	586								
Volume to Capacity	0.22	0.02	0.07	0.24								
Queue Length 95th (ft)	0	1	5	23								
Control Delay (s)	0.0	0.7	12.4	13.1								
Lane LOS		A	B	B								
Approach Delay (s)	0.0	0.7	12.4	13.1								
Approach LOS			B	B								
Intersection Summary												
Average Delay			2.8									
Intersection Capacity Utilization			48.1%		ICU Level of Service				A			
Analysis Period (min)			15									



















Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	291	67	388	308	5	0	0	0	205	8	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1598	1726		1598	1772						1694	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1598	1726		1598	1772						1694	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	10	320	74	426	338	5	0	0	0	225	9	0
RTOR Reduction (vph)	0	10	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	10	384	0	426	342	0	0	0	0	0	234	0
Turn Type	Prot				Prot				Split			
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	25.8		27.8	52.8						14.4	
Effective Green, g (s)	2.8	27.8		29.8	54.8						16.4	
Actuated g/C Ratio	0.03	0.35		0.37	0.68						0.20	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	56	600		595	1214						347	
v/s Ratio Prot	0.01	c0.22		c0.27	0.19						c0.14	
v/s Ratio Perm												
v/c Ratio	0.18	0.64		0.72	0.28						0.67	
Uniform Delay, d1	37.5	21.9		21.5	4.9						29.3	
Progression Factor	1.33	0.49		0.51	0.20						1.00	
Incremental Delay, d2	1.5	5.1		3.3	0.1						5.1	
Delay (s)	51.4	15.8		14.4	1.1						34.4	
Level of Service	D	B		B	A						C	
Approach Delay (s)		16.6			8.4			0.0			34.4	
Approach LOS		B			A			A			C	
Intersection Summary												
HCM Average Control Delay	15.1			HCM Level of Service				B				
HCM Volume to Capacity ratio	0.66											
Actuated Cycle Length (s)	80.0			Sum of lost time (s)				6.0				
Intersection Capacity Utilization	64.1%			ICU Level of Service				C				
Analysis Period (min)	15											
c Critical Lane Group												

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

Existing
 AM PEAK

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	75	421	0	0	640	295	61	0	304	0	0	0	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0				
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00				
Frt	1.00	1.00			1.00	0.85		1.00	0.85				
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00				
Satd. Flow (prot)	1598	1776			1776	1509		1687	1509				
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00				
Satd. Flow (perm)	1598	1776			1776	1509		1687	1509				
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	
Adj. Flow (vph)	81	453	0	0	688	317	66	0	327	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	128	0	0	253	0	0	0	
Lane Group Flow (vph)	81	453	0	0	688	189	0	66	74	0	0	0	
Turn Type	Prot				Perm		Split		Perm				
Protected Phases	5	2			6		8	8					
Permitted Phases						6			8				
Actuated Green, G (s)	6.4	56.0			45.6	45.6		16.0	16.0				
Effective Green, g (s)	8.4	58.0			47.6	47.6		18.0	18.0				
Actuated g/C Ratio	0.11	0.72			0.60	0.60		0.22	0.22				
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	168	1288			1057	898		380	340				
v/s Ratio Prot	c0.05	0.26			c0.39			0.04					
v/s Ratio Perm						0.12			c0.05				
v/c Ratio	0.48	0.35			0.65	0.21		0.17	0.22				
Uniform Delay, d1	33.7	4.1			10.7	7.5		25.0	25.3				
Progression Factor	1.29	1.47			0.71	0.22		1.00	1.00				
Incremental Delay, d2	1.8	0.6			2.9	0.5		1.0	1.5				
Delay (s)	45.4	6.6			10.4	2.2		26.0	26.7				
Level of Service	D	A			B	A		C	C				
Approach Delay (s)		12.5			7.8			26.6			0.0		
Approach LOS		B			A			C			A		
Intersection Summary													
HCM Average Control Delay			12.9		HCM Level of Service					B			
HCM Volume to Capacity ratio			0.52										
Actuated Cycle Length (s)			80.0		Sum of lost time (s)					6.0			
Intersection Capacity Utilization			55.4%		ICU Level of Service					B			
Analysis Period (min)			15										
c	Critical Lane Group												

Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

Existing
AM PEAK























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	↗
Volume (vph)	560	165	33	627	308	51
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3258		1598	3374	1598	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3258		1598	3374	1598	1509
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	636	188	38	712	350	58
RTOR Reduction (vph)	33	0	0	0	0	35
Lane Group Flow (vph)	791	0	38	712	350	23
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	33.8		4.2	42.0	30.0	30.0
Effective Green, g (s)	35.8		6.2	44.0	32.0	32.0
Actuated g/C Ratio	0.45		0.08	0.55	0.40	0.40
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1458		124	1856	639	604
v/s Ratio Prot	c0.24		0.02	c0.21	c0.22	
v/s Ratio Perm						0.02
v/c Ratio	0.54		0.31	0.38	0.55	0.04
Uniform Delay, d1	16.1		34.9	10.3	18.4	14.6
Progression Factor	0.45		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4		1.4	0.6	3.4	0.1
Delay (s)	8.6		36.3	10.9	21.8	14.7
Level of Service	A		D	B	C	B
Approach Delay (s)	8.6			12.2	20.8	
Approach LOS	A			B	C	

Intersection Summary

HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

Existing
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	99	512	0	0	593	39	0	0	0	8	0	67
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	110	569	0	0	659	43	0	0	0	9	0	74
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.93			0.93	0.93	0.93	0.93	0.93	0.93
vC, conflicting volume	702			569			1193	1491	284	1163	1448	329
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	702			378			1051	1372	71	1019	1326	329
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	87			100			100	100	100	94	100	89
cM capacity (veh/h)	858			1059			129	112	891	154	120	652
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	110	284	284	329	329	43	83					
Volume Left	110	0	0	0	0	0	9					
Volume Right	0	0	0	0	0	43	74					
cSH	858	1700	1700	1700	1700	1700	485					
Volume to Capacity	0.13	0.17	0.17	0.19	0.19	0.03	0.17					
Queue Length 95th (ft)	11	0	0	0	0	0	15					
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	0.0	14.0					
Lane LOS	A						B					
Approach Delay (s)	1.6			0.0			14.0					
Approach LOS							B					
Intersection Summary												
Average Delay			1.5									
Intersection Capacity Utilization			37.9%		ICU Level of Service			A				
Analysis Period (min)			15									

Barton Road Interchange Improvement Project
1: Barton Rd & La Cadena Dr

Existing
PM PEAK



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	174	172	665	152	272	530
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	187	185	715	163	292	570
RTOR Reduction (vph)	0	148	0	87	0	0
Lane Group Flow (vph)	187	37	715	76	292	570
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.9	13.9	35.5	35.5	18.6	58.1
Effective Green, g (s)	15.9	15.9	37.5	37.5	20.6	60.1
Actuated g/C Ratio	0.20	0.20	0.47	0.47	0.26	0.75
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	327	309	1627	728	423	2608
v/s Ratio Prot	c0.11		c0.21		c0.18	0.16
v/s Ratio Perm		0.02		0.05		
v/c Ratio	0.57	0.12	0.44	0.10	0.69	0.22
Uniform Delay, d1	29.0	26.3	14.2	11.9	26.8	3.0
Progression Factor	0.95	0.88	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.4	0.2	0.9	0.3	4.8	0.2
Delay (s)	29.8	23.3	15.1	12.2	31.6	3.2
Level of Service	C	C	B	B	C	A
Approach Delay (s)	26.6		14.5			12.8
Approach LOS	C		B			B

Intersection Summary

HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

Existing
PM PEAK



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↕	↕	
Volume (veh/h)	21	502	305	29	20	16
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	24	570	347	33	23	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked						
vC, conflicting volume	380				965	347
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	380				965	347
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				92	97
cM capacity (veh/h)	1168				275	692

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	594	347	33	41
Volume Left	24	0	0	23
Volume Right	0	0	33	18
cSH	1168	1700	1700	375
Volume to Capacity	0.02	0.20	0.02	0.11
Queue Length 95th (ft)	2	0	0	9
Control Delay (s)	0.6	0.0	0.0	15.8
Lane LOS	A			C
Approach Delay (s)	0.6	0.0		15.8
Approach LOS				C

Intersection Summary			
Average Delay		1.0	
Intersection Capacity Utilization		55.9%	ICU Level of Service
Analysis Period (min)		15	B

Barton Road Interchange Improvement Project
3: Barton Rd & La Crosse Ave


















Existing
PM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗			↖			↕			↘	↙
Volume (veh/h)	0	594	2	5	366	0	1	0	61	0	4	91
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	653	2	5	402	0	1	0	67	0	4	100
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	402			655			1169	1067	654	1134	1068	402
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	284			655			1134	1021	654	1095	1022	284
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			99	100	86	100	98	85
cM capacity (veh/h)	1144			923			134	211	463	146	210	677
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	655	408	68	104								
Volume Left	0	5	1	0								
Volume Right	2	0	67	100								
cSH	1700	923	446	619								
Volume to Capacity	0.39	0.01	0.15	0.17								
Queue Length 95th (ft)	0	0	13	15								
Control Delay (s)	0.0	0.2	14.5	12.0								
Lane LOS		A	B	B								
Approach Delay (s)	0.0	0.2	14.5	12.0								
Approach LOS			B	B								
Intersection Summary												
Average Delay			1.9									
Intersection Capacity Utilization			46.0%		ICU Level of Service				A			
Analysis Period (min)			15									



















Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	527	125	298	371	6	0	0	0	266	8	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1774		1644	1822						1742	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1774		1644	1822						1742	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	3	579	137	327	408	7	0	0	0	292	9	0
RTOR Reduction (vph)	0	11	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	3	705	0	327	414	0	0	0	0	0	301	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	32.1		20.5	51.8						15.4	
Effective Green, g (s)	2.8	34.1		22.5	53.8						17.4	
Actuated g/C Ratio	0.03	0.43		0.28	0.67						0.22	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	58	756		462	1225						379	
v/s Ratio Prot	0.00	c0.40		c0.20	0.23						c0.17	
v/s Ratio Perm												
v/c Ratio	0.05	0.93		0.71	0.34						0.79	
Uniform Delay, d1	37.3	21.9		25.8	5.6						29.6	
Progression Factor	1.13	0.61		0.74	0.22						1.00	
Incremental Delay, d2	0.4	19.6		4.1	0.1						10.9	
Delay (s)	42.6	32.9		23.1	1.3						40.5	
Level of Service	D	C		C	A						D	
Approach Delay (s)		33.0			10.9			0.0			40.5	
Approach LOS		C			B			A			D	
Intersection Summary												
HCM Average Control Delay				25.0	HCM Level of Service				C			
HCM Volume to Capacity ratio				0.82								
Actuated Cycle Length (s)				80.0	Sum of lost time (s)				6.0			
Intersection Capacity Utilization				78.3%	ICU Level of Service				D			
Analysis Period (min)				15								
c Critical Lane Group												

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

Existing
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	669	0	0	621	284	54	0	294	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553			
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	132	712	0	0	661	302	57	0	313	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	131	0	0	236	0	0	0
Lane Group Flow (vph)	132	712	0	0	661	171	0	57	77	0	0	0
Turn Type	Prot						Perm	Split	Perm			
Protected Phases	5	2					6	8	8			
Permitted Phases							6			8		
Actuated Green, G (s)	8.8	56.0					43.2	43.2	16.0	16.0		
Effective Green, g (s)	10.8	58.0					45.2	45.2	18.0	18.0		
Actuated g/C Ratio	0.14	0.72					0.57	0.57	0.22	0.22		
Clearance Time (s)	4.0	4.0					4.0	4.0	4.0	4.0		
Vehicle Extension (s)	3.0	3.0					3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	222	1325					1032	877	391	349		
v/s Ratio Prot	0.08	c0.39					c0.36			0.03		
v/s Ratio Perm							0.11			c0.05		
v/c Ratio	0.59	0.54					0.64	0.19	0.15	0.22		
Uniform Delay, d1	32.5	5.0					11.9	8.5	24.8	25.3		
Progression Factor	0.99	0.54					0.76	0.28	1.00	1.00		
Incremental Delay, d2	2.3	0.8					2.9	0.5	0.8	1.4		
Delay (s)	34.6	3.5					11.9	2.9	25.6	26.7		
Level of Service	C	A					B	A	C	C		
Approach Delay (s)	8.4						9.1	26.5		0.0		
Approach LOS	A						A	C		A		
Intersection Summary												
HCM Average Control Delay			11.8		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				4.0			
Intersection Capacity Utilization			60.1%		ICU Level of Service				B			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

Existing
PM PEAK























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	↗
Volume (vph)	745	218	85	730	175	104
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.97		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3353		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3353		1644	3471	1644	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	810	237	92	793	190	113
RTOR Reduction (vph)	32	0	0	0	0	83
Lane Group Flow (vph)	1015	0	92	793	190	30
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	41.0		8.0	53.0	19.0	19.0
Effective Green, g (s)	43.0		10.0	55.0	21.0	21.0
Actuated g/C Ratio	0.54		0.12	0.69	0.26	0.26
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1802		206	2386	432	408
v/s Ratio Prot	c0.30		c0.06	0.23	c0.12	
v/s Ratio Perm						0.02
v/c Ratio	0.56		0.45	0.33	0.44	0.07
Uniform Delay, d1	12.3		32.4	5.1	24.6	22.2
Progression Factor	0.46		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1		1.5	0.4	3.2	0.3
Delay (s)	6.8		34.0	5.4	27.8	22.5
Level of Service	A		C	A	C	C
Approach Delay (s)	6.8			8.4	25.8	
Approach LOS	A			A	C	

Intersection Summary

HCM Average Control Delay	10.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

Existing
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	30	819	0	0	781	19	0	0	0	5	0	34
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	890	0	0	849	21	0	0	0	5	0	37
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.83			0.83	0.83	0.83	0.83	0.83	0.83
vC, conflicting volume	870			890			1417	1825	445	1359	1804	424
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	870			463			1096	1587	0	1027	1562	424
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	100	96	100	94
cM capacity (veh/h)	758			898			124	84	896	149	87	573
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	33	445	445	424	424	21	42					
Volume Left	33	0	0	0	0	0	5					
Volume Right	0	0	0	0	0	21	37					
cSH	758	1700	1700	1700	1700	1700	420					
Volume to Capacity	0.04	0.26	0.26	0.25	0.25	0.01	0.10					
Queue Length 95th (ft)	3	0	0	0	0	0	8					
Control Delay (s)	10.0	0.0	0.0	0.0	0.0	0.0	14.5					
Lane LOS	A						B					
Approach Delay (s)	0.4			0.0			14.5					
Approach LOS							B					
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			36.3%		ICU Level of Service				A			
Analysis Period (min)			15									

2016 Intersection LOS















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2016 Alternative 1

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HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative1 AM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	252	0	78	0	0
Lane Group Flow (vph)	118	77	643	37	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.7	9.7	14.2	14.2	13.9	32.1
Effective Green, g (s)	11.7	11.7	16.2	16.2	15.9	34.1
Actuated g/C Ratio	0.23	0.23	0.33	0.33	0.32	0.68
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	375	355	1098	491	510	2310
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.05		0.02		
v/c Ratio	0.31	0.22	0.59	0.08	0.64	0.33
Uniform Delay, d1	15.7	15.4	14.0	11.6	14.5	3.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3	0.8	0.1	2.8	0.1
Delay (s)	16.2	15.7	14.8	11.7	17.3	3.3
Level of Service	B	B	B	B	B	A
Approach Delay (s)	15.8		14.3			7.5
Approach LOS	B		B			A
Intersection Summary						
HCM Average Control Delay			11.4		HCM Level of Service	B
HCM Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			49.8		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c	Critical Lane Group					

HCM Unsignalized Intersection Capacity Analysis

2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↕	↕	↕
Volume (veh/h)	114	234	446	45	196	21
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	120	246	469	47	206	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.99				0.99	0.99
vC, conflicting volume	517				956	469
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	508				951	460
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	88				16	96
cM capacity (veh/h)	1022				247	586

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	366	469	47	228
Volume Left	120	0	0	206
Volume Right	0	0	47	22
cSH	1022	1700	1700	262
Volume to Capacity	0.12	0.28	0.03	0.87
Queue Length 95th (ft)	10	0	0	185
Control Delay (s)	3.8	0.0	0.0	69.1
Lane LOS	A			F
Approach Delay (s)	3.8	0.0		69.1
Approach LOS				F

Intersection Summary			
Average Delay		15.4	
Intersection Capacity Utilization		67.2%	ICU Level of Service C
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
3: Barton Rd & La Crosse Ave


















Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	422	8	20	304	0	4	0	28	0	9	183
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	444	8	21	320	0	4	0	29	0	9	193
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	320			453			1008	811	448	840	815	320
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	228			453			970	757	448	789	762	228
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	100			98			97	100	95	100	97	74
cM capacity (veh/h)	1216			1082			150	301	600	263	299	741
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	453	341	34	202								
Volume Left	0	21	4	0								
Volume Right	8	0	29	193								
cSH	1700	1082	437	693								
Volume to Capacity	0.27	0.02	0.08	0.29								
Queue Length 95th (ft)	0	1	6	30								
Control Delay (s)	0.0	0.7	13.9	12.3								
Lane LOS		A	B	B								
Approach Delay (s)	0.0	0.7	13.9	12.3								
Approach LOS			B	B								
Intersection Summary												
Average Delay			3.1									
Intersection Capacity Utilization			53.3%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	374	74	564	324	11	0	0	0	229	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.98		1.00	0.99						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1598	1732		1598	1767						1687	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1598	1732		1598	1767						1687	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2	394	78	594	341	12	0	0	0	241	0	0
RTOR Reduction (vph)	0	8	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	464	0	594	352	0	0	0	0	0	241	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	26.7		32.5	58.4						14.8	
Effective Green, g (s)	2.8	28.7		34.5	60.4						16.8	
Actuated g/C Ratio	0.03	0.33		0.40	0.70						0.20	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	52	578		641	1241						330	
v/s Ratio Prot	0.00	c0.27		c0.37	0.20						c0.14	
v/s Ratio Perm												
v/c Ratio	0.04	0.80		0.93	0.28						0.73	
Uniform Delay, d1	40.3	26.1		24.5	4.8						32.5	
Progression Factor	1.00	1.00		0.56	0.39						1.00	
Incremental Delay, d2	0.3	11.2		14.1	0.1						8.1	
Delay (s)	40.6	37.3		27.7	1.9						40.5	
Level of Service	D	D		C	A						D	
Approach Delay (s)		37.3			18.1			0.0			40.5	
Approach LOS		D			B			A			D	
Intersection Summary												
HCM Average Control Delay			26.8			HCM Level of Service					C	
HCM Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			86.0			Sum of lost time (s)				6.0		
Intersection Capacity Utilization			80.6%			ICU Level of Service					D	
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	490	0	0	825	431	74	0	368	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1598	1776			1776	1509		1687	1509			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1598	1776			1776	1509		1687	1509			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	516	0	0	868	454	78	0	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	174	0	0	306	0	0	0
Lane Group Flow (vph)	119	516	0	0	868	280	0	78	81	0	0	0
Turn Type	Prot					Perm	Split		Perm			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			8			
Actuated Green, G (s)	7.0	62.0			51.0	51.0		16.0	16.0			
Effective Green, g (s)	9.0	64.0			53.0	53.0		18.0	18.0			
Actuated g/C Ratio	0.10	0.74			0.62	0.62		0.21	0.21			
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	167	1322			1095	930		353	316			
v/s Ratio Prot	c0.07	0.29			c0.49			0.05				
v/s Ratio Perm						0.19			c0.05			
v/c Ratio	0.71	0.39			0.79	0.30		0.22	0.26			
Uniform Delay, d1	37.2	4.0			12.4	7.8		28.2	28.4			
Progression Factor	1.00	1.05			0.74	0.51		1.00	1.00			
Incremental Delay, d2	8.7	0.5			5.1	0.7		1.4	2.0			
Delay (s)	46.0	4.7			14.3	4.7		29.6	30.4			
Level of Service	D	A			B	A		C	C			
Approach Delay (s)		12.5			11.0			30.2			0.0	
Approach LOS		B			B			C			A	
Intersection Summary												
HCM Average Control Delay			15.1				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			86.0				Sum of lost time (s)				6.0	
Intersection Capacity Utilization			65.9%				ICU Level of Service				C	
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis

6: Barton Rd & Michigan St

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Volume (vph)	648	210	42	864	392	65
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3250		1598	3374	1598	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3250		1598	3374	1598	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	682	221	44	909	413	68
RTOR Reduction (vph)	34	0	0	0	0	40
Lane Group Flow (vph)	869	0	44	909	413	28
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	35.8		4.2	44.0	34.0	34.0
Effective Green, g (s)	37.8		6.2	46.0	36.0	36.0
Actuated g/C Ratio	0.44		0.07	0.53	0.42	0.42
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1428		115	1805	669	632
v/s Ratio Prot	c0.27		0.03	c0.27	c0.26	
v/s Ratio Perm						0.02
v/c Ratio	0.61		0.38	0.50	0.62	0.05
Uniform Delay, d1	18.4		38.1	12.7	19.6	14.8
Progression Factor	0.45		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7		2.1	1.0	4.2	0.1
Delay (s)	10.0		40.2	13.7	23.8	14.9
Level of Service	A		D	B	C	B
Approach Delay (s)	10.0			15.0	22.6	
Approach LOS	A			B	C	

Intersection Summary

HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

















HCM Unsignalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	99	614	0	0	736	39	0	0	0	18	0	170
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	104	646	0	0	775	41	0	0	0	19	0	179
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.87			0.87	0.87	0.87	0.87	0.87	0.87
vC, conflicting volume	816			646			1421	1671	323	1306	1629	387
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	816			299			1188	1475	0	1057	1427	387
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	87			100			100	100	100	86	100	70
cM capacity (veh/h)	776			1066			75	90	931	135	97	597
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	104	323	323	387	387	41	198					
Volume Left	104	0	0	0	0	0	19					
Volume Right	0	0	0	0	0	41	179					
cSH	776	1700	1700	1700	1700	1700	450					
Volume to Capacity	0.13	0.19	0.19	0.23	0.23	0.02	0.44					
Queue Length 95th (ft)	12	0	0	0	0	0	55					
Control Delay (s)	10.4	0.0	0.0	0.0	0.0	0.0	19.1					
Lane LOS	B						C					
Approach Delay (s)	1.4			0.0			19.1					
Approach LOS							C					
Intersection Summary												
Average Delay			2.8									
Intersection Capacity Utilization			49.4%		ICU Level of Service		A					
Analysis Period (min)			15									















HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative1 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	18	324	8	21	365	10	8	1	18	16	1	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	341	8	22	384	11	8	1	19	17	1	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539										
pX, platoon unblocked												
vC, conflicting volume	395			349			828	822	345	836	821	389
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	395			349			828	822	345	836	821	389
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			98			97	100	97	94	100	98
cM capacity (veh/h)	1137			1182			272	293	686	265	293	648
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	368	417	28	28								
Volume Left	19	22	8	17								
Volume Right	8	11	19	11								
cSH	1137	1182	457	341								
Volume to Capacity	0.02	0.02	0.06	0.08								
Queue Length 95th (ft)	1	1	5	7								
Control Delay (s)	0.6	0.6	13.4	16.5								
Lane LOS	A	A	B	C								
Approach Delay (s)	0.6	0.6	13.4	16.5								
Approach LOS			B	C								
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			38.3%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative1 PM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	183	0	166	0	0
Lane Group Flow (vph)	303	117	1158	99	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.2	15.2	25.7	25.7	21.0	50.7
Effective Green, g (s)	17.2	17.2	27.7	27.7	23.0	52.7
Actuated g/C Ratio	0.23	0.23	0.37	0.37	0.31	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	383	361	1301	582	512	2475
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.08		0.06		
v/c Ratio	0.79	0.33	0.89	0.17	0.93	0.37
Uniform Delay, d1	26.7	23.5	21.7	15.4	24.6	4.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.6	0.5	8.0	0.1	22.7	0.1
Delay (s)	37.3	24.1	29.6	15.6	47.4	4.2
Level of Service	D	C	C	B	D	A
Approach Delay (s)	30.7		27.0			18.9
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			24.3		HCM Level of Service	C
HCM Volume to Capacity ratio			0.86			
Actuated Cycle Length (s)			73.9		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

HCM Unsignalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↗	↘	
Volume (veh/h)	35	766	625	22	39	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	806	658	23	41	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.88				0.88	0.88
vC, conflicting volume	681				1538	658
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	574				1543	548
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				61	99
cM capacity (veh/h)	875				106	471

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	843	658	23	47
Volume Left	37	0	0	41
Volume Right	0	0	23	6
cSH	875	1700	1700	118
Volume to Capacity	0.04	0.39	0.01	0.40
Queue Length 95th (ft)	3	0	0	42
Control Delay (s)	1.1	0.0	0.0	54.4
Lane LOS	A			F
Approach Delay (s)	1.1	0.0		54.4
Approach LOS				F

Intersection Summary			
Average Delay		2.2	
Intersection Capacity Utilization		82.6%	ICU Level of Service E
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
3: Barton Rd & La Crosse Ave

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	803	2	5	443	0	1	0	61	0	4	204
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	845	2	5	466	0	1	0	64	0	4	215
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.87						0.87	0.87		0.87	0.87	0.87
vC, conflicting volume	466			847			1540	1323	846	1387	1324	466
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	308			847			1546	1296	846	1370	1297	308
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			98	100	82	100	97	66
cM capacity (veh/h)	1076			781			51	138	359	87	138	631
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	847	472	65	219								
Volume Left	0	5	1	0								
Volume Right	2	0	64	215								
cSH	1700	781	327	590								
Volume to Capacity	0.50	0.01	0.20	0.37								
Queue Length 95th (ft)	0	1	18	43								
Control Delay (s)	0.0	0.2	18.7	14.7								
Lane LOS		A	C	B								
Approach Delay (s)	0.0	0.2	18.7	14.7								
Approach LOS			C	B								
Intersection Summary												
Average Delay			2.8									
Intersection Capacity Utilization			65.0%		ICU Level of Service				C			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis
4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗						↖	
Volume (vph)	5	677	183	436	448	10	0	0	0	296	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1769		1644	1821						1736	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1769		1644	1821						1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	713	193	459	472	11	0	0	0	312	0	0
RTOR Reduction (vph)	0	13	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	5	893	0	459	482	0	0	0	0	0	312	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	2.4	27.0		24.2	48.8						16.8	
Effective Green, g (s)	4.4	29.0		26.2	50.8						18.8	
Actuated g/C Ratio	0.06	0.36		0.33	0.63						0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	90	641		538	1156						408	
v/s Ratio Prot	0.00	c0.51		c0.28	0.26						c0.18	
v/s Ratio Perm												
v/c Ratio	0.06	1.39		0.85	0.42						0.76	
Uniform Delay, d1	35.8	25.5		25.1	7.2						28.5	
Progression Factor	1.00	1.00		0.55	0.55						1.00	
Incremental Delay, d2	0.3	186.5		4.6	0.1						8.3	
Delay (s)	36.1	212.0		18.4	4.1						36.8	
Level of Service	D	F		B	A						D	
Approach Delay (s)		211.1			11.0			0.0			36.8	
Approach LOS		F			B			A			D	

Intersection Summary

HCM Average Control Delay	98.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	159	813	0	0	807	390	86	0	468	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	167	856	0	0	849	411	91	0	493	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	226	0	0	109	0	0	0
Lane Group Flow (vph)	167	856	0	0	849	185	0	91	384	0	0	0
Turn Type	Prot				Perm		Split	Perm				
Protected Phases	5	2			6		8	8				
Permitted Phases					6				8			
Actuated Green, G (s)	8.0	46.0			34.0	34.0			26.0	26.0		
Effective Green, g (s)	10.0	48.0			36.0	36.0			28.0	28.0		
Actuated g/C Ratio	0.12	0.60			0.45	0.45			0.35	0.35		
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)	206	1096			822	699			608	544		
v/s Ratio Prot	0.10	c0.47			c0.46				0.05			
v/s Ratio Perm							0.12			c0.25		
v/c Ratio	0.81	0.78			1.03	0.26			0.15	0.71		
Uniform Delay, d1	34.1	12.0			22.0	13.7			17.8	22.5		
Progression Factor	0.91	0.69			0.92	0.29			1.00	1.00		
Incremental Delay, d2	2.3	0.5			38.6	0.8			0.5	7.5		
Delay (s)	33.2	8.8			58.7	4.9			18.4	30.0		
Level of Service	C	A			E	A			B	C		
Approach Delay (s)	12.8				41.2				28.2		0.0	
Approach LOS	B				D				C		A	
Intersection Summary												
HCM Average Control Delay			28.4		HCM Level of Service				C			
HCM Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				4.0			
Intersection Capacity Utilization			78.4%		ICU Level of Service				D			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Barton Rd & Michigan St

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↗
Volume (vph)	944	337	131	927	270	161
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3334		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3334		1644	3471	1644	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	994	355	138	976	284	169
RTOR Reduction (vph)	45	0	0	0	0	123
Lane Group Flow (vph)	1304	0	138	976	284	46
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	39.0		9.0	52.0	20.0	20.0
Effective Green, g (s)	41.0		11.0	54.0	22.0	22.0
Actuated g/C Ratio	0.51		0.14	0.68	0.28	0.28
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1709		226	2343	452	427
v/s Ratio Prot	c0.39		c0.08	0.28	c0.17	
v/s Ratio Perm						0.03
v/c Ratio	0.76		0.61	0.42	0.63	0.11
Uniform Delay, d1	15.6		32.5	5.9	25.4	21.7
Progression Factor	1.10		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0		4.8	0.5	6.5	0.5
Delay (s)	19.2		37.3	6.4	31.9	22.2
Level of Service	B		D	A	C	C
Approach Delay (s)	19.2			10.2	28.3	
Approach LOS	B			B	C	
Intersection Summary						
HCM Average Control Delay			17.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.69			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			70.3%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK



















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑			↑↑	↗					↕	
Volume (veh/h)	30	1075	0	0	1024	19	0	0	0	5	0	34
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	32	1132	0	0	1078	20	0	0	0	5	0	36
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.72			0.72	0.72	0.72	0.72	0.72	
vC, conflicting volume	1098			1132			1769	2293	566	1707	2273	539
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1098			398			1287	2015	0	1199	1987	539
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			100			100	100	100	94	100	93
cM capacity (veh/h)	620			821			76	39	774	96	40	482

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	32	566	566	539	539	20	41
Volume Left	32	0	0	0	0	0	5
Volume Right	0	0	0	0	0	20	36
cSH	620	1700	1700	1700	1700	1700	317
Volume to Capacity	0.05	0.33	0.33	0.32	0.32	0.01	0.13
Queue Length 95th (ft)	4	0	0	0	0	0	11
Control Delay (s)	11.1	0.0	0.0	0.0	0.0	0.0	18.0
Lane LOS	B						C
Approach Delay (s)	0.3			0.0			18.0
Approach LOS							C

Intersection Summary		
Average Delay		0.5
Intersection Capacity Utilization	41.4%	ICU Level of Service
Analysis Period (min)		15
		A

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative1 PM PEAK















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	419	3	10	411	1	10	0	10	13	3	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	441	3	11	433	1	11	0	11	14	3	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539										
pX, platoon unblocked												
vC, conflicting volume	434			444			917	906	443	916	907	433
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434			444			917	906	443	916	907	433
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			96	100	98	94	99	98
cM capacity (veh/h)	1115			1105			242	270	611	244	270	618
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	448	444	21	27								
Volume Left	4	11	11	14								
Volume Right	3	1	11	11								
cSH	1115	1105	346	323								
Volume to Capacity	0.00	0.01	0.06	0.08								
Queue Length 95th (ft)	0	1	5	7								
Control Delay (s)	0.1	0.3	16.1	17.2								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.1	0.3	16.1	17.2								
Approach LOS			C	C								
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			39.6%		ICU Level of Service				A			
Analysis Period (min)			15									

2016 Alternative 2

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Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2016 Alternative2
 AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	74	0	0
Lane Group Flow (vph)	118	64	643	41	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.3	9.3	18.7	18.7	18.0	40.7
Effective Green, g (s)	11.3	11.3	20.7	20.7	20.0	42.7
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.34	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	311	294	1204	539	551	2484
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.53	0.08	0.59	0.30
Uniform Delay, d1	20.3	19.6	14.8	12.3	15.7	2.6
Progression Factor	0.45	1.22	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.4	1.7	0.3	4.7	0.3
Delay (s)	10.0	24.4	16.5	12.6	20.3	2.9
Level of Service	A	C	B	B	C	A
Approach Delay (s)	20.6		15.9			8.2
Approach LOS	C		B			A
Intersection Summary						
HCM Average Control Delay			13.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative2
AM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	434	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.74			0.93	1.00		0.98			0.78	
Satd. Flow (perm)		2474			3125	1509		1532			1358	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	457	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	3	0	0	0	17	0	30	0	0	9	0
Lane Group Flow (vph)	0	358	0	0	486	30	0	16	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		34.9			34.9	34.9		15.1			15.1	
Effective Green, g (s)		36.9			36.9	36.9		17.1			17.1	
Actuated g/C Ratio		0.64			0.64	0.64		0.29			0.29	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1574			1988	960		452			400	
v/s Ratio Prot												
v/s Ratio Perm		0.14			0.16	0.02		0.01			0.16	
v/c Ratio		0.23			0.24	0.03		0.04			0.55	
Uniform Delay, d1		4.5			4.5	3.9		14.6			17.2	
Progression Factor		0.60			1.28	1.54		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		3.0			6.1	6.1		14.6			18.7	
Level of Service		A			A	A		B			B	
Approach Delay (s)		3.0			6.1	6.1		14.6			18.7	
Approach LOS		A			A	A		B			B	

Intersection Summary

HCM Average Control Delay	7.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			




















Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2016 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↘↗	↑↑					↘	↖	↗
Volume (vph)	0	374	74	564	324	0	0	0	0	229	9	183
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (prot)		3374	1509	3100	3374					1518	1612	1509
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (perm)		3374	1509	3100	3374					1518	1612	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	394	78	594	341	0	0	0	0	241	9	193
RTOR Reduction (vph)	0	0	54	0	0	0	0	0	0	0	0	133
Lane Group Flow (vph)	0	394	24	594	341	0	0	0	0	125	125	60
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		16.0	16.0	14.0	34.0					16.0	16.0	16.0
Effective Green, g (s)		18.0	18.0	16.0	36.0					18.0	18.0	18.0
Actuated g/C Ratio		0.31	0.31	0.28	0.62					0.31	0.31	0.31
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1047	468	855	2094					471	500	468
v/s Ratio Prot		c0.12		c0.19	0.10					c0.08	0.08	
v/s Ratio Perm			0.02									0.04
v/c Ratio		0.38	0.05	0.69	0.16					0.27	0.25	0.13
Uniform Delay, d1		15.6	14.0	18.8	4.6					15.0	15.0	14.4
Progression Factor		0.92	1.23	0.51	0.21					1.00	1.00	1.00
Incremental Delay, d2		1.0	0.2	2.3	0.2					0.3	0.3	0.1
Delay (s)		15.3	17.5	11.9	1.1					15.3	15.2	14.5
Level of Service		B	B	B	A					B	B	B
Approach Delay (s)		15.7			8.0			0.0			14.9	
Approach LOS		B			A			A			B	
Intersection Summary												
HCM Average Control Delay			11.6		HCM Level of Service					B		
HCM Volume to Capacity ratio			0.42									
Actuated Cycle Length (s)			58.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			50.1%		ICU Level of Service					A		
Analysis Period (min)			15									
c Critical Lane Group												























Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2016 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	490	0	0	814	431	74	0	368	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3100	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3100	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	516	0	0	857	454	78	0	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	189	0	159	158	0	0	0
Lane Group Flow (vph)	119	516	0	0	857	265	78	35	35	0	0	0
Turn Type	Prot				Perm		Prot	Perm				
Protected Phases	5	2			6		3	8				
Permitted Phases					6				8			
Actuated Green, G (s)	5.6	41.4			31.8	31.8	8.6	8.6	8.6			
Effective Green, g (s)	7.6	43.4			33.8	33.8	10.6	10.6	10.6			
Actuated g/C Ratio	0.13	0.75			0.58	0.58	0.18	0.18	0.18			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	406	2525			1966	879	292	262	248			
v/s Ratio Prot	c0.04	0.15			c0.25		c0.05	0.02				
v/s Ratio Perm					0.18				0.03			
v/c Ratio	0.29	0.20			0.44	0.30	0.27	0.14	0.14			
Uniform Delay, d1	22.8	2.2			6.8	6.1	20.4	19.9	19.9			
Progression Factor	0.39	0.07			0.39	0.92	1.00	1.00	1.00			
Incremental Delay, d2	0.4	0.2			0.6	0.7	0.5	0.2	0.3			
Delay (s)	9.2	0.3			3.2	6.3	20.9	20.1	20.2			
Level of Service	A	A			A	A	C	C	C			
Approach Delay (s)	2.0				4.3		20.2				0.0	
Approach LOS	A				A		C				A	
Intersection Summary												
HCM Average Control Delay			6.8		HCM Level of Service				A			
HCM Volume to Capacity ratio			0.37									
Actuated Cycle Length (s)			58.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			50.1%		ICU Level of Service				A			
Analysis Period (min)			15									
c	Critical Lane Group											













Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	549	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1746	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1625	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	578	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	88	0	6	0	0	0	28	0	0	121
Lane Group Flow (vph)	104	578	133	44	790	0	413	14	28	0	55	22
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	5.6	21.0	30.8	4.2	19.6		9.8	20.8	25.0		7.0	7.0
Effective Green, g (s)	7.6	23.0	34.8	6.2	21.6		11.8	22.8	29.0		9.0	9.0
Actuated g/C Ratio	0.13	0.40	0.60	0.11	0.37		0.20	0.39	0.50		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	209	1338	957	331	1247		631	698	807		252	234
v/s Ratio Prot	c0.07	0.17	0.03	0.01	c0.24		c0.13	0.01	0.00			
v/s Ratio Perm			0.06						0.01		c0.03	0.01
v/c Ratio	0.50	0.43	0.14	0.13	0.63		0.65	0.02	0.03		0.22	0.09
Uniform Delay, d1	23.4	12.7	5.1	23.5	14.9		21.2	10.8	7.4		21.4	21.0
Progression Factor	1.11	0.57	1.24	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.8	1.0	0.1	0.2	2.5		2.4	0.0	0.0		0.4	0.2
Delay (s)	27.8	8.2	6.3	23.6	17.4		23.7	10.8	7.4		21.9	21.2
Level of Service	C	A	A	C	B		C	B	A		C	C
Approach Delay (s)		10.0			17.7			21.4			21.4	
Approach LOS		A			B			C			C	
Intersection Summary												
HCM Average Control Delay			15.9				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			58.0				Sum of lost time (s)				8.0	
Intersection Capacity Utilization			55.4%				ICU Level of Service				B	
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2016 Alternative2
 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	233	0	164	0	0
Lane Group Flow (vph)	303	67	1158	101	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	10.0	10.0	20.0	20.0	16.0	40.0
Effective Green, g (s)	12.0	12.0	22.0	22.0	18.0	42.0
Actuated g/C Ratio	0.21	0.21	0.38	0.38	0.31	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	321	1317	589	510	2513
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.21	0.88	0.17	0.93	0.37
Uniform Delay, d1	22.4	19.1	16.8	11.9	19.4	3.0
Progression Factor	0.73	0.76	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5	0.3	8.6	0.6	25.7	0.4
Delay (s)	39.9	14.9	25.4	12.6	45.1	3.4
Level of Service	D	B	C	B	D	A
Approach Delay (s)	27.5		23.0			17.6
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			21.6		HCM Level of Service	C
HCM Volume to Capacity ratio			0.87			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative2
PM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	596	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.91			0.90	1.00		1.00			0.82	
Satd. Flow (perm)		3166			3124	1553		1580			1468	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	627	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	5	0	88	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	662	18	0	19	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		42.2			42.2	42.2		7.8			7.8	
Effective Green, g (s)		44.2			44.2	44.2		9.8			9.8	
Actuated g/C Ratio		0.76			0.76	0.76		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2413			2381	1183		267			248	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.01			c0.03	
v/c Ratio		0.33			0.28	0.01		0.07			0.17	
Uniform Delay, d1		2.2			2.1	1.7		20.3			20.6	
Progression Factor		0.68			2.08	2.44		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.0		0.1			0.3	
Delay (s)		1.8			4.6	4.1		20.4			20.9	
Level of Service		A			A	A		C			C	
Approach Delay (s)		1.8			4.6			20.4			20.9	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	4.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			























Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative2
 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↗↗	↑↑					↘	↖	↗
Volume (vph)	0	677	183	436	448	0	0	0	0	296	4	204
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3471	1553	3190	3471					1562	1655	1553
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3471	1553	3190	3471					1562	1655	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	713	193	459	472	0	0	0	0	312	4	215
RTOR Reduction (vph)	0	0	126	0	0	0	0	0	0	0	0	148
Lane Group Flow (vph)	0	713	67	459	472	0	0	0	0	159	157	67
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		18.0	18.0	12.0	34.0					16.0	16.0	16.0
Effective Green, g (s)		20.0	20.0	14.0	36.0					18.0	18.0	18.0
Actuated g/C Ratio		0.34	0.34	0.24	0.62					0.31	0.31	0.31
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1197	536	770	2154					485	514	482
v/s Ratio Prot		c0.21		c0.14	0.14					c0.10	0.09	
v/s Ratio Perm			0.04									0.04
v/c Ratio		0.60	0.12	0.60	0.22					0.33	0.31	0.14
Uniform Delay, d1		15.7	13.0	19.5	4.8					15.4	15.2	14.4
Progression Factor		0.50	0.14	0.54	0.47					1.00	1.00	1.00
Incremental Delay, d2		2.1	0.5	1.2	0.2					0.4	0.3	0.1
Delay (s)		9.9	2.3	11.7	2.5					15.8	15.6	14.5
Level of Service		A	A	B	A					B	B	B
Approach Delay (s)		8.3			7.0			0.0			15.2	
Approach LOS		A			A			A			B	
Intersection Summary												
HCM Average Control Delay			9.3		HCM Level of Service					A		
HCM Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			58.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			50.1%		ICU Level of Service					A		
Analysis Period (min)			15									
c Critical Lane Group												























Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2016 Alternative2
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 							
Volume (vph)	159	813	0	0	797	390	86	0	468	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3190	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3190	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	167	856	0	0	839	411	91	0	493	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	183	0	141	141	0	0	0
Lane Group Flow (vph)	167	856	0	0	839	228	91	106	105	0	0	0
Turn Type	Prot			Perm			Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	5.6	39.8			30.2	30.2	10.2	10.2	10.2			
Effective Green, g (s)	7.6	41.8			32.2	32.2	12.2	12.2	12.2			
Actuated g/C Ratio	0.13	0.72			0.56	0.56	0.21	0.21	0.21			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	418	2502			1927	862	346	310	294			
v/s Ratio Prot	0.05	c0.25			c0.24		0.06	0.07				
v/s Ratio Perm						0.15			c0.07			
v/c Ratio	0.40	0.34			0.44	0.26	0.26	0.34	0.36			
Uniform Delay, d1	23.1	3.0			7.6	6.7	19.1	19.5	19.5			
Progression Factor	0.45	0.10			0.56	0.78	1.00	1.00	1.00			
Incremental Delay, d2	0.5	0.3			0.6	0.6	0.4	0.7	0.7			
Delay (s)	11.1	0.6			4.8	5.9	19.6	20.1	20.3			
Level of Service	B	A			A	A	B	C	C			
Approach Delay (s)		2.3			5.2			20.1			0.0	
Approach LOS		A			A			C			A	
Intersection Summary												
HCM Average Control Delay			7.2		HCM Level of Service				A			
HCM Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			58.0		Sum of lost time (s)				4.0			
Intersection Capacity Utilization			50.1%		ICU Level of Service				A			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative2
PM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3460		3190	1827	1553		1790	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3460		3190	1827	1553		1670	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	160	0	2	0	0	0	17	0	0	24
Lane Group Flow (vph)	32	962	195	138	955	0	284	34	119	0	12	4
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	2.8	19.9	27.8	7.2	24.3		7.9	18.9	26.1		7.0	7.0
Effective Green, g (s)	4.8	21.9	31.8	9.2	26.3		9.9	20.9	30.1		9.0	9.0
Actuated g/C Ratio	0.08	0.38	0.55	0.16	0.45		0.17	0.36	0.52		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	136	1311	905	506	1569		545	658	860		259	241
v/s Ratio Prot	0.02	c0.28	0.04	0.04	c0.28		c0.09	0.02	c0.02			
v/s Ratio Perm			0.09						0.05		0.01	0.00
v/c Ratio	0.24	0.73	0.22	0.27	0.61		0.52	0.05	0.14		0.05	0.02
Uniform Delay, d1	24.9	15.5	6.7	21.5	12.0		21.9	12.1	7.2		20.8	20.8
Progression Factor	1.01	0.72	0.72	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	3.5	0.1	0.3	1.8		0.9	0.0	0.1		0.1	0.0
Delay (s)	26.0	14.7	4.9	21.8	13.7		22.8	12.1	7.3		20.9	20.8
Level of Service	C	B	A	C	B		C	B	A		C	C
Approach Delay (s)		12.4			14.7			17.4			20.8	
Approach LOS		B			B			B			C	
Intersection Summary												
HCM Average Control Delay			14.1			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			58.0			Sum of lost time (s)			4.0			
Intersection Capacity Utilization			55.9%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

2016 Alternative 3

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative3
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	69	0	0
Lane Group Flow (vph)	118	64	643	46	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.3	9.3	21.2	21.2	15.5	40.7
Effective Green, g (s)	11.3	11.3	23.2	23.2	17.5	42.7
Actuated g/C Ratio	0.19	0.19	0.40	0.40	0.30	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	311	294	1350	604	482	2484
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.48	0.08	0.68	0.30
Uniform Delay, d1	20.3	19.6	12.9	10.8	17.8	2.6
Progression Factor	0.55	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.4	1.2	0.2	3.8	0.3
Delay (s)	11.9	20.2	14.1	11.0	21.6	2.9
Level of Service	B	C	B	B	C	A
Approach Delay (s)	18.0		13.6			8.5
Approach LOS	B		B			A
Intersection Summary						
HCM Average Control Delay			12.1		HCM Level of Service	B
HCM Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative3
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	438	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.74			0.93	1.00		0.98			0.78	
Satd. Flow (perm)		2471			3126	1509		1532			1358	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	461	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	3	0	0	0	17	0	30	0	0	9	0
Lane Group Flow (vph)	0	358	0	0	490	30	0	16	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		34.9			34.9	34.9		15.1			15.1	
Effective Green, g (s)		36.9			36.9	36.9		17.1			17.1	
Actuated g/C Ratio		0.64			0.64	0.64		0.29			0.29	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1572			1989	960		452			400	
v/s Ratio Prot												
v/s Ratio Perm		0.14			0.16	0.02		0.01			0.16	
v/c Ratio		0.23			0.25	0.03		0.04			0.55	
Uniform Delay, d1		4.5			4.6	3.9		14.6			17.2	
Progression Factor		0.41			0.47	0.44		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		2.2			2.4	1.8		14.6			18.7	
Level of Service		A			A	A		B			B	
Approach Delay (s)		2.2			2.4			14.6			18.7	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	6.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative3
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	74	374	324	564	233	187
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	394	341	594	245	197
RTOR Reduction (vph)	0	0	0	121	37	86
Lane Group Flow (vph)	78	394	341	473	267	52
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	4.2	30.0	21.8	41.8	20.0	20.0
Effective Green, g (s)	6.2	32.0	23.8	45.8	22.0	22.0
Actuated g/C Ratio	0.11	0.55	0.41	0.79	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	331	1862	1385	1244	1155	521
v/s Ratio Prot	0.03	c0.12	0.10	c0.14	0.09	
v/s Ratio Perm				0.17		0.04
v/c Ratio	0.24	0.21	0.25	0.38	0.23	0.10
Uniform Delay, d1	23.7	6.6	11.2	1.8	12.2	11.6
Progression Factor	0.74	0.50	0.65	0.34	1.00	1.00
Incremental Delay, d2	0.4	0.3	0.4	0.8	0.5	0.4
Delay (s)	18.0	3.5	7.7	1.5	12.7	12.0
Level of Service	B	A	A	A	B	B
Approach Delay (s)		5.9	3.7		12.5	
Approach LOS		A	A		B	

Intersection Summary

HCM Average Control Delay	6.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↖↗	↑↑	↖	↖↗
Volume (vph)	495	113	431	814	74	368
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3374	1509	3100	3374	1598	2656
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3374	1509	3100	3374	1598	2656
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	521	119	454	857	78	387
RTOR Reduction (vph)	0	49	0	0	0	172
Lane Group Flow (vph)	521	70	454	857	78	215
Turn Type		pm+ov	Prot		pm+ov	
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	21.0	30.0	16.0	41.0	9.0	25.0
Effective Green, g (s)	23.0	34.0	18.0	43.0	11.0	29.0
Actuated g/C Ratio	0.40	0.59	0.31	0.74	0.19	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1338	937	962	2501	303	1420
v/s Ratio Prot	c0.15	0.01	c0.15	0.25	c0.05	0.05
v/s Ratio Perm		0.03				0.03
v/c Ratio	0.39	0.07	0.47	0.34	0.26	0.15
Uniform Delay, d1	12.5	5.2	16.2	2.6	20.0	7.8
Progression Factor	0.95	0.91	0.47	0.19	1.00	1.00
Incremental Delay, d2	0.8	0.2	0.3	0.3	2.0	0.0
Delay (s)	12.7	4.9	7.8	0.8	22.1	7.9
Level of Service	B	A	A	A	C	A
Approach Delay (s)	11.3			3.2	10.3	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative3
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	554	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1746	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1625	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	583	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	88	0	6	0	0	0	28	0	0	121
Lane Group Flow (vph)	104	583	133	44	790	0	413	14	28	0	55	22
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	6.4	21.0	30.8	4.2	18.8		9.8	20.8	25.0		7.0	7.0
Effective Green, g (s)	8.4	23.0	34.8	6.2	20.8		11.8	22.8	29.0		9.0	9.0
Actuated g/C Ratio	0.14	0.40	0.60	0.11	0.36		0.20	0.39	0.50		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	231	1338	957	331	1201		631	698	807		252	234
v/s Ratio Prot	c0.07	c0.17	0.03	0.01	c0.24		c0.13	0.01	0.00			
v/s Ratio Perm			0.06						0.01		c0.03	0.01
v/c Ratio	0.45	0.44	0.14	0.13	0.66		0.65	0.02	0.03		0.22	0.09
Uniform Delay, d1	22.7	12.8	5.1	23.5	15.6		21.2	10.8	7.4		21.4	21.0
Progression Factor	0.76	0.52	0.30	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.3	1.0	0.1	0.2	2.8		2.4	0.0	0.0		0.4	0.2
Delay (s)	18.7	7.6	1.6	23.6	18.4		23.7	10.8	7.4		21.9	21.2
Level of Service	B	A	A	C	B		C	B	A		C	C
Approach Delay (s)		7.4			18.7			21.4			21.4	
Approach LOS		A			B			C			C	

Intersection Summary

HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative3
PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	233	0	164	0	0
Lane Group Flow (vph)	303	67	1158	101	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	10.0	10.0	20.0	20.0	16.0	40.0
Effective Green, g (s)	12.0	12.0	22.0	22.0	18.0	42.0
Actuated g/C Ratio	0.21	0.21	0.38	0.38	0.31	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	321	1317	589	510	2513
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.21	0.88	0.17	0.93	0.37
Uniform Delay, d1	22.4	19.1	16.8	11.9	19.4	3.0
Progression Factor	0.66	0.59	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5	0.3	8.6	0.6	23.4	0.4
Delay (s)	38.3	11.5	25.4	12.6	42.7	3.4
Level of Service	D	B	C	B	D	A
Approach Delay (s)	25.0		23.0			16.8
Approach LOS	C		C			B

Intersection Summary

HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative3
PM Peak



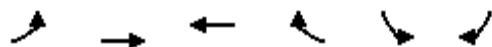
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	598	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.91			0.90	1.00		1.00			0.82	
Satd. Flow (perm)		3166			3124	1553		1580			1468	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	629	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	5	0	88	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	664	18	0	19	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		42.2			42.2	42.2		7.8			7.8	
Effective Green, g (s)		44.2			44.2	44.2		9.8			9.8	
Actuated g/C Ratio		0.76			0.76	0.76		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2413			2381	1183		267			248	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.01			c0.03	
v/c Ratio		0.33			0.28	0.01		0.07			0.17	
Uniform Delay, d1		2.2			2.1	1.7		20.3			20.6	
Progression Factor		0.40			0.36	0.30		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.0		0.1			0.3	
Delay (s)		1.1			1.0	0.5		20.4			20.9	
Level of Service		A			A	A		C			C	
Approach Delay (s)		1.1			1.0			20.4			20.9	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	2.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative3
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	183	677	448	436	298	205
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	193	713	472	459	314	216
RTOR Reduction (vph)	0	0	0	70	23	113
Lane Group Flow (vph)	193	713	472	389	343	51
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	8.0	34.0	22.0	38.0	16.0	16.0
Effective Green, g (s)	10.0	36.0	24.0	42.0	18.0	18.0
Actuated g/C Ratio	0.17	0.62	0.41	0.72	0.31	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	550	2154	1436	1178	978	439
v/s Ratio Prot	0.06	c0.21	0.14	c0.10	c0.11	
v/s Ratio Perm				0.15		0.04
v/c Ratio	0.35	0.33	0.33	0.33	0.35	0.12
Uniform Delay, d1	21.1	5.3	11.5	2.9	15.5	14.3
Progression Factor	0.56	0.39	0.50	0.08	1.00	1.00
Incremental Delay, d2	0.4	0.4	0.6	0.7	1.0	0.5
Delay (s)	12.2	2.5	6.3	1.0	16.5	14.8
Level of Service	B	A	A	A	B	B
Approach Delay (s)		4.5	3.7		16.0	
Approach LOS		A	A		B	

Intersection Summary

HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2016 Alternative3
PM Peak

























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑	↑↓
Volume (vph)	816	159	390	797	86	468
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3471	1553	3190	3471	1644	2733
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3471	1553	3190	3471	1644	2733
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	859	167	411	839	91	493
RTOR Reduction (vph)	0	49	0	0	0	107
Lane Group Flow (vph)	859	118	411	839	91	386
Turn Type		pm+ov	Prot		pm+ov	
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	26.0	33.0	13.0	43.0	7.0	20.0
Effective Green, g (s)	28.0	37.0	15.0	45.0	9.0	24.0
Actuated g/C Ratio	0.48	0.64	0.26	0.78	0.16	0.41
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1676	1044	825	2693	255	1225
v/s Ratio Prot	c0.25	0.02	c0.13	0.24	0.06	c0.08
v/s Ratio Perm		0.06				0.06
v/c Ratio	0.51	0.11	0.50	0.31	0.36	0.32
Uniform Delay, d1	10.3	4.1	18.3	1.9	21.9	11.5
Progression Factor	0.92	1.49	0.89	0.05	1.00	1.00
Incremental Delay, d2	1.1	0.2	0.4	0.3	3.9	0.1
Delay (s)	10.6	6.3	16.7	0.4	25.8	11.6
Level of Service	B	A	B	A	C	B
Approach Delay (s)	9.9			5.7	13.8	
Approach LOS	A			A	B	

Intersection Summary

HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative3
PM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3460		3190	1827	1553		1790	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3460		3190	1827	1553		1670	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	151	0	2	0	0	0	18	0	0	24
Lane Group Flow (vph)	32	962	204	138	955	0	284	34	118	0	12	4
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	2.8	21.5	29.4	5.6	24.3		7.9	18.9	24.5		7.0	7.0
Effective Green, g (s)	4.8	23.5	33.4	7.6	26.3		9.9	20.9	28.5		9.0	9.0
Actuated g/C Ratio	0.08	0.41	0.58	0.13	0.45		0.17	0.36	0.49		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	136	1406	894	418	1569		545	658	817		259	241
v/s Ratio Prot	0.02	c0.28	0.04	0.04	c0.28		c0.09	0.02	c0.02			
v/s Ratio Perm			0.09						0.06		0.01	0.00
v/c Ratio	0.24	0.68	0.23	0.33	0.61		0.52	0.05	0.14		0.05	0.02
Uniform Delay, d1	24.9	14.2	6.0	22.9	12.0		21.9	12.1	8.1		20.8	20.8
Progression Factor	0.87	0.84	0.44	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	2.5	0.1	0.5	1.8		0.9	0.0	0.1		0.1	0.0
Delay (s)	22.4	14.4	2.8	23.4	13.7		22.8	12.1	8.2		20.9	20.8
Level of Service	C	B	A	C	B		C	B	A		C	C
Approach Delay (s)		11.5			14.9			17.6			20.8	
Approach LOS		B			B			B			C	
Intersection Summary												
HCM Average Control Delay			13.9			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			58.0			Sum of lost time (s)			6.0			
Intersection Capacity Utilization			55.9%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

2016 Alternative 4

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Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2016 Alternative4
 AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	70	0	0
Lane Group Flow (vph)	118	64	643	45	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	7.4	7.4	16.9	16.9	11.7	32.6
Effective Green, g (s)	9.4	9.4	18.9	18.9	13.7	34.6
Actuated g/C Ratio	0.20	0.20	0.39	0.39	0.29	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	313	296	1329	594	456	2432
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.48	0.08	0.72	0.31
Uniform Delay, d1	16.8	16.2	10.9	9.1	15.4	2.4
Progression Factor	0.52	2.39	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	1.3	0.2	5.3	0.3
Delay (s)	9.5	39.1	12.2	9.3	20.7	2.7
Level of Service	A	D	B	A	C	A
Approach Delay (s)	31.3		11.7			8.2
Approach LOS	C		B			A
Intersection Summary						
HCM Average Control Delay			13.9		HCM Level of Service	B
HCM Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			48.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative4
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	438	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.75			0.93	1.00		0.98			0.73	
Satd. Flow (perm)		2508			3130	1509		1531			1282	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	461	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	4	0	0	0	19	0	29	0	0	10	0
Lane Group Flow (vph)	0	357	0	0	490	28	0	17	0	0	218	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		26.9			26.9	26.9		13.1			13.1	
Effective Green, g (s)		28.9			28.9	28.9		15.1			15.1	
Actuated g/C Ratio		0.60			0.60	0.60		0.31			0.31	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1510			1885	909		482			403	
v/s Ratio Prot												
v/s Ratio Perm		0.14			0.16	0.02		0.01			0.17	
v/c Ratio		0.24			0.26	0.03		0.04			0.54	
Uniform Delay, d1		4.4			4.5	3.9		11.4			13.6	
Progression Factor		0.21			0.60	0.37		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		1.2			3.0	1.5		11.4			15.1	
Level of Service		A			A	A		B			B	
Approach Delay (s)		1.2			2.9			11.4			15.1	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	48.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative4
 AM Peak



























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	74	374	324	564	233	187
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3215	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3215	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	394	341	594	245	197
RTOR Reduction (vph)	0	0	0	69	23	65
Lane Group Flow (vph)	78	394	341	525	282	73
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	6.5	39.0	28.5	77.5	49.0	49.0
Effective Green, g (s)	8.5	41.0	30.5	81.5	51.0	51.0
Actuated g/C Ratio	0.09	0.43	0.32	0.85	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	274	1441	1072	1313	1708	730
v/s Ratio Prot	c0.03	0.12	0.10	c0.21	0.09	
v/s Ratio Perm				0.14		0.05
v/c Ratio	0.28	0.27	0.32	0.40	0.16	0.10
Uniform Delay, d1	40.9	17.8	24.9	1.7	11.6	11.1
Progression Factor	1.03	0.89	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.5	0.8	0.9	0.2	0.3
Delay (s)	42.9	16.3	25.6	2.6	11.8	11.4
Level of Service	D	B	C	A	B	B
Approach Delay (s)		20.7	11.0		11.7	
Approach LOS		C	B		B	

Intersection Summary

HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2016 Alternative4
AM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	82	315	210	42	561	316	253	145	35	258	110	74
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3374	1509	3100	3275		3100	1669	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3374	1509	3100	3275		3100	1669	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	86	332	221	44	591	333	266	153	37	272	116	78
RTOR Reduction (vph)	0	0	109	0	0	150	0	30	0	0	40	0
Lane Group Flow (vph)	86	332	112	44	591	183	266	160	0	272	154	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	3.6	15.1	23.3	3.7	15.2	25.5	8.2	8.6		10.3	10.7	
Effective Green, g (s)	5.6	17.1	27.3	5.7	17.2	29.5	10.2	10.6		12.3	12.7	
Actuated g/C Ratio	0.10	0.32	0.51	0.11	0.32	0.55	0.19	0.20		0.23	0.24	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	167	1074	823	329	1081	829	589	646		710	395	
v/s Ratio Prot	c0.05	0.10	0.03	0.01	c0.18	0.05	0.09	0.05		c0.09	c0.09	
v/s Ratio Perm			0.05			0.07						
v/c Ratio	0.51	0.31	0.14	0.13	0.55	0.22	0.45	0.25		0.38	0.39	
Uniform Delay, d1	22.8	13.8	7.0	21.8	15.0	6.2	19.3	18.2		17.5	17.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.7	0.2	0.1	0.2	0.6	0.1	0.6	0.2		0.3	0.6	
Delay (s)	25.4	14.0	7.0	21.9	15.6	6.3	19.8	18.4		17.8	17.9	
Level of Service	C	B	A	C	B	A	B	B		B	B	
Approach Delay (s)		13.1			12.7			19.2			17.9	
Approach LOS		B			B			B			B	

Intersection Summary

HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	53.7	Sum of lost time (s)	6.0
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2016 Alternative4
 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	158	0	158	0	0
Lane Group Flow (vph)	303	142	1158	107	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.9	15.9	32.7	32.7	25.4	62.1
Effective Green, g (s)	17.9	17.9	34.7	34.7	27.4	64.1
Actuated g/C Ratio	0.21	0.21	0.40	0.40	0.32	0.75
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	342	323	1401	627	524	2587
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.09		0.07		
v/c Ratio	0.89	0.44	0.83	0.17	0.90	0.36
Uniform Delay, d1	33.1	29.7	23.0	16.4	28.0	3.8
Progression Factor	0.53	0.38	1.00	1.00	1.00	1.00
Incremental Delay, d2	22.3	0.9	5.7	0.6	19.0	0.4
Delay (s)	39.9	12.3	28.7	17.0	47.0	4.2
Level of Service	D	B	C	B	D	A
Approach Delay (s)	26.1		26.5			18.7
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			23.3		HCM Level of Service	C
HCM Volume to Capacity ratio			0.85			
Actuated Cycle Length (s)			86.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative4
PM Peak



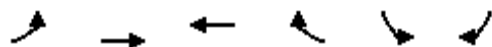
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	598	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.92			0.90	1.00		1.00			0.83	
Satd. Flow (perm)		3179			3141	1553		1580			1489	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	629	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	7	0	83	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	664	16	0	24	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		27.5			27.5	27.5		7.5			7.5	
Effective Green, g (s)		29.5			29.5	29.5		9.5			9.5	
Actuated g/C Ratio		0.69			0.69	0.69		0.22			0.22	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2181			2155	1065		349			329	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.02			c0.03	
v/c Ratio		0.37			0.31	0.01		0.07			0.13	
Uniform Delay, d1		2.8			2.7	2.1		13.3			13.4	
Progression Factor		0.63			1.05	0.35		1.00			1.00	
Incremental Delay, d2		0.4			0.4	0.0		0.1			0.2	
Delay (s)		2.1			3.2	0.8		13.3			13.6	
Level of Service		A			A	A		B			B	
Approach Delay (s)		2.1			3.1			13.3			13.6	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	3.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	43.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2016 Alternative4
PM Peak

























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	183	677	448	436	298	205
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3326	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3326	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	193	713	472	459	314	216
RTOR Reduction (vph)	0	0	0	72	16	101
Lane Group Flow (vph)	193	713	472	387	350	63
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	14.0	47.0	29.0	60.0	31.0	31.0
Effective Green, g (s)	16.0	49.0	31.0	64.0	33.0	33.0
Actuated g/C Ratio	0.19	0.57	0.36	0.74	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	593	1978	1251	1192	1276	542
v/s Ratio Prot	0.06	c0.21	c0.14	c0.12	0.11	
v/s Ratio Perm				0.12		0.04
v/c Ratio	0.33	0.36	0.38	0.32	0.27	0.12
Uniform Delay, d1	30.3	10.0	20.4	3.7	18.3	17.1
Progression Factor	0.94	0.68	0.50	0.54	1.00	1.00
Incremental Delay, d2	0.3	0.5	0.8	0.7	0.5	0.4
Delay (s)	28.9	7.3	10.9	2.7	18.8	17.5
Level of Service	C	A	B	A	B	B
Approach Delay (s)		11.9	6.9		18.4	
Approach LOS		B	A		B	

Intersection Summary

HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2016 Alternative4
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	518	337	131	621	294	176	135	85	327	140	86
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3471	1553	3190	3271		3190	1722	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3471	1553	3190	3271		3190	1722	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	126	545	355	138	654	309	185	142	89	344	147	91
RTOR Reduction (vph)	0	0	142	0	0	116	0	77	0	0	28	0
Lane Group Flow (vph)	126	545	213	138	654	193	185	154	0	344	210	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	10.9	38.4	47.7	7.0	34.5	49.7	9.3	9.4		15.2	15.3	
Effective Green, g (s)	12.9	40.4	51.7	9.0	36.5	53.7	11.3	11.4		17.2	17.3	
Actuated g/C Ratio	0.15	0.47	0.60	0.10	0.42	0.62	0.13	0.13		0.20	0.20	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	247	1631	934	334	1473	970	419	434		638	346	
v/s Ratio Prot	c0.08	0.16	0.03	0.04	c0.19	0.04	c0.06	0.05		0.11	c0.12	
v/s Ratio Perm			0.11			0.08						
v/c Ratio	0.51	0.33	0.23	0.41	0.44	0.20	0.44	0.35		0.54	0.61	
Uniform Delay, d1	33.6	14.3	7.9	36.0	17.6	6.9	34.4	34.0		30.8	31.3	
Progression Factor	0.99	0.72	0.24	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.7	0.5	0.1	0.8	1.0	0.1	0.7	0.5		0.9	3.0	
Delay (s)	34.9	10.8	2.0	36.9	18.5	7.0	35.2	34.5		31.7	34.3	
Level of Service	C	B	A	D	B	A	D	C		C	C	
Approach Delay (s)		10.7			17.6			34.8			32.8	
Approach LOS		B			B			C			C	

Intersection Summary















HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

2016 Alternative 5

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Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2016 Alternative5
 AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	265	0	70	0	0
Lane Group Flow (vph)	118	64	643	45	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	7.4	7.4	16.9	16.9	11.7	32.6
Effective Green, g (s)	9.4	9.4	18.9	18.9	13.7	34.6
Actuated g/C Ratio	0.20	0.20	0.39	0.39	0.29	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	313	296	1329	594	456	2432
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.22	0.48	0.08	0.72	0.31
Uniform Delay, d1	16.8	16.2	10.9	9.1	15.4	2.4
Progression Factor	0.71	2.05	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	1.3	0.2	5.3	0.3
Delay (s)	12.6	33.6	12.2	9.3	20.7	2.7
Level of Service	B	C	B	A	C	A
Approach Delay (s)	28.1		11.7			8.2
Approach LOS	C		B			A
Intersection Summary						
HCM Average Control Delay			13.2		HCM Level of Service	B
HCM Volume to Capacity ratio			0.52			
Actuated Cycle Length (s)			48.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			51.6%		ICU Level of Service	A
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative5
AM Peak


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	114	218	11	28	438	45	3	1	40	190	6	21
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		0.98			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3302			3364	1509		1552			1679	
Flt Permitted		0.75			0.93	1.00		0.98			0.73	
Satd. Flow (perm)		2508			3130	1509		1531			1282	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	229	12	29	461	47	3	1	42	200	6	22
RTOR Reduction (vph)	0	4	0	0	0	19	0	29	0	0	10	0
Lane Group Flow (vph)	0	357	0	0	490	28	0	17	0	0	218	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		26.9			26.9	26.9		13.1			13.1	
Effective Green, g (s)		28.9			28.9	28.9		15.1			15.1	
Actuated g/C Ratio		0.60			0.60	0.60		0.31			0.31	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1510			1885	909		482			403	
v/s Ratio Prot												
v/s Ratio Perm		0.14			0.16	0.02		0.01			0.17	
v/c Ratio		0.24			0.26	0.03		0.04			0.54	
Uniform Delay, d1		4.4			4.5	3.9		11.4			13.6	
Progression Factor		0.40			0.78	0.91		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.1		0.0			1.5	
Delay (s)		2.1			3.8	3.6		11.4			15.1	
Level of Service		A			A	A		B			B	
Approach Delay (s)		2.1			3.8			11.4			15.1	
Approach LOS		A			A			B			B	

Intersection Summary

HCM Average Control Delay	5.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	48.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2016 Alternative5
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	261	74	564	250	431	74	0	368	233	0	187
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1603	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1603	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	275	78	594	263	454	78	0	387	245	0	197
RTOR Reduction (vph)	0	0	56	0	0	225	0	0	222	0	0	157
Lane Group Flow (vph)	119	275	22	594	263	229	0	78	165	122	123	40
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	8.4	25.4	25.4	29.4	46.4	46.4		7.6	37.0	17.6	17.6	17.6
Effective Green, g (s)	10.4	27.4	27.4	31.4	48.4	48.4		9.6	41.0	19.6	19.6	19.6
Actuated g/C Ratio	0.11	0.29	0.29	0.33	0.50	0.50		0.10	0.43	0.20	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	336	963	431	1014	1701	761		169	1134	310	327	308
v/s Ratio Prot	0.04	0.08		c0.19	0.08			c0.05	0.05	c0.08	0.08	
v/s Ratio Perm			0.01			c0.15			0.01			0.03
v/c Ratio	0.35	0.29	0.05	0.59	0.15	0.30		0.46	0.15	0.39	0.38	0.13
Uniform Delay, d1	39.7	26.7	24.9	26.9	12.8	13.9		40.8	16.8	33.1	32.9	31.2
Progression Factor	0.89	1.06	1.43	0.64	0.49	0.19		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.7	0.2	0.8	0.2	0.9		2.0	0.1	3.7	3.3	0.9
Delay (s)	36.1	28.9	35.7	17.9	6.4	3.6		42.8	16.9	36.8	36.2	32.1
Level of Service	D	C	D	B	A	A		D	B	D	D	C
Approach Delay (s)		31.9			10.6			21.2			34.5	
Approach LOS		C			B			C			C	
Intersection Summary												
HCM Average Control Delay			20.1				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.43									
Actuated Cycle Length (s)			96.0				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			48.4%				ICU Level of Service		A			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative5
AM Peak

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	549	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1746	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1622	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	578	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	61	0	4	0	0	0	32	0	0	127
Lane Group Flow (vph)	104	578	160	44	792	0	413	14	23	0	55	16
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	10.4	47.7	65.4	5.7	43.0		17.7	30.6	36.3		8.9	8.9
Effective Green, g (s)	12.4	49.7	69.4	7.7	45.0		19.7	32.6	40.3		10.9	10.9
Actuated g/C Ratio	0.13	0.52	0.72	0.08	0.47		0.21	0.34	0.42		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	206	1747	1091	249	1569		636	603	665		184	171
v/s Ratio Prot	c0.07	0.17	0.03	0.01	c0.24		c0.13	0.01	0.00			
v/s Ratio Perm			0.08						0.01		c0.03	0.01
v/c Ratio	0.50	0.33	0.15	0.18	0.50		0.65	0.02	0.03		0.30	0.09
Uniform Delay, d1	38.9	13.5	4.1	41.2	17.7		35.0	21.1	16.4		39.0	38.1
Progression Factor	0.69	0.52	0.20	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.9	0.5	0.1	0.3	1.2		2.3	0.0	0.0		0.9	0.2
Delay (s)	28.6	7.4	0.9	41.5	18.9		37.3	21.1	16.4		40.0	38.4
Level of Service	C	A	A	D	B		D	C	B		D	D
Approach Delay (s)		8.3			20.1			34.4			38.8	
Approach LOS		A			C			C			D	

Intersection Summary

HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	96.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2016 Alternative5
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	233	0	164	0	0
Lane Group Flow (vph)	303	67	1158	101	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	10.0	10.0	20.0	20.0	16.0	40.0
Effective Green, g (s)	12.0	12.0	22.0	22.0	18.0	42.0
Actuated g/C Ratio	0.21	0.21	0.38	0.38	0.31	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	340	321	1317	589	510	2513
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.21	0.88	0.17	0.93	0.37
Uniform Delay, d1	22.4	19.1	16.8	11.9	19.4	3.0
Progression Factor	0.82	1.16	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5	0.3	8.6	0.6	23.4	0.4
Delay (s)	41.8	22.3	25.4	12.6	42.7	3.4
Level of Service	D	C	C	B	D	A
Approach Delay (s)	32.1		23.0			16.8
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			22.0		HCM Level of Service	C
HCM Volume to Capacity ratio			0.87			
Actuated Cycle Length (s)			58.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2016 Alternative5
PM Peak


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	35	721	3	33	598	22	1	0	101	37	2	6
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.87			0.98	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3461			3462	1553		1582			1724	
Flt Permitted		0.91			0.90	1.00		1.00			0.82	
Satd. Flow (perm)		3166			3124	1553		1580			1468	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	759	3	35	629	23	1	0	106	39	2	6
RTOR Reduction (vph)	0	0	0	0	0	5	0	88	0	0	5	0
Lane Group Flow (vph)	0	799	0	0	664	18	0	19	0	0	42	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		42.2			42.2	42.2		7.8			7.8	
Effective Green, g (s)		44.2			44.2	44.2		9.8			9.8	
Actuated g/C Ratio		0.76			0.76	0.76		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2413			2381	1183		267			248	
v/s Ratio Prot												
v/s Ratio Perm		c0.25			0.21	0.01		0.01			c0.03	
v/c Ratio		0.33			0.28	0.01		0.07			0.17	
Uniform Delay, d1		2.2			2.1	1.7		20.3			20.6	
Progression Factor		0.36			1.53	1.85		1.00			1.00	
Incremental Delay, d2		0.3			0.3	0.0		0.1			0.3	
Delay (s)		1.1			3.5	3.1		20.4			20.9	
Level of Service		A			A	A		C			C	
Approach Delay (s)		1.1			3.5			20.4			20.9	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	3.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	58.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			























Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2016 Alternative5
PM Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	159	518	183	436	362	390	86	0	468	298	0	205	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00	
Satd. Flow (prot)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1649	1553	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00	
Satd. Flow (perm)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1649	1553	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	167	545	193	459	381	411	91	0	493	314	0	216	
RTOR Reduction (vph)	0	0	124	0	0	235	0	0	142	0	0	179	
Lane Group Flow (vph)	167	545	69	459	381	176	0	91	351	157	157	37	
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm	
Protected Phases	5	2		1	6		8	8	1	4	4		
Permitted Phases			2			6			8			4	
Actuated Green, G (s)	5.6	18.6	18.6	9.8	22.8	22.8		5.6	15.4	8.0	8.0	8.0	
Effective Green, g (s)	7.6	20.6	20.6	11.8	24.8	24.8		7.6	19.4	10.0	10.0	10.0	
Actuated g/C Ratio	0.13	0.36	0.36	0.20	0.43	0.43		0.13	0.33	0.17	0.17	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	418	1233	552	649	1484	664		227	914	269	284	268	
v/s Ratio Prot	0.05	c0.16		c0.14	0.11			c0.05	0.08	c0.10	0.10		
v/s Ratio Perm			0.04			0.11			0.05			0.02	
v/c Ratio	0.40	0.44	0.12	0.71	0.26	0.26		0.40	0.38	0.58	0.55	0.14	
Uniform Delay, d1	23.1	14.3	12.6	21.5	10.7	10.7		23.1	14.7	22.1	22.0	20.3	
Progression Factor	0.95	0.46	0.15	0.62	0.40	0.42		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	1.1	0.4	3.0	0.4	0.8		1.2	0.3	9.0	7.6	1.1	
Delay (s)	22.6	7.6	2.4	16.4	4.6	5.3		24.3	15.0	31.0	29.5	21.4	
Level of Service	C	A	A	B	A	A		C	B	C	C	C	
Approach Delay (s)		9.3			9.2			16.4			26.7		
Approach LOS		A			A			B			C		
Intersection Summary													
HCM Average Control Delay			13.3		HCM Level of Service					B			
HCM Volume to Capacity ratio			0.51										
Actuated Cycle Length (s)			58.0		Sum of lost time (s)					8.0			
Intersection Capacity Utilization			52.8%		ICU Level of Service					A			
Analysis Period (min)			15										
c	Critical Lane Group												

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2016 Alternative5
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3460		3190	1827	1553		1790	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3460		3190	1827	1553		1670	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	160	0	2	0	0	0	17	0	0	24
Lane Group Flow (vph)	32	962	195	138	955	0	284	34	119	0	12	4
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	2.8	19.9	27.8	7.2	24.3		7.9	18.9	26.1		7.0	7.0
Effective Green, g (s)	4.8	21.9	31.8	9.2	26.3		9.9	20.9	30.1		9.0	9.0
Actuated g/C Ratio	0.08	0.38	0.55	0.16	0.45		0.17	0.36	0.52		0.16	0.16
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	136	1311	905	506	1569		545	658	860		259	241
v/s Ratio Prot	0.02	c0.28	0.04	c0.04	c0.28		c0.09	0.02	c0.02			
v/s Ratio Perm			0.09						0.05		0.01	0.00
v/c Ratio	0.24	0.73	0.22	0.27	0.61		0.52	0.05	0.14		0.05	0.02
Uniform Delay, d1	24.9	15.5	6.7	21.5	12.0		21.9	12.1	7.2		20.8	20.8
Progression Factor	1.14	0.94	1.51	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	3.3	0.1	0.3	1.8		0.9	0.0	0.1		0.1	0.0
Delay (s)	29.2	17.8	10.3	21.8	13.7		22.8	12.1	7.3		20.9	20.8
Level of Service	C	B	B	C	B		C	B	A		C	C
Approach Delay (s)		16.1			14.7			17.4			20.8	
Approach LOS		B			B			B			C	
Intersection Summary												
HCM Average Control Delay			15.9			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			58.0			Sum of lost time (s)			4.0			
Intersection Capacity Utilization			55.9%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

2016 Alternative 6

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HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative6 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	264	0	70	0	0
Lane Group Flow (vph)	118	65	643	45	327	755
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	8.4	8.4	18.8	18.8	13.8	36.6
Effective Green, g (s)	10.4	10.4	20.8	20.8	15.8	38.6
Actuated g/C Ratio	0.20	0.20	0.39	0.39	0.30	0.73
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	314	305	1362	592	476	2528
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.38	0.21	0.47	0.08	0.69	0.30
Uniform Delay, d1	18.5	17.9	12.0	10.1	16.4	2.5
Progression Factor	0.80	1.10	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3	1.2	0.3	4.1	0.3
Delay (s)	15.5	20.0	13.2	10.3	20.5	2.8
Level of Service	B	C	B	B	C	A
Approach Delay (s)	18.8		12.7			8.2
Approach LOS	B		B			A

Intersection Summary

HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	114	250	477	46	196	21
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1598	1776	3374	1509	1589	
Flt Permitted	0.45	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	761	1776	3374	1509	1589	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	263	502	48	206	22
RTOR Reduction (vph)	0	0	0	17	8	0
Lane Group Flow (vph)	120	263	502	31	220	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	32.7	32.7	32.7	32.7	12.3	
Effective Green, g (s)	34.7	34.7	34.7	34.7	14.3	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.27	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	498	1163	2209	988	429	
v/s Ratio Prot		0.15	0.15			
v/s Ratio Perm	c0.16			0.02	c0.14	
v/c Ratio	0.24	0.23	0.23	0.03	0.51	
Uniform Delay, d1	3.8	3.7	3.7	3.2	16.4	
Progression Factor	0.75	0.74	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.4	0.2	0.1	1.0	
Delay (s)	3.8	3.1	4.0	3.3	17.4	
Level of Service	A	A	A	A	B	
Approach Delay (s)		3.4	3.9		17.4	
Approach LOS		A	A		B	

Intersection Summary

HCM Average Control Delay	6.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	74	354	17	0	323	564	0	0	20	233	0	196
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	0.99			1.00	0.85			0.86	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1598	3351			3374	1509			1536	3100		1509
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1598	3351			3374	1509			1536	3100		1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	373	18	0	340	594	0	0	21	245	0	206
RTOR Reduction (vph)	0	4	0	0	0	232	0	0	17	0	0	158
Lane Group Flow (vph)	78	387	0	0	340	362	0	0	4	245	0	48
Turn Type	Prot					Perm			custom	Prot		custom
Protected Phases	5	2			6					4		
Permitted Phases						6			8			4
Actuated Green, G (s)	5.6	60.0			50.4	50.4			18.0	18.0		18.0
Effective Green, g (s)	7.6	62.0			52.4	52.4			18.0	20.0		20.0
Actuated g/C Ratio	0.09	0.72			0.61	0.61			0.21	0.23		0.23
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	141	2416			2056	919			321	721		351
v/s Ratio Prot	c0.05	0.12			0.10					c0.08		
v/s Ratio Perm						c0.24			0.00			0.03
v/c Ratio	0.55	0.16			0.17	0.39			0.01	0.34		0.14
Uniform Delay, d1	37.6	3.8			7.3	8.6			27.0	27.5		26.2
Progression Factor	1.00	1.00			1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	4.6	0.1			0.2	1.3			0.0	1.3		0.8
Delay (s)	42.2	3.9			7.5	9.9			27.0	28.8		27.0
Level of Service	D	A			A	A			C	C		C
Approach Delay (s)		10.3			9.0			27.0			27.9	
Approach LOS		B			A			C			C	

Intersection Summary		
HCM Average Control Delay	14.1	HCM Level of Service
HCM Volume to Capacity ratio	0.39	B
Actuated Cycle Length (s)	86.0	Sum of lost time (s)
Intersection Capacity Utilization	47.4%	6.0
Analysis Period (min)	15	ICU Level of Service
		A
c Critical Lane Group		

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	341	101	136	457	287	408
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.91	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3077	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3100	1509	1598	3374	3077	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	106	143	481	302	429
RTOR Reduction (vph)	0	71	0	0	273	0
Lane Group Flow (vph)	359	35	143	481	458	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	9.0	31.0	18.0	
Effective Green, g (s)	18.0	18.0	11.0	33.0	20.0	
Actuated g/C Ratio	0.33	0.33	0.20	0.60	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	1015	494	320	2024	1119	
v/s Ratio Prot	c0.12		c0.09	0.14	c0.15	
v/s Ratio Perm		0.02				
v/c Ratio	0.35	0.07	0.45	0.24	0.41	
Uniform Delay, d1	14.1	12.7	19.3	5.1	13.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.3	4.5	0.3	1.1	
Delay (s)	15.0	13.0	23.8	5.4	14.2	
Level of Service	B	B	C	A	B	
Approach Delay (s)	14.6			9.6	14.2	
Approach LOS	B			A	B	
























Intersection Summary

HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	287	221	473	286	39	466	13	319	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.86	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3313		3100	1454	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3313		3100	1454	1434	1598	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	302	233	498	301	41	491	14	336	19	36	143
RTOR Reduction (vph)	0	0	122	0	16	0	0	100	109	0	121	0
Lane Group Flow (vph)	104	302	111	498	326	0	491	75	66	19	58	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	6.1	10.8	27.0	14.3	19.0		16.2	22.7	22.7	1.3	7.8	
Effective Green, g (s)	8.1	12.8	31.0	16.3	21.0		18.2	24.7	24.7	3.3	9.8	
Actuated g/C Ratio	0.12	0.20	0.48	0.25	0.32		0.28	0.38	0.38	0.05	0.15	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	199	663	765	776	1069		867	552	544	81	235	
v/s Ratio Prot	c0.07	c0.09	0.04	c0.16	0.10		c0.16	0.05		0.01	c0.04	
v/s Ratio Perm			0.03						0.05			
v/c Ratio	0.52	0.46	0.15	0.64	0.30		0.57	0.14	0.12	0.23	0.24	
Uniform Delay, d1	26.7	23.1	9.6	21.8	16.6		20.1	13.2	13.1	29.7	24.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	0.5	0.1	1.8	0.7		0.9	0.1	0.1	1.5	0.5	
Delay (s)	29.2	23.6	9.7	23.6	17.3		20.9	13.3	13.2	31.2	24.9	
Level of Service	C	C	A	C	B		C	B	B	C	C	
Approach Delay (s)		19.4			21.0			17.7			25.5	
Approach LOS		B			C			B			C	
Intersection Summary												
HCM Average Control Delay			19.9				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			65.1				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			59.7%				ICU Level of Service		B			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative6 AM Peak

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	18	324	8	58	365	10	12	1	38	16	1	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	341	8	61	384	11	13	1	40	17	1	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	395			349			906	900	345	935	899	389
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	395			349			906	900	345	935	899	389
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			95			95	100	94	92	100	98
cM capacity (veh/h)	1137			1182			234	255	686	214	255	648

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	368	456	54	28
Volume Left	19	61	13	17
Volume Right	8	11	40	11
cSH	1137	1182	462	287
Volume to Capacity	0.02	0.05	0.12	0.10
Queue Length 95th (ft)	1	4	10	8
Control Delay (s)	0.6	1.6	13.8	18.9
Lane LOS	A	A	B	C
Approach Delay (s)	0.6	1.6	13.8	18.9
Approach LOS			B	C

Intersection Summary			
Average Delay		2.4	
Intersection Capacity Utilization		50.8%	ICU Level of Service
Analysis Period (min)		15	A

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative6 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	238	0	170	0	0
Lane Group Flow (vph)	303	62	1158	95	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.0	9.0	17.0	17.0	15.0	36.0
Effective Green, g (s)	11.0	11.0	19.0	19.0	17.0	38.0
Actuated g/C Ratio	0.21	0.21	0.36	0.36	0.32	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	341	322	1244	557	527	2489
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.04		0.06		
v/c Ratio	0.89	0.19	0.93	0.17	0.90	0.37
Uniform Delay, d1	20.4	17.3	16.4	11.6	17.2	2.9
Progression Factor	0.88	1.22	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.1	0.3	13.6	0.7	18.0	0.4
Delay (s)	41.1	21.5	29.9	12.3	35.2	3.3
Level of Service	D	C	C	B	D	A
Approach Delay (s)	31.4		26.6			14.1
Approach LOS	C		C			B
Intersection Summary						
HCM Average Control Delay			22.4		HCM Level of Service	C
HCM Volume to Capacity ratio			0.88			
Actuated Cycle Length (s)			53.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			83.6%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	35	774	636	22	39	6
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1644	1827	3471	1553	1630	
Flt Permitted	0.38	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	665	1827	3471	1553	1630	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	815	669	23	41	6
RTOR Reduction (vph)	0	0	0	6	5	0
Lane Group Flow (vph)	37	815	669	17	42	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	37.5	37.5	37.5	37.5	7.5	
Effective Green, g (s)	39.5	39.5	39.5	39.5	9.5	
Actuated g/C Ratio	0.75	0.75	0.75	0.75	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	496	1362	2587	1157	292	
v/s Ratio Prot		c0.45	0.19			
v/s Ratio Perm	0.06			0.01	c0.03	
v/c Ratio	0.07	0.60	0.26	0.01	0.14	
Uniform Delay, d1	1.8	3.1	2.1	1.7	18.3	
Progression Factor	0.64	0.52	0.77	0.39	1.00	
Incremental Delay, d2	0.3	1.8	0.2	0.0	0.2	
Delay (s)	1.5	3.5	1.9	0.7	18.6	
Level of Service	A	A	A	A	B	
Approach Delay (s)		3.4	1.8		18.6	
Approach LOS		A	A		B	




















Intersection Summary

HCM Average Control Delay	3.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	182	626	5	0	448	436	0	0	50	298	0	209
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1644	3467			3471	1553			1580	3190		1553
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1644	3467			3471	1553			1580	3190		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	192	659	5	0	472	459	0	0	53	314	0	220
RTOR Reduction (vph)	0	0	0	0	0	240	0	0	50	0	0	178
Lane Group Flow (vph)	192	664	0	0	472	219	0	0	3	314	0	42
Turn Type	Prot					Perm			custom	Prot		custom
Protected Phases	5	2			6					4		
Permitted Phases						6			8			4
Actuated Green, G (s)	17.9	70.4			48.5	48.5			5.6	18.0		18.0
Effective Green, g (s)	19.9	72.4			50.5	50.5			5.6	20.0		20.0
Actuated g/C Ratio	0.19	0.68			0.48	0.48			0.05	0.19		0.19
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	309	2368			1654	740			83	602		293
v/s Ratio Prot	c0.12	0.19			0.14					c0.10		
v/s Ratio Perm						c0.14			c0.00			0.03
v/c Ratio	0.62	0.28			0.29	0.30			0.03	0.52		0.14
Uniform Delay, d1	39.6	6.6			16.8	16.9			47.6	38.7		35.8
Progression Factor	0.90	0.58			1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	3.2	0.2			0.4	1.0			0.2	3.2		1.0
Delay (s)	39.0	4.1			17.2	17.9			47.8	41.9		36.9
Level of Service	D	A			B	B			D	D		D
Approach Delay (s)		11.9			17.6			47.8			39.8	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM Average Control Delay			21.2				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			106.0				Sum of lost time (s)			10.0		
Intersection Capacity Utilization			44.3%				ICU Level of Service			A		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	428	126	89	431	431	460
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.92	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3202	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3202	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	451	133	94	454	454	484
RTOR Reduction (vph)	0	89	0	0	290	0
Lane Group Flow (vph)	451	44	94	454	648	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	7.0	31.0	20.0	
Effective Green, g (s)	18.0	18.0	9.0	33.0	22.0	
Actuated g/C Ratio	0.33	0.33	0.16	0.60	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	1044	508	269	2083	1281	
v/s Ratio Prot	c0.14		c0.06	0.13	c0.20	
v/s Ratio Perm		0.03				
v/c Ratio	0.43	0.09	0.35	0.22	0.51	
Uniform Delay, d1	14.5	12.8	20.4	5.1	12.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	0.3	3.6	0.2	1.4	
Delay (s)	15.8	13.1	24.0	5.3	13.8	
Level of Service	B	B	C	A	B	
Approach Delay (s)	15.2			8.5	13.8	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	573	370	521	500	19	356	32	470	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3452		3190	1508	1475	1644	1608	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3452		3190	1508	1475	1644	1608	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	603	389	548	526	20	375	34	495	5	7	28
RTOR Reduction (vph)	0	0	191	0	4	0	0	152	171	0	24	0
Lane Group Flow (vph)	32	603	198	548	542	0	375	115	91	5	11	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	2.6	14.2	28.7	12.5	24.1		14.5	20.4	20.4	1.3	7.2	
Effective Green, g (s)	4.6	16.2	32.7	14.5	26.1		16.5	22.4	22.4	3.3	9.2	
Actuated g/C Ratio	0.07	0.25	0.51	0.23	0.41		0.26	0.35	0.35	0.05	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	117	873	837	718	1399		817	525	513	84	230	
v/s Ratio Prot	0.02	c0.17	0.06	c0.17	0.16		c0.12	c0.08		c0.00	0.01	
v/s Ratio Perm			0.07						0.06			
v/c Ratio	0.27	0.69	0.24	0.76	0.39		0.46	0.22	0.18	0.06	0.05	
Uniform Delay, d1	28.3	21.8	8.9	23.3	13.5		20.2	14.8	14.6	29.1	23.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	2.4	0.1	4.8	0.8		0.4	0.2	0.2	0.3	0.1	
Delay (s)	29.6	24.2	9.0	28.2	14.3		20.6	15.0	14.8	29.4	23.9	
Level of Service	C	C	A	C	B		C	B	B	C	C	
Approach Delay (s)		18.6			21.3			17.3			24.6	
Approach LOS		B			C			B			C	

Intersection Summary

HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative6 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	4	419	3	47	411	1	11	0	60	13	3	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	441	3	49	433	1	12	0	63	14	3	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	434			444			995	984	443	1046	985	433
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434			444			995	984	443	1046	985	433
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			94	100	90	92	99	98
cM capacity (veh/h)	1115			1105			208	235	611	177	234	618

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	448	483	75	27
Volume Left	4	49	12	14
Volume Right	3	1	63	11
cSH	1115	1105	470	253
Volume to Capacity	0.00	0.04	0.16	0.11
Queue Length 95th (ft)	0	4	14	9
Control Delay (s)	0.1	1.3	14.1	20.9
Lane LOS	A	A	B	C
Approach Delay (s)	0.1	1.3	14.1	20.9
Approach LOS			B	C

Intersection Summary			
Average Delay		2.2	
Intersection Capacity Utilization		61.2%	ICU Level of Service
Analysis Period (min)		15	B

2016 Alternative 7

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HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative7 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	112	313	611	109	311	717
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	329	643	115	327	755
RTOR Reduction (vph)	0	264	0	77	0	0
Lane Group Flow (vph)	118	65	643	38	327	755
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.4	9.4	17.0	17.0	19.0	40.0
Effective Green, g (s)	11.4	11.4	19.0	19.0	21.0	42.0
Actuated g/C Ratio	0.20	0.20	0.33	0.33	0.37	0.73
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	317	300	1117	499	585	2469
v/s Ratio Prot	c0.07		c0.19		c0.20	0.22
v/s Ratio Perm		0.04		0.03		
v/c Ratio	0.37	0.22	0.58	0.08	0.56	0.31
Uniform Delay, d1	19.9	19.3	15.9	13.2	14.5	2.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.4	2.2	0.3	3.8	0.3
Delay (s)	20.6	19.6	18.0	13.5	18.3	3.0
Level of Service	C	B	B	B	B	A
Approach Delay (s)	19.9		17.3			7.6
Approach LOS	B		B			A

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	6.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak






















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕↕	↗	↘↘	
Volume (vph)	114	234	475	56	196	21
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)		2.0	2.0	2.0	2.0	
Lane Util. Factor		1.00	0.95	1.00	1.00	
Frt		1.00	1.00	0.85	0.99	
Flt Protected		0.98	1.00	1.00	0.96	
Satd. Flow (prot)		1747	3374	1509	1589	
Flt Permitted		0.74	1.00	1.00	0.96	
Satd. Flow (perm)		1312	3374	1509	1589	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	246	500	59	206	22
RTOR Reduction (vph)	0	0	0	16	5	0
Lane Group Flow (vph)	0	366	500	43	223	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)		59.9	59.9	59.9	17.1	
Effective Green, g (s)		61.9	61.9	61.9	19.1	
Actuated g/C Ratio		0.73	0.73	0.73	0.22	
Clearance Time (s)		4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		955	2457	1099	357	
v/s Ratio Prot			0.15			
v/s Ratio Perm		c0.28		0.03	c0.14	
v/c Ratio		0.38	0.20	0.04	0.62	
Uniform Delay, d1		4.4	3.7	3.2	29.7	
Progression Factor		1.00	0.86	0.71	1.00	
Incremental Delay, d2		1.2	0.2	0.1	3.4	
Delay (s)		5.5	3.4	2.4	33.1	
Level of Service		A	A	A	C	
Approach Delay (s)		5.5	3.3		33.1	
Approach LOS		A	A		C	

Intersection Summary

HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
4: Barton Rd & I-215 SB Ramps






















Barton Rd Interchange Improvement
2016 Alternative7 AM Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	74	346	8	0	335	564	0	0	28	229	0	192	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00	
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85	
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (prot)	1682	3363			3374	1509			1536	3100		1509	
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (perm)	1682	3363			3374	1509			1536	3100		1509	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	78	364	8	0	353	594	0	0	29	241	0	202	
RTOR Reduction (vph)	0	1	0	0	0	159	0	0	27	0	0	113	
Lane Group Flow (vph)	78	371	0	0	353	435	0	0	2	241	0	89	
Turn Type	Prot				pm+ov				custom	Prot		custom	
Protected Phases	5	2			6	7				7		5	
Permitted Phases						6			8			4	
Actuated Green, G (s)	8.0	56.8			44.8	58.2			2.8	13.4		28.2	
Effective Green, g (s)	10.0	58.8			46.8	62.2			4.8	15.4		32.2	
Actuated g/C Ratio	0.12	0.69			0.55	0.73			0.06	0.18		0.38	
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	198	2326			1858	1140			87	562		607	
v/s Ratio Prot	c0.05	0.11			0.10	c0.07				c0.08		c0.02	
v/s Ratio Perm						0.22			0.00			0.04	
v/c Ratio	0.39	0.16			0.19	0.38			0.02	0.43		0.15	
Uniform Delay, d1	34.7	4.5			9.6	4.2			37.9	30.9		17.4	
Progression Factor	0.87	0.52			0.20	1.98			1.00	1.00		1.00	
Incremental Delay, d2	1.2	0.1			0.2	0.2			0.1	0.5		0.1	
Delay (s)	31.2	2.5			2.1	8.6			38.0	31.4		17.5	
Level of Service	C	A			A	A			D	C		B	
Approach Delay (s)		7.5			6.2			38.0			25.1		
Approach LOS		A			A			D			C		
Intersection Summary													
HCM Average Control Delay			11.5									HCM Level of Service	B
HCM Volume to Capacity ratio			0.37										
Actuated Cycle Length (s)			85.0									Sum of lost time (s)	4.0
Intersection Capacity Utilization			47.4%									ICU Level of Service	A
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	113	490	0	0	814	431	74	0	368	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1598	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1598	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	119	516	0	0	857	454	78	0	387	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	196	0	167	166	0	0	0
Lane Group Flow (vph)	119	516	0	0	857	258	78	27	27	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	5	2			6		3		8			
Permitted Phases						6						8
Actuated Green, G (s)	17.0	67.3			46.3	46.3	9.7	9.7	9.7			
Effective Green, g (s)	19.0	69.3			48.3	48.3	11.7	11.7	11.7			
Actuated g/C Ratio	0.22	0.82			0.57	0.57	0.14	0.14	0.14			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	357	2751			1917	857	220	197	187			
v/s Ratio Prot	c0.07	0.15			c0.25		c0.05	0.02				
v/s Ratio Perm						0.17			0.02			
v/c Ratio	0.33	0.19			0.45	0.30	0.35	0.14	0.14			
Uniform Delay, d1	27.7	1.7			10.6	9.6	33.2	32.2	32.2			
Progression Factor	1.04	0.51			0.30	0.50	1.00	1.00	1.00			
Incremental Delay, d2	2.5	0.1			0.6	0.8	1.0	0.3	0.4			
Delay (s)	31.3	1.0			3.8	5.6	34.2	32.5	32.6			
Level of Service	C	A			A	A	C	C	C			
Approach Delay (s)		6.7			4.4			32.8			0.0	
Approach LOS		A			A			C			A	
Intersection Summary												
HCM Average Control Delay			10.5		HCM Level of Service					B		
HCM Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			85.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			50.9%		ICU Level of Service					A		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak


























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↗↘	↑	↗	↘
Volume (vph)	114	63	189	97	114	343
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.95		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3194		3273	1776	1687	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3194		3273	1776	1687	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	66	199	102	120	361
RTOR Reduction (vph)	59	0	0	0	0	212
Lane Group Flow (vph)	127	0	199	102	120	149
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	8.9		29.1	42.0	35.0	35.0
Effective Green, g (s)	8.9		29.1	42.0	35.0	35.0
Actuated g/C Ratio	0.10		0.34	0.49	0.41	0.41
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	334		1121	878	695	621
v/s Ratio Prot	c0.04		c0.06	0.06	0.07	
v/s Ratio Perm						c0.10
v/c Ratio	0.38		0.18	0.12	0.17	0.24
Uniform Delay, d1	35.5		19.6	11.5	15.8	16.3
Progression Factor	1.00		0.97	0.86	1.00	1.00
Incremental Delay, d2	0.7		0.3	0.3	0.5	0.9
Delay (s)	36.2		19.3	10.2	16.4	17.2
Level of Service	D		B	B	B	B
Approach Delay (s)	36.2			16.2	17.0	
Approach LOS	D			B	B	

Intersection Summary

HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative7 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	549	210	42	717	39	392	13	52	18	34	136
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.91	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	1598	3348		3100	1535	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.73	1.00	
Satd. Flow (perm)	1598	3374	1509	1598	3348		3100	1535	1434	1233	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	578	221	44	755	41	413	14	55	19	36	143
RTOR Reduction (vph)	0	0	64	0	4	0	0	14	22	0	125	0
Lane Group Flow (vph)	104	578	157	44	792	0	413	21	12	19	54	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	10.9	41.0	56.3	4.2	34.3		15.3	27.8	27.8	8.5	8.5	
Effective Green, g (s)	12.9	43.0	60.3	6.2	36.3		17.3	29.8	29.8	10.5	10.5	
Actuated g/C Ratio	0.15	0.51	0.71	0.07	0.43		0.20	0.35	0.35	0.12	0.12	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	243	1707	1106	117	1430		631	538	503	152	193	
v/s Ratio Prot	c0.07	c0.17	0.03	0.03	c0.24		c0.13	0.01			c0.03	
v/s Ratio Perm			0.08						0.01	0.02		
v/c Ratio	0.43	0.34	0.14	0.38	0.55		0.65	0.04	0.02	0.12	0.28	
Uniform Delay, d1	32.7	12.5	4.0	37.6	18.3		31.1	18.2	18.1	33.2	33.8	
Progression Factor	0.99	0.94	1.22	1.00	1.00		0.87	0.63	0.49	1.00	1.00	
Incremental Delay, d2	1.2	0.5	0.1	2.0	1.6		2.3	0.0	0.0	0.4	0.8	
Delay (s)	33.4	12.3	4.9	39.6	19.8		29.3	11.5	8.9	33.5	34.6	
Level of Service	C	B	A	D	B		C	B	A	C	C	
Approach Delay (s)		12.9			20.9			26.6			34.5	
Approach LOS		B			C			C			C	

Intersection Summary		
HCM Average Control Delay	20.2	HCM Level of Service C
HCM Volume to Capacity ratio	0.50	
Actuated Cycle Length (s)	85.0	Sum of lost time (s) 6.0
Intersection Capacity Utilization	62.2%	ICU Level of Service B
Analysis Period (min)	15	
c Critical Lane Group		

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative 7 AM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	18	324	8	50	365	10	12	1	18	16	2	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	341	8	53	384	11	13	1	19	17	2	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	395			349			889	883	345	897	882	389
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	395			349			889	883	345	897	882	389
tC, single (s)	4.2			4.2			7.2	6.6	6.3	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.6	4.1	3.4	3.6	4.1	3.4
p0 queue free %	98			96			95	100	97	93	99	98
cM capacity (veh/h)	1137			1182			241	262	686	236	263	648

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	368	447	33	29
Volume Left	19	53	13	17
Volume Right	8	11	19	11
cSH	1137	1182	388	308
Volume to Capacity	0.02	0.04	0.08	0.10
Queue Length 95th (ft)	1	3	7	8
Control Delay (s)	0.6	1.4	15.1	17.9
Lane LOS	A	A	C	C
Approach Delay (s)	0.6	1.4	15.1	17.9
Approach LOS			C	C

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		47.6%	ICU Level of Service
Analysis Period (min)		15	A

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2016 Alternative7 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	288	285	1100	252	450	877
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	303	300	1158	265	474	923
RTOR Reduction (vph)	0	159	0	162	0	0
Lane Group Flow (vph)	303	141	1158	103	474	923
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.9	15.9	31.0	31.0	26.1	61.1
Effective Green, g (s)	17.9	17.9	33.0	33.0	28.1	63.1
Actuated g/C Ratio	0.21	0.21	0.39	0.39	0.33	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	346	327	1348	603	543	2577
v/s Ratio Prot	c0.18		c0.33		c0.29	0.27
v/s Ratio Perm		0.09		0.07		
v/c Ratio	0.88	0.43	0.86	0.17	0.87	0.36
Uniform Delay, d1	32.5	29.1	23.9	17.0	26.8	3.8
Progression Factor	0.72	0.49	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.0	0.9	7.3	0.6	17.4	0.4
Delay (s)	44.5	15.1	31.2	17.6	44.2	4.2
Level of Service	D	B	C	B	D	A
Approach Delay (s)	29.9		28.6			17.8
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	24.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c	Critical Lane Group		

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2016 Alternative7 PM Peak






















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕↕	↗	↘↘	
Volume (vph)	35	766	634	32	39	6
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)		2.0	2.0	2.0	2.0	
Lane Util. Factor		1.00	0.95	1.00	1.00	
Frt		1.00	1.00	0.85	0.98	
Flt Protected		1.00	1.00	1.00	0.96	
Satd. Flow (prot)		1823	3471	1553	1630	
Flt Permitted		0.96	1.00	1.00	0.96	
Satd. Flow (perm)		1748	3471	1553	1630	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	806	667	34	41	6
RTOR Reduction (vph)	0	0	0	5	5	0
Lane Group Flow (vph)	0	843	667	29	42	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)		70.0	70.0	70.0	7.0	
Effective Green, g (s)		72.0	72.0	72.0	9.0	
Actuated g/C Ratio		0.85	0.85	0.85	0.11	
Clearance Time (s)		4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		1481	2940	1315	173	
v/s Ratio Prot			0.19			
v/s Ratio Perm		c0.48		0.02	c0.03	
v/c Ratio		0.57	0.23	0.02	0.24	
Uniform Delay, d1		1.9	1.2	1.0	34.9	
Progression Factor		0.49	0.62	0.20	1.00	
Incremental Delay, d2		1.5	0.2	0.0	0.7	
Delay (s)		2.5	0.9	0.2	35.6	
Level of Service		A	A	A	D	
Approach Delay (s)		2.5	0.9		35.6	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	2.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
4: Barton Rd & I-215 SB Ramps























Barton Rd Interchange Improvement
2016 Alternative7 PM Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	183	616	2	0	458	436	0	0	61	296	0	208	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00	
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85	
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (prot)	1731	3470			3471	1553			1580	3190		1553	
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (perm)	1731	3470			3471	1553			1580	3190		1553	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	193	648	2	0	482	459	0	0	64	312	0	219	
RTOR Reduction (vph)	0	0	0	0	0	174	0	0	58	0	0	45	
Lane Group Flow (vph)	193	650	0	0	482	285	0	0	6	312	0	174	
Turn Type	Prot				pm+ov				custom	Prot		custom	
Protected Phases	5	2			6	7				7		5	
Permitted Phases						6			8			4	
Actuated Green, G (s)	14.7	52.7			34.0	48.7			5.6	14.7		39.0	
Effective Green, g (s)	16.7	54.7			36.0	52.7			7.6	16.7		43.0	
Actuated g/C Ratio	0.20	0.64			0.42	0.62			0.09	0.20		0.51	
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	340	2233			1470	963			141	627		822	
v/s Ratio Prot	c0.11	0.19			c0.14	0.06				c0.10		c0.04	
v/s Ratio Perm						0.13			0.00			0.07	
v/c Ratio	0.57	0.29			0.33	0.30			0.04	0.50		0.21	
Uniform Delay, d1	30.9	6.6			16.4	7.5			35.4	30.4		11.6	
Progression Factor	0.83	0.70			0.51	2.03			1.00	1.00		1.00	
Incremental Delay, d2	1.8	0.3			0.6	0.2			0.1	0.6		0.1	
Delay (s)	27.3	5.0			9.0	15.4			35.5	31.0		11.7	
Level of Service	C	A			A	B			D	C		B	
Approach Delay (s)		10.1			12.1			35.5			23.1		
Approach LOS		B			B			D			C		
Intersection Summary													
HCM Average Control Delay			14.5									HCM Level of Service	B
HCM Volume to Capacity ratio			0.39										
Actuated Cycle Length (s)			85.0									Sum of lost time (s)	8.0
Intersection Capacity Utilization			44.4%									ICU Level of Service	A
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2016 Alternative 7 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	159	813	0	0	797	390	86	0	468	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1644	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1644	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	167	856	0	0	839	411	91	0	493	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	188	0	185	185	0	0	0
Lane Group Flow (vph)	167	856	0	0	839	223	91	62	61	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	18.0	66.1			44.1	44.1	10.9	10.9	10.9			
Effective Green, g (s)	20.0	68.1			46.1	46.1	12.9	12.9	12.9			
Actuated g/C Ratio	0.24	0.80			0.54	0.54	0.15	0.15	0.15			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	387	2781			1883	842	250	224	212			
v/s Ratio Prot	c0.10	0.25			c0.24		c0.06	0.04				
v/s Ratio Perm						0.14			0.04			
v/c Ratio	0.43	0.31			0.45	0.26	0.36	0.28	0.29			
Uniform Delay, d1	27.7	2.2			11.7	10.4	32.4	31.9	32.0			
Progression Factor	1.21	1.63			0.49	0.39	1.00	1.00	1.00			
Incremental Delay, d2	0.7	0.3			0.7	0.7	0.9	0.7	0.8			
Delay (s)	34.2	3.9			6.4	4.7	33.3	32.6	32.7			
Level of Service	C	A			A	A	C	C	C			
Approach Delay (s)		8.9			5.9			32.8			0.0	
Approach LOS		A			A			C			A	
Intersection Summary												
HCM Average Control Delay			12.4		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.42									
Actuated Cycle Length (s)			85.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			53.1%		ICU Level of Service				A			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2016 Alternative7 PM Peak



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑	↖	↗
Volume (vph)	108	117	351	124	108	323
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.92		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3201		3367	1827	1736	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3201		3367	1827	1736	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	114	123	369	131	114	340
RTOR Reduction (vph)	110	0	0	0	0	220
Lane Group Flow (vph)	127	0	369	131	114	120
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	8.9		34.1	47.0	30.0	30.0
Effective Green, g (s)	8.9		34.1	47.0	30.0	30.0
Actuated g/C Ratio	0.10		0.40	0.55	0.35	0.35
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	335		1351	1010	613	548
v/s Ratio Prot	c0.04		c0.11	0.07	0.07	
v/s Ratio Perm						c0.08
v/c Ratio	0.38		0.27	0.13	0.19	0.22
Uniform Delay, d1	35.5		17.1	9.2	19.0	19.3
Progression Factor	1.00		0.94	1.03	1.00	1.00
Incremental Delay, d2	0.7		0.5	0.3	0.7	0.9
Delay (s)	36.2		16.5	9.7	19.7	20.2
Level of Service	D		B	A	B	C
Approach Delay (s)	36.2			14.7	20.1	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	33.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2016 Alternative 7 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	914	337	131	890	19	270	32	129	5	7	27
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	1.5	1.5	1.0	1.5	1.0		1.0	1.0	1.0	1.5	1.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.91	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3460		3190	1577	1475	1644	1608	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.53	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3460		3190	1577	1475	911	1608	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	962	355	138	937	20	284	34	136	5	7	28
RTOR Reduction (vph)	0	0	115	0	2	0	0	38	59	0	25	0
Lane Group Flow (vph)	32	962	240	138	955	0	284	49	24	5	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	4.5	41.3	53.4	11.0	48.3		12.1	22.7	22.7	7.1	7.1	
Effective Green, g (s)	6.5	43.3	57.4	13.0	50.3		14.1	24.7	24.7	9.1	9.1	
Actuated g/C Ratio	0.08	0.51	0.68	0.15	0.59		0.17	0.29	0.29	0.11	0.11	
Clearance Time (s)	3.5	3.5	3.0	3.5	3.0		3.0	3.0	3.0	3.5	3.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	126	1768	1049	251	2048		529	458	429	98	172	
v/s Ratio Prot	0.02	c0.28	0.04	c0.08	0.28		c0.09	c0.03			0.01	
v/s Ratio Perm			0.12						0.02	0.01		
v/c Ratio	0.25	0.54	0.23	0.55	0.47		0.54	0.11	0.06	0.05	0.06	
Uniform Delay, d1	37.0	14.2	5.3	33.3	9.8		32.5	22.1	21.7	34.1	34.1	
Progression Factor	0.78	0.62	1.73	1.00	1.00		0.85	0.63	0.39	1.00	1.00	
Incremental Delay, d2	1.0	1.1	0.1	2.5	0.8		1.0	0.1	0.1	0.2	0.1	
Delay (s)	29.7	9.9	9.3	35.8	10.5		28.6	14.0	8.5	34.3	34.2	
Level of Service	C	A	A	D	B		C	B	A	C	C	
Approach Delay (s)		10.2			13.7			22.1			34.2	
Approach LOS		B			B			C			C	

Intersection Summary

HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
8: Barton Rd & Terrace Ave

Barton Rd Interchange Improvement
2016 Alternative 7 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	4	419	3	19	411	1	11	0	10	13	3	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	4	441	3	20	433	1	12	0	11	14	3	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		539			1273							
pX, platoon unblocked												
vC, conflicting volume	434			444			936	925	443	935	926	433
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	434			444			936	925	443	935	926	433
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			95	100	98	94	99	98
cM capacity (veh/h)	1115			1105			233	261	611	236	261	618

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	448	454	22	27
Volume Left	4	20	12	14
Volume Right	3	1	11	11
cSH	1115	1105	330	314
Volume to Capacity	0.00	0.02	0.07	0.09
Queue Length 95th (ft)	0	1	5	7
Control Delay (s)	0.1	0.6	16.7	17.6
Lane LOS	A	A	C	C
Approach Delay (s)	0.1	0.6	16.7	17.6
Approach LOS			C	C

Intersection Summary			
Average Delay		1.2	
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

2040 Intersection LOS















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2040 Alternative 1

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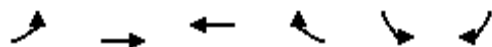
Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative1
AM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	347	0	191	0	0
Lane Group Flow (vph)	291	238	1083	87	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.4	15.4	23.0	23.0	29.6	56.6
Effective Green, g (s)	17.4	17.4	25.0	25.0	31.6	58.6
Actuated g/C Ratio	0.22	0.22	0.31	0.31	0.40	0.73
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	358	338	1085	485	649	2543
v/s Ratio Prot	c0.18		c0.31		c0.40	0.45
v/s Ratio Perm		0.15		0.06		
v/c Ratio	0.81	0.70	1.00	0.18	1.01	0.62
Uniform Delay, d1	29.8	28.9	27.5	20.0	24.2	5.2
Progression Factor	0.74	0.72	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.8	6.3	26.9	0.8	36.9	1.1
Delay (s)	34.7	27.0	54.4	20.8	61.1	6.4
Level of Service	C	C	D	C	E	A
Approach Delay (s)	29.5		47.5			22.4
Approach LOS	C		D			C
Intersection Summary						
HCM Average Control Delay			31.4		HCM Level of Service	C
HCM Volume to Capacity ratio			0.94			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative1
AM PEAK



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↗	↘	
Volume (veh/h)	178	672	808	75	190	24
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	187	707	851	79	200	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.84				0.84	0.84
vC, conflicting volume	929				1933	851
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	820				2016	726
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	72				0	93
cM capacity (veh/h)	671				38	353

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	895	851	79	225
Volume Left	187	0	0	200
Volume Right	0	0	79	25
cSH	671	1700	1700	43
Volume to Capacity	0.28	0.50	0.05	5.28
Queue Length 95th (ft)	29	0	0	Err
Control Delay (s)	7.3	0.0	0.0	Err
Lane LOS	A			F
Approach Delay (s)	7.3	0.0		Err
Approach LOS				F

Intersection Summary			
Average Delay		1102.2	
Intersection Capacity Utilization		115.3%	ICU Level of Service H
Analysis Period (min)		15	

Barton Road Interchange Improvement Project
3: Barton Rd & La Crosse Ave

2040 Alternative1
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	858	3	21	570	0	7	0	17	0	22	306
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	903	3	22	600	0	7	0	18	0	23	322
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.82						0.82	0.82		0.82	0.82	0.82
vC, conflicting volume	600			906			1883	1549	905	1567	1551	600
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	398			906			1969	1560	905	1582	1562	398
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			36	100	95	100	74	39
cM capacity (veh/h)	939			743			12	88	332	66	88	529
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	906	622	25	345								
Volume Left	0	22	7	0								
Volume Right	3	0	18	322								
cSH	1700	743	36	395								
Volume to Capacity	0.53	0.03	0.69	0.87								
Queue Length 95th (ft)	0	2	61	217								
Control Delay (s)	0.0	0.8	223.4	51.9								
Lane LOS		A	F	F								
Approach Delay (s)	0.0	0.8	223.4	51.9								
Approach LOS			F	F								
Intersection Summary												
Average Delay			12.7									
Intersection Capacity Utilization			77.5%		ICU Level of Service				D			
Analysis Period (min)			15									

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative1
AM PEAK





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	754	119	907	591	11	0	0	0	382	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.98		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1790		1644	1822						1736	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1790		1644	1822						1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	2	794	125	955	622	12	0	0	0	402	0	0
RTOR Reduction (vph)	0	7	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	912	0	955	633	0	0	0	0	0	402	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	24.8		27.2	51.2						16.0	
Effective Green, g (s)	2.8	26.8		29.2	53.2						18.0	
Actuated g/C Ratio	0.03	0.34		0.36	0.67						0.22	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	58	600		600	1212						391	
v/s Ratio Prot	0.00	c0.51		c0.58	0.35						c0.23	
v/s Ratio Perm												
v/c Ratio	0.03	1.52		1.59	0.52						1.03	
Uniform Delay, d1	37.3	26.6		25.4	6.9						31.0	
Progression Factor	1.30	0.54		0.61	0.12						1.00	
Incremental Delay, d2	0.2	240.4		267.0	0.0						52.9	
Delay (s)	48.8	254.6		282.6	0.9						83.9	
Level of Service	D	F		F	A						F	
Approach Delay (s)		254.2			170.2			0.0			83.9	
Approach LOS		F			F			A			F	

Intersection Summary

HCM Average Control Delay	184.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	132.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative1
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	909	0	0	1377	868	132	0	574	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	957	0	0	1449	914	139	0	604	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	312	0	0	143	0	0	0
Lane Group Flow (vph)	239	957	0	0	1449	602	0	139	461	0	0	0
Turn Type	Prot				Perm		Split	Perm				
Protected Phases	5	2			6		8	8				
Permitted Phases					6				8			
Actuated Green, G (s)	8.0	55.0			43.0	43.0			17.0	17.0		
Effective Green, g (s)	10.0	57.0			45.0	45.0			19.0	19.0		
Actuated g/C Ratio	0.12	0.71			0.56	0.56			0.24	0.24		
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		
Lane Grp Cap (vph)	206	1302			1028	874			412	369		
v/s Ratio Prot	c0.15	0.52			c0.79				0.08			
v/s Ratio Perm							0.39			c0.30		
v/c Ratio	1.16	0.74			1.41	0.69			0.34	1.25		
Uniform Delay, d1	35.0	6.9			17.5	12.5			25.3	30.5		
Progression Factor	1.35	0.17			0.83	0.39			1.00	1.00		
Incremental Delay, d2	77.4	0.3			185.6	1.0			2.2	132.5		
Delay (s)	124.6	1.5			200.2	5.9			27.5	163.0		
Level of Service	F	A			F	A			C	F		
Approach Delay (s)	26.1				125.0				137.6		0.0	
Approach LOS	C				F				F		A	
Intersection Summary												
HCM Average Control Delay			99.7		HCM Level of Service				F			
HCM Volume to Capacity ratio			1.31									
Actuated Cycle Length (s)			80.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			103.5%		ICU Level of Service				G			
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

2040 Alternative1
AM PEAK























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Volume (vph)	1003	480	173	1350	896	183
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.95		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3303		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3303		1644	3471	1644	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1056	505	182	1421	943	193
RTOR Reduction (vph)	72	0	0	0	0	101
Lane Group Flow (vph)	1490	0	182	1421	943	92
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	26.0		7.0	37.0	35.0	35.0
Effective Green, g (s)	28.0		9.0	39.0	37.0	37.0
Actuated g/C Ratio	0.35		0.11	0.49	0.46	0.46
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1156		185	1692	760	718
v/s Ratio Prot	c0.45		c0.11	0.41	c0.57	
v/s Ratio Perm						0.06
v/c Ratio	1.29		0.98	0.84	1.24	0.13
Uniform Delay, d1	26.0		35.4	17.8	21.5	12.3
Progression Factor	1.10		1.00	1.00	1.00	1.00
Incremental Delay, d2	132.6		61.0	5.2	119.4	0.4
Delay (s)	161.2		96.5	23.0	140.9	12.7
Level of Service	F		F	C	F	B
Approach Delay (s)	161.2			31.3	119.1	
Approach LOS	F			C	F	

Intersection Summary

HCM Average Control Delay	101.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	115.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			













Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative1
AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	155	1031	0	0	1358	65	0	0	0	21	0	165
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	163	1085	0	0	1429	68	0	0	0	22	0	174
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.69			0.69	0.69	0.69	0.69	0.69	
vC, conflicting volume	1498			1085			2300	2909	543	2298	2841	715
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1498			219			1983	2869	0	1981	2769	715
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	62			100			100	100	100	0	100	53
cM capacity (veh/h)	434			918			9	7	742	17	8	369
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	163	543	543	715	715	68	196					
Volume Left	163	0	0	0	0	0	22					
Volume Right	0	0	0	0	0	68	174					
cSH	434	1700	1700	1700	1700	1700	112					
Volume to Capacity	0.38	0.32	0.32	0.42	0.42	0.04	1.74					
Queue Length 95th (ft)	43	0	0	0	0	0	381					
Control Delay (s)	18.2	0.0	0.0	0.0	0.0	0.0	434.9					
Lane LOS	C						F					
Approach Delay (s)	2.4			0.0			434.9					
Approach LOS							F					
Intersection Summary												
Average Delay			30.0									
Intersection Capacity Utilization			70.7%		ICU Level of Service				C			
Analysis Period (min)			15									

Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2040 Alternative1
 PM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	293	0	150	0	0
Lane Group Flow (vph)	359	413	2497	247	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	16.0	16.0	34.0	34.0	18.0	56.0
Effective Green, g (s)	18.0	18.0	36.0	36.0	20.0	58.0
Actuated g/C Ratio	0.22	0.22	0.45	0.45	0.25	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	370	349	1562	699	411	2516
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.27		0.16		
v/c Ratio	0.97	1.18	1.60	0.35	1.75	0.83
Uniform Delay, d1	30.7	31.0	22.0	14.4	30.0	7.6
Progression Factor	0.61	0.74	1.00	1.00	1.00	1.00
Incremental Delay, d2	36.7	106.1	272.4	1.4	346.1	3.3
Delay (s)	55.6	129.2	294.4	15.8	376.1	10.9
Level of Service	E	F	F	B	F	B
Approach Delay (s)	104.4		256.2			104.4
Approach LOS	F		F			F

Intersection Summary

HCM Average Control Delay	169.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.51		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative1
PM PEAK



















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕	↕	↕	
Volume (veh/h)	52	1420	1111	26	38	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	55	1495	1169	27	40	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)			565			
pX, platoon unblocked	0.66				0.66	0.66
vC, conflicting volume	1197				2774	1169
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1041				3430	999
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	87				0	98
cM capacity (veh/h)	436				4	193

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	1549	1169	27	43
Volume Left	55	0	0	40
Volume Right	0	0	27	3
cSH	436	1700	1700	5
Volume to Capacity	0.13	0.69	0.02	9.04
Queue Length 95th (ft)	11	0	0	Err
Control Delay (s)	14.4	0.0	0.0	Err
Lane LOS	B			F
Approach Delay (s)	14.4	0.0		Err
Approach LOS				F

Intersection Summary			
Average Delay		162.7	
Intersection Capacity Utilization		133.3%	ICU Level of Service H
Analysis Period (min)		15	


















Barton Road Interchange Improvement Project
3: Barton Rd & La Crosse Ave

2040 Alternative1
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1455	3	7	769	0	8	0	63	0	6	360
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	1532	3	7	809	0	8	0	66	0	6	379
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					95							
pX, platoon unblocked	0.69						0.69	0.69		0.69	0.69	0.69
vC, conflicting volume	809			1535			2739	2357	1533	2424	2359	809
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	495			1535			3303	2747	1533	2844	2750	495
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			0	100	53	100	52	3
cM capacity (veh/h)	727			428			0	13	142	4	13	392
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	1535	817	75	385								
Volume Left	0	7	8	0								
Volume Right	3	0	66	379								
cSH	1700	428	1	266								
Volume to Capacity	0.90	0.02	122.68	1.45								
Queue Length 95th (ft)	0	1	Err	539								
Control Delay (s)	0.0	0.6	Err	256.2								
Lane LOS		A	F	F								
Approach Delay (s)	0.0	0.6	Err	256.2								
Approach LOS			F	F								
Intersection Summary												
Average Delay			301.1									
Intersection Capacity Utilization			111.5%		ICU Level of Service				H			
Analysis Period (min)			15									



















Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative1
 PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1255	258	615	776	10	0	0	0	523	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0		2.0	2.0						2.0	
Lane Util. Factor	1.00	1.00		1.00	1.00						1.00	
Frt	1.00	0.97		1.00	1.00						1.00	
Flt Protected	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (prot)	1644	1780		1644	1823						1736	
Flt Permitted	0.95	1.00		0.95	1.00						0.95	
Satd. Flow (perm)	1644	1780		1644	1823						1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	1321	272	647	817	11	0	0	0	551	0	0
RTOR Reduction (vph)	0	10	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	5	1583	0	647	827	0	0	0	0	0	551	0
Turn Type	Prot			Prot			Split					
Protected Phases	5	2		1	6					4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	33.8		16.2	49.2						18.0	
Effective Green, g (s)	2.8	35.8		18.2	51.2						20.0	
Actuated g/C Ratio	0.03	0.45		0.23	0.64						0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0						4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0						3.0	
Lane Grp Cap (vph)	58	797		374	1167						434	
v/s Ratio Prot	0.00	c0.89		c0.39	0.45						c0.32	
v/s Ratio Perm												
v/c Ratio	0.09	1.99		1.73	0.71						1.27	
Uniform Delay, d1	37.4	22.1		30.9	9.5						30.0	
Progression Factor	0.93	0.64		0.50	0.49						1.00	
Incremental Delay, d2	0.3	445.9		329.5	0.2						138.4	
Delay (s)	34.9	460.1		344.9	4.9						168.4	
Level of Service	C	F		F	A						F	
Approach Delay (s)		458.8		154.0				0.0			168.4	
Approach LOS		F		F				A			F	
Intersection Summary												
HCM Average Control Delay	290.6			HCM Level of Service				F				
HCM Volume to Capacity ratio	1.70											
Actuated Cycle Length (s)	80.0			Sum of lost time (s)				6.0				
Intersection Capacity Utilization	158.3%			ICU Level of Service				H				
Analysis Period (min)	15											
c Critical Lane Group												

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative1
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	267	1512	0	0	1367	655	34	0	901	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1644	1827			1827	1553		1736	1553			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1644	1827			1827	1553		1736	1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	1592	0	0	1439	689	36	0	948	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	237	0	0	20	0	0	0
Lane Group Flow (vph)	281	1592	0	0	1439	452	0	36	929	0	0	0
Turn Type	Prot				Perm		Split		Perm			
Protected Phases	5	2			6		8	8				
Permitted Phases						6			8			
Actuated Green, G (s)	8.0	46.0			34.0	34.0		26.0	26.0			
Effective Green, g (s)	10.0	48.0			36.0	36.0		28.0	28.0			
Actuated g/C Ratio	0.12	0.60			0.45	0.45		0.35	0.35			
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	206	1096			822	699		608	544			
v/s Ratio Prot	0.17	c0.87			c0.79			0.02				
v/s Ratio Perm						0.29			c0.60			
v/c Ratio	1.36	1.45			1.75	0.65		0.06	1.71			
Uniform Delay, d1	35.0	16.0			22.0	17.1		17.3	26.0			
Progression Factor	0.80	0.56			0.85	0.48		1.00	1.00			
Incremental Delay, d2	166.7	204.1			340.6	2.6		0.2	325.9			
Delay (s)	194.6	213.1			359.3	10.8		17.4	351.9			
Level of Service	F	F			F	B		B	F			
Approach Delay (s)		210.3			246.5			339.6			0.0	
Approach LOS		F			F			F			A	

Intersection Summary

HCM Average Control Delay	251.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	142.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			





















Barton Road Interchange Improvement Project
6: Barton Rd & Michigan St

2040 Alternative1
PM PEAK

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	↗
Volume (vph)	1796	616	259	1506	516	364
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0		2.0	2.0	2.0	2.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3338		1644	3471	1644	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3338		1644	3471	1644	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1891	648	273	1585	543	383
RTOR Reduction (vph)	42	0	0	0	0	152
Lane Group Flow (vph)	2497	0	273	1585	543	231
Turn Type			Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Actuated Green, G (s)	39.0		9.0	52.0	20.0	20.0
Effective Green, g (s)	41.0		11.0	54.0	22.0	22.0
Actuated g/C Ratio	0.51		0.14	0.68	0.28	0.28
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1711		226	2343	452	427
v/s Ratio Prot	c0.75		c0.17	0.46	c0.33	
v/s Ratio Perm						0.15
v/c Ratio	1.46		1.21	0.68	1.20	0.54
Uniform Delay, d1	19.5		34.5	7.8	29.0	24.7
Progression Factor	1.03		1.00	1.00	1.00	1.00
Incremental Delay, d2	206.9		127.5	1.6	110.1	4.8
Delay (s)	227.0		162.0	9.4	139.1	29.5
Level of Service	F		F	A	F	C
Approach Delay (s)	227.0			31.8	93.8	
Approach LOS	F			C	F	
Intersection Summary						
HCM Average Control Delay			135.7		HCM Level of Service	F
HCM Volume to Capacity ratio			1.32			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			124.7%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative1
PM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Volume (veh/h)	45	2115	0	0	1732	23	0	0	0	3	0	33
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	47	2226	0	0	1823	24	0	0	0	3	0	35
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		287										
pX, platoon unblocked				0.50			0.50	0.50	0.50	0.50	0.50	
vC, conflicting volume	1847			2226			3267	4168	1113	3031	4144	912
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1847			1455			3534	5334	0	3062	5285	912
tC, single (s)	4.2			4.2			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	85			100			100	100	100	0	100	87
cM capacity (veh/h)	317			226			1	0	540	2	0	273
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1					
Volume Total	47	1113	1113	912	912	24	38					
Volume Left	47	0	0	0	0	0	3					
Volume Right	0	0	0	0	0	24	35					
cSH	317	1700	1700	1700	1700	1700	25					
Volume to Capacity	0.15	0.65	0.65	0.54	0.54	0.01	1.52					
Queue Length 95th (ft)	13	0	0	0	0	0	117					
Control Delay (s)	18.4	0.0	0.0	0.0	0.0	0.0	603.7					
Lane LOS	C						F					
Approach Delay (s)	0.4			0.0			603.7					
Approach LOS							F					
Intersection Summary												
Average Delay			5.7									
Intersection Capacity Utilization			71.7%		ICU Level of Service				C			
Analysis Period (min)			15									

2040 Alternative 2

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative2
AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	306	0	188	0	0
Lane Group Flow (vph)	291	279	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	16.0	16.0	27.0	27.0	35.0	66.0
Effective Green, g (s)	18.0	18.0	29.0	29.0	37.0	68.0
Actuated g/C Ratio	0.20	0.20	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	320	302	1087	486	657	2549
v/s Ratio Prot	0.18		c0.32		c0.41	0.47
v/s Ratio Perm		c0.19		0.06		
v/c Ratio	0.91	0.93	1.00	0.18	0.99	0.62
Uniform Delay, d1	35.2	35.3	30.4	22.0	26.4	5.1
Progression Factor	0.71	0.85	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.7	31.1	26.4	0.8	33.7	1.1
Delay (s)	51.6	61.2	56.9	22.8	60.1	6.2
Level of Service	D	E	E	C	E	A
Approach Delay (s)	58.0		49.9			22.0
Approach LOS	E		D			C

Intersection Summary

HCM Average Control Delay	37.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative2
AM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.96			0.73	
Satd. Flow (perm)		2104			2874	1509		1522			1270	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	23	0	32	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	56	0	22	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		61.9			61.9	61.9		20.1			20.1	
Effective Green, g (s)		63.9			63.9	63.9		22.1			22.1	
Actuated g/C Ratio		0.71			0.71	0.71		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1494			2041	1071		374			312	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.42	0.05		0.06			0.70	
Uniform Delay, d1		6.5			5.4	3.9		26.0			30.9	
Progression Factor		0.20			1.52	2.27		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			7.0	
Delay (s)		2.2			8.9	9.0		26.1			37.9	
Level of Service		A			A	A		C			D	
Approach Delay (s)		2.2			8.9			26.1			37.9	
Approach LOS		A			A			C			D	

Intersection Summary

HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑	↑	↑
Volume (vph)	0	754	119	907	591	0	0	0	0	382	22	306
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (prot)		3374	1509	3100	3374					1518	1615	1509
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.96	1.00
Satd. Flow (perm)		3374	1509	3100	3374					1518	1615	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	794	125	955	622	0	0	0	0	402	23	322
RTOR Reduction (vph)	0	0	83	0	0	0	0	0	0	0	0	254
Lane Group Flow (vph)	0	794	42	955	622	0	0	0	0	213	212	68
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		28.0	28.0	33.0	65.0					17.0	17.0	17.0
Effective Green, g (s)		30.0	30.0	35.0	67.0					19.0	19.0	19.0
Actuated g/C Ratio		0.33	0.33	0.39	0.74					0.21	0.21	0.21
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1125	503	1206	2512					320	341	319
v/s Ratio Prot		c0.24		c0.31	0.18					c0.14	0.13	
v/s Ratio Perm			0.03									0.05
v/c Ratio		0.71	0.08	0.79	0.25					0.67	0.62	0.21
Uniform Delay, d1		26.2	20.6	24.3	3.6					32.6	32.2	29.3
Progression Factor		0.69	0.40	0.57	0.14					1.00	1.00	1.00
Incremental Delay, d2		3.2	0.3	2.8	0.2					5.2	3.5	0.3
Delay (s)		21.2	8.5	16.7	0.7					37.7	35.7	29.7
Level of Service		C	A	B	A					D	D	C
Approach Delay (s)		19.4			10.4			0.0			33.7	
Approach LOS		B			B			A			C	
Intersection Summary												
HCM Average Control Delay			18.3			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)				6.0		
Intersection Capacity Utilization			82.4%			ICU Level of Service				E		
Analysis Period (min)			15									
c Critical Lane Group												























Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative2
AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	909	0	0	1366	868	132	0	574	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3100	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	3100	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	957	0	0	1438	914	139	0	604	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	280	0	158	158	0	0	0
Lane Group Flow (vph)	239	957	0	0	1438	634	139	144	144	0	0	0
Turn Type	Prot				Perm		Prot	Perm				
Protected Phases	5	2			6		3	8				
Permitted Phases					6				8			
Actuated Green, G (s)	8.0	67.9			55.9	55.9	14.1	14.1	14.1			
Effective Green, g (s)	10.0	69.9			57.9	57.9	16.1	16.1	16.1			
Actuated g/C Ratio	0.11	0.78			0.64	0.64	0.18	0.18	0.18			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	344	2620			2171	971	286	257	243			
v/s Ratio Prot	c0.08	0.28			c0.43		0.09	0.10				
v/s Ratio Perm					0.42				c0.11			
v/c Ratio	0.69	0.37			0.66	0.65	0.49	0.56	0.59			
Uniform Delay, d1	38.5	3.1			10.0	9.9	33.2	33.7	33.9			
Progression Factor	0.76	0.00			0.57	0.43	1.00	1.00	1.00			
Incremental Delay, d2	4.3	0.3			0.5	1.0	1.3	2.8	3.9			
Delay (s)	33.5	0.3			6.2	5.2	34.5	36.5	37.8			
Level of Service	C	A			A	A	C	D	D			
Approach Delay (s)	6.9				5.8		36.7				0.0	
Approach LOS	A				A		D				A	
Intersection Summary												
HCM Average Control Delay			11.5		HCM Level of Service						B	
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)						6.0	
Intersection Capacity Utilization			82.4%		ICU Level of Service						E	
Analysis Period (min)			15									
c	Critical Lane Group											















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative2
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1742	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.89	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1572	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	117	0	4	0	0	0	26	0	0	122
Lane Group Flow (vph)	163	893	388	182	1335	0	943	43	128	0	57	18
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	7.0	34.1	59.1	7.9	35.0		25.0	36.0	43.9		7.0	7.0
Effective Green, g (s)	9.0	36.1	63.1	9.9	37.0		27.0	38.0	47.9		9.0	9.0
Actuated g/C Ratio	0.10	0.40	0.70	0.11	0.41		0.30	0.42	0.53		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	160	1353	1058	341	1376		930	750	837		157	151
v/s Ratio Prot	c0.10	0.26	0.11	0.06	c0.40		c0.30	0.02	0.02			
v/s Ratio Perm			0.15						0.07		c0.04	0.01
v/c Ratio	1.02	0.66	0.37	0.53	0.97		1.01	0.06	0.15		0.36	0.12
Uniform Delay, d1	40.5	22.0	5.4	37.9	26.0		31.5	15.4	10.7		37.8	36.9
Progression Factor	0.78	0.65	0.85	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	72.4	2.3	0.2	1.6	18.1		33.0	0.0	0.1		1.4	0.3
Delay (s)	104.1	16.6	4.8	39.5	44.1		64.5	15.4	10.8		39.3	37.2
Level of Service	F	B	A	D	D		E	B	B		D	D
Approach Delay (s)		21.9			43.5			55.4			37.8	
Approach LOS		C			D			E			D	
Intersection Summary												
HCM Average Control Delay			38.7			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			88.1%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2040 Alternative2
 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.74	1.11	1.00	1.00	1.00	1.00
Incremental Delay, d2	199.9	321.8	200.6	1.2	267.4	1.9
Delay (s)	228.1	364.1	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	318.2		194.5			81.5
Approach LOS	F		F			F

Intersection Summary

HCM Average Control Delay	167.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative2
PM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.55	
Satd. Flow (perm)		2953			2727	1553		1580			996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	61	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	141	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		68.9			68.9	68.9		13.1			13.1	
Effective Green, g (s)		70.9			70.9	70.9		15.1			15.1	
Actuated g/C Ratio		0.79			0.79	0.79		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2326			2148	1223		265			167	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.09			0.04	
v/c Ratio		0.62			0.54	0.02		0.53			0.24	
Uniform Delay, d1		3.9			3.5	2.1		34.2			32.5	
Progression Factor		0.52			0.18	0.01		1.00			1.00	
Incremental Delay, d2		0.5			0.9	0.0		2.1			0.8	
Delay (s)		2.6			1.6	0.1		36.3			33.2	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.6			1.5			36.3			33.2	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative2
 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑					↑	↑	↑
Volume (vph)	0	1255	258	615	776	0	0	0	0	523	6	360
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0	2.0	2.0	2.0					2.0	2.0	2.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.95	0.95	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		3471	1553	3190	3471					1562	1655	1553
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		3471	1553	3190	3471					1562	1655	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1321	272	647	817	0	0	0	0	551	6	379
RTOR Reduction (vph)	0	0	151	0	0	0	0	0	0	0	0	192
Lane Group Flow (vph)	0	1321	121	647	817	0	0	0	0	281	276	187
Turn Type			Perm	Prot						Prot		Perm
Protected Phases		2		1	6					7	4	
Permitted Phases			2									4
Actuated Green, G (s)		38.0	38.0	21.0	63.0					19.0	19.0	19.0
Effective Green, g (s)		40.0	40.0	23.0	65.0					21.0	21.0	21.0
Actuated g/C Ratio		0.44	0.44	0.26	0.72					0.23	0.23	0.23
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1543	690	815	2507					364	386	362
v/s Ratio Prot		c0.38		c0.20	0.24					c0.18	0.17	
v/s Ratio Perm			0.08									0.12
v/c Ratio		0.86	0.18	0.79	0.33					0.77	0.72	0.52
Uniform Delay, d1		22.4	15.1	31.3	4.5					32.3	31.7	30.1
Progression Factor		0.78	0.61	0.42	0.48					1.00	1.00	1.00
Incremental Delay, d2		5.2	0.5	2.8	0.2					9.8	6.2	1.3
Delay (s)		22.7	9.6	15.9	2.3					42.0	37.9	31.3
Level of Service		C	A	B	A					D	D	C
Approach Delay (s)		20.5			8.3			0.0			36.5	
Approach LOS		C			A			A			D	
Intersection Summary												
HCM Average Control Delay			19.8		HCM Level of Service					B		
HCM Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					6.0		
Intersection Capacity Utilization			87.7%		ICU Level of Service					E		
Analysis Period (min)			15									
c Critical Lane Group												























Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative2
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	267	1512	0	0	1357	655	34	0	901	0	0	0	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0				
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	0.95				
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85				
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (prot)	3190	3471			3471	1553	1644	1475	1398				
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (perm)	3190	3471			3471	1553	1644	1475	1398				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	281	1592	0	0	1428	689	36	0	948	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	360	0	18	18	0	0	0	
Lane Group Flow (vph)	281	1592	0	0	1428	329	36	456	456	0	0	0	
Turn Type	Prot					Perm	Prot		Perm				
Protected Phases	5	2			6		3	8					
Permitted Phases						6			8				
Actuated Green, G (s)	7.0	52.0			41.0	41.0	30.0	30.0	30.0				
Effective Green, g (s)	9.0	54.0			43.0	43.0	32.0	32.0	32.0				
Actuated g/C Ratio	0.10	0.60			0.48	0.48	0.36	0.36	0.36				
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)	319	2083			1658	742	585	524	497				
v/s Ratio Prot	0.09	c0.46			c0.41		0.02	0.31					
v/s Ratio Perm						0.21			c0.33				
v/c Ratio	0.88	0.76			0.86	0.44	0.06	0.87	0.92				
Uniform Delay, d1	40.0	13.3			20.9	15.6	19.1	27.1	27.7				
Progression Factor	0.71	0.21			0.58	0.95	1.00	1.00	1.00				
Incremental Delay, d2	14.4	1.5			3.5	1.1	0.0	14.6	21.7				
Delay (s)	42.9	4.3			15.7	15.9	19.2	41.6	49.5				
Level of Service	D	A			B	B	B	D	D				
Approach Delay (s)		10.1			15.8			44.6			0.0		
Approach LOS		B			B			D			A		
Intersection Summary													
HCM Average Control Delay			19.3		HCM Level of Service				B				
HCM Volume to Capacity ratio			0.86										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				4.0				
Intersection Capacity Utilization			87.7%		ICU Level of Service				E				
Analysis Period (min)			15										
c	Critical Lane Group												

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative2
PM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.99	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3463		3190	1827	1553		1800	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3463		3190	1827	1553		1684	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	148	0	1	0	0	0	5	0	0	24
Lane Group Flow (vph)	47	1843	500	273	1569	0	543	103	301	0	10	3
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	4.2	46.0	60.0	7.0	48.8		14.0	25.0	32.0		7.0	7.0
Effective Green, g (s)	6.2	48.0	64.0	9.0	50.8		16.0	27.0	36.0		9.0	9.0
Actuated g/C Ratio	0.07	0.53	0.71	0.10	0.56		0.18	0.30	0.40		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	113	1851	1104	319	1955		567	548	656		168	155
v/s Ratio Prot	0.03	c0.53	0.08	c0.09	0.45		c0.17	0.06	c0.05			
v/s Ratio Perm			0.24						0.15		0.01	0.00
v/c Ratio	0.42	1.00	0.45	0.86	0.80		0.96	0.19	0.46		0.06	0.02
Uniform Delay, d1	40.2	20.9	5.5	39.9	15.6		36.7	23.4	19.8		36.7	36.5
Progression Factor	0.92	0.81	1.43	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	14.8	0.2	19.6	3.6		27.2	0.2	0.5		0.1	0.0
Delay (s)	38.3	31.7	8.1	59.4	19.2		63.9	23.5	20.3		36.8	36.6
Level of Service	D	C	A	E	B		E	C	C		D	D
Approach Delay (s)		25.8			25.2			45.5			36.6	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay			29.2			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			88.4%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2040 Alternative 3

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative3
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	344	0	188	0	0
Lane Group Flow (vph)	291	241	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.0	13.0	24.0	24.0	31.0	59.0
Effective Green, g (s)	15.0	15.0	26.0	26.0	33.0	61.0
Actuated g/C Ratio	0.19	0.19	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	300	283	1097	490	659	2573
v/s Ratio Prot	c0.18		c0.32		c0.41	0.47
v/s Ratio Perm		0.16		0.06		
v/c Ratio	0.97	0.85	0.99	0.18	0.99	0.61
Uniform Delay, d1	32.3	31.4	26.8	19.4	23.4	4.2
Progression Factor	0.59	1.28	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.4	20.0	24.3	0.8	32.6	1.1
Delay (s)	60.4	60.1	51.1	20.2	56.0	5.3
Level of Service	E	E	D	C	E	A
Approach Delay (s)	60.2		44.8			20.2
Approach LOS	E		D			C
Intersection Summary						
HCM Average Control Delay			35.5		HCM Level of Service	D
HCM Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative3
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.63			0.86	1.00		0.96			0.74	
Satd. Flow (perm)		2134			2893	1509		1522			1297	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	24	0	31	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	55	0	23	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		53.9			53.9	53.9		18.1			18.1	
Effective Green, g (s)		55.9			55.9	55.9		20.1			20.1	
Actuated g/C Ratio		0.70			0.70	0.70		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1491			2021	1054		382			326	
v/s Ratio Prot												
v/s Ratio Perm		c0.41			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.43	0.05		0.06			0.67	
Uniform Delay, d1		6.2			5.2	3.8		22.8			27.0	
Progression Factor		0.29			0.39	0.00		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			5.4	
Delay (s)		2.7			2.6	0.1		22.8			32.3	
Level of Service		A			A	A		C			C	
Approach Delay (s)		2.7			2.4			22.8			32.3	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	44	27	104
Lane Group Flow (vph)	125	794	622	911	472	121
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	5.6	31.0	21.4	62.4	41.0	41.0
Effective Green, g (s)	7.6	33.0	23.4	66.4	43.0	43.0
Actuated g/C Ratio	0.09	0.41	0.29	0.83	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	295	1392	987	1290	1637	739
v/s Ratio Prot	0.04	c0.24	0.18	c0.38	0.15	
v/s Ratio Perm				0.22		0.09
v/c Ratio	0.42	0.57	0.63	0.71	0.29	0.16
Uniform Delay, d1	34.1	18.1	24.5	2.8	10.1	9.4
Progression Factor	0.86	1.00	0.73	1.82	1.00	1.00
Incremental Delay, d2	0.8	1.4	2.6	2.8	0.4	0.5
Delay (s)	30.1	19.5	20.5	7.9	10.6	9.9
Level of Service	C	B	C	A	B	A
Approach Delay (s)		20.9	12.9		10.3	
Approach LOS		C	B		B	

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative3
AM Peak



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑	↑↓
Volume (vph)	909	227	868	1366	132	574
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3374	1509	3100	3374	1598	2656
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3374	1509	3100	3374	1598	2656
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	957	239	914	1438	139	604
RTOR Reduction (vph)	0	18	0	0	0	32
Lane Group Flow (vph)	957	221	914	1438	139	572
Turn Type		pm+ov	Prot		pm+ov	
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	29.0	40.0	28.0	61.0	11.0	39.0
Effective Green, g (s)	31.0	44.0	30.0	63.0	13.0	43.0
Actuated g/C Ratio	0.39	0.55	0.38	0.79	0.16	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1307	868	1163	2657	260	1494
v/s Ratio Prot	c0.28	0.04	c0.29	0.43	c0.09	0.14
v/s Ratio Perm		0.10				0.07
v/c Ratio	0.73	0.25	0.79	0.54	0.53	0.38
Uniform Delay, d1	21.0	9.4	22.2	3.1	30.7	10.8
Progression Factor	0.67	0.32	0.54	0.04	1.00	1.00
Incremental Delay, d2	3.3	0.6	0.3	0.1	7.7	0.2
Delay (s)	17.3	3.6	12.2	0.2	38.4	10.9
Level of Service	B	A	B	A	D	B
Approach Delay (s)	14.6			4.9	16.1	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative3
AM Peak















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1742	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.89	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1577	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	140	0	5	0	0	0	23	0	0	123
Lane Group Flow (vph)	163	893	365	182	1334	0	943	43	131	0	57	16
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	7.0	29.0	50.0	7.0	29.0		21.0	32.0	39.0		7.0	7.0
Effective Green, g (s)	9.0	31.0	54.0	9.0	31.0		23.0	34.0	43.0		9.0	9.0
Actuated g/C Ratio	0.11	0.39	0.68	0.11	0.39		0.29	0.42	0.54		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	180	1307	1019	349	1297		891	755	849		177	170
v/s Ratio Prot	c0.10	0.26	0.10	0.06	c0.40		c0.30	0.02	0.02			
v/s Ratio Perm			0.14						0.07		c0.04	0.01
v/c Ratio	0.91	0.68	0.36	0.52	1.03		1.06	0.06	0.15		0.32	0.09
Uniform Delay, d1	35.1	20.4	5.6	33.5	24.5		28.5	13.6	9.3		32.7	31.8
Progression Factor	0.79	0.65	5.51	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	35.2	2.3	0.2	1.4	32.6		46.8	0.0	0.1		1.1	0.2
Delay (s)	62.9	15.7	30.9	34.9	57.1		75.3	13.6	9.4		33.7	32.1
Level of Service	E	B	C	C	E		E	B	A		C	C
Approach Delay (s)		25.5			54.4			64.1			32.6	
Approach LOS		C			D			E			C	

Intersection Summary

HCM Average Control Delay	45.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative3
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	321	0	150	0	0
Lane Group Flow (vph)	359	385	2497	247	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	11.0	11.0	37.0	37.0	20.0	61.0
Effective Green, g (s)	13.0	13.0	39.0	39.0	22.0	63.0
Actuated g/C Ratio	0.16	0.16	0.49	0.49	0.28	0.79
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	267	252	1692	757	452	2733
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.25		0.16		
v/c Ratio	1.34	1.53	1.48	0.33	1.59	0.76
Uniform Delay, d1	33.5	33.5	20.5	12.5	29.0	4.5
Progression Factor	0.59	1.12	1.00	1.00	1.00	1.00
Incremental Delay, d2	174.8	254.3	217.3	1.1	275.2	2.1
Delay (s)	194.7	291.9	237.8	13.6	304.2	6.6
Level of Service	F	F	F	B	F	A
Approach Delay (s)	259.1		207.1			82.8
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			163.7		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative3
PM Peak



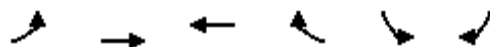
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.86			0.80	1.00		0.99			0.61	
Satd. Flow (perm)		2974			2760	1553		1580			1100	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	56	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	146	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		59.5			59.5	59.5		12.5			12.5	
Effective Green, g (s)		61.5			61.5	61.5		14.5			14.5	
Actuated g/C Ratio		0.77			0.77	0.77		0.18			0.18	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2286			2122	1194		286			199	
v/s Ratio Prot												
v/s Ratio Perm		c0.48			0.42	0.01		c0.09			0.04	
v/c Ratio		0.63			0.55	0.02		0.51			0.20	
Uniform Delay, d1		4.1			3.7	2.2		29.5			27.8	
Progression Factor		0.59			0.68	0.17		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.4			0.5	
Delay (s)		3.0			3.4	0.4		31.0			28.4	
Level of Service		A			A	A		C			C	
Approach Delay (s)		3.0			3.3			31.0			28.4	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 PM Peak



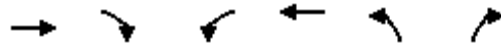
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	50	17	180
Lane Group Flow (vph)	272	1321	817	597	625	108
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	14.0	44.0	26.0	54.0	28.0	28.0
Effective Green, g (s)	16.0	46.0	28.0	58.0	30.0	30.0
Actuated g/C Ratio	0.20	0.58	0.35	0.72	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	638	1996	1215	1165	1182	530
v/s Ratio Prot	0.09	c0.38	c0.24	0.19	c0.20	
v/s Ratio Perm				0.19		0.08
v/c Ratio	0.43	0.66	0.67	0.51	0.53	0.20
Uniform Delay, d1	28.0	11.7	22.1	4.8	19.5	16.9
Progression Factor	0.73	0.49	0.78	0.10	1.00	1.00
Incremental Delay, d2	0.4	1.4	2.7	1.4	1.7	0.9
Delay (s)	20.9	7.1	19.9	1.9	21.2	17.8
Level of Service	C	A	B	A	C	B
Approach Delay (s)		9.5	12.0		20.1	
Approach LOS		A	B		C	

Intersection Summary

HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative3
PM Peak

























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑↓	↑↑	↑	↑↓
Volume (vph)	1512	267	655	1357	34	901
Ideal Flow (vphpl)	1900	1900	1800	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	0.88
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3471	1553	3190	3471	1644	2733
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3471	1553	3190	3471	1644	2733
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1592	281	689	1428	36	948
RTOR Reduction (vph)	0	13	0	0	0	21
Lane Group Flow (vph)	1592	268	689	1428	36	927
Turn Type		pm+ov	Prot			pm+ov
Protected Phases	2	8	1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	41.0	48.0	20.0	65.0	7.0	27.0
Effective Green, g (s)	43.0	52.0	22.0	67.0	9.0	31.0
Actuated g/C Ratio	0.54	0.65	0.28	0.84	0.11	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1866	1048	877	2907	185	1127
v/s Ratio Prot	c0.46	0.03	0.22	0.41	0.02	c0.23
v/s Ratio Perm		0.14				0.11
v/c Ratio	0.85	0.26	0.79	0.49	0.19	0.82
Uniform Delay, d1	15.8	5.9	26.8	1.8	32.2	22.0
Progression Factor	0.72	0.77	0.68	0.18	1.00	1.00
Incremental Delay, d2	4.1	0.5	2.4	0.3	2.3	5.0
Delay (s)	15.6	5.0	20.7	0.6	34.5	27.0
Level of Service	B	A	C	A	C	C
Approach Delay (s)	14.0			7.1	27.3	
Approach LOS	B			A	C	

Intersection Summary

HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative3
PM Peak













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.99	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3463		3190	1827	1553		1800	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3463		3190	1827	1553		1686	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	181	0	1	0	0	0	5	0	0	24
Lane Group Flow (vph)	47	1843	467	273	1569	0	543	103	301	0	10	3
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	4.2	37.4	48.4	8.6	41.8		11.0	22.0	30.6		7.0	7.0
Effective Green, g (s)	6.2	39.4	52.4	10.6	43.8		13.0	24.0	34.6		9.0	9.0
Actuated g/C Ratio	0.08	0.49	0.65	0.13	0.55		0.16	0.30	0.43		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	127	1709	1056	423	1896		518	548	710		190	175
v/s Ratio Prot	0.03	c0.53	0.07	c0.09	c0.45		c0.17	0.06	c0.06			
v/s Ratio Perm			0.23						0.14		0.01	0.00
v/c Ratio	0.37	1.08	0.44	0.65	0.83		1.05	0.19	0.42		0.05	0.02
Uniform Delay, d1	35.0	20.3	6.7	32.9	15.0		33.5	20.8	15.8		31.7	31.6
Progression Factor	0.99	0.84	0.72	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	41.5	0.2	3.4	4.3		52.8	0.2	0.4		0.1	0.0
Delay (s)	35.5	58.7	5.0	36.3	19.3		86.3	20.9	16.2		31.8	31.6
Level of Service	D	E	A	D	B		F	C	B		C	C
Approach Delay (s)		44.5			21.8			56.7			31.7	
Approach LOS		D			C			E			C	
Intersection Summary												
HCM Average Control Delay			38.8			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)			4.0			
Intersection Capacity Utilization			88.4%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2040 Alternative 4

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative4
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	344	0	188	0	0
Lane Group Flow (vph)	291	241	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.0	13.0	24.0	24.0	31.0	59.0
Effective Green, g (s)	15.0	15.0	26.0	26.0	33.0	61.0
Actuated g/C Ratio	0.19	0.19	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	300	283	1097	490	659	2573
v/s Ratio Prot	c0.18		c0.32		c0.41	0.47
v/s Ratio Perm		0.16		0.06		
v/c Ratio	0.97	0.85	0.99	0.18	0.99	0.61
Uniform Delay, d1	32.3	31.4	26.8	19.4	23.4	4.2
Progression Factor	0.51	1.18	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.4	20.0	24.3	0.8	32.6	1.1
Delay (s)	58.0	57.0	51.1	20.2	56.0	5.3
Level of Service	E	E	D	C	E	A
Approach Delay (s)	57.3		44.8			20.2
Approach LOS	E		D			C
Intersection Summary						
HCM Average Control Delay			35.0		HCM Level of Service	C
HCM Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative4
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.63			0.86	1.00		0.96			0.74	
Satd. Flow (perm)		2134			2893	1509		1522			1297	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	24	0	31	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	55	0	23	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		53.9			53.9	53.9		18.1			18.1	
Effective Green, g (s)		55.9			55.9	55.9		20.1			20.1	
Actuated g/C Ratio		0.70			0.70	0.70		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1491			2021	1054		382			326	
v/s Ratio Prot												
v/s Ratio Perm		c0.41			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.43	0.05		0.06			0.67	
Uniform Delay, d1		6.2			5.2	3.8		22.8			27.0	
Progression Factor		0.35			0.38	0.00		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			5.4	
Delay (s)		3.1			2.6	0.1		22.8			32.3	
Level of Service		A			A	A		C			C	
Approach Delay (s)		3.1			2.4			22.8			32.3	
Approach LOS		A			A			C			C	

Intersection Summary

HCM Average Control Delay	6.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 AM Peak

























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3100	3374	3374	1509	3215	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3100	3374	3374	1509	3215	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	44	27	104
Lane Group Flow (vph)	125	794	622	911	472	121
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	5.6	31.0	21.4	62.4	41.0	41.0
Effective Green, g (s)	7.6	33.0	23.4	66.4	43.0	43.0
Actuated g/C Ratio	0.09	0.41	0.29	0.83	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	295	1392	987	1290	1728	739
v/s Ratio Prot	0.04	c0.24	0.18	c0.38	0.15	
v/s Ratio Perm				0.22		0.09
v/c Ratio	0.42	0.57	0.63	0.71	0.27	0.16
Uniform Delay, d1	34.1	18.1	24.5	2.8	10.0	9.4
Progression Factor	1.12	1.22	0.50	2.43	1.00	1.00
Incremental Delay, d2	0.8	1.4	1.7	1.9	0.4	0.5
Delay (s)	39.0	23.5	14.0	8.7	10.4	9.9
Level of Service	D	C	B	A	B	A
Approach Delay (s)		25.6	10.8		10.2	
Approach LOS		C	B		B	

Intersection Summary

HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			















Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2040 Alternative4
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	146	909	480	173	837	561	529	387	92	402	172	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3374	1509	3100	3276		3100	1660	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3374	1509	3100	3276		3100	1660	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	154	957	505	182	881	591	557	407	97	423	181	139
RTOR Reduction (vph)	0	0	125	0	0	87	0	26	0	0	35	0
Lane Group Flow (vph)	154	957	380	182	881	504	557	478	0	423	285	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	9.0	26.6	41.8	7.0	24.6	36.6	15.2	18.4		12.0	15.2	
Effective Green, g (s)	11.0	28.6	45.8	9.0	26.6	40.6	17.2	20.4		14.0	17.2	
Actuated g/C Ratio	0.14	0.36	0.57	0.11	0.33	0.51	0.21	0.25		0.18	0.21	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	220	1206	902	349	1122	766	667	835		543	357	
v/s Ratio Prot	c0.10	c0.28	0.09	0.06	0.26	0.12	c0.18	0.15		0.14	c0.17	
v/s Ratio Perm			0.16			0.22						
v/c Ratio	0.70	0.79	0.42	0.52	0.79	0.66	0.84	0.57		0.78	0.80	
Uniform Delay, d1	32.9	23.1	9.6	33.5	24.1	14.6	30.0	26.0		31.5	29.7	
Progression Factor	0.95	0.76	0.16	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.9	5.2	0.3	1.4	5.5	2.1	8.9	1.0		7.0	11.7	
Delay (s)	40.3	22.8	1.8	34.9	29.7	16.6	38.9	26.9		38.5	41.5	
Level of Service	D	C	A	C	C	B	D	C		D	D	
Approach Delay (s)		17.9			25.6			33.2			39.8	
Approach LOS		B			C			C			D	
Intersection Summary												
HCM Average Control Delay			26.8				HCM Level of Service				C	
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			6.0		
Intersection Capacity Utilization			78.1%				ICU Level of Service			D		
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative4
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.62	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	199.9	321.8	200.6	1.2	267.4	1.9
Delay (s)	223.4	360.3	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	314.1		194.5			81.5
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			166.5		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative4
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.55	
Satd. Flow (perm)		2953			2727	1553		1580			996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	61	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	141	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		68.9			68.9	68.9		13.1			13.1	
Effective Green, g (s)		70.9			70.9	70.9		15.1			15.1	
Actuated g/C Ratio		0.79			0.79	0.79		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2326			2148	1223		265			167	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.09			0.04	
v/c Ratio		0.62			0.54	0.02		0.53			0.24	
Uniform Delay, d1		3.9			3.5	2.1		34.2			32.5	
Progression Factor		0.62			0.60	0.11		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		2.1			0.8	
Delay (s)		2.9			2.9	0.3		36.3			33.2	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.9			2.9			36.3			33.2	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	5.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 PM Peak



























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	3190	3471	3471	1553	3326	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	3190	3471	3471	1553	3326	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	49	15	179
Lane Group Flow (vph)	272	1321	817	598	627	109
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	16.0	50.0	30.0	62.0	32.0	32.0
Effective Green, g (s)	18.0	52.0	32.0	66.0	34.0	34.0
Actuated g/C Ratio	0.20	0.58	0.36	0.73	0.38	0.38
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	638	2005	1234	1173	1256	534
v/s Ratio Prot	0.09	c0.38	c0.24	c0.19	0.19	
v/s Ratio Perm				0.19		0.08
v/c Ratio	0.43	0.66	0.66	0.51	0.50	0.20
Uniform Delay, d1	31.5	13.0	24.4	5.1	21.5	18.9
Progression Factor	0.86	0.60	0.35	0.13	1.00	1.00
Incremental Delay, d2	0.4	1.4	1.5	0.9	1.4	0.9
Delay (s)	27.5	9.2	10.0	1.6	22.9	19.7
Level of Service	C	A	B	A	C	B
Approach Delay (s)		12.3	6.3		21.9	
Approach LOS		B	A		C	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Barton Rd & I-215 NB Ramps

2040 Alternative4
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	191	1512	616	259	997	469	360	261	197	631	270	34
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3471	1553	3190	3248		3190	1796	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3471	1553	3190	3248		3190	1796	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	201	1592	648	273	1049	494	379	275	207	664	284	36
RTOR Reduction (vph)	0	0	76	0	0	80	0	121	0	0	5	0
Lane Group Flow (vph)	201	1592	572	273	1049	414	379	361	0	664	315	0
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		
Protected Phases	5	2	3	1	6	7	3	8		7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	11.8	36.0	47.0	7.0	31.2	48.3	11.0	13.9		17.1	20.0	
Effective Green, g (s)	13.8	38.0	51.0	9.0	33.2	52.3	13.0	15.9		19.1	22.0	
Actuated g/C Ratio	0.15	0.42	0.57	0.10	0.37	0.58	0.14	0.18		0.21	0.24	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	252	1466	880	319	1280	902	461	574		677	439	
v/s Ratio Prot	0.12	c0.46	0.09	0.09	c0.30	0.10	c0.12	c0.11		c0.21	0.18	
v/s Ratio Perm			0.27			0.17						
v/c Ratio	0.80	1.09	0.65	0.86	0.82	0.46	0.82	0.63		0.98	0.72	
Uniform Delay, d1	36.8	26.0	13.4	39.9	25.7	10.8	37.4	34.3		35.3	31.1	
Progression Factor	1.12	0.72	0.68	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.5	49.5	1.6	19.6	6.0	0.4	11.3	2.2		29.7	5.5	
Delay (s)	55.8	68.3	10.7	59.4	31.6	11.1	48.6	36.5		64.9	36.7	
Level of Service	E	E	B	E	C	B	D	D		E	D	
Approach Delay (s)		52.0			30.2			41.8			55.7	
Approach LOS		D			C			D			E	

Intersection Summary















HCM Average Control Delay	44.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

2040 Alternative 5

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative5
AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	344	0	188	0	0
Lane Group Flow (vph)	291	241	1083	90	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	13.0	13.0	24.0	24.0	31.0	59.0
Effective Green, g (s)	15.0	15.0	26.0	26.0	33.0	61.0
Actuated g/C Ratio	0.19	0.19	0.32	0.32	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	300	283	1097	490	659	2573
v/s Ratio Prot	c0.18		c0.32		c0.41	0.47
v/s Ratio Perm		0.16		0.06		
v/c Ratio	0.97	0.85	0.99	0.18	0.99	0.61
Uniform Delay, d1	32.3	31.4	26.8	19.4	23.4	4.2
Progression Factor	0.76	0.95	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.4	20.0	24.3	0.8	32.6	1.1
Delay (s)	65.9	49.7	51.1	20.2	56.0	5.3
Level of Service	E	D	D	C	E	A
Approach Delay (s)	55.1		44.8			20.2
Approach LOS	E		D			C
Intersection Summary						
HCM Average Control Delay			34.5		HCM Level of Service	C
HCM Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			80.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative5
AM Peak


























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.63			0.86	1.00		0.96			0.74	
Satd. Flow (perm)		2134			2893	1509		1522			1297	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	24	0	31	0	0	6	0
Lane Group Flow (vph)	0	874	0	0	866	55	0	23	0	0	219	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		53.9			53.9	53.9		18.1			18.1	
Effective Green, g (s)		55.9			55.9	55.9		20.1			20.1	
Actuated g/C Ratio		0.70			0.70	0.70		0.25			0.25	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1491			2021	1054		382			326	
v/s Ratio Prot												
v/s Ratio Perm		c0.41			0.30	0.04		0.01			c0.17	
v/c Ratio		0.59			0.43	0.05		0.06			0.67	
Uniform Delay, d1		6.2			5.2	3.8		22.8			27.0	
Progression Factor		0.22			1.00	1.44		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			5.4	
Delay (s)		2.3			5.8	5.5		22.8			32.3	
Level of Service		A			A	A		C			C	
Approach Delay (s)		2.3			5.8			22.8			32.3	
Approach LOS		A			A			C			C	

Intersection Summary		
HCM Average Control Delay	7.6	HCM Level of Service
HCM Volume to Capacity ratio	0.60	A
Actuated Cycle Length (s)	80.0	Sum of lost time (s)
Intersection Capacity Utilization	74.7%	4.0
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		D























Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2040 Alternative5
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	527	119	907	459	868	132	0	574	382	22	306
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.96	1.00
Satd. Flow (prot)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1615	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.96	1.00
Satd. Flow (perm)	3100	3374	1509	3100	3374	1509		1687	2656	1518	1615	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	555	125	955	483	914	139	0	604	402	23	322
RTOR Reduction (vph)	0	0	94	0	0	423	0	0	56	0	0	262
Lane Group Flow (vph)	239	555	31	955	483	491	0	139	548	213	212	60
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	7.0	18.0	18.0	26.0	37.0	37.0		7.0	33.0	13.0	13.0	13.0
Effective Green, g (s)	9.0	20.0	20.0	28.0	39.0	39.0		9.0	37.0	15.0	15.0	15.0
Actuated g/C Ratio	0.11	0.25	0.25	0.35	0.49	0.49		0.11	0.46	0.19	0.19	0.19
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	349	844	377	1085	1645	736		190	1228	285	303	283
v/s Ratio Prot	c0.08	c0.16		c0.31	0.14			c0.08	0.16	c0.14	0.13	
v/s Ratio Perm			0.02			0.33			0.05			0.04
v/c Ratio	0.68	0.66	0.08	0.88	0.29	0.67		0.73	0.45	0.75	0.70	0.21
Uniform Delay, d1	34.1	26.9	23.0	24.4	12.3	15.6		34.3	14.6	30.7	30.4	27.5
Progression Factor	0.88	0.82	0.58	0.59	0.38	1.94		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.7	3.4	0.4	0.9	0.0	0.4		13.5	0.3	16.3	12.7	1.7
Delay (s)	34.6	25.5	13.8	15.2	4.7	30.7		47.8	14.8	47.0	43.0	29.2
Level of Service	C	C	B	B	A	C		D	B	D	D	C
Approach Delay (s)		26.3			19.1			21.0			38.2	
Approach LOS		C			B			C			D	
Intersection Summary												
HCM Average Control Delay			23.8				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			78.3%				ICU Level of Service		D			
Analysis Period (min)			15									
c	Critical Lane Group											















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative5
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1598	3374	1509	3100	3348		3100	1776	1509		1742	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.89	1.00
Satd. Flow (perm)	1598	3374	1509	3100	3348		3100	1776	1509		1577	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	140	0	5	0	0	0	23	0	0	123
Lane Group Flow (vph)	163	893	365	182	1334	0	943	43	131	0	57	16
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	7.0	29.0	50.0	7.0	29.0		21.0	32.0	39.0		7.0	7.0
Effective Green, g (s)	9.0	31.0	54.0	9.0	31.0		23.0	34.0	43.0		9.0	9.0
Actuated g/C Ratio	0.11	0.39	0.68	0.11	0.39		0.29	0.42	0.54		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	180	1307	1019	349	1297		891	755	849		177	170
v/s Ratio Prot	c0.10	0.26	0.10	0.06	c0.40		c0.30	0.02	0.02			
v/s Ratio Perm			0.14						0.07		c0.04	0.01
v/c Ratio	0.91	0.68	0.36	0.52	1.03		1.06	0.06	0.15		0.32	0.09
Uniform Delay, d1	35.1	20.4	5.6	33.5	24.5		28.5	13.6	9.3		32.7	31.8
Progression Factor	0.99	0.74	0.91	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	35.2	2.3	0.2	1.4	32.6		46.8	0.0	0.1		1.1	0.2
Delay (s)	70.1	17.5	5.3	34.9	57.1		75.3	13.6	9.4		33.7	32.1
Level of Service	E	B	A	C	E		E	B	A		C	C
Approach Delay (s)		19.0			54.4			64.1			32.6	
Approach LOS		B			D			E			C	
Intersection Summary												
HCM Average Control Delay			43.4			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			88.1%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative5
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.72	1.09	1.00	1.00	1.00	1.00
Incremental Delay, d2	199.9	321.8	200.6	1.2	267.4	1.9
Delay (s)	227.4	363.2	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	317.5		194.5			81.5
Approach LOS	F		F			F

Intersection Summary

HCM Average Control Delay	167.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative5
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕			↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.55	
Satd. Flow (perm)		2953			2727	1553		1580			996	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	6	0	61	0	0	2	0
Lane Group Flow (vph)	0	1437	0	0	1167	21	0	141	0	0	41	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		68.9			68.9	68.9		13.1			13.1	
Effective Green, g (s)		70.9			70.9	70.9		15.1			15.1	
Actuated g/C Ratio		0.79			0.79	0.79		0.17			0.17	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2326			2148	1223		265			167	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.09			0.04	
v/c Ratio		0.62			0.54	0.02		0.53			0.24	
Uniform Delay, d1		3.9			3.5	2.1		34.2			32.5	
Progression Factor		0.57			0.75	0.27		1.00			1.00	
Incremental Delay, d2		0.5			0.9	0.0		2.1			0.8	
Delay (s)		2.8			3.5	0.6		36.3			33.2	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.8			3.5			36.3			33.2	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			























Barton Road Interchange Improvement Project
4: Barton Rd & I-215 Ramps

2040 Alternative5
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	267	988	258	615	742	655	34	0	901	523	6	360
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		1.00	0.88	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (prot)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1655	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.95	1.00	0.95	0.95	1.00
Satd. Flow (perm)	3190	3471	1553	3190	3471	1553		1736	2733	1562	1655	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	1040	272	647	781	689	36	0	948	551	6	379
RTOR Reduction (vph)	0	0	170	0	0	346	0	0	24	0	0	303
Lane Group Flow (vph)	281	1040	102	647	781	343	0	36	924	281	276	76
Turn Type	Prot		Perm	Prot		Perm	Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	11.0	31.8	31.8	22.0	42.8	42.8		4.2	26.2	16.0	16.0	16.0
Effective Green, g (s)	13.0	33.8	33.8	24.0	44.8	44.8		6.2	30.2	18.0	18.0	18.0
Actuated g/C Ratio	0.14	0.38	0.38	0.27	0.50	0.50		0.07	0.34	0.20	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	461	1304	583	851	1728	773		120	917	312	331	311
v/s Ratio Prot	0.09	c0.30		0.20	0.22			0.02	c0.27	c0.18	0.17	
v/s Ratio Perm			0.07			0.22			0.07			0.05
v/c Ratio	0.61	0.80	0.18	0.76	0.45	0.44		0.30	1.01	0.90	0.83	0.24
Uniform Delay, d1	36.1	25.0	18.8	30.4	14.6	14.6		39.8	29.9	35.1	34.6	30.3
Progression Factor	0.94	0.64	0.45	0.74	0.87	1.22		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	4.2	0.5	2.3	0.5	1.0		1.4	31.6	30.9	21.3	1.9
Delay (s)	35.9	20.3	9.0	24.8	13.2	18.8		41.2	61.5	66.0	55.8	32.1
Level of Service	D	C	A	C	B	B		D	E	E	E	C
Approach Delay (s)		21.1			18.6			60.8			49.3	
Approach LOS		C			B			E			D	
Intersection Summary												
HCM Average Control Delay			31.8				HCM Level of Service		C			
HCM Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)		8.0			
Intersection Capacity Utilization			84.1%				ICU Level of Service		E			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative5
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.99	1.00
Satd. Flow (prot)	1644	3471	1553	3190	3463		3190	1827	1553		1800	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		0.92	1.00
Satd. Flow (perm)	1644	3471	1553	3190	3463		3190	1827	1553		1684	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	157	0	1	0	0	0	5	0	0	24
Lane Group Flow (vph)	47	1843	491	273	1569	0	543	103	301	0	10	3
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov	Perm		Perm
Protected Phases	5	2	3	1	6		3	8	1		4	
Permitted Phases			2						8	4		4
Actuated Green, G (s)	4.2	44.4	58.4	8.6	48.8		14.0	25.0	33.6		7.0	7.0
Effective Green, g (s)	6.2	46.4	62.4	10.6	50.8		16.0	27.0	37.6		9.0	9.0
Actuated g/C Ratio	0.07	0.52	0.69	0.12	0.56		0.18	0.30	0.42		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	113	1789	1077	376	1955		567	548	683		168	155
v/s Ratio Prot	0.03	c0.53	0.08	0.09	c0.45		c0.17	0.06	c0.05			
v/s Ratio Perm			0.23						0.14		0.01	0.00
v/c Ratio	0.42	1.03	0.46	0.73	0.80		0.96	0.19	0.44		0.06	0.02
Uniform Delay, d1	40.2	21.8	6.2	38.3	15.6		36.7	23.4	18.7		36.7	36.5
Progression Factor	1.02	0.98	1.05	1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.1	22.6	0.1	6.8	3.6		27.2	0.2	0.5		0.1	0.0
Delay (s)	42.1	44.0	6.7	45.1	19.2		63.9	23.5	19.1		36.8	36.6
Level of Service	D	D	A	D	B		E	C	B		D	D
Approach Delay (s)		34.5			23.0			45.1			36.6	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay			32.4			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)		4.0				
Intersection Capacity Utilization			88.4%			ICU Level of Service		E				
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative6
AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	275	0	183	0	0
Lane Group Flow (vph)	291	310	1083	95	653	1578
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	17.0	17.0	32.0	32.0	39.0	75.0
Effective Green, g (s)	19.0	19.0	34.0	34.0	41.0	77.0
Actuated g/C Ratio	0.19	0.19	0.34	0.34	0.41	0.77
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	304	295	1180	513	655	2673
v/s Ratio Prot	0.18		c0.31		c0.41	0.45
v/s Ratio Perm		c0.20		0.06		
v/c Ratio	0.96	1.05	0.92	0.18	1.00	0.59
Uniform Delay, d1	40.1	40.5	31.7	23.2	29.4	4.8
Progression Factor	0.58	0.53	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.1	64.1	12.7	0.8	34.1	1.0
Delay (s)	61.4	85.5	44.3	24.0	63.6	5.8
Level of Service	E	F	D	C	E	A
Approach Delay (s)	77.5		40.2			22.7
Approach LOS	E		D			C

Intersection Summary

HCM Average Control Delay	38.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.96			0.71	
Satd. Flow (perm)		2081			2856	1509		1522			1250	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	22	0	32	0	0	5	0
Lane Group Flow (vph)	0	874	0	0	866	57	0	22	0	0	220	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.2			70.2	70.2		21.8			21.8	
Effective Green, g (s)		72.2			72.2	72.2		23.8			23.8	
Actuated g/C Ratio		0.72			0.72	0.72		0.24			0.24	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1502			2062	1089		362			298	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.18	
v/c Ratio		0.58			0.42	0.05		0.06			0.74	
Uniform Delay, d1		6.7			5.5	4.0		29.5			35.2	
Progression Factor		0.19			0.41	0.01		1.00			1.00	
Incremental Delay, d2		0.9			0.5	0.1		0.1			9.2	
Delay (s)		2.1			2.8	0.1		29.5			44.4	
Level of Service		A			A	A		C			D	
Approach Delay (s)		2.1			2.6			29.5			44.4	
Approach LOS		A			A			C			D	

Intersection Summary

HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative6
AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1598	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1598	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	69	22	106
Lane Group Flow (vph)	125	794	622	886	477	119
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	12.0	41.0	25.0	76.0	51.0	51.0
Effective Green, g (s)	14.0	43.0	27.0	80.0	53.0	53.0
Actuated g/C Ratio	0.14	0.43	0.27	0.80	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	224	1451	911	1237	1614	728
v/s Ratio Prot	0.08	c0.24	0.18	c0.38	0.16	
v/s Ratio Perm				0.21		0.09
v/c Ratio	0.56	0.55	0.68	0.72	0.30	0.16
Uniform Delay, d1	40.1	21.2	32.7	4.7	13.1	12.1
Progression Factor	0.93	0.93	0.91	2.70	1.00	1.00
Incremental Delay, d2	2.5	1.2	1.8	1.6	0.5	0.5
Delay (s)	40.0	20.9	31.5	14.2	13.6	12.6
Level of Service	D	C	C	B	B	B
Approach Delay (s)		23.5	21.0		13.3	
Approach LOS		C	C		B	

Intersection Summary

HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	499	207	348	1083	794	747
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3129	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3100	1509	1598	3374	3129	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	525	218	366	1140	836	786
RTOR Reduction (vph)	0	121	0	0	170	0
Lane Group Flow (vph)	525	97	366	1140	1453	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	24.0	76.0	48.0	
Effective Green, g (s)	18.0	18.0	26.0	78.0	50.0	
Actuated g/C Ratio	0.18	0.18	0.26	0.78	0.50	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	558	272	415	2632	1565	
v/s Ratio Prot	c0.17		c0.23	0.34	c0.46	
v/s Ratio Perm		0.06				
v/c Ratio	0.94	0.36	0.88	0.43	0.93	
Uniform Delay, d1	40.5	35.9	35.5	3.7	23.3	
Progression Factor	1.00	1.00	1.00	1.00	0.34	
Incremental Delay, d2	26.0	3.6	22.7	0.5	4.9	
Delay (s)	66.4	39.5	58.2	4.2	12.8	
Level of Service	E	D	E	A	B	
Approach Delay (s)	58.5			17.3	12.8	
Approach LOS	E			B	B	
























Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
AM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	482	499	1042	338	65	1028	41	513	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	507	525	1097	356	68	1082	43	540	22	35	139
RTOR Reduction (vph)	0	0	64	0	16	0	0	156	176	0	126	0
Lane Group Flow (vph)	163	507	461	1097	408	0	1082	141	110	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	14.3	15.9	48.3	28.7	30.3		32.4	36.6	36.6	2.8	7.0	
Effective Green, g (s)	16.3	17.9	52.3	30.7	32.3		34.4	38.6	38.6	4.8	9.0	
Actuated g/C Ratio	0.16	0.18	0.52	0.31	0.32		0.34	0.39	0.39	0.05	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	260	604	819	952	1064		1066	568	554	77	141	
v/s Ratio Prot	0.10	c0.15	0.19	c0.35	0.12		c0.35	0.10		0.01	c0.03	
v/s Ratio Perm			0.11						0.08			
v/c Ratio	0.63	0.84	0.56	1.15	0.38		1.02	0.25	0.20	0.29	0.34	
Uniform Delay, d1	39.0	39.7	16.1	34.6	26.2		32.8	20.8	20.4	45.9	42.7	
Progression Factor	0.75	0.73	0.30	1.00	1.00		0.72	0.14	0.02	1.00	1.00	
Incremental Delay, d2	4.2	9.1	0.8	80.7	1.0		28.6	0.2	0.1	2.0	1.4	
Delay (s)	33.4	37.9	5.6	115.3	27.2		52.2	3.1	0.6	48.0	44.1	
Level of Service	C	D	A	F	C		D	A	A	D	D	
Approach Delay (s)		23.1			90.8			34.6			44.6	
Approach LOS		C			F			C			D	

Intersection Summary

HCM Average Control Delay	50.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2040 Alternative6
 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.78	0.78	1.00	1.00	1.00	1.00
Incremental Delay, d2	200.1	321.9	200.6	1.2	267.4	1.9
Delay (s)	229.5	351.8	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	310.6		194.5			81.5
Approach LOS	F		F			F

Intersection Summary			
HCM Average Control Delay	165.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.50	
Satd. Flow (perm)		2953			2728	1553		1579			900	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	5	0	79	0	0	3	0
Lane Group Flow (vph)	0	1437	0	0	1167	22	0	123	0	0	40	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.1			70.1	70.1		11.9			11.9	
Effective Green, g (s)		72.1			72.1	72.1		13.9			13.9	
Actuated g/C Ratio		0.80			0.80	0.80		0.15			0.15	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2366			2185	1244		244			139	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.08			0.04	
v/c Ratio		0.61			0.53	0.02		0.50			0.29	
Uniform Delay, d1		3.5			3.1	1.8		34.9			33.7	
Progression Factor		0.79			1.68	1.38		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.6			1.2	
Delay (s)		3.2			6.0	2.5		36.5			34.9	
Level of Service		A			A	A		D			C	
Approach Delay (s)		3.2			5.9			36.5			34.9	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1644	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1644	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	92	15	205
Lane Group Flow (vph)	272	1321	817	555	627	83
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	19.1	58.0	34.9	58.9	24.0	24.0
Effective Green, g (s)	21.1	60.0	36.9	62.9	26.0	26.0
Actuated g/C Ratio	0.23	0.67	0.41	0.70	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	385	2314	1423	1120	910	408
v/s Ratio Prot	c0.17	c0.38	0.24	0.14	c0.20	
v/s Ratio Perm				0.21		0.06
v/c Ratio	0.71	0.57	0.57	0.50	0.69	0.20
Uniform Delay, d1	31.6	8.1	20.5	6.2	28.4	24.2
Progression Factor	1.11	0.45	0.68	1.65	1.00	1.00
Incremental Delay, d2	4.8	0.8	1.3	1.2	4.3	1.1
Delay (s)	39.8	4.4	15.2	11.5	32.7	25.3
Level of Service	D	A	B	B	C	C
Approach Delay (s)		10.5	13.6		30.4	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	700	235	168	905	809	754
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3220	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3220	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	737	247	177	953	852	794
RTOR Reduction (vph)	0	110	0	0	185	0
Lane Group Flow (vph)	737	137	177	953	1461	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	21.8	21.8	10.8	60.2	45.4	
Effective Green, g (s)	23.8	23.8	12.8	62.2	47.4	
Actuated g/C Ratio	0.26	0.26	0.14	0.69	0.53	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	844	411	234	2399	1696	
v/s Ratio Prot	c0.23		c0.11	0.27	c0.45	
v/s Ratio Perm		0.09				
v/c Ratio	0.87	0.33	0.76	0.40	0.86	
Uniform Delay, d1	31.7	26.7	37.1	5.9	18.5	
Progression Factor	1.00	1.00	1.00	1.00	0.49	
Incremental Delay, d2	9.9	0.5	13.0	0.5	2.9	
Delay (s)	41.6	27.2	50.1	6.4	11.9	
Level of Service	D	C	D	A	B	
Approach Delay (s)	38.0			13.3	11.9	
Approach LOS	D			B	B	

Intersection Summary

HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1085	649	914	814	23	550	98	958	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.88	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1142	683	962	857	24	579	103	1008	3	7	27
RTOR Reduction (vph)	0	0	111	0	2	0	0	160	381	0	23	0
Lane Group Flow (vph)	47	1142	572	962	879	0	579	407	163	3	11	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.2	26.6	42.6	21.0	43.4		16.0	25.0	25.0	1.4	10.4	
Effective Green, g (s)	6.2	28.6	46.6	23.0	45.4		18.0	27.0	27.0	3.4	12.4	
Actuated g/C Ratio	0.07	0.32	0.52	0.26	0.50		0.20	0.30	0.30	0.04	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	113	1103	839	815	1744		638	457	443	62	222	
v/s Ratio Prot	0.03	c0.33	0.14	c0.30	0.25		c0.18	c0.27		0.00	c0.01	
v/s Ratio Perm			0.23						0.11			
v/c Ratio	0.42	1.04	0.68	1.18	0.50		0.91	0.89	0.37	0.05	0.05	
Uniform Delay, d1	40.2	30.7	16.2	33.5	14.8		35.2	30.1	24.8	41.7	33.7	
Progression Factor	0.93	0.88	0.73	1.00	1.00		0.91	0.48	0.74	1.00	1.00	
Incremental Delay, d2	2.0	33.8	1.8	93.7	1.0		13.9	16.1	0.4	0.3	0.1	
Delay (s)	39.2	60.9	13.6	127.2	15.9		45.8	30.6	18.7	42.1	33.8	
Level of Service	D	E	B	F	B		D	C	B	D	C	
Approach Delay (s)		43.1			74.0			32.0			34.4	
Approach LOS		D			E			C			C	

Intersection Summary

HCM Average Control Delay	50.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

2040 Alternative 6

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Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative6
AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	275	0	183	0	0
Lane Group Flow (vph)	291	310	1083	95	653	1578
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	17.0	17.0	32.0	32.0	39.0	75.0
Effective Green, g (s)	19.0	19.0	34.0	34.0	41.0	77.0
Actuated g/C Ratio	0.19	0.19	0.34	0.34	0.41	0.77
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	304	295	1180	513	655	2673
v/s Ratio Prot	0.18		c0.31		c0.41	0.45
v/s Ratio Perm		c0.20		0.06		
v/c Ratio	0.96	1.05	0.92	0.18	1.00	0.59
Uniform Delay, d1	40.1	40.5	31.7	23.2	29.4	4.8
Progression Factor	0.58	0.57	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.1	64.1	12.7	0.8	34.1	1.0
Delay (s)	61.4	87.3	44.3	24.0	63.6	5.8
Level of Service	E	F	D	C	E	A
Approach Delay (s)	78.7		40.2			22.7
Approach LOS	E		D			C

Intersection Summary

HCM Average Control Delay	39.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.96			0.71	
Satd. Flow (perm)		2081			2856	1509		1522			1250	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	22	0	32	0	0	5	0
Lane Group Flow (vph)	0	874	0	0	866	57	0	22	0	0	220	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.2			70.2	70.2		21.8			21.8	
Effective Green, g (s)		72.2			72.2	72.2		23.8			23.8	
Actuated g/C Ratio		0.72			0.72	0.72		0.24			0.24	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1502			2062	1089		362			298	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.18	
v/c Ratio		0.58			0.42	0.05		0.06			0.74	
Uniform Delay, d1		6.7			5.5	4.0		29.5			35.2	
Progression Factor		0.19			0.38	0.00		1.00			1.00	
Incremental Delay, d2		0.9			0.5	0.1		0.1			9.2	
Delay (s)		2.1			2.7	0.1		29.5			44.4	
Level of Service		A			A	A		C			D	
Approach Delay (s)		2.1			2.5			29.5			44.4	
Approach LOS		A			A			C			D	

Intersection Summary

HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1598	3374	3374	1509	3046	1374
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1598	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	69	22	106
Lane Group Flow (vph)	125	794	622	886	477	119
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	12.0	41.0	25.0	76.0	51.0	51.0
Effective Green, g (s)	14.0	43.0	27.0	80.0	53.0	53.0
Actuated g/C Ratio	0.14	0.43	0.27	0.80	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	224	1451	911	1237	1614	728
v/s Ratio Prot	0.08	c0.24	0.18	c0.38	0.16	
v/s Ratio Perm				0.21		0.09
v/c Ratio	0.56	0.55	0.68	0.72	0.30	0.16
Uniform Delay, d1	40.1	21.2	32.7	4.7	13.1	12.1
Progression Factor	0.96	0.98	0.91	2.70	1.00	1.00
Incremental Delay, d2	2.5	1.2	1.8	1.6	0.5	0.5
Delay (s)	41.0	22.0	31.5	14.2	13.6	12.6
Level of Service	D	C	C	B	B	B
Approach Delay (s)		24.6	21.0		13.3	
Approach LOS		C	C		B	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	2.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	499	207	348	1083	794	747
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3129	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3100	1509	1598	3374	3129	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	525	218	366	1140	836	786
RTOR Reduction (vph)	0	121	0	0	170	0
Lane Group Flow (vph)	525	97	366	1140	1453	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	16.0	16.0	24.0	76.0	48.0	
Effective Green, g (s)	18.0	18.0	26.0	78.0	50.0	
Actuated g/C Ratio	0.18	0.18	0.26	0.78	0.50	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	558	272	415	2632	1565	
v/s Ratio Prot	c0.17		c0.23	0.34	c0.46	
v/s Ratio Perm		0.06				
v/c Ratio	0.94	0.36	0.88	0.43	0.93	
Uniform Delay, d1	40.5	35.9	35.5	3.7	23.3	
Progression Factor	1.00	1.00	1.00	1.00	0.34	
Incremental Delay, d2	26.0	3.6	22.7	0.5	4.9	
Delay (s)	66.4	39.5	58.2	4.2	12.8	
Level of Service	E	D	E	A	B	
Approach Delay (s)	58.5			17.3	12.8	
Approach LOS	E			B	B	
























Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
AM Peak













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	482	499	1042	338	65	1028	41	513	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3293		3100	1471	1434	1598	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	507	525	1097	356	68	1082	43	540	22	35	139
RTOR Reduction (vph)	0	0	64	0	16	0	0	156	176	0	126	0
Lane Group Flow (vph)	163	507	461	1097	408	0	1082	141	110	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	14.3	15.9	48.3	28.7	30.3		32.4	36.6	36.6	2.8	7.0	
Effective Green, g (s)	16.3	17.9	52.3	30.7	32.3		34.4	38.6	38.6	4.8	9.0	
Actuated g/C Ratio	0.16	0.18	0.52	0.31	0.32		0.34	0.39	0.39	0.05	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	260	604	819	952	1064		1066	568	554	77	141	
v/s Ratio Prot	0.10	c0.15	0.19	c0.35	0.12		c0.35	0.10		0.01	c0.03	
v/s Ratio Perm			0.11						0.08			
v/c Ratio	0.63	0.84	0.56	1.15	0.38		1.02	0.25	0.20	0.29	0.34	
Uniform Delay, d1	39.0	39.7	16.1	34.6	26.2		32.8	20.8	20.4	45.9	42.7	
Progression Factor	0.75	0.73	0.30	1.00	1.00		0.72	0.14	0.02	1.00	1.00	
Incremental Delay, d2	4.2	9.1	0.8	80.7	1.0		28.6	0.2	0.1	2.0	1.4	
Delay (s)	33.4	37.9	5.6	115.3	27.2		52.2	3.1	0.6	48.0	44.1	
Level of Service	C	D	A	F	C		D	A	A	D	D	
Approach Delay (s)		23.1			90.8			34.6			44.6	
Approach LOS		C			F			C			D	

Intersection Summary

HCM Average Control Delay	50.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
1: Barton Rd & La Canada Dr

2040 Alternative6
PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.81	0.71	1.00	1.00	1.00	1.00
Incremental Delay, d2	200.1	321.9	200.6	1.2	267.4	1.9
Delay (s)	230.8	349.1	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	309.2		194.5			81.5
Approach LOS	F		F			F
Intersection Summary						
HCM Average Control Delay			165.7		HCM Level of Service	F
HCM Volume to Capacity ratio			1.49			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			135.4%		ICU Level of Service	H
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative6
PM Peak



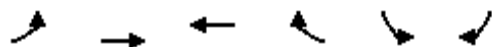
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.50	
Satd. Flow (perm)		2953			2728	1553		1579			900	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	5	0	79	0	0	3	0
Lane Group Flow (vph)	0	1437	0	0	1167	22	0	123	0	0	40	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.1			70.1	70.1		11.9			11.9	
Effective Green, g (s)		72.1			72.1	72.1		13.9			13.9	
Actuated g/C Ratio		0.80			0.80	0.80		0.15			0.15	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2366			2185	1244		244			139	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.08			0.04	
v/c Ratio		0.61			0.53	0.02		0.50			0.29	
Uniform Delay, d1		3.5			3.1	1.8		34.9			33.7	
Progression Factor		0.59			1.30	0.88		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.6			1.2	
Delay (s)		2.5			4.8	1.6		36.5			34.9	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.5			4.8			36.5			34.9	
Approach LOS		A			A			D			C	

Intersection Summary

HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1644	3471	3471	1553	3151	1413
Flt Permitted	0.95	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1644	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	92	15	205
Lane Group Flow (vph)	272	1321	817	555	627	83
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	4	4	
Permitted Phases				6		4
Actuated Green, G (s)	19.1	58.0	34.9	58.9	24.0	24.0
Effective Green, g (s)	21.1	60.0	36.9	62.9	26.0	26.0
Actuated g/C Ratio	0.23	0.67	0.41	0.70	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	385	2314	1423	1120	910	408
v/s Ratio Prot	c0.17	c0.38	0.24	0.14	c0.20	
v/s Ratio Perm				0.21		0.06
v/c Ratio	0.71	0.57	0.57	0.50	0.69	0.20
Uniform Delay, d1	31.6	8.1	20.5	6.2	28.4	24.2
Progression Factor	1.07	0.49	0.68	1.65	1.00	1.00
Incremental Delay, d2	4.8	0.8	1.3	1.2	4.3	1.1
Delay (s)	38.6	4.8	15.2	11.5	32.7	25.3
Level of Service	D	A	B	B	C	C
Approach Delay (s)		10.6	13.6		30.4	
Approach LOS		B	B		C	

Intersection Summary

HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	700	235	168	905	809	754
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3220	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3220	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	737	247	177	953	852	794
RTOR Reduction (vph)	0	110	0	0	185	0
Lane Group Flow (vph)	737	137	177	953	1461	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	21.8	21.8	10.8	60.2	45.4	
Effective Green, g (s)	23.8	23.8	12.8	62.2	47.4	
Actuated g/C Ratio	0.26	0.26	0.14	0.69	0.53	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	844	411	234	2399	1696	
v/s Ratio Prot	c0.23		c0.11	0.27	c0.45	
v/s Ratio Perm		0.09				
v/c Ratio	0.87	0.33	0.76	0.40	0.86	
Uniform Delay, d1	31.7	26.7	37.1	5.9	18.5	
Progression Factor	1.00	1.00	1.00	1.00	0.49	
Incremental Delay, d2	9.9	0.5	13.0	0.5	2.9	
Delay (s)	41.6	27.2	50.1	6.4	11.9	
Level of Service	D	C	D	A	B	
Approach Delay (s)	38.0			13.3	11.9	
Approach LOS	D			B	B	

Intersection Summary

HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative6
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1085	649	914	814	23	550	98	958	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.88	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3457		3190	1523	1475	1644	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1142	683	962	857	24	579	103	1008	3	7	27
RTOR Reduction (vph)	0	0	111	0	2	0	0	160	381	0	23	0
Lane Group Flow (vph)	47	1142	572	962	879	0	579	407	163	3	11	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.2	26.6	42.6	21.0	43.4		16.0	25.0	25.0	1.4	10.4	
Effective Green, g (s)	6.2	28.6	46.6	23.0	45.4		18.0	27.0	27.0	3.4	12.4	
Actuated g/C Ratio	0.07	0.32	0.52	0.26	0.50		0.20	0.30	0.30	0.04	0.14	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	113	1103	839	815	1744		638	457	443	62	222	
v/s Ratio Prot	0.03	c0.33	0.14	c0.30	0.25		c0.18	c0.27		0.00	c0.01	
v/s Ratio Perm			0.23						0.11			
v/c Ratio	0.42	1.04	0.68	1.18	0.50		0.91	0.89	0.37	0.05	0.05	
Uniform Delay, d1	40.2	30.7	16.2	33.5	14.8		35.2	30.1	24.8	41.7	33.7	
Progression Factor	0.89	0.86	0.68	1.00	1.00		0.91	0.48	0.74	1.00	1.00	
Incremental Delay, d2	2.0	33.8	1.8	93.7	1.0		13.9	16.1	0.4	0.3	0.1	
Delay (s)	37.6	60.1	12.8	127.2	15.9		45.8	30.6	18.7	42.1	33.8	
Level of Service	D	E	B	F	B		D	C	B	D	C	
Approach Delay (s)		42.3			74.0			32.0			34.4	
Approach LOS		D			E			C			C	















Intersection Summary		
HCM Average Control Delay	49.8	HCM Level of Service D
HCM Volume to Capacity ratio	0.95	
Actuated Cycle Length (s)	90.0	Sum of lost time (s) 6.0
Intersection Capacity Utilization	92.3%	ICU Level of Service F
Analysis Period (min)	15	
c Critical Lane Group		

2040 Alternative 7

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Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2040 Alternative7
 AM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	276	556	1029	264	620	1499
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	291	585	1083	278	653	1578
RTOR Reduction (vph)	0	290	0	187	0	0
Lane Group Flow (vph)	291	295	1083	91	653	1578
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	17.0	17.0	29.0	29.0	37.0	70.0
Effective Green, g (s)	19.0	19.0	31.0	31.0	39.0	72.0
Actuated g/C Ratio	0.20	0.20	0.33	0.33	0.41	0.76
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	320	302	1101	492	656	2557
v/s Ratio Prot	0.18		c0.32		c0.41	0.47
v/s Ratio Perm		c0.20		0.06		
v/c Ratio	0.91	0.98	0.98	0.18	1.00	0.62
Uniform Delay, d1	37.2	37.8	31.7	22.9	27.9	5.2
Progression Factor	1.00	1.27	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.7	43.5	23.5	0.8	34.0	1.1
Delay (s)	63.9	91.6	55.2	23.8	62.0	6.4
Level of Service	E	F	E	C	E	A
Approach Delay (s)	82.4		48.8			22.6
Approach LOS	F		D			C
Intersection Summary						
HCM Average Control Delay			42.3		HCM Level of Service	D
HCM Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			95.0		Sum of lost time (s)	6.0
Intersection Capacity Utilization			90.8%		ICU Level of Service	E
Analysis Period (min)			15			
c	Critical Lane Group					

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative7
AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	178	647	7	50	772	75	8	4	40	186	4	24
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		4.0			4.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.90			0.98	
Flt Protected		0.99			1.00	1.00		0.99			0.96	
Satd. Flow (prot)		3334			3364	1509		1578			1676	
Flt Permitted		0.62			0.85	1.00		0.95			0.76	
Satd. Flow (perm)		2093			2865	1509		1515			1336	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	681	7	53	813	79	8	4	42	196	4	25
RTOR Reduction (vph)	0	1	0	0	0	22	0	33	0	0	5	0
Lane Group Flow (vph)	0	874	0	0	866	57	0	21	0	0	220	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		66.2			66.2	66.2		20.8			20.8	
Effective Green, g (s)		68.2			68.2	68.2		20.8			20.8	
Actuated g/C Ratio		0.72			0.72	0.72		0.22			0.22	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		1503			2057	1083		332			293	
v/s Ratio Prot												
v/s Ratio Perm		c0.42			0.30	0.04		0.01			c0.16	
v/c Ratio		0.58			0.42	0.05		0.06			0.75	
Uniform Delay, d1		6.5			5.4	3.9		29.4			34.7	
Progression Factor		0.70			0.94	0.42		1.00			1.00	
Incremental Delay, d2		0.9			0.6	0.1		0.1			10.0	
Delay (s)		5.4			5.7	1.7		29.5			44.7	
Level of Service		A			A	A		C			D	
Approach Delay (s)		5.4			5.4			29.5			44.7	
Approach LOS		A			A			C			D	

Intersection Summary

HCM Average Control Delay	10.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
4: Barton Rd & I-215 SB Ramps

2040 Alternative7
AM Peak
























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	119	754	591	907	382	306
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.97	0.85
Flt Protected	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1682	3374	3374	1509	3046	1374
Flt Permitted	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1682	3374	3374	1509	3046	1374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	125	794	622	955	402	322
RTOR Reduction (vph)	0	0	0	67	31	26
Lane Group Flow (vph)	125	794	622	888	468	199
Turn Type	Prot			pm+ov		custom
Protected Phases	5	2	6	7	7	5
Permitted Phases				6		4
Actuated Green, G (s)	11.0	55.3	40.3	72.0	31.7	42.7
Effective Green, g (s)	13.0	57.3	42.3	76.0	33.7	46.7
Actuated g/C Ratio	0.14	0.60	0.45	0.80	0.35	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	230	2035	1502	1239	1081	704
v/s Ratio Prot	c0.07	0.24	0.18	c0.25	0.15	0.04
v/s Ratio Perm				0.33		0.11
v/c Ratio	0.54	0.39	0.41	0.72	0.43	0.28
Uniform Delay, d1	38.2	9.8	17.9	4.5	23.4	14.3
Progression Factor	1.03	0.94	0.33	2.41	1.00	1.00
Incremental Delay, d2	2.2	0.5	0.6	1.3	0.3	0.2
Delay (s)	41.6	9.6	6.5	12.0	23.6	14.5
Level of Service	D	A	A	B	C	B
Approach Delay (s)		14.0	9.9		20.8	
Approach LOS		B	A		C	

Intersection Summary

HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
5: Barton Rd & I-215 NB Ramps

2040 Alternative7
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	227	909	0	0	1366	868	132	0	574	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1598	3374			3374	1509	1598	1434	1358			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1598	3374			3374	1509	1598	1434	1358			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	239	957	0	0	1438	914	139	0	604	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	265	0	180	180	0	0	0
Lane Group Flow (vph)	239	957	0	0	1438	649	139	122	122	0	0	0
Turn Type	Prot			Perm			Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	19.0	74.0			51.0	51.0	13.0	13.0	13.0			
Effective Green, g (s)	21.0	76.0			53.0	53.0	15.0	15.0	15.0			
Actuated g/C Ratio	0.22	0.80			0.56	0.56	0.16	0.16	0.16			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	353	2699			1882	842	252	226	214			
v/s Ratio Prot	c0.15	0.28			0.43		0.09	0.08				
v/s Ratio Perm						c0.43			c0.09			
v/c Ratio	0.68	0.35			0.76	0.77	0.55	0.54	0.57			
Uniform Delay, d1	33.9	2.7			16.2	16.3	36.9	36.8	37.0			
Progression Factor	0.90	0.70			0.30	0.73	1.00	1.00	1.00			
Incremental Delay, d2	9.5	0.3			0.3	0.6	2.6	2.5	3.4			
Delay (s)	40.0	2.2			5.1	12.5	39.5	39.3	40.5			
Level of Service	D	A			A	B	D	D	D			
Approach Delay (s)		9.7			8.0			39.8			0.0	
Approach LOS		A			A			D			A	

Intersection Summary

HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
6: Commerce Way & Michigan Ave

2040 Alternative7
AM Peak



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑	↖	↗
Volume (vph)	274	163	490	196	270	809
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.94		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3185		3273	1776	1687	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3185		3273	1776	1687	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	288	172	516	206	284	852
RTOR Reduction (vph)	93	0	0	0	0	357
Lane Group Flow (vph)	367	0	516	206	284	495
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	16.0		22.0	42.0	45.0	45.0
Effective Green, g (s)	16.0		22.0	42.0	45.0	45.0
Actuated g/C Ratio	0.17		0.23	0.44	0.47	0.47
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	536		758	785	799	715
v/s Ratio Prot	c0.12		c0.16	0.12	0.17	
v/s Ratio Perm						c0.33
v/c Ratio	0.68		0.68	0.26	0.36	0.69
Uniform Delay, d1	37.1		33.3	16.7	15.8	19.6
Progression Factor	1.00		0.70	0.76	1.00	1.00
Incremental Delay, d2	3.6		4.2	0.7	1.2	5.4
Delay (s)	40.7		27.4	13.3	17.1	25.0
Level of Service	D		C	B	B	C
Approach Delay (s)	40.7			23.4	23.0	
Approach LOS	D			C	C	

Intersection Summary

HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			















Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative7
AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	848	480	173	1207	65	896	41	146	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.91	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	1598	3348		3100	1541	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.56	1.00	
Satd. Flow (perm)	1598	3374	1509	1598	3348		3100	1541	1434	949	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	893	505	182	1271	68	943	43	154	22	35	139
RTOR Reduction (vph)	0	0	125	0	4	0	0	35	57	0	126	0
Lane Group Flow (vph)	163	893	380	182	1335	0	943	67	38	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	13.5	35.3	60.3	11.7	33.5		25.0	36.0	36.0	7.0	7.0	
Effective Green, g (s)	15.5	37.3	64.3	13.7	35.5		27.0	38.0	38.0	9.0	9.0	
Actuated g/C Ratio	0.16	0.39	0.68	0.14	0.37		0.28	0.40	0.40	0.09	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	261	1325	1021	230	1251		881	616	574	90	148	
v/s Ratio Prot	0.10	c0.26	0.11	0.11	c0.40		c0.30	0.04			c0.03	
v/s Ratio Perm			0.15						0.03	0.02		
v/c Ratio	0.62	0.67	0.37	0.79	1.07		1.07	0.11	0.07	0.24	0.33	
Uniform Delay, d1	37.0	23.8	6.6	39.3	29.8		34.0	17.9	17.6	39.8	40.2	
Progression Factor	1.04	1.04	1.50	1.00	1.00		0.89	0.78	0.83	1.00	1.00	
Incremental Delay, d2	4.1	2.5	0.2	16.8	45.5		44.9	0.0	0.0	1.4	1.3	
Delay (s)	42.6	27.2	10.1	56.0	75.2		75.0	13.9	14.5	41.3	41.5	
Level of Service	D	C	B	E	E		E	B	B	D	D	
Approach Delay (s)		23.3			72.9			64.5			41.4	
Approach LOS		C			E			E			D	
Intersection Summary												
HCM Average Control Delay			51.8			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			95.0			Sum of lost time (s)			6.0			
Intersection Capacity Utilization			94.7%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

Barton Road Interchange Improvement Project
 1: Barton Rd & La Canada Dr

2040 Alternative7
 PM Peak

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	341	671	2372	377	682	1984
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	359	706	2497	397	718	2088
RTOR Reduction (vph)	0	299	0	133	0	0
Lane Group Flow (vph)	359	407	2497	264	718	2088
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	12.0	12.0	43.0	43.0	23.0	70.0
Effective Green, g (s)	14.0	14.0	45.0	45.0	25.0	72.0
Actuated g/C Ratio	0.16	0.16	0.50	0.50	0.28	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	242	1736	777	457	2777
v/s Ratio Prot	0.22		c0.72		c0.44	0.60
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.40	1.68	1.44	0.34	1.57	0.75
Uniform Delay, d1	38.0	38.0	22.5	13.6	32.5	4.5
Progression Factor	0.86	1.50	1.00	1.00	1.00	1.00
Incremental Delay, d2	200.1	321.9	200.6	1.2	267.4	1.9
Delay (s)	232.9	378.8	223.1	14.7	299.9	6.4
Level of Service	F	F	F	B	F	A
Approach Delay (s)	329.6		194.5			81.5
Approach LOS	F		F			F

Intersection Summary

HCM Average Control Delay	168.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	135.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
2: Barton Rd & Grand Terrace Rd

2040 Alternative7
PM Peak



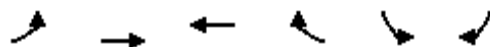
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕	↗		↕↕			↕↕	
Volume (vph)	52	1305	8	58	1051	26	11	6	175	34	4	3
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)		2.0			2.0	2.0		2.0			2.0	
Lane Util. Factor		0.95			0.95	1.00		1.00			1.00	
Frt		1.00			1.00	0.85		0.88			0.99	
Flt Protected		1.00			1.00	1.00		1.00			0.96	
Satd. Flow (prot)		3462			3462	1553		1598			1737	
Flt Permitted		0.85			0.79	1.00		0.99			0.50	
Satd. Flow (perm)		2953			2728	1553		1579			900	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1374	8	61	1106	27	12	6	184	36	4	3
RTOR Reduction (vph)	0	0	0	0	0	5	0	79	0	0	3	0
Lane Group Flow (vph)	0	1437	0	0	1167	22	0	123	0	0	40	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Actuated Green, G (s)		70.1			70.1	70.1		11.9			11.9	
Effective Green, g (s)		72.1			72.1	72.1		13.9			13.9	
Actuated g/C Ratio		0.80			0.80	0.80		0.15			0.15	
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)		2366			2185	1244		244			139	
v/s Ratio Prot												
v/s Ratio Perm		c0.49			0.43	0.01		c0.08			0.04	
v/c Ratio		0.61			0.53	0.02		0.50			0.29	
Uniform Delay, d1		3.5			3.1	1.8		34.9			33.7	
Progression Factor		0.63			0.57	0.28		1.00			1.00	
Incremental Delay, d2		0.5			0.8	0.0		1.6			1.2	
Delay (s)		2.7			2.5	0.5		36.5			34.9	
Level of Service		A			A	A		D			C	
Approach Delay (s)		2.7			2.5	0.5		36.5			34.9	
Approach LOS		A			A	A		D			C	

Intersection Summary

HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative7
 PM Peak
























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	258	1255	776	615	523	360
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	0.91
Frt	1.00	1.00	1.00	0.85	0.98	0.85
Flt Protected	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (prot)	1731	3471	3471	1553	3151	1413
Flt Permitted	1.00	1.00	1.00	1.00	0.96	1.00
Satd. Flow (perm)	1731	3471	3471	1553	3151	1413
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	272	1321	817	647	551	379
RTOR Reduction (vph)	0	0	0	97	16	203
Lane Group Flow (vph)	272	1321	817	550	626	85
Turn Type	Prot			pm+ov		Perm
Protected Phases	5	2	6	7	7	
Permitted Phases				6		7
Actuated Green, G (s)	22.0	57.5	31.5	56.0	24.5	24.5
Effective Green, g (s)	24.0	59.5	33.5	60.0	26.5	26.5
Actuated g/C Ratio	0.27	0.66	0.37	0.67	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	462	2295	1292	1070	928	416
v/s Ratio Prot	0.16	c0.38	c0.24	0.15	c0.20	
v/s Ratio Perm				0.20		0.06
v/c Ratio	0.59	0.58	0.63	0.51	0.68	0.20
Uniform Delay, d1	28.7	8.3	23.2	7.6	28.0	23.8
Progression Factor	0.69	0.47	0.10	0.83	1.00	1.00
Incremental Delay, d2	1.6	0.9	0.8	0.1	2.0	0.2
Delay (s)	21.5	4.8	3.1	6.5	29.9	24.1
Level of Service	C	A	A	A	C	C
Approach Delay (s)		7.6	4.6		28.1	
Approach LOS		A	A		C	

Intersection Summary

HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative7
 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	267	1512	0	0	1357	655	34	0	901	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1644	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1644	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	1592	0	0	1428	689	36	0	948	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	227	0	27	27	0	0	0
Lane Group Flow (vph)	281	1592	0	0	1428	462	36	447	447	0	0	0
Turn Type	Prot					Perm		Prot		Perm		
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	16.0	56.0			36.0	36.0	26.0	26.0	26.0			
Effective Green, g (s)	18.0	58.0			38.0	38.0	28.0	28.0	28.0			
Actuated g/C Ratio	0.20	0.64			0.42	0.42	0.31	0.31	0.31			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	329	2237			1466	656	511	459	435			
v/s Ratio Prot	c0.17	0.46			c0.41		0.02	0.30				
v/s Ratio Perm						0.30			c0.32			
v/c Ratio	0.85	0.71			0.97	0.70	0.07	0.97	1.03			
Uniform Delay, d1	34.7	10.5			25.5	21.4	21.8	30.6	31.0			
Progression Factor	1.00	0.98			0.59	0.55	1.00	1.00	1.00			
Incremental Delay, d2	19.8	1.6			11.0	2.9	0.1	35.1	50.5			
Delay (s)	54.5	11.8			26.0	14.6	21.9	65.7	81.5			
Level of Service	D	B			C	B	C	E	F			
Approach Delay (s)		18.2			22.3			71.7			0.0	
Approach LOS		B			C			E			A	
Intersection Summary												
HCM Average Control Delay			30.5		HCM Level of Service				C			
HCM Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			87.7%		ICU Level of Service				E			
Analysis Period (min)			15									
c	Critical Lane Group											

Barton Road Interchange Improvement Project
6: Commerce Way & Michigan Ave

2040 Alternative7
PM Peak


























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑	↖	↗
Volume (vph)	245	219	657	225	220	660
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.93		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3225		3367	1827	1736	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3225		3367	1827	1736	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	258	231	692	237	232	695
RTOR Reduction (vph)	188	0	0	0	0	425
Lane Group Flow (vph)	301	0	692	237	232	270
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	13.1		29.9	47.0	35.0	35.0
Effective Green, g (s)	13.1		29.9	47.0	35.0	35.0
Actuated g/C Ratio	0.15		0.33	0.52	0.39	0.39
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	469		1119	954	675	604
v/s Ratio Prot	c0.09		c0.21	0.13	0.13	
v/s Ratio Perm						c0.17
v/c Ratio	0.64		0.62	0.25	0.34	0.45
Uniform Delay, d1	36.2		25.3	11.8	19.4	20.3
Progression Factor	1.00		0.67	0.64	1.00	1.00
Incremental Delay, d2	3.0		1.8	0.4	1.4	2.4
Delay (s)	39.2		18.7	8.0	20.8	22.7
Level of Service	D		B	A	C	C
Approach Delay (s)	39.2			16.0	22.2	
Approach LOS	D			B	C	

Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Barton Road Interchange Improvement Project
7: Barton Rd & Vivienda Av

2040 Alternative7
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1751	616	259	1469	23	516	98	291	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3463		3190	1601	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.44	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3463		3190	1601	1475	769	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1843	648	273	1546	24	543	103	306	3	7	27
RTOR Reduction (vph)	0	0	155	0	1	0	0	43	142	0	24	0
Lane Group Flow (vph)	47	1843	493	273	1569	0	543	170	54	3	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	8.1	42.4	54.4	12.6	46.9		12.0	23.0	23.0	7.0	7.0	
Effective Green, g (s)	10.1	44.4	58.4	14.6	48.9		14.0	25.0	25.0	9.0	9.0	
Actuated g/C Ratio	0.11	0.49	0.65	0.16	0.54		0.16	0.28	0.28	0.10	0.10	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	184	1712	1042	267	1882		496	445	410	77	161	
v/s Ratio Prot	0.03	c0.53	0.07	c0.17	c0.45		c0.17	c0.11			0.01	
v/s Ratio Perm			0.24						0.04	0.00		
v/c Ratio	0.26	1.08	0.47	1.02	0.83		1.09	0.38	0.13	0.04	0.06	
Uniform Delay, d1	36.5	22.8	8.0	37.7	17.2		38.0	26.3	24.4	36.6	36.7	
Progression Factor	0.92	0.74	0.46	1.00	1.00		1.04	1.08	1.55	1.00	1.00	
Incremental Delay, d2	0.4	41.2	0.2	61.0	4.5		63.4	0.4	0.1	0.2	0.2	
Delay (s)	33.8	58.0	3.9	98.7	21.7		102.8	28.8	38.0	36.8	36.8	
Level of Service	C	E	A	F	C		F	C	D	D	D	
Approach Delay (s)		43.7			33.1			72.9			36.8	
Approach LOS		D			C			E			D	
Intersection Summary												
HCM Average Control Delay			45.2			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			6.0			
Intersection Capacity Utilization			95.8%			ICU Level of Service			F			
Analysis Period (min)			15									
c	Critical Lane Group											

2040 Alternative 6 (Without Bi-County)

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HCM Signalized Intersection Capacity Analysis
1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt6 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	294	594	1099	282	662	1601
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1553	3471	1509	1598	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1553	3471	1509	1598	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	309	625	1157	297	697	1685
RTOR Reduction (vph)	0	307	0	198	0	0
Lane Group Flow (vph)	309	318	1157	99	697	1685
Heavy Vehicles (%)	7%	4%	4%	7%	7%	4%
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	15.0	15.0	28.0	28.0	35.0	67.0
Effective Green, g (s)	17.0	17.0	30.0	30.0	37.0	69.0
Actuated g/C Ratio	0.19	0.19	0.33	0.33	0.41	0.77
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	302	293	1157	503	657	2661
v/s Ratio Prot	0.19		c0.33		c0.44	0.49
v/s Ratio Perm		c0.20		0.07		
v/c Ratio	1.02	1.08	1.00	0.20	1.06	0.63
Uniform Delay, d1	36.5	36.5	30.0	21.4	26.5	4.8
Progression Factor	0.94	0.99	1.00	1.00	1.00	1.00
Incremental Delay, d2	54.7	73.7	26.5	0.9	52.4	1.2
Delay (s)	89.1	109.8	56.5	22.3	78.9	5.9
Level of Service	F	F	E	C	E	A
Approach Delay (s)	102.9		49.5			27.3
Approach LOS	F		D			C

Intersection Summary

HCM Average Control Delay	48.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	178	660	928	981	190	24
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1598	1776	3374	1509	1586	
Flt Permitted	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	1598	1776	3374	1509	1586	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	695	977	1033	200	25
RTOR Reduction (vph)	0	0	0	293	5	0
Lane Group Flow (vph)	187	695	977	740	220	0
Turn Type	Prot		Perm			
Protected Phases	7	4	8			
Permitted Phases				8	1	
Actuated Green, G (s)	11.7	67.1	51.4	51.4	14.9	
Effective Green, g (s)	13.7	69.1	53.4	53.4	16.9	
Actuated g/C Ratio	0.15	0.77	0.59	0.59	0.19	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	243	1364	2002	895	298	
v/s Ratio Prot	c0.12	0.39	0.29			
v/s Ratio Perm				c0.49	c0.14	
v/c Ratio	0.77	0.51	0.49	0.83	0.74	
Uniform Delay, d1	36.6	4.0	10.5	14.6	34.5	
Progression Factor	0.88	0.19	0.58	0.86	1.00	
Incremental Delay, d2	6.7	0.6	0.8	8.4	9.2	
Delay (s)	38.8	1.4	6.9	20.9	43.7	
Level of Service	D	A	A	C	D	
Approach Delay (s)		9.3	14.1		43.7	
Approach LOS		A	B		D	

Intersection Summary

HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Alignment) Alt6 AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	732	11	0	721	803	0	0	22	382	0	326
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1598	3366			3374	1509			1536	3100		1509
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1598	3366			3374	1509			1536	3100		1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	112	771	12	0	759	845	0	0	23	402	0	343
RTOR Reduction (vph)	0	1	0	0	0	520	0	0	22	0	0	171
Lane Group Flow (vph)	112	782	0	0	759	325	0	0	1	402	0	172
Turn Type	Prot			Perm			custom			Prot		custom
Protected Phases	7	4		8						1		
Permitted Phases						8			2			6
Actuated Green, G (s)	9.0	45.6			32.6	32.6			2.8	29.6		36.4
Effective Green, g (s)	11.0	47.6			34.6	34.6			2.8	31.6		38.4
Actuated g/C Ratio	0.12	0.53			0.38	0.38			0.03	0.35		0.43
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	195	1780			1297	580			48	1088		644
v/s Ratio Prot	c0.07	0.23			c0.22					c0.13		
v/s Ratio Perm						0.22			0.00			c0.11
v/c Ratio	0.57	0.44			0.59	0.56			0.01	0.37		0.27
Uniform Delay, d1	37.3	13.0			22.0	21.7			42.3	21.8		16.7
Progression Factor	0.76	0.58			1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	10.0	0.7			1.9	3.9			0.1	1.0		1.0
Delay (s)	38.4	8.2			23.9	25.6			42.4	22.7		17.7
Level of Service	D	A			C	C			D	C		B
Approach Delay (s)		11.9			24.8			42.4			20.4	
Approach LOS		B			C			D			C	
Intersection Summary												
HCM Average Control Delay	20.4			HCM Level of Service			C					
HCM Volume to Capacity ratio	0.47											
Actuated Cycle Length (s)	90.0			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	62.6%			ICU Level of Service			B					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 AM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	611	238	365	1114	803	751
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.93	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3100	1509	1598	3374	3129	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	3100	1509	137	3374	3129	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	643	251	384	1173	845	791
RTOR Reduction (vph)	0	195	0	0	172	0
Lane Group Flow (vph)	643	56	384	1173	1464	0
Turn Type		Perm	pm+pt			
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	20.0	20.0	70.0	70.0	45.0	
Effective Green, g (s)	22.0	22.0	72.0	72.0	47.0	
Actuated g/C Ratio	0.22	0.22	0.73	0.73	0.48	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	696	339	444	2479	1501	
v/s Ratio Prot	c0.21		c0.20	0.35	c0.47	
v/s Ratio Perm		0.04	0.43			
v/c Ratio	0.92	0.17	0.86	0.47	0.98	
Uniform Delay, d1	37.2	30.6	29.0	5.3	24.9	
Progression Factor	1.00	1.00	1.00	1.00	0.35	
Incremental Delay, d2	18.0	0.2	19.6	0.7	9.7	
Delay (s)	55.1	30.8	48.6	5.9	18.3	
Level of Service	E	C	D	A	B	
Approach Delay (s)	48.3			16.5	18.3	
Approach LOS	D			B	B	
























Intersection Summary

HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	98.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	491	490	1065	306	65	1086	35	603	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	1.6	1.9	1.6	1.9	1.6		1.6	2.0	1.9	1.9	1.9	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.87	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	3100	3286		3100	1461	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	1598	3374	1509	3100	3286		3100	1461	1434	919	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	517	516	1121	322	68	1143	37	635	22	35	139
RTOR Reduction (vph)	0	0	72	0	21	0	0	165	2	0	126	0
Lane Group Flow (vph)	163	517	444	1121	369	0	1143	177	328	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		pm+ov		Perm	
Protected Phases	7	4	5	3	8		5	2	3		6	
Permitted Phases			4						2		6	
Actuated Green, G (s)	28.4	12.1	44.5	31.1	15.4		32.4	43.0	74.1	7.1	7.1	
Effective Green, g (s)	30.4	14.1	48.5	33.1	17.4		34.4	45.0	78.1	9.1	9.1	
Actuated g/C Ratio	0.31	0.14	0.49	0.34	0.18		0.35	0.46	0.80	0.09	0.09	
Clearance Time (s)	3.6	3.9	3.6	3.9	3.6		3.6	4.0	3.9	3.9	3.9	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0		2.0	3.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	496	485	747	1047	583		1088	671	1143	85	145	
v/s Ratio Prot	0.10	c0.15	0.21	c0.36	0.11		c0.37	0.12	c0.10		0.03	
v/s Ratio Perm			0.09						0.13		0.02	
v/c Ratio	0.33	1.07	0.59	1.07	0.63		1.05	0.26	0.29	0.26	0.33	
Uniform Delay, d1	26.0	42.0	17.7	32.5	37.3		31.8	16.3	2.6	41.3	41.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.70	0.11	0.85	1.00	1.00	
Incremental Delay, d2	0.1	59.6	0.9	48.8	1.7		38.5	0.2	0.0	7.2	6.0	
Delay (s)	26.1	101.5	18.6	81.2	39.0		60.7	1.9	2.3	48.6	47.6	
Level of Service	C	F	B	F	D		E	A	A	D	D	
Approach Delay (s)		55.5			70.3			39.0			47.7	
Approach LOS		E			E			D			D	
Intersection Summary												
HCM Average Control Delay			53.6				HCM Level of Service				D	
HCM Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			98.0				Sum of lost time (s)			5.4		
Intersection Capacity Utilization			101.5%				ICU Level of Service			G		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2040 (3+1 No Alignmt) Alt6 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	344	677	2392	380	688	2000
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	362	713	2518	400	724	2105
RTOR Reduction (vph)	0	405	0	226	0	0
Lane Group Flow (vph)	362	308	2518	174	724	2105
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	9.0	9.0	17.0	17.0	15.0	36.0
Effective Green, g (s)	11.0	11.0	19.0	19.0	17.0	38.0
Actuated g/C Ratio	0.21	0.21	0.36	0.36	0.32	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	341	322	1244	557	527	2489
v/s Ratio Prot	c0.22		c0.73		c0.44	0.61
v/s Ratio Perm		0.20		0.11		
v/c Ratio	1.06	0.96	2.02	0.31	1.37	0.85
Uniform Delay, d1	21.0	20.8	17.0	12.3	18.0	5.4
Progression Factor	1.14	3.22	1.00	1.00	1.00	1.00
Incremental Delay, d2	63.3	35.8	463.7	1.5	180.0	3.8
Delay (s)	87.3	102.8	480.7	13.7	198.0	9.2
Level of Service	F	F	F	B	F	A
Approach Delay (s)	97.5		416.7			57.5
Approach LOS	F		F			E

Intersection Summary

HCM Average Control Delay	217.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.52		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	136.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Alignment) Alt6 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	140	1293	1170	32	38	3
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1644	1827	3471	1553	1638	
Flt Permitted	0.20	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	338	1827	3471	1553	1638	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	147	1361	1232	34	40	3
RTOR Reduction (vph)	0	0	0	9	2	0
Lane Group Flow (vph)	147	1361	1232	25	41	0
Turn Type	Perm			Perm		
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	37.5	37.5	37.5	37.5	7.5	
Effective Green, g (s)	39.5	39.5	39.5	39.5	9.5	
Actuated g/C Ratio	0.75	0.75	0.75	0.75	0.18	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	252	1362	2587	1157	294	
v/s Ratio Prot		c0.74	0.35			
v/s Ratio Perm	0.44			0.02	c0.02	
v/c Ratio	0.58	1.00	0.48	0.02	0.14	
Uniform Delay, d1	3.0	6.7	2.7	1.7	18.3	
Progression Factor	0.68	0.99	0.92	0.40	1.00	
Incremental Delay, d2	5.6	18.4	0.5	0.0	0.2	
Delay (s)	7.7	25.1	3.0	0.7	18.5	
Level of Service	A	C	A	A	B	
Approach Delay (s)		23.4	2.9		18.5	
Approach LOS		C	A		B	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	53.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	239	1167	13	0	819	570	0	0	88	523	0	366
Ideal Flow (vphpl)	1800	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			4.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1644	3465			3471	1553			1580	3190		1553
Flt Permitted	0.95	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1644	3465			3471	1553			1580	3190		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	252	1228	14	0	862	600	0	0	93	551	0	385
RTOR Reduction (vph)	0	1	0	0	0	340	0	0	51	0	0	312
Lane Group Flow (vph)	252	1241	0	0	862	260	0	0	42	551	0	73
Turn Type	Prot			Perm			custom			Prot		custom
Protected Phases	5	2			6					4		
Permitted Phases						6			8			4
Actuated Green, G (s)	20.5	68.4			43.9	43.9			7.6	18.0		18.0
Effective Green, g (s)	22.5	70.4			45.9	45.9			7.6	20.0		20.0
Actuated g/C Ratio	0.21	0.66			0.43	0.43			0.07	0.19		0.19
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	349	2301			1503	672			113	602		293
v/s Ratio Prot	c0.15	0.36			c0.25					c0.17		
v/s Ratio Perm						0.17			c0.03			0.05
v/c Ratio	0.72	0.54			0.57	0.39			0.37	0.92		0.25
Uniform Delay, d1	38.8	9.3			22.7	20.5			46.9	42.2		36.6
Progression Factor	0.91	0.79			1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	2.9	0.4			1.6	1.7			2.1	20.9		2.0
Delay (s)	38.4	7.7			24.3	22.1			49.0	63.0		38.6
Level of Service	D	A			C	C			D	E		D
Approach Delay (s)		12.9			23.4			49.0			53.0	
Approach LOS		B			C			D			D	
Intersection Summary												
HCM Average Control Delay			27.0		HCM Level of Service					C		
HCM Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			106.0		Sum of lost time (s)					10.0		
Intersection Capacity Utilization			64.3%		ICU Level of Service					C		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
5: I-215 NB Ramps & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt6 PM Peak


























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	647	227	179	902	823	840
Ideal Flow (vphpl)	1800	1900	1800	1900	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.92	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	3190	1553	1644	3471	3208	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	3190	1553	1644	3471	3208	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	681	239	188	949	866	884
RTOR Reduction (vph)	0	181	0	0	203	0
Lane Group Flow (vph)	681	58	188	949	1547	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	19.8	19.8	10.9	62.2	47.3	
Effective Green, g (s)	21.8	21.8	12.9	64.2	49.3	
Actuated g/C Ratio	0.24	0.24	0.14	0.71	0.55	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	773	376	236	2476	1757	
v/s Ratio Prot	c0.21		c0.11	0.27	c0.48	
v/s Ratio Perm		0.04				
v/c Ratio	0.88	0.15	0.80	0.38	0.88	
Uniform Delay, d1	32.9	26.8	37.3	5.1	17.8	
Progression Factor	1.00	1.00	1.00	1.00	0.32	
Incremental Delay, d2	11.5	0.2	16.8	0.5	2.3	
Delay (s)	44.3	27.0	54.1	5.5	8.0	
Level of Service	D	C	D	A	A	
Approach Delay (s)	39.8			13.6	8.0	
Approach LOS	D			B	A	

Intersection Summary

HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt6 PM Peak















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1049	682	982	817	23	545	99	905	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	1.5	2.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.88	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	3190	3457		3190	1526	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1644	3471	1553	3190	3457		3190	1526	1475	1644	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1104	718	1034	860	24	574	104	953	3	7	27
RTOR Reduction (vph)	0	0	126	0	2	0	0	144	362	0	24	0
Lane Group Flow (vph)	47	1104	592	1034	882	0	574	389	162	3	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Prot		
Protected Phases	5	2	3	1	6		3	8		7	4	
Permitted Phases			2						8			
Actuated Green, G (s)	4.2	22.2	42.0	25.0	43.0		19.8	25.9	25.9	1.4	7.0	
Effective Green, g (s)	6.2	24.2	46.0	27.0	45.0		21.8	27.9	27.9	3.4	9.0	
Actuated g/C Ratio	0.07	0.27	0.51	0.30	0.50		0.24	0.31	0.31	0.04	0.10	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	3.5	4.0	
Vehicle Extension (s)	3.0	3.0	2.0	3.0	3.0		2.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	113	933	794	957	1729		773	473	457	62	161	
v/s Ratio Prot	0.03	c0.32	0.18	c0.32	0.26		0.18	c0.25		0.00	c0.01	
v/s Ratio Perm			0.20						0.11			
v/c Ratio	0.42	1.18	0.75	1.08	0.51		0.74	0.82	0.36	0.05	0.06	
Uniform Delay, d1	40.2	32.9	17.4	31.5	15.1		31.5	28.8	24.1	41.7	36.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.70	0.39	0.49	1.00	1.00	
Incremental Delay, d2	2.5	93.5	3.4	53.3	1.1		2.8	9.1	0.4	0.3	0.2	
Delay (s)	42.6	126.4	20.7	84.8	16.2		24.8	20.5	12.1	42.1	36.8	
Level of Service	D	F	C	F	B		C	C	B	D	D	
Approach Delay (s)		83.7			53.2			19.3			37.3	
Approach LOS		F			D			B			D	
Intersection Summary												
HCM Average Control Delay			53.4			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			92.3%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

2040 Alternative 7 (Without Bi-County)

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HCM Signalized Intersection Capacity Analysis
1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
2040 (3+1 No Alignmt) Alt7 AM PEAK

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Volume (vph)	294	594	1099	282	662	1601
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1598	1509	3374	1509	1598	3374
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1598	1509	3374	1509	1598	3374
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	309	625	1157	297	697	1685
RTOR Reduction (vph)	0	445	0	203	0	0
Lane Group Flow (vph)	309	180	1157	94	697	1685
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	11.9	11.9	17.0	17.0	19.0	40.0
Effective Green, g (s)	13.9	13.9	19.0	19.0	21.0	42.0
Actuated g/C Ratio	0.23	0.23	0.32	0.32	0.35	0.70
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	371	350	1070	479	560	2366
v/s Ratio Prot	c0.19		c0.34		c0.44	0.50
v/s Ratio Perm		0.12		0.06		
v/c Ratio	0.83	0.52	1.08	0.20	1.24	0.71
Uniform Delay, d1	21.9	20.1	20.4	14.9	19.4	5.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.7	1.3	52.3	0.9	124.5	1.9
Delay (s)	36.6	21.3	72.7	15.8	144.0	7.2
Level of Service	D	C	E	B	F	A
Approach Delay (s)	26.4		61.1			47.2
Approach LOS	C		E			D
Intersection Summary						
HCM Average Control Delay			47.4		HCM Level of Service	D
HCM Volume to Capacity ratio			1.05			
Actuated Cycle Length (s)			59.9		Sum of lost time (s)	6.0
Intersection Capacity Utilization			96.3%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 AM PEAK



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	178	660	981	79	190	24
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1598	1776	3374	1509	1586	
Flt Permitted	0.24	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	407	1776	3374	1509	1586	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	187	695	1033	83	200	25
RTOR Reduction (vph)	0	0	0	22	6	0
Lane Group Flow (vph)	187	695	1033	61	219	0
Turn Type	Perm		Perm			
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	60.1	60.1	60.1	60.1	16.9	
Effective Green, g (s)	62.1	62.1	62.1	62.1	18.9	
Actuated g/C Ratio	0.73	0.73	0.73	0.73	0.22	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	297	1298	2465	1102	353	
v/s Ratio Prot		0.39	0.31			
v/s Ratio Perm	c0.46			0.04	c0.14	
v/c Ratio	0.63	0.54	0.42	0.06	0.62	
Uniform Delay, d1	5.7	5.1	4.4	3.2	29.8	
Progression Factor	1.00	1.00	0.33	0.05	1.00	
Incremental Delay, d2	9.7	1.6	0.5	0.1	3.2	
Delay (s)	15.4	6.7	2.0	0.2	33.0	
Level of Service	B	A	A	A	C	
Approach Delay (s)		8.5	1.8		33.0	
Approach LOS		A	A		C	

Intersection Summary				
HCM Average Control Delay		7.6	HCM Level of Service	A
HCM Volume to Capacity ratio		0.62		
Actuated Cycle Length (s)		85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization		60.2%	ICU Level of Service	B
Analysis Period (min)		15		
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 AM PEAK

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	732	11	0	721	803	0	0	22	382	0	326
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1682	3366			3374	1509			1536	3100		1509
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1682	3366			3374	1509			1536	3100		1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	112	771	12	0	759	845	0	0	23	402	0	343
RTOR Reduction (vph)	0	1	0	0	0	223	0	0	22	0	0	11
Lane Group Flow (vph)	112	782	0	0	759	622	0	0	1	402	0	332
Turn Type	Prot				pm+ov				custom	Prot		custom
Protected Phases	5	2			6	7				7		5
Permitted Phases						6			8			4
Actuated Green, G (s)	8.0	49.9			37.9	58.2			2.8	20.3		35.1
Effective Green, g (s)	10.0	51.9			39.9	62.2			4.8	22.3		39.1
Actuated g/C Ratio	0.12	0.61			0.47	0.73			0.06	0.26		0.46
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0
Lane Grp Cap (vph)	198	2055			1584	1140			87	813		730
v/s Ratio Prot	c0.07	0.23			0.22	c0.14				0.13		c0.05
v/s Ratio Perm						0.27			0.00			0.17
v/c Ratio	0.57	0.38			0.48	0.55			0.01	0.49		0.46
Uniform Delay, d1	35.4	8.4			15.4	5.1			37.9	26.6		15.7
Progression Factor	0.91	0.88			0.33	9.52			1.00	1.00		1.00
Incremental Delay, d2	3.2	0.5			0.6	0.3			0.1	0.5		0.5
Delay (s)	35.5	7.9			5.6	48.7			37.9	27.0		16.1
Level of Service	D	A			A	D			D	C		B
Approach Delay (s)		11.3			28.3			37.9			22.0	
Approach LOS		B			C			D			C	
Intersection Summary												
HCM Average Control Delay			22.3				HCM Level of Service			C		
HCM Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			85.0				Sum of lost time (s)		4.0			
Intersection Capacity Utilization			62.6%				ICU Level of Service			B		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
 5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
 2040 (3+1 No Alignmnt) Alt7 AM PEAK

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	231	908	0	0	1366	885	159	0	690	0	0	0	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0				
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95				
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85				
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (prot)	1598	3374			3374	1509	1598	1434	1358				
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00				
Satd. Flow (perm)	1598	3374			3374	1509	1598	1434	1358				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	243	956	0	0	1438	932	167	0	726	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	302	0	146	146	0	0	0	
Lane Group Flow (vph)	243	956	0	0	1438	630	167	217	217	0	0	0	
Turn Type	Prot					Perm	Prot		Perm				
Protected Phases	5	2			6		3	8					
Permitted Phases						6			8				
Actuated Green, G (s)	17.0	61.0			40.0	40.0	16.0	16.0	16.0				
Effective Green, g (s)	19.0	63.0			42.0	42.0	18.0	18.0	18.0				
Actuated g/C Ratio	0.22	0.74			0.49	0.49	0.21	0.21	0.21				
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0				
Lane Grp Cap (vph)	357	2501			1667	746	338	304	288				
v/s Ratio Prot	c0.15	0.28			c0.43		0.10	0.15					
v/s Ratio Perm						0.42			c0.16				
v/c Ratio	0.68	0.38			0.86	0.84	0.49	0.71	0.75				
Uniform Delay, d1	30.2	4.0			19.0	18.7	29.5	31.1	31.4				
Progression Factor	0.96	0.79			1.00	1.00	1.00	1.00	1.00				
Incremental Delay, d2	9.5	0.4			6.2	11.3	1.1	7.7	10.7				
Delay (s)	38.5	3.6			25.1	29.9	30.6	38.9	42.1				
Level of Service	D	A			C	C	C	D	D				
Approach Delay (s)		10.6			27.0			38.6			0.0		
Approach LOS		B			C			D			A		
Intersection Summary													
HCM Average Control Delay			24.9									HCM Level of Service	C
HCM Volume to Capacity ratio			0.78										
Actuated Cycle Length (s)			85.0									Sum of lost time (s)	6.0
Intersection Capacity Utilization			92.5%									ICU Level of Service	F
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 AM PEAK



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑	↖	↗
Volume (vph)	277	169	507	202	279	838
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.94		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3182		3273	1776	1687	1509
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3182		3273	1776	1687	1509
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	292	178	534	213	294	882
RTOR Reduction (vph)	98	0	0	0	0	357
Lane Group Flow (vph)	372	0	534	213	294	525
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	16.0		22.0	42.0	45.0	45.0
Effective Green, g (s)	16.0		22.0	42.0	45.0	45.0
Actuated g/C Ratio	0.17		0.23	0.44	0.47	0.47
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	536		758	785	799	715
v/s Ratio Prot	c0.12		c0.16	0.12	0.17	
v/s Ratio Perm						c0.35
v/c Ratio	0.69		0.70	0.27	0.37	0.73
Uniform Delay, d1	37.2		33.5	16.8	15.9	20.2
Progression Factor	1.00		0.80	0.83	1.00	1.00
Incremental Delay, d2	3.9		4.6	0.7	1.3	6.6
Delay (s)	41.1		31.5	14.7	17.2	26.8
Level of Service	D		C	B	B	C
Approach Delay (s)	41.1			26.7	24.4	
Approach LOS	D			C	C	
























Intersection Summary

HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 AM PEAK

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	947	497	180	1192	65	927	35	152	21	33	132
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1598	3374	1509	1598	3348		3100	1527	1434	1598	1563	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.57	1.00	
Satd. Flow (perm)	1598	3374	1509	1598	3348		3100	1527	1434	955	1563	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	163	997	523	189	1255	68	976	37	160	22	35	139
RTOR Reduction (vph)	0	0	123	0	4	0	0	38	58	0	126	0
Lane Group Flow (vph)	163	997	400	189	1319	0	976	63	38	22	48	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	13.5	35.1	60.1	11.9	33.5		25.0	36.0	36.0	7.0	7.0	
Effective Green, g (s)	15.5	37.1	64.1	13.9	35.5		27.0	38.0	38.0	9.0	9.0	
Actuated g/C Ratio	0.16	0.39	0.67	0.15	0.37		0.28	0.40	0.40	0.09	0.09	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	261	1318	1018	234	1251		881	611	574	90	148	
v/s Ratio Prot	0.10	c0.30	0.11	0.12	c0.39		c0.31	0.04			c0.03	
v/s Ratio Perm			0.15						0.03	0.02		
v/c Ratio	0.62	0.76	0.39	0.81	1.05		1.11	0.10	0.07	0.24	0.33	
Uniform Delay, d1	37.0	25.0	6.8	39.3	29.8		34.0	17.8	17.6	39.8	40.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.90	0.82	0.88	1.00	1.00	
Incremental Delay, d2	4.6	4.1	0.3	18.2	41.0		58.4	0.0	0.0	1.4	1.3	
Delay (s)	41.6	29.1	7.1	57.4	70.7		88.9	14.7	15.4	41.3	41.5	
Level of Service	D	C	A	E	E		F	B	B	D	D	
Approach Delay (s)		23.5			69.1			76.5			41.4	
Approach LOS		C			E			E			D	

Intersection Summary

HCM Average Control Delay	53.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 1: Barton Rd & La Canada Dr

Barton Rd Interchange Improvement
 2040 (3+1 No Alignment) Alt7 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	344	677	2392	380	688	2000
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1644	1553	3471	1553	1644	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1644	1553	3471	1553	1644	3471
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	362	713	2518	400	724	2105
RTOR Reduction (vph)	0	317	0	141	0	0
Lane Group Flow (vph)	362	396	2518	259	724	2105
Turn Type		Perm		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		8		2		
Actuated Green, G (s)	16.0	16.0	31.0	31.0	26.0	61.0
Effective Green, g (s)	18.0	18.0	33.0	33.0	28.0	63.0
Actuated g/C Ratio	0.21	0.21	0.39	0.39	0.33	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	348	329	1348	603	542	2573
v/s Ratio Prot	0.22		c0.73		c0.44	0.61
v/s Ratio Perm		c0.26		0.17		
v/c Ratio	1.04	1.20	1.87	0.43	1.34	0.82
Uniform Delay, d1	33.5	33.5	26.0	19.1	28.5	7.2
Progression Factor	0.65	0.84	1.00	1.00	1.00	1.00
Incremental Delay, d2	57.2	115.5	393.4	2.2	163.3	3.0
Delay (s)	79.0	143.7	419.4	21.3	191.8	10.3
Level of Service	E	F	F	C	F	B
Approach Delay (s)	121.9		364.9			56.7
Approach LOS	F		F			E

Intersection Summary

HCM Average Control Delay	198.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.50		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	136.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Barton Rd & Grand Terrace Rd

Barton Rd Interchange Improvement
2040 (3+1 No Alignment) Alt7 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	52	1381	1170	32	38	3
Ideal Flow (vphpl)	1800	1900	1900	1900	1800	1900
Total Lost time (s)	2.0	2.0	2.0	2.0	2.0	
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1644	1827	3471	1553	1638	
Flt Permitted	0.21	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	364	1827	3471	1553	1638	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	55	1454	1232	34	40	3
RTOR Reduction (vph)	0	0	0	5	3	0
Lane Group Flow (vph)	55	1454	1232	29	40	0
Turn Type	Perm		Perm			
Protected Phases		2	6			
Permitted Phases	2			6	4	
Actuated Green, G (s)	70.0	70.0	70.0	70.0	7.0	
Effective Green, g (s)	72.0	72.0	72.0	72.0	9.0	
Actuated g/C Ratio	0.85	0.85	0.85	0.85	0.11	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	308	1548	2940	1315	173	
v/s Ratio Prot		c0.80	0.35			
v/s Ratio Perm	0.15			0.02	c0.02	
v/c Ratio	0.18	0.94	0.42	0.02	0.23	
Uniform Delay, d1	1.2	4.9	1.5	1.0	34.8	
Progression Factor	0.76	2.11	0.51	0.00	1.00	
Incremental Delay, d2	0.8	8.2	0.4	0.0	0.7	
Delay (s)	1.7	18.5	1.2	0.0	35.5	
Level of Service	A	B	A	A	D	
Approach Delay (s)		17.9	1.1		35.5	
Approach LOS		B	A		D	

Intersection Summary				
HCM Average Control Delay		10.6	HCM Level of Service	B
HCM Volume to Capacity ratio		0.85		
Actuated Cycle Length (s)		85.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization		85.2%	ICU Level of Service	E
Analysis Period (min)		15		
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis

4: Barton Rd & I-215 SB Ramps























Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (vph)	239	1167	13	0	760	570	0	0	88	523	0	366	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	2.0	2.0			2.0	2.0			2.0	2.0		2.0	
Lane Util. Factor	1.00	0.95			0.95	1.00			1.00	0.97		1.00	
Frt	1.00	1.00			1.00	0.85			0.86	1.00		0.85	
Flt Protected	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (prot)	1731	3465			3471	1553			1580	3190		1553	
Flt Permitted	1.00	1.00			1.00	1.00			1.00	0.95		1.00	
Satd. Flow (perm)	1731	3465			3471	1553			1580	3190		1553	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	252	1228	14	0	800	600	0	0	93	551	0	385	
RTOR Reduction (vph)	0	1	0	0	0	247	0	0	35	0	0	6	
Lane Group Flow (vph)	252	1241	0	0	800	353	0	0	58	551	0	379	
Turn Type	Prot				pm+ov				custom	Prot		custom	
Protected Phases	5	2			6	7				7		5	
Permitted Phases						6			8			4	
Actuated Green, G (s)	15.4	45.3			25.9	46.0			7.6	20.1		47.1	
Effective Green, g (s)	17.4	47.3			27.9	50.0			9.6	22.1		51.1	
Actuated g/C Ratio	0.20	0.56			0.33	0.59			0.11	0.26		0.60	
Clearance Time (s)	4.0	4.0			4.0	4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	354	1928			1139	914			178	829		970	
v/s Ratio Prot	c0.15	c0.36			0.23	0.10				c0.17		c0.08	
v/s Ratio Perm						0.13			0.04			0.16	
v/c Ratio	0.71	0.64			0.70	0.39			0.33	0.66		0.39	
Uniform Delay, d1	31.5	13.0			24.9	9.3			34.7	28.1		8.8	
Progression Factor	0.89	1.16			1.07	7.92			1.00	1.00		1.00	
Incremental Delay, d2	2.6	0.6			1.4	0.1			1.1	2.0		0.3	
Delay (s)	30.5	15.8			28.0	73.9			35.8	30.2		9.1	
Level of Service	C	B			C	E			D	C		A	
Approach Delay (s)		18.2			47.7			35.8			21.5		
Approach LOS		B			D			D			C		
Intersection Summary													
HCM Average Control Delay			29.9									HCM Level of Service	C
HCM Volume to Capacity ratio			0.62										
Actuated Cycle Length (s)			85.0									Sum of lost time (s)	6.0
Intersection Capacity Utilization			64.3%									ICU Level of Service	C
Analysis Period (min)			15										
c	Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

5: Barton Rd & I-215 NB Ramps

Barton Rd Interchange Improvement
2040 (3+1 No Alignmnt) Alt7 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Volume (vph)	295	1481	0	0	1357	724	32	0	842	0	0	0
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1800	1800	1900	1900
Total Lost time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0			
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1644	3471			3471	1553	1644	1475	1398			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1644	3471			3471	1553	1644	1475	1398			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	311	1559	0	0	1428	762	34	0	886	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	266	0	40	40	0	0	0
Lane Group Flow (vph)	311	1559	0	0	1428	496	34	403	403	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	5	2			6		3	8				
Permitted Phases						6			8			
Actuated Green, G (s)	18.0	57.0			35.0	35.0	20.0	20.0	20.0			
Effective Green, g (s)	20.0	59.0			37.0	37.0	22.0	22.0	22.0			
Actuated g/C Ratio	0.24	0.69			0.44	0.44	0.26	0.26	0.26			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	387	2409			1511	676	426	382	362			
v/s Ratio Prot	c0.19	0.45			c0.41		0.02	0.27				
v/s Ratio Perm						0.32			c0.29			
v/c Ratio	0.80	0.65			0.95	0.73	0.08	1.05	1.11			
Uniform Delay, d1	30.6	7.2			23.0	19.9	23.8	31.5	31.5			
Progression Factor	1.20	1.53			1.00	1.00	1.00	1.00	1.00			
Incremental Delay, d2	9.2	1.1			13.3	6.9	0.1	61.2	81.5			
Delay (s)	45.9	12.1			36.3	26.9	23.9	92.7	113.0			
Level of Service	D	B			D	C	C	F	F			
Approach Delay (s)		17.7			33.0			100.0			0.0	
Approach LOS		B			C			F			A	
Intersection Summary												
HCM Average Control Delay			39.6		HCM Level of Service				D			
HCM Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			85.0		Sum of lost time (s)				6.0			
Intersection Capacity Utilization			89.5%		ICU Level of Service				E			
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis
6: Commerce Way & Michigan Ave

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 PM Peak


























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑↑	↑	↑	↑
Volume (vph)	246	218	653	224	219	657
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	1.00	1.00	1.00
Frt	0.93		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3227		3367	1827	1736	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3227		3367	1827	1736	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	259	229	687	236	231	692
RTOR Reduction (vph)	193	0	0	0	0	448
Lane Group Flow (vph)	295	0	687	236	231	244
Turn Type			Prot			Perm
Protected Phases	4		3	8	2	
Permitted Phases						2
Actuated Green, G (s)	13.3		29.7	47.0	30.0	30.0
Effective Green, g (s)	13.3		29.7	47.0	30.0	30.0
Actuated g/C Ratio	0.16		0.35	0.55	0.35	0.35
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	505		1176	1010	613	548
v/s Ratio Prot	c0.09		c0.20	0.13	0.13	
v/s Ratio Perm						c0.16
v/c Ratio	0.58		0.58	0.23	0.38	0.45
Uniform Delay, d1	33.3		22.6	9.8	20.5	21.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7		2.1	0.5	1.8	2.6
Delay (s)	35.0		24.7	10.3	22.3	23.7
Level of Service	D		C	B	C	C
Approach Delay (s)	35.0			21.0	23.4	
Approach LOS	D			C	C	

Intersection Summary			
HCM Average Control Delay	24.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
7: Barton Rd & Vivienda Av

Barton Rd Interchange Improvement
2040 (3+1 No Aligmnt) Alt7 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1664	613	258	1541	23	513	99	290	3	7	26
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	1.5	1.5	1.0	1.5	1.0		1.0	1.0	1.0	1.5	1.5	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	0.95	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1644	3471	1553	1644	3464		3190	1602	1475	1644	1609	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.44	1.00	
Satd. Flow (perm)	1644	3471	1553	1644	3464		3190	1602	1475	761	1609	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1752	645	272	1622	24	540	104	305	3	7	27
RTOR Reduction (vph)	0	0	138	0	1	0	0	40	138	0	24	0
Lane Group Flow (vph)	47	1752	507	272	1645	0	540	174	57	3	10	0
Turn Type	Prot		pm+ov	Prot			Prot		Perm	Perm		
Protected Phases	5	2	3	1	6		3	8				4
Permitted Phases			2						8	4		
Actuated Green, G (s)	4.5	45.5	60.9	13.5	55.0		15.4	26.0	26.0	7.1	7.1	
Effective Green, g (s)	6.5	47.5	64.9	15.5	57.0		17.4	28.0	28.0	9.1	9.1	
Actuated g/C Ratio	0.07	0.50	0.68	0.16	0.60		0.18	0.29	0.29	0.10	0.10	
Clearance Time (s)	3.5	3.5	3.0	3.5	3.0		3.0	3.0	3.0	3.5	3.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	112	1736	1061	268	2078		584	472	435	73	154	
v/s Ratio Prot	0.03	c0.50	0.09	c0.17	0.47		c0.17	c0.11			0.01	
v/s Ratio Perm			0.24						0.04	0.00		
v/c Ratio	0.42	1.01	0.48	1.01	0.79		0.92	0.37	0.13	0.04	0.06	
Uniform Delay, d1	42.4	23.8	7.1	39.8	14.5		38.2	26.5	24.6	39.0	39.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	23.9	0.3	58.8	3.2		20.5	0.5	0.1	0.2	0.2	
Delay (s)	45.0	47.6	7.4	98.6	17.7		58.7	27.0	24.7	39.2	39.2	
Level of Service	D	D	A	F	B		E	C	C	D	D	
Approach Delay (s)		37.0			29.1			44.6			39.2	
Approach LOS		D			C			D			D	
Intersection Summary												
HCM Average Control Delay			35.5				HCM Level of Service			D		
HCM Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			95.0				Sum of lost time (s)			5.0		
Intersection Capacity Utilization			93.2%				ICU Level of Service			F		
Analysis Period (min)			15									
c	Critical Lane Group											

Existing Queuing Analysis

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Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 AM PEAK



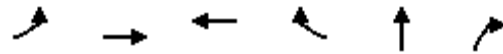
Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	10	394	426	343	234
v/c Ratio	0.07	0.58	0.80	0.27	0.67
Control Delay	47.1	13.8	22.5	1.3	39.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	13.8	22.5	1.3	39.5
Queue Length 50th (ft)	4	57	137	8	106
Queue Length 95th (ft)	m16	120	213	24	180
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	138	678	599	1286	381
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.07	0.58	0.71	0.27	0.61

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

Existing
 AM PEAK



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	81	453	688	317	66	327
v/c Ratio	0.41	0.35	0.64	0.31	0.17	0.55
Control Delay	47.8	6.8	10.9	0.9	26.5	7.3
Queue Delay	0.0	1.0	0.0	0.0	0.0	0.0
Total Delay	47.8	7.8	11.0	0.9	26.5	7.3
Queue Length 50th (ft)	45	102	177	3	27	0
Queue Length 95th (ft)	m76	143	230	3	59	64
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	200	1288	1074	1038	380	593
Starvation Cap Reductn	0	570	11	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.63	0.65	0.31	0.17	0.55

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

Existing
 PM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	3	716	327	415	301
v/c Ratio	0.02	0.85	0.83	0.32	0.79
Control Delay	39.3	24.0	37.8	1.6	46.6
Queue Delay	0.0	0.0	0.0	0.2	0.0
Total Delay	39.3	24.0	37.8	1.8	46.6
Queue Length 50th (ft)	2	146	173	16	142
Queue Length 95th (ft)	m7	#507	#297	27	#261
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	129	838	411	1299	392
Starvation Cap Reductn	0	0	0	340	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	0.85	0.80	0.43	0.77

Intersection Summary

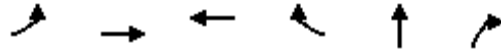
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

Existing
 PM PEAK



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	132	712	661	302	57	313
v/c Ratio	0.53	0.54	0.63	0.30	0.15	0.53
Control Delay	35.4	3.6	12.7	1.1	26.1	7.5
Queue Delay	0.0	1.5	0.1	0.0	0.0	0.0
Total Delay	35.4	5.1	12.8	1.1	26.1	7.5
Queue Length 50th (ft)	72	120	177	0	23	3
Queue Length 95th (ft)	m89	m92	243	13	53	66
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	267	1325	1051	1021	391	586
Starvation Cap Reductn	0	405	24	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.77	0.64	0.30	0.15	0.53

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

2016 Queuing Analysis

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Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative1 AM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	2	472	594	353	241
v/c Ratio	0.02	0.81	0.93	0.27	0.73
Control Delay	37.5	39.0	31.7	2.0	46.2
Queue Delay	0.0	0.0	2.3	0.0	0.0
Total Delay	37.5	39.0	34.1	2.0	46.2
Queue Length 50th (ft)	1	232	228	14	121
Queue Length 95th (ft)	8	#404	m#478	m73	#215
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	121	586	654	1307	353
Starvation Cap Reductn	0	0	19	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	0.81	0.94	0.27	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

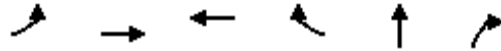
m Volume for 95th percentile queue is metered by upstream signal.

Queues

Barton Rd Interchange Improvement

5: Barton Rd & I-215 NB Ramps

2016 Alternative1 AM PEAK



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	119	516	868	454	78	387
v/c Ratio	0.71	0.39	0.79	0.41	0.22	0.62
Control Delay	54.3	4.9	15.1	1.4	30.2	8.3
Queue Delay	0.0	1.5	1.2	0.0	0.0	0.0
Total Delay	54.3	6.4	16.2	1.4	30.2	8.3
Queue Length 50th (ft)	52	94	192	8	35	0
Queue Length 95th (ft)	m77	m124	571	8	74	75
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	167	1322	1095	1104	353	622
Starvation Cap Reductn	0	596	0	0	0	0
Spillback Cap Reductn	0	0	80	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.71	0.86	0.41	0.22	0.62

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative1 PM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	5	906	459	483	312
v/c Ratio	0.03	1.25	0.97	0.39	0.77
Control Delay	30.0	149.4	37.4	4.5	42.1
Queue Delay	0.0	38.6	0.0	0.3	0.0
Total Delay	30.0	188.0	37.4	4.7	42.1
Queue Length 50th (ft)	2	~588	230	20	143
Queue Length 95th (ft)	11	#813	m231	m97	#253
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	184	724	473	1263	434
Starvation Cap Reductn	0	0	0	287	0
Spillback Cap Reductn	0	47	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.03	1.34	0.97	0.49	0.72

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

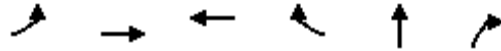
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
5: Barton Rd & I-215 NB Ramps



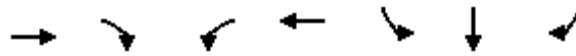
Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	167	856	849	411	91	493
v/c Ratio	0.81	0.78	1.03	0.44	0.15	0.76
Control Delay	37.0	9.5	61.3	1.9	18.7	23.8
Queue Delay	0.0	62.1	0.0	0.0	0.0	0.0
Total Delay	37.0	71.6	61.3	1.9	18.7	23.8
Queue Length 50th (ft)	93	185	~468	6	31	142
Queue Length 95th (ft)	m91	m139	#692	9	63	#277
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	206	1096	822	925	608	652
Starvation Cap Reductn	0	338	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.81	1.13	1.03	0.44	0.15	0.76

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative2
 AM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	394	78	594	341	125	125	193
v/c Ratio	0.38	0.15	0.69	0.16	0.27	0.25	0.32
Control Delay	15.6	6.2	14.1	1.1	16.9	16.6	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.6	6.2	14.1	1.1	16.9	16.6	4.5
Queue Length 50th (ft)	68	6	82	1	33	33	0
Queue Length 95th (ft)	66	20	126	6	71	71	37
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1047	522	855	2094	471	501	601
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.15	0.69	0.16	0.27	0.25	0.32

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2016 Alternative2
 AM Peak

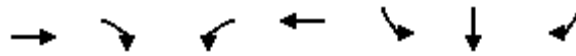


Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	119	516	857	454	78	194	193
v/c Ratio	0.25	0.20	0.43	0.42	0.27	0.34	0.35
Control Delay	9.7	0.3	3.5	1.9	22.2	1.6	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.7	0.3	3.5	1.9	22.2	1.6	1.7
Queue Length 50th (ft)	9	1	7	0	24	0	0
Queue Length 95th (ft)	19	1	62	13	52	0	0
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	481	2525	2013	1083	496	702	679
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.20	0.43	0.42	0.16	0.28	0.28

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative2
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	713	193	459	472	159	157	215
v/c Ratio	0.60	0.29	0.60	0.22	0.33	0.31	0.34
Control Delay	10.0	1.5	13.9	2.5	17.7	17.3	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.0	1.5	13.9	2.5	17.7	17.3	4.4
Queue Length 50th (ft)	37	1	80	7	44	43	0
Queue Length 95th (ft)	64	0	38	26	88	86	39
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1197	662	770	2154	485	514	630
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.29	0.60	0.22	0.33	0.31	0.34

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2016 Alternative2
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	167	856	839	411	91	247	246
v/c Ratio	0.34	0.34	0.43	0.39	0.26	0.55	0.56
Control Delay	11.7	0.7	5.5	2.1	19.7	10.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.7	0.7	5.5	2.1	19.7	10.9	11.4
Queue Length 50th (ft)	15	4	61	0	28	22	21
Queue Length 95th (ft)	m27	5	55	12	52	67	67
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	495	2500	1974	1060	510	581	557
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.34	0.43	0.39	0.18	0.43	0.44

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative3
 AM Peak

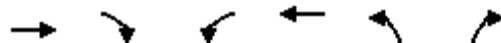


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	78	394	341	594	304	138
v/c Ratio	0.16	0.21	0.23	0.43	0.26	0.23
Control Delay	16.7	3.6	8.0	1.0	10.5	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.7	3.6	8.0	1.0	10.5	3.8
Queue Length 50th (ft)	10	15	27	0	28	0
Queue Length 95th (ft)	20	24	51	0	52	30
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	481	1862	1478	1383	1192	607
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.21	0.23	0.43	0.26	0.23

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

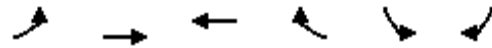
2016 Alternative3
 AM Peak



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	521	119	454	857	78	387
v/c Ratio	0.39	0.12	0.47	0.34	0.26	0.24
Control Delay	12.9	1.3	9.0	0.8	22.7	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.9	1.3	9.0	0.8	22.7	1.8
Queue Length 50th (ft)	65	1	38	7	23	3
Queue Length 95th (ft)	95	12	58	7	55	21
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1338	982	962	2501	303	1580
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.12	0.47	0.34	0.26	0.24
Intersection Summary						

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative3
 PM Peak

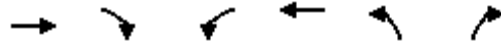


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	193	713	472	459	366	164
v/c Ratio	0.35	0.33	0.33	0.37	0.37	0.30
Control Delay	13.7	2.5	6.4	0.9	15.3	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.7	2.5	6.4	0.9	15.3	4.7
Queue Length 50th (ft)	19	21	43	2	45	0
Queue Length 95th (ft)	41	24	45	0	75	38
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	550	2154	1436	1239	1002	552
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.33	0.33	0.37	0.37	0.30

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2016 Alternative3
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	859	167	411	839	91	493
v/c Ratio	0.51	0.15	0.50	0.31	0.36	0.37
Control Delay	10.8	2.0	18.4	0.4	26.4	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.8	2.0	18.4	0.4	26.4	7.4
Queue Length 50th (ft)	82	0	68	1	29	35
Queue Length 95th (ft)	118	8	125	3	66	66
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1676	1088	825	2693	255	1326
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.15	0.50	0.31	0.36	0.37

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative4
 AM Peak

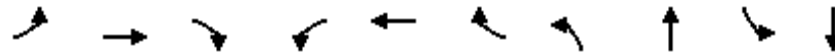


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	78	394	341	594	304	138
v/c Ratio	0.24	0.27	0.31	0.43	0.18	0.17
Control Delay	42.7	16.4	26.3	1.3	10.0	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.7	16.4	26.3	1.3	10.0	2.6
Queue Length 50th (ft)	23	71	84	8	38	0
Queue Length 95th (ft)	45	101	125	24	60	29
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	355	1441	1101	1385	1730	795
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.27	0.31	0.43	0.18	0.17

Intersection Summary

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2016 Alternative4
 AM Peak

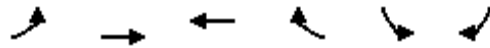


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	86	332	221	44	591	333	266	190	272	194
v/c Ratio	0.29	0.30	0.23	0.07	0.55	0.33	0.43	0.27	0.37	0.43
Control Delay	26.1	16.1	2.7	20.4	18.1	1.5	24.0	17.8	20.4	17.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.1	16.1	2.7	20.4	18.1	1.5	24.0	17.8	20.4	17.3
Queue Length 50th (ft)	26	30	0	6	86	0	41	23	40	41
Queue Length 95th (ft)	70	90	33	19	149	15	85	52	77	96
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	295	1478	952	657	1384	1010	636	1233	760	649
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.22	0.23	0.07	0.43	0.33	0.42	0.15	0.36	0.30

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2016 Alternative4
 PM Peak

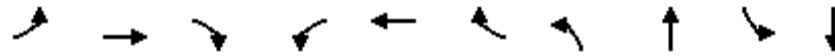


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	193	713	472	459	366	164
v/c Ratio	0.33	0.36	0.38	0.36	0.28	0.26
Control Delay	30.2	7.4	11.1	1.4	17.7	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	7.4	11.1	1.4	17.7	4.1
Queue Length 50th (ft)	53	82	94	8	63	0
Queue Length 95th (ft)	78	113	74	20	96	40
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	593	1978	1251	1258	1293	643
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.36	0.38	0.36	0.28	0.26

Intersection Summary

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2016 Alternative4
 PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	126	545	355	138	654	309	185	231	344	238
v/c Ratio	0.51	0.33	0.33	0.41	0.44	0.28	0.44	0.45	0.54	0.63
Control Delay	40.1	11.6	0.9	40.1	20.3	1.2	37.8	23.4	33.8	34.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.1	11.6	0.9	40.1	20.3	1.2	37.8	23.4	33.8	34.0
Queue Length 50th (ft)	54	57	0	36	133	0	47	37	85	100
Queue Length 95th (ft)	87	98	0	64	200	13	79	68	124	165
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	274	1631	1085	334	1473	1096	445	755	665	467
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.33	0.33	0.41	0.44	0.28	0.42	0.31	0.52	0.51

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 Ramps

2016 Alternative5
 AM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	119	275	78	594	263	454	78	387	122	123	197
v/c Ratio	0.35	0.28	0.16	0.59	0.15	0.46	0.40	0.29	0.39	0.38	0.42
Control Delay	38.3	29.8	10.3	19.5	6.7	1.6	45.7	1.4	37.8	37.2	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	29.8	10.3	19.5	6.7	1.6	45.7	1.4	37.8	37.2	8.0
Queue Length 50th (ft)	31	71	5	164	13	0	44	0	68	69	0
Queue Length 95th (ft)	60	104	37	167	32	0	89	13	126	127	57
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	355	991	498	1033	1729	995	211	1361	310	327	465
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.28	0.16	0.58	0.15	0.46	0.37	0.28	0.39	0.38	0.42

Intersection Summary

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 Ramps

2016 Alternative5
 PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	167	545	193	459	381	411	91	493	157	157	216
v/c Ratio	0.34	0.41	0.27	0.76	0.24	0.44	0.34	0.49	0.58	0.55	0.48
Control Delay	22.9	7.4	1.3	22.9	5.0	2.1	25.9	6.4	32.4	30.3	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.9	7.4	1.3	22.9	5.0	2.1	25.9	6.4	32.4	30.3	7.9
Queue Length 50th (ft)	19	27	1	82	32	0	29	22	53	53	0
Queue Length 95th (ft)	38	50	0	#130	28	12	65	42	#120	#108	48
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	495	1329	714	605	1580	931	269	1005	269	284	447
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.41	0.27	0.76	0.24	0.44	0.34	0.49	0.58	0.55	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Queues
4: Barton Rd & I-215 SB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	78	391	340	594	21	245	206
v/c Ratio	0.47	0.16	0.16	0.51	0.03	0.34	0.40
Control Delay	46.1	3.8	7.7	2.5	0.1	29.1	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	3.8	7.7	2.5	0.1	29.1	6.9
Queue Length 50th (ft)	40	27	40	0	0	57	0
Queue Length 95th (ft)	85	41	59	40	0	90	53
Internal Link Dist (ft)		270	1430				
Turn Bay Length (ft)	250			185			630
Base Capacity (vph)	167	2419	2087	1160	766	721	509
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.16	0.16	0.51	0.03	0.34	0.40

Intersection Summary

Queues
5: I-215 NB Ramps & Vivienda Av



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	359	106	143	481	731
v/c Ratio	0.35	0.19	0.45	0.24	0.53
Control Delay	15.3	4.5	24.5	5.5	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	15.3	4.5	24.5	5.5	6.9
Queue Length 50th (ft)	44	0	42	32	35
Queue Length 95th (ft)	74	26	87	51	72
Internal Link Dist (ft)	423			334	2145
Turn Bay Length (ft)		240	410		
Base Capacity (vph)	1015	565	320	2024	1392
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.19	0.45	0.24	0.53

Intersection Summary

Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative6 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	192	664	472	459	53	314	220
v/c Ratio	0.62	0.28	0.28	0.46	0.17	0.52	0.47
Control Delay	42.8	4.1	18.4	3.6	1.2	42.3	8.6
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Total Delay	42.8	4.5	18.4	3.6	1.2	42.3	8.6
Queue Length 50th (ft)	108	57	101	0	0	100	0
Queue Length 95th (ft)	183	78	154	61	0	144	63
Internal Link Dist (ft)		270	1430				
Turn Bay Length (ft)	250			185			630
Base Capacity (vph)	319	2395	1681	989	425	602	472
Starvation Cap Reductn	0	1123	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.52	0.28	0.46	0.12	0.52	0.47

Intersection Summary

Queues
5: I-215 NB Ramps & Vivienda Av



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	451	133	94	454	938
v/c Ratio	0.43	0.22	0.35	0.22	0.60
Control Delay	16.1	4.3	24.6	5.4	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	16.1	4.3	24.6	5.4	7.7
Queue Length 50th (ft)	58	0	28	30	52
Queue Length 95th (ft)	92	29	64	48	98
Internal Link Dist (ft)	423			334	2145
Turn Bay Length (ft)		240	410		
Base Capacity (vph)	1044	598	269	2083	1572
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.22	0.35	0.22	0.60

Intersection Summary

Queues
4: Barton Rd & I-215 SB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	78	372	353	594	29	241	202
v/c Ratio	0.39	0.15	0.18	0.45	0.06	0.43	0.30
Control Delay	36.1	2.8	2.2	1.9	0.2	32.6	4.0
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	36.1	2.8	2.2	2.0	0.2	32.6	4.0
Queue Length 50th (ft)	42	11	2	8	0	59	7
Queue Length 95th (ft)	78	33	16	40	0	87	38
Internal Link Dist (ft)		435	455				
Turn Bay Length (ft)	250						500
Base Capacity (vph)	198	2425	1955	1311	618	985	678
Starvation Cap Reductn	0	0	0	99	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.15	0.18	0.49	0.05	0.24	0.30

Intersection Summary

Queues
5: Barton Rd & I-215 NB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	119	516	857	454	78	194	193
v/c Ratio	0.33	0.19	0.45	0.43	0.35	0.34	0.35
Control Delay	32.0	1.1	4.0	1.7	37.0	1.7	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.0	1.1	4.0	1.7	37.0	1.7	1.7
Queue Length 50th (ft)	59	7	15	0	38	0	0
Queue Length 95th (ft)	114	25	44	0	77	0	0
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	357	2749	1916	1053	395	674	656
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.19	0.45	0.43	0.20	0.29	0.29

Intersection Summary

Queues

Barton Rd Interchange Improvement

4: Barton Rd & I-215 SB Ramps

2016 Alternative7 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBR	SBL	SBR
Lane Group Flow (vph)	193	650	482	459	64	312	219
v/c Ratio	0.57	0.29	0.32	0.40	0.19	0.50	0.26
Control Delay	30.4	5.5	10.2	2.2	1.3	32.6	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	5.5	10.2	2.2	1.3	32.6	5.2
Queue Length 50th (ft)	76	51	33	1	0	77	32
Queue Length 95th (ft)	129	107	68	24	0	107	44
Internal Link Dist (ft)		435	455				
Turn Bay Length (ft)	250						500
Base Capacity (vph)	389	2266	1502	1189	484	733	893
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.29	0.32	0.39	0.13	0.43	0.25

Intersection Summary

Queues
5: Barton Rd & I-215 NB Ramps



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	167	856	839	411	91	247	246
v/c Ratio	0.43	0.31	0.45	0.40	0.37	0.60	0.62
Control Delay	37.6	4.5	6.9	1.6	35.3	13.1	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.6	4.5	6.9	1.6	35.3	13.1	13.7
Queue Length 50th (ft)	79	36	53	0	45	14	13
Queue Length 95th (ft)	141	197	108	21	81	77	78
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	387	2781	1883	1030	426	543	523
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.31	0.45	0.40	0.21	0.45	0.47

Intersection Summary

2040 Queuing Analysis

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Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative1
 AM PEAK



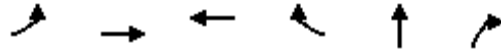
Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	2	919	955	634	402
v/c Ratio	0.02	1.36	1.79	0.49	1.03
Control Delay	45.0	186.3	375.4	0.9	86.4
Queue Delay	0.0	0.0	0.0	1.2	0.0
Total Delay	45.0	186.3	375.4	2.1	86.4
Queue Length 50th (ft)	1	~595	~740	3	~218
Queue Length 95th (ft)	m3	m#697	m#491	m9	#386
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	123	678	534	1285	391
Starvation Cap Reductn	0	0	0	412	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.02	1.36	1.79	0.73	1.03

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative1
 AM PEAK



Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	239	957	1449	914	139	604
v/c Ratio	1.16	0.74	1.41	0.77	0.34	1.18
Control Delay	120.4	1.6	205.3	2.3	28.1	122.0
Queue Delay	0.0	2.3	0.0	0.5	0.0	0.0
Total Delay	120.4	3.9	205.3	2.8	28.1	122.0
Queue Length 50th (ft)	~145	4	~1016	15	58	~290
Queue Length 95th (ft)	m102	m3	m#1020	m21	108	#490
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	206	1302	1028	1186	412	512
Starvation Cap Reductn	0	216	0	56	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.16	0.88	1.41	0.81	0.34	1.18

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative1
 PM PEAK



Lane Group	EBL	EBT	WBL	WBT	SBT
Lane Group Flow (vph)	5	1593	647	828	551
v/c Ratio	0.03	1.82	2.10	0.67	1.27
Control Delay	31.4	389.2	514.9	4.6	167.6
Queue Delay	0.0	15.2	0.0	2.8	174.0
Total Delay	31.4	404.4	514.9	7.4	341.6
Queue Length 50th (ft)	3	~1254	~548	8	~353
Queue Length 95th (ft)	m6	m#1062	m#252	m28	#541
Internal Link Dist (ft)		15		368	202
Turn Bay Length (ft)	95		120		
Base Capacity (vph)	151	876	308	1241	434
Starvation Cap Reductn	0	0	0	293	0
Spillback Cap Reductn	0	16	0	0	102
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.03	1.85	2.10	0.87	1.66

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

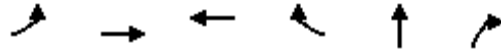
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative1
 PM PEAK



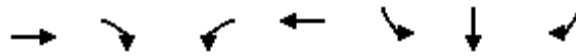
Lane Group	EBL	EBT	WBT	WBR	NBT	NBR
Lane Group Flow (vph)	281	1592	1439	689	36	948
v/c Ratio	1.36	1.45	1.75	0.74	0.06	1.68
Control Delay	194.5	221.2	361.4	6.2	17.7	338.5
Queue Delay	0.0	150.2	0.0	0.2	0.0	0.0
Total Delay	194.5	371.4	361.4	6.4	17.7	338.5
Queue Length 50th (ft)	~197	~1157	~1112	31	12	~704
Queue Length 95th (ft)	m89	m246	m#1235	m62	31	#932
Internal Link Dist (ft)		368	470		907	
Turn Bay Length (ft)	150					250
Base Capacity (vph)	206	1096	822	936	608	563
Starvation Cap Reductn	0	205	0	21	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.36	1.79	1.75	0.75	0.06	1.68

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative2
 AM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	794	125	955	622	213	212	322
v/c Ratio	0.71	0.21	0.79	0.25	0.67	0.62	0.56
Control Delay	21.4	2.4	18.3	0.7	44.1	41.3	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.4	2.4	18.3	0.7	44.1	41.3	7.9
Queue Length 50th (ft)	163	2	211	8	117	115	0
Queue Length 95th (ft)	236	m11	298	6	#212	194	69
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1125	586	1206	2512	320	341	573
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.21	0.79	0.25	0.67	0.62	0.56

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative2
 AM Peak



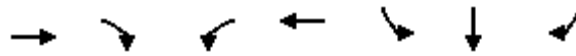
Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	239	957	1438	914	139	302	302
v/c Ratio	0.69	0.36	0.66	0.73	0.49	0.73	0.76
Control Delay	38.0	0.3	6.9	2.0	38.0	23.4	25.2
Queue Delay	0.0	0.0	0.2	1.1	0.0	0.0	0.0
Total Delay	38.0	0.3	7.1	3.2	38.0	23.4	25.2
Queue Length 50th (ft)	76	0	88	22	72	60	60
Queue Length 95th (ft)	m#111	0	m165	m29	121	148	152
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	344	2622	2172	1252	373	482	464
Starvation Cap Reductn	0	0	176	148	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.36	0.72	0.83	0.37	0.63	0.65

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative2
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1321	272	647	817	281	276	379
v/c Ratio	0.86	0.32	0.79	0.33	0.77	0.72	0.68
Control Delay	23.4	2.1	17.9	2.4	48.3	43.6	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	2.1	17.9	2.4	48.3	43.6	18.0
Queue Length 50th (ft)	382	5	106	20	157	152	62
Queue Length 95th (ft)	474	14	m156	m50	#286	#265	165
Internal Link Dist (ft)	500			810		1234	
Turn Bay Length (ft)			315				500
Base Capacity (vph)	1543	841	815	2507	364	386	554
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.32	0.79	0.33	0.77	0.72	0.68

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative2
 PM Peak



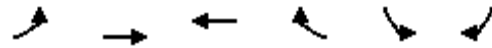
Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	281	1592	1428	689	36	474	474
v/c Ratio	0.88	0.76	0.86	0.63	0.06	0.87	0.92
Control Delay	48.1	4.4	16.7	2.8	18.9	44.1	51.8
Queue Delay	0.0	0.9	0.0	0.8	0.0	0.1	0.2
Total Delay	48.1	5.3	16.7	3.6	18.9	44.2	52.0
Queue Length 50th (ft)	85	148	261	30	13	243	250
Queue Length 95th (ft)	m#114	143	m385	m53	33	#432	#451
Internal Link Dist (ft)		810	540			1416	
Turn Bay Length (ft)	300						500
Base Capacity (vph)	319	2083	1659	1102	603	559	530
Starvation Cap Reductn	0	0	0	170	0	0	0
Spillback Cap Reductn	0	234	0	0	0	2	2
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.88	0.86	0.86	0.74	0.06	0.85	0.90

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 AM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.36	0.57	0.61	0.71	0.30	0.27
Control Delay	30.9	19.8	20.6	6.4	9.5	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.9	19.8	20.6	6.4	9.5	2.3
Queue Length 50th (ft)	29	161	129	132	57	0
Queue Length 95th (ft)	m53	246	186	2	85	32
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	349	1392	1021	1347	1664	843
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.57	0.61	0.71	0.30	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative3
 AM Peak



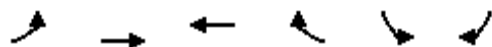
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	957	239	914	1438	139	604
v/c Ratio	0.73	0.27	0.79	0.54	0.53	0.40
Control Delay	17.6	3.0	12.7	0.2	39.2	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.6	3.0	12.7	0.2	39.2	9.5
Queue Length 50th (ft)	217	9	159	4	64	77
Queue Length 95th (ft)	300	30	m156	m2	121	114
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1307	885	1163	2657	260	1524
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.27	0.79	0.54	0.53	0.40

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative3
 PM Peak

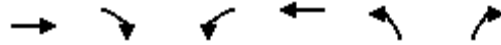


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.43	0.66	0.67	0.53	0.54	0.41
Control Delay	22.5	7.3	20.2	1.8	20.7	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.5	7.3	20.2	1.8	20.7	4.2
Queue Length 50th (ft)	59	136	187	1	121	0
Queue Length 95th (ft)	85	106	240	0	171	52
Internal Link Dist (ft)		500	810		1233	
Turn Bay Length (ft)	220			185		630
Base Capacity (vph)	638	1996	1215	1211	1199	710
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.66	0.67	0.53	0.54	0.41

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative3
 PM Peak



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1592	281	689	1428	36	948
v/c Ratio	0.85	0.27	0.79	0.49	0.19	0.83
Control Delay	16.2	4.0	22.5	0.6	35.1	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.2	4.0	22.5	0.6	35.1	27.9
Queue Length 50th (ft)	252	34	160	1	17	225
Queue Length 95th (ft)	427	70	m181	m1	44	#321
Internal Link Dist (ft)	810			540	1400	
Turn Bay Length (ft)		185	220			620
Base Capacity (vph)	1866	1060	877	2907	185	1147
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.27	0.79	0.49	0.19	0.83

Intersection Summary

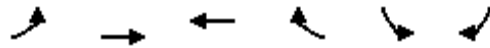
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 AM Peak



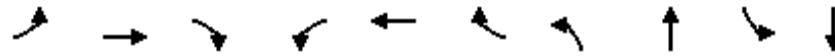
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.36	0.57	0.61	0.71	0.28	0.27
Control Delay	39.6	23.9	14.0	6.7	9.3	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.6	23.9	14.0	6.7	9.3	2.3
Queue Length 50th (ft)	34	198	100	79	56	0
Queue Length 95th (ft)	m51	231	m148	m412	84	32
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	349	1392	1021	1347	1755	843
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.57	0.61	0.71	0.28	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2040 Alternative4
 AM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	154	957	505	182	881	591	557	504	423	320
v/c Ratio	0.70	0.79	0.50	0.52	0.78	0.69	0.84	0.59	0.78	0.82
Control Delay	49.6	23.5	2.2	39.4	30.5	10.4	43.3	27.2	43.1	43.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.6	23.5	2.2	39.4	30.5	10.4	43.3	27.2	43.1	43.6
Queue Length 50th (ft)	80	227	0	44	208	78	138	106	105	130
Queue Length 95th (ft)	#165	294	23	76	282	147	#220	155	#170	#258
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	220	1207	1019	349	1123	853	665	886	543	408
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.79	0.50	0.52	0.78	0.69	0.84	0.57	0.78	0.78

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative4
 PM Peak



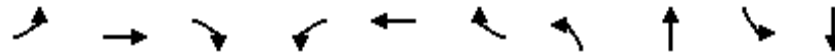
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.43	0.66	0.66	0.53	0.50	0.40
Control Delay	29.1	9.4	10.1	1.3	22.3	4.3
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	29.1	9.6	10.1	1.3	22.3	4.3
Queue Length 50th (ft)	77	158	152	0	136	0
Queue Length 95th (ft)	110	196	m177	m0	187	54
Internal Link Dist (ft)		500	1360		1233	
Turn Bay Length (ft)	260			290		630
Base Capacity (vph)	638	2005	1234	1218	1272	713
Starvation Cap Reductn	0	125	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.70	0.66	0.53	0.50	0.40

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 6: Barton Rd & I-215 NB Ramps

2040 Alternative4
 PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	201	1592	648	273	1049	494	379	482	664	320
v/c Ratio	0.80	1.09	0.68	0.86	0.82	0.50	0.82	0.69	0.98	0.72
Control Delay	63.1	70.6	7.3	65.6	32.3	5.4	53.6	29.2	68.2	41.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.1	70.6	7.3	65.6	32.3	5.4	53.6	29.2	68.2	41.1
Queue Length 50th (ft)	106	~540	58	80	280	39	109	92	~211	164
Queue Length 95th (ft)	m#215	#671	99	#148	363	75	#180	143	#331	#275
Internal Link Dist (ft)		1360			610			453		1349
Turn Bay Length (ft)	400		200	210		330	180			
Base Capacity (vph)	256	1466	956	319	1281	982	461	767	677	444
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	1.09	0.68	0.86	0.82	0.50	0.82	0.63	0.98	0.72

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 Ramps

2040 Alternative5
 AM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	239	555	125	955	483	914	139	604	213	212	322
v/c Ratio	0.68	0.66	0.27	0.88	0.29	0.79	0.73	0.47	0.75	0.70	0.59
Control Delay	39.8	25.8	4.2	16.7	4.8	5.3	58.4	7.4	48.9	44.5	8.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.8	25.8	4.2	16.7	4.8	5.3	58.4	7.4	48.9	44.5	8.6
Queue Length 50th (ft)	55	119	5	188	38	50	68	43	107	105	0
Queue Length 95th (ft)	#104	178	m23	m183	m40	m43	#155	65	#216	#205	67
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	349	844	471	1085	1645	1158	190	1284	285	303	545
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.66	0.27	0.88	0.29	0.79	0.73	0.47	0.75	0.70	0.59

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	281	1040	272	647	781	689	36	948	281	276	379
v/c Ratio	0.61	0.76	0.35	0.76	0.44	0.61	0.21	1.03	0.90	0.83	0.62
Control Delay	39.3	20.1	2.3	26.5	13.2	3.1	40.5	62.3	68.1	57.5	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.3	20.1	2.3	26.5	13.2	3.1	40.5	62.3	68.1	57.5	8.4
Queue Length 50th (ft)	81	196	0	154	121	28	19	182	165	160	0
Queue Length 95th (ft)	120	#394	13	m202	m142	m50	48	#323	#318	#300	77
Internal Link Dist (ft)		500			1430		728			1234	
Turn Bay Length (ft)	270		210	540		450		650			750
Base Capacity (vph)	461	1366	776	851	1790	1134	174	917	312	331	614
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.76	0.35	0.76	0.44	0.61	0.21	1.03	0.90	0.83	0.62

Intersection Summary

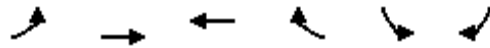
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 AM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.56	0.55	0.68	0.74	0.31	0.27
Control Delay	47.4	22.3	31.9	8.7	12.4	2.5
Queue Delay	0.0	1.3	0.0	0.0	0.0	0.0
Total Delay	47.4	23.6	31.9	8.7	12.4	2.5
Queue Length 50th (ft)	68	179	207	142	78	0
Queue Length 95th (ft)	130	215	m222	m136	110	37
Internal Link Dist (ft)		270	1430		1233	
Turn Bay Length (ft)	225			185		630
Base Capacity (vph)	224	1451	911	1299	1635	834
Starvation Cap Reductn	0	425	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.77	0.68	0.74	0.31	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	525	218	366	1140	1622
v/c Ratio	0.94	0.55	0.88	0.43	0.94
Control Delay	67.5	19.1	59.6	4.2	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	67.5	19.1	59.6	4.2	12.4
Queue Length 50th (ft)	172	39	224	101	86
Queue Length 95th (ft)	#273	114	#390	128	m101
Internal Link Dist (ft)	423			439	2145
Turn Bay Length (ft)		80	410		
Base Capacity (vph)	558	393	415	2632	1734
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.94	0.55	0.88	0.43	0.94

Intersection Summary

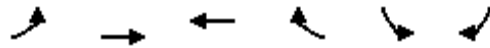
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative6
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.70	0.57	0.57	0.54	0.69	0.47
Control Delay	41.8	4.9	16.0	6.7	32.1	6.0
Queue Delay	0.2	0.4	0.0	0.0	0.0	0.0
Total Delay	42.0	5.3	16.0	6.7	32.1	6.0
Queue Length 50th (ft)	127	81	152	130	161	0
Queue Length 95th (ft)	191	102	m184	m161	221	63
Internal Link Dist (ft)		270	1430		1233	
Turn Bay Length (ft)	225			185		630
Base Capacity (vph)	457	2314	1421	1205	926	613
Starvation Cap Reductn	12	463	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.71	0.57	0.54	0.69	0.47

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: I-215 NB Ramps & Vivienda Av

2040 Alternative6
 PM Peak



Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	737	247	177	953	1646
v/c Ratio	0.87	0.47	0.76	0.40	0.87
Control Delay	44.4	14.6	59.2	6.5	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	44.4	14.6	59.2	6.5	10.5
Queue Length 50th (ft)	205	44	98	105	107
Queue Length 95th (ft)	#303	113	#198	137	m130
Internal Link Dist (ft)	423			439	2145
Turn Bay Length (ft)		80	410		
Base Capacity (vph)	851	523	237	2397	1882
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.87	0.47	0.75	0.40	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative7
 AM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	125	794	622	955	499	225
v/c Ratio	0.54	0.39	0.41	0.74	0.45	0.31
Control Delay	47.7	12.0	7.6	8.6	21.0	9.5
Queue Delay	0.0	0.0	0.0	0.3	0.0	0.0
Total Delay	47.7	12.0	7.6	8.9	21.0	9.5
Queue Length 50th (ft)	80	145	62	135	106	61
Queue Length 95th (ft)	124	242	197	211	106	67
Internal Link Dist (ft)		435	455		1273	
Turn Bay Length (ft)	300					500
Base Capacity (vph)	230	2036	1503	1299	1625	730
Starvation Cap Reductn	0	0	0	59	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.39	0.41	0.77	0.31	0.31

Intersection Summary

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative7
 AM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	239	957	1438	914	139	302	302
v/c Ratio	0.68	0.35	0.76	0.83	0.55	0.74	0.76
Control Delay	40.9	2.4	5.4	5.9	44.8	23.6	25.3
Queue Delay	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Total Delay	40.9	2.4	5.4	6.6	44.8	23.6	25.3
Queue Length 50th (ft)	140	19	159	52	78	50	50
Queue Length 95th (ft)	#211	106	m192	m62	134	147	150
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	353	2700	1883	1107	303	445	431
Starvation Cap Reductn	0	0	0	42	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.35	0.76	0.86	0.46	0.68	0.70

Intersection Summary

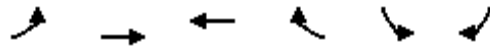
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 4: Barton Rd & I-215 SB Ramps

2040 Alternative7
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	272	1321	817	647	642	288
v/c Ratio	0.59	0.58	0.63	0.56	0.68	0.47
Control Delay	24.9	5.0	3.2	3.7	31.0	5.7
Queue Delay	0.0	0.2	0.0	0.1	0.1	0.0
Total Delay	24.9	5.2	3.2	3.8	31.1	5.7
Queue Length 50th (ft)	119	104	13	0	155	0
Queue Length 95th (ft)	195	100	m15	m1	213	61
Internal Link Dist (ft)		435	455		1273	
Turn Bay Length (ft)	300					500
Base Capacity (vph)	462	2296	1293	1158	996	638
Starvation Cap Reductn	0	267	0	68	0	0
Spillback Cap Reductn	0	0	0	0	34	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.65	0.63	0.59	0.67	0.45

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Barton Road Interchange Improvement Project
 5: Barton Rd & I-215 NB Ramps

2040 Alternative7
 PM Peak



Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR
Lane Group Flow (vph)	281	1592	1428	689	36	474	474
v/c Ratio	0.85	0.71	0.97	0.78	0.07	0.98	1.03
Control Delay	56.3	12.1	27.9	8.7	22.4	65.4	79.0
Queue Delay	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Total Delay	56.3	12.7	27.9	8.7	22.4	65.4	79.0
Queue Length 50th (ft)	164	285	295	73	14	260	~288
Queue Length 95th (ft)	#296	359	m#506	m102	36	#474	#490
Internal Link Dist (ft)		455	730			1450	
Turn Bay Length (ft)	320			130			490
Base Capacity (vph)	329	2237	1466	883	511	486	462
Starvation Cap Reductn	0	271	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.81	0.97	0.78	0.07	0.98	1.03

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

APPENDIX E
Freeway Ramp & Mainline
LOS Calculation Worksheets

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**Existing Barton Road Interchange
Ramp LOS**

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Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5736	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	462	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	289	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5736	462	289	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1509	122	76	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6249	503	315	pcph

----- Estimation of V12 Merge Areas -----

L = 1139.53 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3714 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6752	7050	No
FO			
v	4217	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.4$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.544
S
Space mean speed in ramp influence area, S = 52.5 mph
R
Space mean speed in outer lanes, S = 57.1 mph
0
Space mean speed for all vehicles, S = 54.1 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6069	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	333	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	492	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6069	333	492	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1597	88	129	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6612	363	536	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.578 Using Equation 5
FD
v = v + (v - v) P = 3975 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	6612	7050	No
Fi F			
v	3975	4400	No
12			
v = v - v	6249	7050	No
FO F R			
v	363	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 36.0 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence E

----- Speed Estimation -----

Intermediate speed variable, D = 0.461
S
Space mean speed in ramp influence area, S = 54.4 mph
R
Space mean speed in outer lanes, S = 64.9 mph
0
Space mean speed for all vehicles, S = 58.2 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4511	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	370	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	342	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4511	370	342	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1187	97	90	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4915	403	373	pcph

----- Estimation of V12 Merge Areas -----

L = 832.65 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2921 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5318	7050	No
FO			
v	3324	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, D = 5.475 + 0.00734 v_R + 0.0078 v₁₂ - 0.00627 L_A = 27.5 pc/mi/ln
Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable, M = 0.387
S
Space mean speed in ramp influence area, S = 56.1 mph
R
Space mean speed in outer lanes, S = 59.6 mph
0
Space mean speed for all vehicles, S = 57.4 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4876	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	365	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	450	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4876	365	450	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1283	96	118	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5312	398	490	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.609 Using Equation 5
FD
v = v + (v - v) P = 3390 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5312	7050	No
Fi F			
v	3390	4400	No
12			
v = v - v	4914	7050	No
FO F R			
v	398	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 31.0 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.464
S
Space mean speed in ramp influence area, S = 54.3 mph
R
Space mean speed in outer lanes, S = 67.7 mph
0
Space mean speed for all vehicles, S = 58.5 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4915	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	431	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	366	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4915	431	366	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1293	113	96	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5277	463	393	pcph

----- Estimation of V12 Merge Areas -----

L = 922.96 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3136 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5740	7050	No
FO			
v	3599	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.422
S
Space mean speed in ramp influence area, S = 55.3 mph
R
Space mean speed in outer lanes, S = 59.1 mph
0
Space mean speed for all vehicles, S = 56.7 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5276	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	361	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	363	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5276	361	363	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1388	95	96	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5665	388	390	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.601 Using Equation 5
FD
v = v + (v - v) P = 3557 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5665	7050	No
Fi F			
v	3557	4400	No
12			
v = v - v	5277	7050	No
FO F R			
v	388	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 32.4 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.463
S
Space mean speed in ramp influence area, S = 54.4 mph
R
Space mean speed in outer lanes, S = 67.0 mph
0
Space mean speed for all vehicles, S = 58.5 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5271	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	406	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	441	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5271	406	441	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1387	107	116	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5659	436	473	pcph

----- Estimation of V12 Merge Areas -----

L = 998.93 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3363 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6095	7050	No
FO			
v	3799	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 31.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.453
S
Space mean speed in ramp influence area, S = 54.6 mph
R
Space mean speed in outer lanes, S = 58.5 mph
0
Space mean speed for all vehicles, S = 56.0 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5685	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	414	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	379	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5685	414	379	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1496	109	100	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6104	445	407	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.587 Using Equation 5
FD
v = v + (v - v) P = 3766 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	6104	7050	No
Fi F			
v	3766	4400	No
12			
v = v - v	5659	7050	No
FO F R			
v	445	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 34.2 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.468
S
Space mean speed in ramp influence area, S = 54.2 mph
R
Space mean speed in outer lanes, S = 66.1 mph
0
Space mean speed for all vehicles, S = 58.2 mph

**Existing Adjacent Interchange
Ramp LOS**

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Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5456	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	613	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1013	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5456	613	1013	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1436	161	267	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5944	668	1104	pcph

----- Estimation of V12 Merge Areas -----

L = 1109.57 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3533 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6612	7050	No
FO			
v	4201	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.2$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.539
S
Space mean speed in ramp influence area, S = 52.6 mph
R
Space mean speed in outer lanes, S = 57.8 mph
0
Space mean speed for all vehicles, S = 54.4 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6474	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1018	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	600	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6474	1018	600	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1704	268	158	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7053	1109	654	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.533 Using Equation 5
FD
v = v + (v - v) P = 4275 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	7053	7050	Yes
Fi F			
v	4275	4400	No
12			
v = v - v	5944	7050	No
FO F R			
v	1109	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 38.6 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable, D = 0.528
S
Space mean speed in ramp influence area, S = 52.9 mph
R
Space mean speed in outer lanes, S = 64.4 mph
0
Space mean speed for all vehicles, S = 56.9 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6010	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	354	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	652	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6010	354	652	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1582	93	172	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6548	386	710	pcph

----- Estimation of V12 Merge Areas -----

L = 1178.48 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3891 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6934	7050	No
FO			
v	4277	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 34.9$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.560
S
Space mean speed in ramp influence area, S = 52.1 mph
R
Space mean speed in outer lanes, S = 56.3 mph
0
Space mean speed for all vehicles, S = 53.7 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6198	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	188	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	332	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6198	188	332	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1631	49	87	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6753	205	362	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.582 Using Equation 5
FD
v = v + (v - v) P = 4014 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	6753	7050	No
Fi F			
v	4014	4400	No
12			
v = v - v	6548	7050	No
FO F R			
v	205	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 36.3 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence E

----- Speed Estimation -----

Intermediate speed variable, D = 0.446
S
Space mean speed in ramp influence area, S = 54.7 mph
R
Space mean speed in outer lanes, S = 64.5 mph
0
Space mean speed for all vehicles, S = 58.3 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4511	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	663	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	739	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4511	663	739	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1187	174	194	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4915	722	805	pcph

----- Estimation of V12 Merge Areas -----

L = 900.92 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2921 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5637	7050	No
FO			
v	3643	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.8$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.428
S
Space mean speed in ramp influence area, S = 55.2 mph
R
Space mean speed in outer lanes, S = 59.6 mph
0
Space mean speed for all vehicles, S = 56.7 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4881	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	847	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	532	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4881	847	532	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1284	223	140	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5318	923	580	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.585 Using Equation 5
FD
v = v + (v - v) P = 3492 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5318	7050	No
Fi F			
v	3492	4400	No
12			
v = v - v	4395	7050	No
FO F R			
v	923	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 31.9 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.511
S
Space mean speed in ramp influence area, S = 53.2 mph
R
Space mean speed in outer lanes, S = 68.1 mph
0
Space mean speed for all vehicles, S = 57.6 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3872	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1004	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	217	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3872	1004	217	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1019	264	57	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4218	1094	236	pcph

----- Estimation of V12 Merge Areas -----

L = 831.37 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2507 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5312	7050	No
FO			
v	3601	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.3$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.422
S
Space mean speed in ramp influence area, S = 55.3 mph
R
Space mean speed in outer lanes, S = 60.6 mph
0
Space mean speed for all vehicles, S = 56.9 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4113	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	241	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	782	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4113	241	782	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1082	63	206	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4481	263	852	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.636 Using Equation 5
FD
v = v + (v - v) P = 2945 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	4481	7050	No
Fi F			
v	2945	4400	No
12			
v = v - v	4218	7050	No
FO F R			
v	263	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 27.1 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable, D = 0.452
S
Space mean speed in ramp influence area, S = 54.6 mph
R
Space mean speed in outer lanes, S = 69.2 mph
0
Space mean speed for all vehicles, S = 58.9 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4303	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	973	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1188	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4303	973	1188	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1132	256	313	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4620	1045	1276	pcph

----- Estimation of V12 Merge Areas -----

L = 906.91 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2746 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5665	7050	No
FO			
v	3791	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 30.8$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.452
S
Space mean speed in ramp influence area, S = 54.6 mph
R
Space mean speed in outer lanes, S = 60.1 mph
0
Space mean speed for all vehicles, S = 56.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5619	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1316	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	786	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5619	1316	786	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1479	346	207	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6033	1413	844	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.544 Using Equation 5
FD
v = v + (v - v) P = 3927 pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	6033	7050	No
Fi F			
v	3927	4400	No
12			
v = v - v	4620	7050	No
FO F R			
v	1413	2000	No
R			

Level of Service Determination (if not F)

Density, D = 4.252 + 0.0086 v - 0.009 L = 35.6 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	D = 0.555	
	S	
Space mean speed in ramp influence area,	S = 52.2	mph
	R	
Space mean speed in outer lanes,	S = 67.0	mph
	0	
Space mean speed for all vehicles,	S = 56.6	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5055 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 285 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 863 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5055	285	863	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1330	75	227	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	5427	306	927

pcph

Estimation of V12 Merge Areas

L = 921.46 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3225 pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5733	7050	No
FO			
v	3531	4600	No
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.412
S
Space mean speed in ramp influence area, S = 55.5 mph
R
Space mean speed in outer lanes, S = 58.9 mph
0
Space mean speed for all vehicles, S = 56.8 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5346	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	291	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	353	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5346	291	353	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1407	77	93	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5740	312	379	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.602 Using Equation 5
FD
v = v + (v - v) P = 3580 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5740	7050	No
Fi F			
v	3580	4400	No
12			
v = v - v	5428	7050	No
FO F R			
v	312	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 32.6 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.456
S
Space mean speed in ramp influence area, S = 54.5 mph
R
Space mean speed in outer lanes, S = 66.8 mph
0
Space mean speed for all vehicles, S = 58.6 mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5271	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	653	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	572	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5271	653	572	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1387	172	151	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5659	701	614	pcph

----- Estimation of V12 Merge Areas -----

L = 1055.64 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 3363 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	6360	7050	No
FO			
v	4064	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 33.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, M = 0.506
S
Space mean speed in ramp influence area, S = 53.4 mph
R
Space mean speed in outer lanes, S = 58.5 mph
0
Space mean speed for all vehicles, S = 55.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Diverge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5677 vph

Off Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-Flow speed on ramp 35.0 mph
Volume on ramp 826 vph
Length of first accel/decel lane 270 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent ramp 475 vph
Position of adjacent ramp Downstream
Type of adjacent ramp On
Distance to adjacent ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5677	826	475	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1494	217	125	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	6095	887	510

pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.567 Using Equation 5
FD
 $v = v + (v - v) P = 3839$ pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	6095	7050	No
Fi F			
v	3839	4400	No
12			
$v = v - v$	5208	7050	No
FO F R			
v	887	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 34.8$ pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.508$
S
Space mean speed in ramp influence area, $S = 53.3$ mph
R
Space mean speed in outer lanes, $S = 66.4$ mph
0
Space mean speed for all vehicles, $S = 57.5$ mph

Phone: Fax:
E-mail:

----- Merge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4701	vph

----- On Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	285	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	249	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4701	285	249	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1237	75	66	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5047	306	267	pcph

----- Estimation of V12 Merge Areas -----

L = 840.14 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
v = v (P) = 2999 pc/h
12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5353	7050	No
FO			
v	3305	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.4$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable, M = 0.385
S
Space mean speed in ramp influence area, S = 56.1 mph
R
Space mean speed in outer lanes, S = 59.4 mph
0
Space mean speed for all vehicles, S = 57.4 mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 3/27/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: Existing
Description: Barton Road Interchange Improvement Project

----- Freeway Data -----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4992	vph

----- Off Ramp Data -----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	291	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	969	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4992	291	969	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1314	77	255	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5360	312	1040	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 25-8 or 25-9)
EQ
P = 0.612 Using Equation 5
FD
v = v + (v - v) P = 3400 pc/h
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v = v	5360	7050	No
Fi F			
v	3400	4400	No
12			
v = v - v	5048	7050	No
FO F R			
v	312	2000	No
R			

----- Level of Service Determination (if not F) -----

Density, D = 4.252 + 0.0086 v - 0.009 L = 31.1 pc/mi/ln
R 12 D

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable, D = 0.456
S
Space mean speed in ramp influence area, S = 54.5 mph
R
Space mean speed in outer lanes, S = 67.6 mph
0
Space mean speed for all vehicles, S = 58.7 mph

Existing Freeway Mainline LOS

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Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4881	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1284	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1773	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1773	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.7	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company:
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4511	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1187	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1638	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1638	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	27.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	4876	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1283	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1771	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	1771	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington Ave to Barton
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6069	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1597	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2204	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2204	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	53.9	mi/h
Number of lanes, N	3	
Density, D	40.9	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5736	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1509	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2083	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2083	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	3	
Density, D	36.8	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	6198	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1631	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2251	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	2251	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	52.6	mi/h
Number of lanes, N	3	
Density, D	42.8	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington to Barton Rd
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5276	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1388	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1888	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1888	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	3	
Density, D	31.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5346	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1407	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1913	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1913	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.9	mi/h
Number of lanes, N	3	
Density, D	32.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4915	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1293	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1759	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1759	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5685	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1496	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2035	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2035	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	57.4	mi/h
Number of lanes, N	3	
Density, D	35.4	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

2009 NB Barton to Washington PM.txt

HCS+: Basic Freeway Segments Release 5.3

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5677	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1494	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2032	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2032	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	57.5	mi/h
Number of lanes, N	3	
Density, D	35.4	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 3/27/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: Existing
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5271	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1387	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1886	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1886	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	3	
Density, D	31.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

**2016 Barton Road Interchange
Ramp LOS**

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2016 AM NB Barton Off_Alt1.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: **2016 No Project**
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5250	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	442	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	544	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5250	442	544	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1382	116	143	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM NB Barton Off_Alt1.txt
Flow rate, vp 5720 482 593 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P = 0.595$ Using Equation 5
 $FD =$
 $v_{12} = v_R + (v_F - v_R) P = 3598$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{F0}$	5720	7050	No
$v = v_F - v_{R0}$	5238	7050	No
v_R	482	2000	No
$v_{3 or av34}$	2122 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 or av34} > 2700$ pc/h?		No	
Is $v_{3 or av34} > 1.5 v_{12}$		No	
If yes, $v_{12A} = 3598$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3598	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 32.8$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D_S = 0.471$
Space mean speed in ramp influence area,	$S_R = 54.2$ mph
Space mean speed in outer lanes,	$S_O = 66.9$ mph
Space mean speed for all vehicles,	$S = 58.3$ mph

2016 PM NB Barton Off_Alt1.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: **2016 No Project**
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6098	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	553	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	549	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6098	553	549	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1605	146	144	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Barton Off_Alt1.txt
Flow rate, vp 6547 594 589 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P = 0.569$ Using Equation 5
 $FD =$
 $v_{12} = v_R + (v_F - v_R) P = 3981$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{EO}$	6547	7050	No
$v = v_{FO}$	5953	7050	No
$v = v_R$	594	2000	No
$v = v_{3 or av34}$	2566 pc/h	(Equation 25-15 or 25-16)	
Is $v > 2700$ pc/h?		No	
Is $v > 1.5 v_{12}$?		No	
If yes, $v_{12A} = 3981$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3981	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 36.1$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$D_S = 0.481$
Space mean speed in ramp influence area,	$S_R = 53.9$ mph
Space mean speed in outer lanes,	$S_O = 65.2$ mph
Space mean speed for all vehicles,	$S = 57.8$ mph

2016 AM NB Barton Off.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5250	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	442	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	544	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5250	442	544	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1382	116	143	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM NB Barton Off.txt
Flow rate, vp 5720 482 593 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.260 \text{ Using Equation 0}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 1844 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	5720	9400	No
$v_{Fi} = v_{F - v_{R}}$	5238	9400	No
$v_{FO} = v_{F - v_{R}}$	482	3800	No
v_R	1938 pc/h	(Equation 25-15 or 25-16)	
$v_{3 \text{ or } av34}$	> 2700 pc/h?	No	
$v_{3 \text{ or } av34}$	> 1.5 v / 2	Yes	
If yes, $v_{12A} = 2288$	12	(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12A}	Actual 2288	Max Desirable 4400	Violation? No
-----------	----------------	-----------------------	------------------

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 14.6 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.471$

Space mean speed in ramp influence area, $S = 54.2 \text{ mph}$

Space mean speed in outer lanes, $S = 68.5 \text{ mph}$

Space mean speed for all vehicles, $S = 61.9 \text{ mph}$

2016 AM NB Barton On.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4764 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 544 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 442 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4764	544	442	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1254	143	116	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM NB Barton On.txt
Flow rate, vp 5190 593 482 pcph

Estimation of V12 Merge Areas

L_{EO} = 932.16 (Equation 25-2 or 25-3)
P_{FM} = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3084 pc/h

Capacity Checks

v_{FO} Actual 5783 Maximum 7050 LOS F? No
v₃ v_{av34} 2106 pc/h (Equation 25-4 or 25-5)
Is v₃ v_{av34} > 2700 pc/h? No
Is v₃ v_{av34} > 1.5 v₁₂ /2 No
If yes, v_{12A} = 3084 (Equation 25-8)

Flow Entering Merge Influence Area

v_{R12} Actual 3084 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_R + 0.0078 v_A - 0.00627 L_A = 30.1 pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M_S = 0.433
Space mean speed in ramp influence area, S_R = 55.0 mph
Space mean speed in outer lanes, S_O = 59.2 mph
Space mean speed for all vehicles, S_F = 56.5 mph

2016 AM SB Barton Off.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5990	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	421	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	639	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5990	421	639	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1576	111	168	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM SB Barton Off.txt
Flow rate, vp 6526 459 696 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.576 \text{ Using Equation 5}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 3952 \text{ pc/h}$$

Capacity Checks

$v = v_{12}$	Actual	Maximum	LOS F?
v_{12}	6526	7050	No
$v_{F0} = v_F - v_R$	6067	7050	No
v_R	459	2000	No
$v_{3 or av34}$	2574 pc/h	(Equation 25-15 or 25-16)	
$v_{3 or av34} > 2700 \text{ pc/h?}$		No	
$v_{3 or av34} > 1.5 v_{12} / 2$		No	
$v_{12A} = 3952$		(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12}	Actual	Max Desirable	Violation?
v_{12}	3952	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{D12} = 35.8 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, $D = 0.469$

Space mean speed in ramp influence area, $S = 54.2 \text{ mph}$

Space mean speed in outer lanes, $S = 65.2 \text{ mph}$

Space mean speed for all vehicles, $S = 58.1 \text{ mph}$

2016 AM SB Barton On.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5502	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	639	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	421	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5502	639	421	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1448	168	111	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, fP	1.00	1.00	1.00	

2016 AM SB Barton On.txt
Flow rate, vp 5994 696 459 pcph

Estimation of V12 Merge Areas

$L_{EO} = 1126.26$ (Equation 25-2 or 25-3)
 $P_{FM} = 0.594$ Using Equation 1
 $v_{12} = v_{FM} (P_{FM}) = 3562$ pc/h

Capacity Checks

v_{FO}	Actual	Maximum	LOS F?
	6690	7050	No
$v_{3 \text{ or } av34}$	2432 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12}$?		No	
If yes, $v_{12A} = 3562$		(Equation 25-8)	

Flow Entering Merge Influence Area

v_{R12}	Actual	Max Desirable	Violation?
	3562	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_{R12} + 0.0078 v_{A12} - 0.00627 L_{A12} = 34.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$M_S = 0.555$
Space mean speed in ramp influence area,	$S_R = 52.2$ mph
Space mean speed in outer lanes,	$S_O = 57.7$ mph
Space mean speed for all vehicles,	$S = 54.1$ mph

2016 PM NB Barton Off.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6098	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	553	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane	500	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	549	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6098	553	549	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1605	146	144	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Barton Off.txt
Flow rate, vp 6547 594 589 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.260 \text{ Using Equation 0}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 2142 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{EO}$	6547	9400	No
$v = v_{FO}$	5953	9400	No
$v = v_R$	594	3800	No
$v = v_{3 \text{ or } av34}$	2202 pc/h	(Equation 25-15 or 25-16)	
Is $v > 2700$ pc/h?		No	
Is $v > 1.5 v_{12}$?		Yes	
If yes, $v_{12A} = 2618$		(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12A}	Actual 2618	Max Desirable 4400	Violation? No
-----------	----------------	-----------------------	------------------

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 17.4$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	$D = 0.481$
Space mean speed in ramp influence area,	$S = 53.9$ mph
Space mean speed in outer lanes,	$S = 67.5$ mph
Space mean speed for all vehicles,	$S = 61.3$ mph

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HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5552	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	549	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	553	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5552	549	553	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1461	144	146	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Barton On.txt
Flow rate, vp 5961 589 594 pcph

Estimation of V12 Merge Areas

L_{EO} = 1096.30 (Equation 25-2 or 25-3)
P = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3543 pc/h

Capacity Checks

v _{FO}	Actual	Maximum	LOS F?
	6550	7050	No
v _{3 or av34}	2418 pc/h	(Equation 25-4 or 25-5)	
Is v _{3 or av34} > 2700 pc/h?			No
Is v _{3 or av34} > 1.5 v ₁₂ / 2			No
If yes, v _{12A} = 3543		(Equation 25-8)	

Flow Entering Merge Influence Area

v _{R12}	Actual	Max Desirable	Violation?
	3543	4600	No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_{R12} + 0.0078 v_A - 0.00627 L_A = 33.7 pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M	= 0.522
Space mean speed in ramp influence area,	S _R	= 53.0 mph
Space mean speed in outer lanes,	S _O	= 57.8 mph
Space mean speed for all vehicles,	S	= 54.7 mph

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HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5577	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	503	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	618	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5577	503	618	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1468	132	163	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Barton Off.txt
Flow rate, vp 5988 540 664 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.585 \text{ Using Equation 5}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 3730 \text{ pc/h}$$

Capacity Checks

v_{12}	Actual	Maximum	LOS F?
	5988	7050	No
v_{Fi}			
v_{FO}	5448	7050	No
v_R	540	2000	No
$v_{3 \text{ or } av34}$	2258 pc/h		(Equation 25-15 or 25-16)
$v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
$v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
$v_{12A} = 3730$			(Equation 25-18)

Flow Entering Diverge Influence Area

v_{12}	Actual	Max Desirable	Violation?
	3730	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{D12} = 33.9 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D_S = 0.477$

Space mean speed in ramp influence area, $S_R = 54.0 \text{ mph}$

Space mean speed in outer lanes, $S_O = 66.4 \text{ mph}$

Space mean speed for all vehicles, $S = 58.1 \text{ mph}$

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HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Barton Road On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4960	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	618	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	503	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4960	618	503	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1305	163	132	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Barton On.txt
Flow rate, vp 5325 664 540 pcph

Estimation of V12 Merge Areas

$L_{EO} = 976.25$ (Equation 25-2 or 25-3)
 $P_{FM} = 0.594$ Using Equation 1
 $v_{12} = v_F(P_{FM}) = 3165$ pc/h

Capacity Checks

v_{FO}	Actual	Maximum	LOS F?
	5989	7050	No
$v_{3 \text{ or } av34}$	2160 pc/h		(Equation 25-4 or 25-5)
$I_s v_{3 \text{ or } av34} > 2700$ pc/h?			No
$I_s v_{3 \text{ or } av34} > 1.5 v_{12} / 2$			No
If yes, $v_{12A} = 3165$			(Equation 25-8)

Flow Entering Merge Influence Area

v_{R12}	Actual	Max Desirable	Violation?
	3165	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_{R12} + 0.0078 v_{A12} - 0.00627 L_{A12} = 31.3$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$M_S = 0.458$
Space mean speed in ramp influence area,	$S_R = 54.5$ mph
Space mean speed in outer lanes,	$S_O = 59.0$ mph
Space mean speed for all vehicles,	$S = 56.0$ mph

**2016 Adjacent Interchange
Ramp LOS**

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2016 AM NB Iowa Off. txt
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Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-Flow speed on freeway	65.0	mph
Volume on freeway	4474	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	349	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1074	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4474	349	1074	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1177	92	283	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

2016 AM NB Iowa Off. txt
Flow rate, vp 4874 380 1170 pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.621 Using Equation 5
FD
 $v = v + (v - v) P = 3169$ pc/h
12 R F R FD

Capacity Checks

v = v	Actual	Maximum	LOS F?
Fi = v	4874	7050	No
v = v - v	4494	7050	No
FO = v - v			
v	380	2000	No
v			
v	1705 pc/h	(Equation 25-15 or 25-16)	
Is v or av34	> 2700 pc/h?	No	
Is v or av34	> 1.5 v /2	No	
If yes, v	= 3169	(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

v	Actual	Max Desirable	Violation?
12	3169	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 29.1$ pc/mi /ln
R 12 D
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	D = 0.462
Space mean speed in ramp influence area,	S = 54.4 mph
Space mean speed in outer lanes,	S = 68.6 mph
Space mean speed for all vehicles,	S = 58.6 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4177 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 1074 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 349 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4177	1074	349	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1099	283	92	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Merge Areas

L = 918.89 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 2705$ pc/h
12 F FM

Capacity Checks

v F0 Actual 5721 Maximum 7050 LOS F? No
v 3 or v av34 1846 pc/h (Equation 25-4 or 25-5)
Is v 3 or v av34 > 2700 pc/h? No
Is v 3 or v av34 > 1.5 v /2 No
If yes, v 12A = 2705 (Equation 25-8)

Flow Entering Merge Influence Area

v R12 Actual 2705 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 31.4$ pc/mi/ln
R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.467
Space mean speed in ramp influence area, S_R = 54.3 mph
Space mean speed in outer lanes, S_O = 60.2 mph
Space mean speed for all vehicles, S = 56.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis: Diverge
Number of lanes in freeway: 3
Free-Flow speed on freeway: 65.0 mph
Volume on freeway: 5308 vph

Off Ramp Data

Side of freeway: Right
Number of lanes in ramp: 1
Free-Flow speed on ramp: 35.0 mph
Volume on ramp: 1047 vph
Length of first accel/decel lane: 270 ft
Length of second accel/decel lane: ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent ramp: 670 vph
Position of adjacent ramp: Downstream
Type of adjacent ramp: On
Distance to adjacent ramp: 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5308	1047	670	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1397	276	176	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Diverge Areas

$$L = \text{(Equation 25-8 or 25-9)}$$

$$EQ$$

$$P = 0.563 \text{ Using Equation 5}$$

$$FD$$

$$v = v + (v - v) P = 3754 \text{ pc/h}$$

$$12 \quad R \quad F \quad R \quad FD$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	5783	7050	No
$F_i = F$			
$v = v - v$	4642	7050	No
$F_0 = F - R$			
v	1141	2000	No
R			
v	2029 pc/h	(Equation 25-15 or 25-16)	
$3 \text{ or } av34$			
$I_s \quad v = v$	> 2700 pc/h?	No	
$3 \text{ or } av34$			
$I_s \quad v = v$	> 1.5 v /2	No	
$3 \text{ or } av34$			
$I_f \text{ yes, } v = 3754$		(Equation 25-18)	
$12A$			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	3754	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 34.1 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D = 0.531$
Space mean speed in ramp influence area,	$S = 52.8 \text{ mph}$
Space mean speed in outer lanes,	$S = 67.3 \text{ mph}$
Space mean speed for all vehicles,	$S = 57.1 \text{ mph}$

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4287 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 670 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 1047 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4287	670	1047	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1128	176	276	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Merge Areas

L = 850.41 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 2776$ pc/h
12 F FM

Capacity Checks

Actual Maximum LOS F?
v F0 5401 7050 No
v 3 or v av34 1895 pc/h (Equation 25-4 or 25-5)
Is v 3 or v av34 > 2700 pc/h? No
Is v 3 or v av34 > 1.5 v /2 No
If yes, v 12A = 2776 (Equation 25-8)

Flow Entering Merge Influence Area

Actual Max Desirable Violation?
v R12 2776 4600 No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 28.7$ pc/mi/ln
R R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.409
Space mean speed in ramp influence area, S_R = 55.6 mph
Space mean speed in outer lanes, S_O = 60.0 mph
Space mean speed for all vehicles, S = 57.1 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis: Diverge
Number of lanes in freeway: 3
Free-Flow speed on freeway: 65.0 mph
Volume on freeway: 6140 vph

Off Ramp Data

Side of freeway: Right
Number of lanes in ramp: 1
Free-Flow speed on ramp: 35.0 mph
Volume on ramp: 410 vph
Length of first accel/decel lane: 270 ft
Length of second accel/decel lane: ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent ramp: 531 vph
Position of adjacent ramp: Downstream
Type of adjacent ramp: On
Distance to adjacent ramp: 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6140	410	531	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1616	108	140	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Diverge Areas

$$L = \text{(Equation 25-8 or 25-9)}$$

$$EQ$$

$$P = 0.572 \text{ Using Equation 5}$$

$$FD$$

$$v = v + (v - v) P = 4019 \text{ pc/h}$$

$$12 \quad R \quad F \quad R \quad FD$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	6689	7050	No
$F_i = F$			
$v = v - v$	6242	7050	No
$F_0 = F - R$			
v	447	2000	No
R			
v	2670 pc/h	(Equation 25-15 or 25-16)	
$3 \text{ or } av34$			
Is $v > 2700 \text{ pc/h?}$		No	
$3 \text{ or } av34$			
Is $v > 1.5 v / 2$		No	
$3 \text{ or } av34$			
If yes, $v = 4019$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

v	Actual	Max Desirable	Violation?
12	4019	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 36.4 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$D = 0.468$
Space mean speed in ramp influence area,	$S = 54.2 \text{ mph}$
Space mean speed in outer lanes,	$S = 64.8 \text{ mph}$
Space mean speed for all vehicles,	$S = 58.0 \text{ mph}$

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5724 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 531 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 410 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5724	531	410	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1506	140	108	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Estimation of V12 Merge Areas

L = 1153.01 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 3706$ pc/h
12 F FM

Capacity Checks

v F0 Actual 6815 Maximum 7050 LOS F? No
v 3 or v av34 2530 pc/h (Equation 25-4 or 25-5)
Is v 3 or v av34 > 2700 pc/h? No
Is v 3 or v av34 > 1.5 v /2 No
If yes, v 12A = 3706 (Equation 25-8)

Flow Entering Merge Influence Area

v R12 Actual 3706 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 34.9$ pc/mi/ln
R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.562
Space mean speed in ramp influence area, S_R = 52.1 mph
Space mean speed in outer lanes, S_O = 57.1 mph
Space mean speed for all vehicles, S = 53.8 mph

2016 AM SB Washington Off. txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis: Diverge
Number of lanes in freeway: 3
Free-Flow speed on freeway: 65.0 mph
Volume on freeway: 6207 vph

Off Ramp Data

Side of freeway: Right
Number of lanes in ramp: 1
Free-Flow speed on ramp: 35.0 mph
Volume on ramp: 1062 vph
Length of first accel/decel lane: 270 ft
Length of second accel/decel lane: ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent ramp: 686 vph
Position of adjacent ramp: Downstream
Type of adjacent ramp: On
Distance to adjacent ramp: 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6207	1062	686	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1633	279	181	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

Flow rate, vp 2016 AM SB Washington Off. txt
6762 1157 747 pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.538 Using Equation 5
FD
 $v = v + (v - v) P = 4171$ pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	6762	7050	No
$F_i = F$			
$v = v - v$	5605	7050	No
$F_0 = F - v$			
v	1157	2000	No
R			
v	2591 pc/h	(Equation 25-15 or 25-16)	
$3 \text{ or } av34$			
Is $v > 2700$ pc/h?		No	
$3 \text{ or } av34$			
Is $v > 1.5 v / 2$		No	
$3 \text{ or } av34$			
If yes, $v = 4171$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

v	Actual	Max Desirable	Violation?
12	4171	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 37.7$ pc/mi/ln
R 12 D
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, $D = 0.532$
Space mean speed in ramp influence area, $S = 52.8$ mph
Space mean speed in outer lanes, $S = 65.1$ mph
Space mean speed for all vehicles, $S = 56.9$ mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5305 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 686 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 1062 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5305	686	1062	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1396	181	279	v
Trucks and buses	7	7	7	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.966	0.966	0.966	
Driver population factor, FP	1.00	1.00	1.00	

2016 AM SB Washington On.txt
Flow rate, vp 5780 747 1157 pcph

Estimation of V12 Merge Areas

L = 1091.38 (Equation 25-2 or 25-3)
EQ
P = 0.594 Using Equation 1
FM
 $v = v \left(\frac{P}{F} \right) = 3435$ pc/h
12 F FM

Capacity Checks

Actual Maximum LOS F?
v F0 6527 7050 No
v 3 or v av34 2345 pc/h (Equation 25-4 or 25-5)
Is v 3 or v av34 > 2700 pc/h? No
Is v 3 or v av34 > 1.5 v /2 No
If yes, v 12A = 3435 (Equation 25-8)

Flow Entering Merge Influence Area

Actual Max Desirable Violation?
v R12 3435 4600 No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 34.0$ pc/mi/ln
R 12 A
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.534
Space mean speed in ramp influence area, S_R = 52.7 mph
Space mean speed in outer lanes, S_O = 58.2 mph
Space mean speed for all vehicles, S = 54.6 mph

2016 PM NB Iowa Off. txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5321	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	380	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1100	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5321	380	1100	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1400	100	289	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Iowa Off. txt
Flow rate, vp 5713 408 1181 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P_{FD} = 0.598$ Using Equation 5
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 3583$ pc/h

Capacity Checks

v_{12}	Actual	Maximum	LOS F?
	5713	7050	No
v_{F0}			
v_{R0}	5305	7050	No
v_{R0}	408	2000	No
v_{12}	2130 pc/h	(Equation 25-15 or 25-16)	
v_{12}	> 2700 pc/h?	No	
v_{12}	$> 1.5 v_{12} / 2$	No	
If yes, v_{12}	$= 3583$	(Equation 25-18)	

Flow Entering Diverge Influence Area

v_{12}	Actual	Max Desirable	Violation?
	3583	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{12} = 32.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D_S = 0.465$
Space mean speed in ramp influence area,	$S_R = 54.3$ mph
Space mean speed in outer lanes,	$S_O = 66.9$ mph
Space mean speed for all vehicles,	$S = 58.4$ mph

2016 PM NB Iowa On.txt
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Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Iowa Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 4998 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 1100 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 380 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4998	1100	380	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1315	289	100	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Iowa On.txt
Flow rate, vp 5366 1181 408 pcph

Estimation of V12 Merge Areas

L_{EO} = 1095.66 (Equation 25-2 or 25-3)
P = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3189 pc/h

Capacity Checks

v_{FO} Actual 6547 Maximum 7050 LOS F? No
v₃ v_{av34} 2177 pc/h (Equation 25-4 or 25-5)
Is v₃ v_{av34} > 2700 pc/h? No
Is v₃ v_{av34} > 1.5 v₁₂ /2 No
If yes, v_{12A} = 3189 (Equation 25-8)

Flow Entering Merge Influence Area

v_{R12} Actual 3189 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_{R12} + 0.0078 v_A - 0.00627 L_A = 35.3 pc/mi/ln
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, M = 0.587
Space mean speed in ramp influence area, S = 51.5 mph
Space mean speed in outer lanes, R = 59.0 mph
Space mean speed for all vehicles, S₀ = 53.8 mph

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Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6101	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	954	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	655	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6101	954	655	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1606	251	172	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Mt Vernon Off. txt
Flow rate, vp 6551 1024 703 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P = 0.549 \text{ Using Equation 5}$$

$$v_{12} = v_R + (v_F - v_R) P = 4059 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	6551	7050	No
$v = v_F - v_R$	5527	7050	No
v_R	1024	2000	No
$v_{3 \text{ or } av34}$	2492 pc/h		(Equation 25-15 or 25-16)
$v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
$v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
$v_{12A} = 4059$			(Equation 25-18)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4059	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 36.7 \text{ pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable, $D_S = 0.520$

Space mean speed in ramp influence area, $S_R = 53.0 \text{ mph}$

Space mean speed in outer lanes, $S_O = 65.5 \text{ mph}$

Space mean speed for all vehicles, $S = 57.2 \text{ mph}$

2016 PM NB Mt Vernon On.txt
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Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Junction: Mt. Vernon Avenue On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5118	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	655	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	954	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5118	655	954	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1347	172	251	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM NB Mt Vernon On.txt
Flow rate, vp 5495 703 1024 pcph

Estimation of V12 Merge Areas

L_{EO} = 1020.97 (Equation 25-2 or 25-3)
P = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3266 pc/h

Capacity Checks

v _{FO}	Actual	Maximum	LOS F?
	6198	7050	No
v _{3 or av34}	2229 pc/h	(Equation 25-4 or 25-5)	
Is v _{3 or av34} > 2700 pc/h?			No
Is v _{3 or av34} > 1.5 v ₁₂ / 2			No
If yes, v _{12A} = 3266		(Equation 25-8)	

Flow Entering Merge Influence Area

v _{R12}	Actual	Max Desirable	Violation?
	3266	4600	No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_{R12} + 0.0078 v_A - 0.00627 L_A = 32.3 pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M = 0.485	
Space mean speed in ramp influence area,	S = 53.8	mph
Space mean speed in outer lanes,	R = 58.8	mph
Space mean speed for all vehicles,	O = 55.5	mph

2016 PM SB La Cadena Off. txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5578	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	583	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	438	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5578	583	438	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1468	153	115	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB La Cadena Off. txt
Flow rate, vp 5989 626 470 pcph

Estimation of V12 Diverge Areas

$$L_{EO} = \text{(Equation 25-8 or 25-9)}$$

$$P_{FD} = 0.581 \text{ Using Equation 5}$$

$$v_{12} = v_R + (v_F - v_R) P_{FD} = 3744 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{EO}$	5989	7050	No
$v = v_{FO} - v_{FR}$	5363	7050	No
v_R	626	2000	No
$v_{3 \text{ or } av34}$	2245 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3744$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3744	4400	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D = 34.0 \text{ pc/mi/ln}$$

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$D_S = 0.484$
Space mean speed in ramp influence area,	$S_R = 53.9 \text{ mph}$
Space mean speed in outer lanes,	$S_O = 66.4 \text{ mph}$
Space mean speed for all vehicles,	$S = 58.0 \text{ mph}$

2016 PM SB La Cadena On.txt
HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: La Cadena Drive On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis Merge
Number of lanes in freeway 3
Free-flow speed on freeway 65.0 mph
Volume on freeway 5019 vph

On Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-flow speed on ramp 35.0 mph
Volume on ramp 438 vph
Length of first accel/decel lane 600 ft
Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 583 vph
Position of adjacent Ramp Upstream
Type of adjacent Ramp Off
Distance to adjacent Ramp 2000 ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5019	438	583	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1321	115	153	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB La Cadena On.txt
Flow rate, vp 5389 470 626 pcph

Estimation of V12 Merge Areas

L_{EO} = 948.43 (Equation 25-2 or 25-3)
P_{FM} = 0.594 Using Equation 1
v₁₂ = v_F (P_{FM}) = 3203 pc/h

Capacity Checks

v_{FO} Actual 5859 Maximum 7050 LOS F? No
v₃ v_{av34} 2186 pc/h (Equation 25-4 or 25-5)
Is v₃ v_{av34} > 2700 pc/h? No
Is v₃ v_{av34} > 1.5 v₁₂ /2 No
If yes, v_{12A} = 3203 (Equation 25-8)

Flow Entering Merge Influence Area

v_{R12} Actual 3203 Max Desirable 4600 Violation? No

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v_R + 0.0078 v_A - 0.00627 L_A = 30.1 pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M_S = 0.433
Space mean speed in ramp influence area, S_R = 55.1 mph
Space mean speed in outer lanes, S_O = 58.9 mph
Space mean speed for all vehicles, S = 56.4 mph

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HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street Off Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5703	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1415	vph
Length of first accel/decel lane	270	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1077	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5703	1415	1077	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1501	372	283	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	0.00	0.00	%
Length	0.00	0.00	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Washington Off. txt
Flow rate, vp 6123 1519 1156 pcph

Estimation of V12 Diverge Areas

$L_{EO} =$ (Equation 25-8 or 25-9)
 $P_{FD} = 0.537$ Using Equation 5
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 3992$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{12}	6123	7050	No
$v_{Fi} = v_{F0}$	4604	7050	No
v_{R0}	1519	2000	No
$v_{3 \text{ or } av34}$	2131 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12}$		No	
If yes, $v_{12A} = 3992$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3992	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{D12} = 36.2$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence E

Speed Estimation

Intermediate speed variable,	$D_S = 0.565$
Space mean speed in ramp influence area,	$S_R = 52.0$ mph
Space mean speed in outer lanes,	$S_0 = 66.9$ mph
Space mean speed for all vehicles,	$S = 56.4$ mph

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HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Iteris, Inc.
Agency/Co.: Iteris, Inc.
Date performed: 04/03/2009
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-215 Southbound
Junction: Washington Street On Ramp
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4501	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1077	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1415	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2000	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4501	1077	1415	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1184	283	372	v
Trucks and buses	4	4	4	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
Heavy vehicle adjustment, FHV	0.980	0.980	0.980	
Driver population factor, fP	1.00	1.00	1.00	

2016 PM SB Washington On.txt
Flow rate, vp 4833 1156 1519 pcph

Estimation of V12 Merge Areas

$L_{EO} = 976.25$ (Equation 25-2 or 25-3)
 $P_{FM} = 0.594$ Using Equation 1
 $v_{12} = v_F(P_{FM}) = 2872$ pc/h

Capacity Checks

v_{FO}	Actual	Maximum	LOS F?
	5989	7050	No
$v_{3 \text{ or } av34}$	1961 pc/h	(Equation 25-4 or 25-5)	
$I_s v_{3 \text{ or } av34} > 2700$ pc/h?		No	
$I_s v_{3 \text{ or } av34} > 1.5 v_{12} / 2$	12	No	
If yes, $v_{12A} = 2872$		(Equation 25-8)	

Flow Entering Merge Influence Area

v_{R12}	Actual	Max Desirable	Violation?
	2872	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_A - 0.00627 L_A = 32.6$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$M_S = 0.498$
Space mean speed in ramp influence area,	$S_R = 53.5$ mph
Space mean speed in outer lanes,	$S_O = 59.7$ mph
Space mean speed for all vehicles,	$S = 55.4$ mph

2016 Weaving LOS

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2016 NB Iowa to Barton AM.txt
HCS+: Freeway Weaving Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Iteris, Inc
Agency/Co.: Iteris, Inc
Date Performed: 4/20/2009
Analysis Time Period: AM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Weaving Location: Iowa Av On to Barton Off
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
Weaving number of lanes, N 4
Weaving segment length, L 1490 ft
Terrain type Level
Grade Length %
Weaving type A mi
Volume ratio, VR 0.25
Weaving ratio, R 0.26

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	V ₀₁	V ₀₂	V _{w1}	V _{w2}	
Volume, V	3825	90	983	352	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v ₁₅	1007	24	259	93	v
Trucks and buses	7	7	7	7	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5*	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.966	0.966	0.966	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4167	98	1070	383	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.92	0.26
Weaving and non-weaving speeds, Si	32.15	54.66
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		1.45
Maximum number of lanes, Nw (max) (Exhibit 24-7)		1.40

2016 NB Iowa to Barton AM.txt
Type of operation is Constrained

Weaving Segment	Speed	Density	Level of Service	Capacity
Weaving segment speed, S	46.40	mph		
Weaving segment density, D	30.81	pc/mi/ln		
Level of service, LOS	D			
Capacity of base condition, cb	7433	pc/h		
Capacity as a 15-minute flow rate, c	7182	pc/h		
Capacity as a full-hour volume, ch	6823	pc/h		

Limitations on Weaving Segments

Analyzed	If Max Exceeded	See Note	
Weaving flow rate, Vw	1453	2800	a
Average flow rate (pcphpl)	1429	2300	b
Volume ratio, VR	0.25	0.35	c
Weaving ratio, R	0.26	N/A	d
Weaving length (ft)	1490	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2016 NB Iowa to Barton PM.txt
HCS+: Freeway Weaving Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Iteris, Inc
Agency/Co.: Iteris, Inc
Date Performed: 4/20/2009
Analysis Time Period: PM Peak Hour
Freeway/Dir of Travel: I-215 Northbound
Weaving Location: Iowa Av On to Barton Off
Jurisdiction:
Analysis Year: 2016
Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
Weaving number of lanes, N 4
Weaving segment length, L 1490 ft
Terrain type Level
Grade Length %
Weaving type A mi
Volume ratio, VR 0.24
Weaving ratio, R 0.31

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	V _{o1}	V _{o2}	V _{w1}	V _{w2}	
Volume, V	4544	100	1000	454	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v ₁₅	1196	26	263	119	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5*	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, f _{HV}	0.980	0.980	0.980	0.980	
Driver population adjustment, f _P	1.00	1.00	1.00	1.00	
Flow rate, v	4878	107	1073	487	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, W _i	2.12	0.30
Weaving and non-weaving speeds, S _i	31.00	53.60
Number of lanes required for unconstrained operation, N _w (Exhibit 24-7)		1.42
Maximum number of lanes, N _w (max) (Exhibit 24-7)		1.40

2016 NB Iowa to Barton PM.txt
Type of operation is Constrained

Weaving Segment	Speed	Density	Level of Service	Capacity
Weaving segment speed, S	45.66	mph		
Weaving segment density, D	35.83	pc/mi/ln		
Level of service, LOS	E			
Capacity of base condition, c _b	7537	pc/h		
Capacity as a 15-minute flow rate, c	7389	pc/h		
Capacity as a full-hour volume, c _h	7020	pc/h		

Limitations on Weaving Segments

	Analyzed	If Max Exceeded	See Note
Weaving flow rate, V _w	1560	2800	a
Average flow rate (pcphpl)	1636	2300	b
Volume ratio, VR	0.24	0.35	c
Weaving ratio, R	0.31	N/A	d
Weaving length (ft)	1490	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2016 Freeway Mainline LOS

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Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5250	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1382	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1907	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1907	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.0	mi/h
Number of lanes, N	3	
Density, D	32.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6098	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1605	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2182	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2182	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.5	mi/h
Number of lanes, N	3	
Density, D	40.0	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4764	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1254	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1730	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1730	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	3	
Density, D	28.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5552	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1461	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1987	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1987	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.1	mi/h
Number of lanes, N	3	
Density, D	34.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

2016 NB Barton to Washington AM.txt

HCS+: Basic Freeway Segments Release 5.4

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5308	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1397	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1928	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1928	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.8	mi/h
Number of lanes, N	3	
Density, D	32.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6101	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1606	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2184	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2184	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.5	mi/h
Number of lanes, N	3	
Density, D	40.1	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5250	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1382	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1430	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1430	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	23.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5250	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1382	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1907	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1907	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.0	mi/h
Number of lanes, N	3	
Density, D	32.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	6098	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1605	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1637	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	1637	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	27.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2016 No Project
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6098	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1605	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2182	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2182	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.5	mi/h
Number of lanes, N	3	
Density, D	40.0	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5502	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1448	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1998	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1998	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.0	mi/h
Number of lanes, N	3	
Density, D	34.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	4960	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1305	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1775	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1775	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.8	mi/h
Number of lanes, N	3	
Density, D	29.7	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	6140	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1616	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2230	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2230	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	53.2	mi/h
Number of lanes, N	3	
Density, D	41.9	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5578	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1468	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1996	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1996	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.0	mi/h
Number of lanes, N	3	
Density, D	34.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington Ave to Barton
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	5990	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1576	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2175	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	2175	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	54.7	mi/h
Number of lanes, N	3	
Density, D	39.8	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 04/03/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington to Barton Rd
 Jurisdiction:
 Analysis Year: 2016
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	5577	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1468	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1996	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1996	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	58.0	mi/h
Number of lanes, N	3	
Density, D	34.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

2040 Freeway Ramp LOS

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Year 2040 Barton Road Freeway Ramp LOS Calculations

I-215 Freeway Ramp	Lanes	Capacity	AM Peak						PM Peak					
			Vol	PCE Vol	PHF Vol	V/C	Density	LOS	Vol	PCE Vol	PHF Vol	V/C	Density	LOS
Northbound														
Barton Rd Off Ramp	2	4600	706	734	773	0.17	6.8	A	935	954	1004	0.22	8.8	A
Barton Rd On Ramp	1	2300	1095	1139	1199	0.52	21.0	C	922	940	990	0.43	17.3	B
Southbound														
Barton Rd Off Ramp	2	4600	703	731	770	0.17	6.7	A	890	908	956	0.21	8.4	A
Barton Rd On Ramp	1	2300	1047	1089	1146	0.50	20.1	C	883	901	948	0.41	16.6	B

Year 2040 Adjacent Interchange Ramp LOS Calculations

I-215 Freeway Ramp	Lanes	Capacity	AM Peak						PM Peak					
			Vol	PCE Vol	PHF Vol	V/C	Density	LOS	Vol	PCE Vol	PHF Vol	V/C	Density	LOS
Northbound														
Iowa Ave Off Ramp	2	4600	720	749	788	0.17	6.9	A	692	706	743	0.16	6.5	A
Iowa Ave On Ramp	1	2300	1312	1364	1436	0.62	25.1	C	1754	1789	1883	0.82	33.0	D
Washington Rd Off Ramp	2	4600	1731	1800	1895	0.41	16.6	B	1391	1419	1493	0.32	13.1	B
Washington Rd On Ramp	1	2300	1678	1745	1837	0.80	32.1	D	1338	1365	1437	0.62	25.1	C
Southbound														
Washington Rd Off Ramp	2	4600	1212	1260	1327	0.29	11.6	B	1755	1790	1884	0.41	16.5	B
Washington Rd On Ramp	1	2300	935	972	1024	0.45	17.9	B	1432	1461	1538	0.67	26.9	C
Iowa Ave Off Ramp	2	4600	1169	1216	1280	0.28	11.2	B	1582	1614	1699	0.37	14.9	B
Iowa Ave On Ramp	1	2300	1136	1181	1244	0.54	21.8	C	964	983	1035	0.45	18.1	B

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2040 Weaving LOS

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2040 NB Iowa to Barton AM_Type B.txt

HCS+: Freeway Weaving Release 5.3

Operational Analysis

Analyst: Iteris, Inc.
 Agency/Co.: Iteris, Inc.
 Date Performed: 7/24/2009
 Analysis Time Period: AM Peak Hour
 Freeway/Dir of Travel: I-215 Northbound
 Weaving Location: Iowa Av On to Barton Off
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
 Weaving number of lanes, N 5
 Weaving segment length, L 2400 ft
 Terrain type Level
 Grade %
 Length mi
 Weaving type B
 Volume ratio, VR 0.21
 Weaving ratio, R 0.33

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	A-C	B-D	A-D	B-C	
Volume, V	6509	110	1206	596	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v15	1713	29	317	157	v
Trucks and buses	7	7	7	7	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.966	0.966	0.966	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7091	119	1313	649	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.48	0.24
Weaving and non-weaving speeds, Si	48.75	55.33
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		1.07
Maximum number of lanes, Nw (max) (Exhibit 24-7)		3.50
Type of operation is		Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S 53.78 mph
 Weaving segment density, D 34.11 pc/mi/ln
 Level of service, LOS D

2040 NB Iowa to Barton AM_Type B.txt

Capacity of base condition, cb 11210 pc/h
 Capacity as a 15-minute flow rate, c 10831 pc/h
 Capacity as a full-hour volume, ch 10289 pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded	See Note
Weaving flow rate, Vw	1962	4000	a
Average flow rate (pcphpl)	1834	2300	b
Volume ratio, VR	0.21	0.80	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	2400	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2040 NB Iowa to Barton PM_Type B.txt

HCS+: Freeway Weaving Release 5.3

Operational Analysis

Analyst: Iteris, Inc.
 Agency/Co.: Iteris, Inc.
 Date Performed: 7/24/2009
 Analysis Time Period: PM Peak Hour
 Freeway/Dir of Travel: I-215 Northbound
 Weaving Location: Iowa Av On to Barton Off
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Inputs

Freeway free-flow speed, SFF 60 mph
 Weaving number of lanes, N 5
 Weaving segment length, L 2400 ft
 Terrain type Level
 Grade %
 Length mi
 Weaving type B
 Volume ratio, VR 0.24
 Weaving ratio, R 0.33

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		veh/h
	A-C	B-D	A-D	B-C	
Volume, V	7340	166	1588	769	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v15	1932	44	418	202	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.980	0.980	0.980	0.980	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7880	178	1705	825	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.56	0.31
Weaving and non-weaving speeds, Si	47.11	53.09
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		1.22
Maximum number of lanes, Nw (max) (Exhibit 24-7)		3.50
Type of operation is		Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S 51.53 mph
 Weaving segment density, D 41.10 pc/mi/ln
 Level of service, LOS E

2040 NB Iowa to Barton PM_Type B.txt

Capacity of base condition, cb 11009 pc/h
 Capacity as a 15-minute flow rate, c 10793 pc/h
 Capacity as a full-hour volume, ch 10253 pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded	See Note
Weaving flow rate, Vw	2530	4000	a
Average flow rate (pcphpl)	2117	2300	b
Volume ratio, VR	0.24	0.80	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	2400	2500	e

Notes:

- Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- Capacity constrained by basic freeway capacity.
- Capacity occurs under constrained operating conditions.
- Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

2040 Freeway Mainline LOS

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2040 SB Washington to Barton AM.txt

HCS+: Basic Freeway Segments Release 5.21

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington Ave to Barton
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8342	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2195	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1818	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1818	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.6	mi/h
Number of lanes, N	5	
Density, D	30.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8676	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2283	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1890	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1890	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	5	
Density, D	32.0	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	7639	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2010	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2081	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2081	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	4	
Density, D	36.7	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8417	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2215	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1834	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1834	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.5	mi/h
Number of lanes, N	5	
Density, D	30.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

2040 NB Barton to Washington AM.txt

HCS+: Basic Freeway Segments Release 5.21

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8660	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2279	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	1887	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1887	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.1	mi/h
Number of lanes, N	5	
Density, D	31.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: AM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	7711	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2029	v
Trucks and buses	7	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.966	
Driver population factor, fp	1.00	
Flow rate, vp	2100	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2100	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.3	mi/h
Number of lanes, N	4	
Density, D	37.3	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

 Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd to Iowa Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

 Flow Inputs and Adjustments

Volume, V	8604	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2264	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1848	pc/h/ln

 Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

 LOS and Performance Measures

Flow rate, vp	1848	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.4	mi/h
Number of lanes, N	5	
Density, D	31.1	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	7670	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2018	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2059	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2059	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	57.0	mi/h
Number of lanes, N	4	
Density, D	36.1	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

2040 SB Washington to Barton PM.txt

HCS+: Basic Freeway Segments Release 5.21

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Southbound
 From/To: Washington to Barton Rd
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8560	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2253	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	1838	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1838	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.5	mi/h
Number of lanes, N	5	
Density, D	30.9	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Iowa Ave to Barton Rd
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	9863	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2596	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2118	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2118	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	55.9	mi/h
Number of lanes, N	5	
Density, D	37.9	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd to Washington Ave
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	9692	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2551	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fhv	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2081	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	5	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, flw	0.0	mi/h
Lateral clearance adjustment, flc	0.0	mi/h
Interchange density adjustment, fid	0.0	mi/h
Number of lanes adjustment, fn	0.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2081	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	56.6	mi/h
Number of lanes, N	5	
Density, D	36.7	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Operational Analysis

Analyst: Iteris, Inc
 Agency or Company: Iteris, Inc
 Date Performed: 1/29/2008
 Analysis Time Period: PM Peak Hour
 Freeway/Direction: I-215 Northbound
 From/To: Barton Rd Off to Barton Rd On
 Jurisdiction:
 Analysis Year: 2040
 Description: Barton Road Interchange Improvement Project

Flow Inputs and Adjustments

Volume, V	8928	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2349	v
Trucks and buses	4	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.980	
Driver population factor, fp	1.00	
Flow rate, vp	2396	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	2396	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S		mi/h
Number of lanes, N	4	
Density, D		pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

APPENDIX F
Traffic Index
Calculation Worksheets

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 NB Off Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 6/9/11
 6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
	2040	2060
ADT	11,688	14,960
%TRUCKS	4.00%	4.00%
#TRUCKS	0	598

20-YEAR T.I.

AXLES	1-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	468	x 61.4%	x 1380	396306	7926
3.	468	x 15.7%	x 3680	270349	5407
4.	468	x 11.4%	x 5880	314160	6283
5.	468	x 11.4%	x 13780	736246	14725
		100%			
TOTAL				1717061	34341
T.I. =				9.60	6.03
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	598	x 61.4%	x 2760	1014544	20291
3.	598	x 15.7%	x 7360	692092	13842
4.	598	x 11.4%	x 11760	804250	16085
5.	598	x 11.4%	x 27560	1884789	37696
TOTAL				4395675	87914
T.I. =				10.73	6.74
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 NB On Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 6/9/11
 6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
	2040	2060
ADT	11,525	14,752
%TRUCKS	4.00%	4.00%
#TRUCKS	0	461
		590

20-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 20yr Constant	ONE-WAY 20 Yr. ESAL	Shoulders
2.	461	61.4%	x 1380	390796	7816
3.	461	15.7%	x 3680	266590	5332
4.	461	11.4%	x 5880	309792	6196
5.	461	11.4%	x 13780	726009	14520
		100%			
TOTAL				1693187	33864
T.I. =				9.58	6.02
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 40yr Constant	ONE-WAY 40 Yr. ESAL	Shoulders
2.	590	61.4%	x 2760	1000438	20009
3.	590	15.7%	x 7360	682470	13649
4.	590	11.4%	x 11760	793068	15861
5.	590	11.4%	x 27560	1858583	37172
TOTAL				4334559	86691
T.I. =				10.72	6.73
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 SB Off Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 6/9/11
 6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
	2040	2060
ADT	11,113	14,224
%TRUCKS	4.00%	4.00%
#TRUCKS	0	569

20-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 20yr Constant	ONE-WAY 20 Yr. ESAL	Shoulders
2.	445	61.4%	x 1380	376809	7536
3.	445	15.7%	x 3680	257048	5141
4.	445	11.4%	x 5880	298704	5974
5.	445	11.4%	x 13780	700024	14000
		100%			
TOTAL				1632585	32652
T.I. =				9.54	5.99
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY # of Trucks	% Trucks	ESAL 40yr Constant	ONE-WAY 40 Yr. ESAL	Shoulders
2.	569	61.4%	x 2760	964631	19293
3.	569	15.7%	x 7360	658043	13161
4.	569	11.4%	x 11760	764682	15294
5.	569	11.4%	x 27560	1792061	35841
TOTAL				4179418	83588
T.I. =				10.67	6.70
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 SB On Ramps
 Construction Yr: 2015

CALC BY: SBG
 CHK BY:
 DATE: 3/3/09

6/9/11

YEAR	MID YR 20 YR TI	MID YR 40 YR TI
	2040	2060
ADT	10,988	14,064
%TRUCKS	4.00%	4.00%
#TRUCKS	0	563

20-YEAR T.I.

AXLES	1-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	440	61.4%	x 1380	372570	7451
3.	440	15.7%	x 3680	254157	5083
4.	440	11.4%	x 5880	295344	5907
5.	440	11.4%	x 13780	692150	13843
		100%			
TOTAL				1614221	32284
T.I. =				9.53	5.98
USE				9.50	6.00

40-YEAR T.I.

AXLES	1-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	563	61.4%	x 2760	953780	19076
3.	563	15.7%	x 7360	650641	13013
4.	563	11.4%	x 11760	756081	15122
5.	563	11.4%	x 27560	1771903	35438
TOTAL				4132405	82648
T.I. =				10.66	6.69
USE				10.50	6.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road
 I-215 NB Aux Lane
 Construction Yr: 2015

CALC BY: SBG

CHK BY:

DATE: 6/9/11

6/9/11

	MID YR 20 YR TI	MID YR 40 YR TI
YEAR	2040	2060
ADT	33,238	42,545
%TRUCKS	4.00%	4.00%
#TRUCKS	0	1,702

20-YEAR T.I.

AXLES	1-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	1,330	x 61.4%	x 1380	1127053	22541
3.	1,330	x 15.7%	x 3680	768842	15377
4.	1,330	x 11.4%	x 5880	893437	17869
5.	1,330	x 11.4%	x 13780	2093804	41876
		100%			
TOTAL				4883137	97663
T.I. =				10.87	6.82
USE				11.00	7.00

40-YEAR T.I.

AXLES	1-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	1,702	x 61.4%	x 2760	2885256	57705
3.	1,702	x 15.7%	x 7360	1968237	39365
4.	1,702	x 11.4%	x 11760	2287200	45744
5.	1,702	x 11.4%	x 27560	5360138	107203
TOTAL				12500831	250017
T.I. =				12.16	7.63
USE				12.00	7.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Barton Road CALC BY: SBG

between I-215 on/off ramp CHK BY:

Construction Yr: 2015 DATE: 3/3/09

6/9/11

	MID YR 20 YR TI	MID YR 40 YR TI
YEAR	2040	2060
ADT	55,300	70,784
%TRUCKS	4.00%	4.00%
#TRUCKS	0	2,831

20-YEAR T.I.

AXLES	2-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	2,212	x 61.4%	x 1380	937572	18751
3.	2,212	x 15.7%	x 3680	639584	12792
4.	2,212	x 11.4%	x 5880	743232	14865
5.	2,212	x 11.4%	x 13780	1741792	34836
		100%			
TOTAL				4062180	81244
T.I. =				10.63	6.68
USE				10.50	6.50

40-YEAR T.I.

AXLES	2-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	2,831	x 61.4%	x 2760	2400184	48004
3.	2,831	x 15.7%	x 7360	1637335	32747
4.	2,831	x 11.4%	x 11760	1902674	38053
5.	2,831	x 11.4%	x 27560	4458988	89180
TOTAL				10399181	207984
T.I. =				11.89	7.47
USE				12.00	7.50

T.I. CALC FORM

DATA is for: Barton Rd Interchange

CO., ROUTE, PM: Commerce Way
 between I-215 NB ramps &
 Construction Yr: 2015

CALC BY: mhc
 CHK BY: sbg
 DATE: 4/27/09
 6/9/11

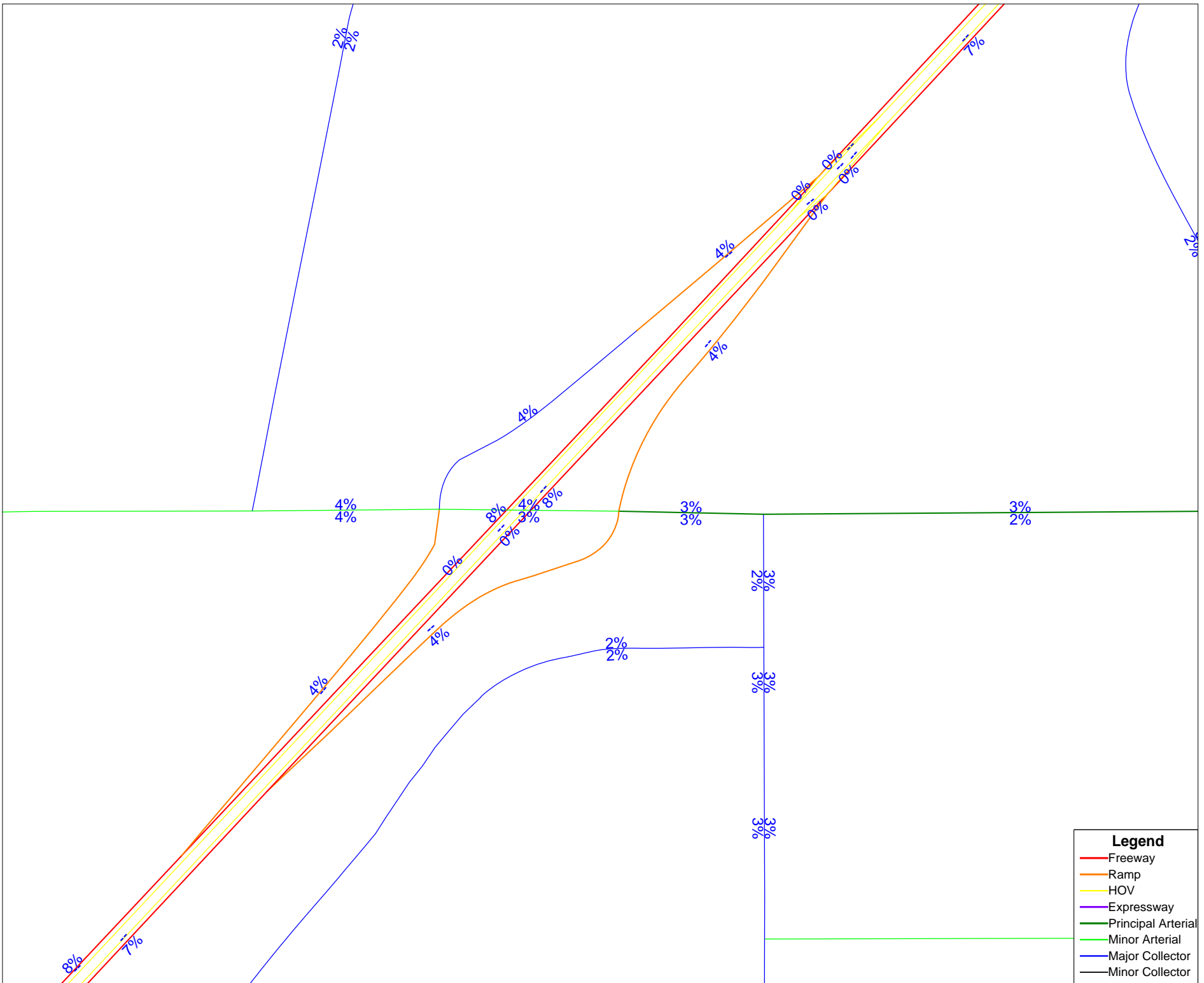
	MID YR 20 YR TI	MID YR 40 YR TI
YEAR	2040	2060
ADT	29,265	37,459
%TRUCKS	4.00%	4.00%
#TRUCKS	0	1,498

20-YEAR T.I.

AXLES	2-WAY		ESAL 20yr Constant	ONE-WAY	
	# of Trucks	% Trucks		20 Yr. ESAL	Shoulders
2.	1,171	x 61.4%	x 1380	496167	9923
3.	1,171	x 15.7%	x 3680	338471	6769
4.	1,171	x 11.4%	x 5880	393322	7866
5.	1,171	x 11.4%	x 13780	921764	18435
		100%			
TOTAL				2149723	42994
T.I. =				9.86	6.19
USE				10.00	6.00

40-YEAR T.I.

AXLES	2-WAY		ESAL 40yr Constant	ONE-WAY	
	# of Trucks	% Trucks		40 Yr. ESAL	Shoulders
2.	1,498	x 61.4%	x 2760	1270188	25404
3.	1,498	x 15.7%	x 7360	866485	17330
4.	1,498	x 11.4%	x 11760	1006903	20138
5.	1,498	x 11.4%	x 27560	2359716	47194
TOTAL				5503292	110066
T.I. =				11.02	6.92
USE				11.00	7.00



- Legend**
- Freeway
 - Ramp
 - HOV
 - Expressway
 - Principal Arterial
 - Minor Arterial
 - Major Collector
 - Minor Collector

Memorandum

Date: November 22, 2013
To: Joe Meraz, Caltrans Project Manager
From: Steve Greene, AECOM
Subject: I-215/Barton Road Interchange Improvement Project – Traffic Volume Comparison

This memorandum summarizes a comparison of anticipated opening year traffic volumes for the proposed I-215 Barton Road Interchange Improvement project in the Cities of Grand Terrace and Colton, San Bernardino County. The purpose of this memorandum is to provide conclusion on whether previously approved opening year (2016) traffic volumes are appropriate for use as the basis for traffic analysis for the project's revised opening year of 2018.

The Traffic Operations Analysis (TOA) report for this project was approved on December 21, 2011. In that document, the existing year traffic conditions were analyzed based on the 2009 intersection turning movement volumes. Opening year (2016) volumes were developed by interpolating between the 2009 volumes and the horizon year 2040 volumes, which were developed using the regional travel demand model.

In June 2012, AECOM prepared a memo to determine whether the 2009 volumes still represented 2012 traffic conditions, as traffic volumes are typically considered relevant for three years per Caltrans and FHWA practice; beyond that period, traffic volumes are reexamined to determine whether conditions have changed to the point of affecting the outcome of the TOA or other technical studies. The June 2012 analysis compared new traffic counts conducted in 2012 to the earlier traffic counts from 2009. The conclusion of that memo was that traffic volumes at the freeway interchange had decreased slightly from the 2009 volumes. Level of service (LOS) values were calculated using the 2009 traffic volumes and the 2012 traffic volumes. The calculated LOS values were almost identical at the ramp terminus intersections. Therefore, the memo concluded that the incorporating the 2012 traffic volumes into the TOA would not have an effect on its conclusions and recommended that the approved TOA remain in effect. Caltrans concurred with this recommendation on June 25, 2013. .

Thus, the current situation with regard to traffic volumes and analysis is as follows:

- 2012 volumes have been determined to be slightly lower than 2009 volumes
- 2016 volumes were developed by interpolating between 2009 volumes and 2040 volumes
- 2040 forecast volumes have not changed

From these facts, we can conclude that opening year 2018 volumes developed now (using 2012 base year volumes and horizon year 2040 volumes) would be very similar to the year 2016 volumes in the TOA that were developed using 2009 base year volumes and horizon year 2040 volumes. The slight decrease in volumes from 2009 to 2012 would be offset by the slightly later opening year, resulting in very similar volumes.

Conclusion/Recommendation

Based on the traffic count comparison conducted in June, 2012, traffic volumes were slightly lower than those collected in 2009. The decrease in the existing volumes would be offset by the project's revised opening year of 2018. Therefore, the "opening" year 2016 volumes in the TOA are appropriate to use as the updated 2018 opening year volumes.