

Final Traffic Operations Analysis Report

I-215 University Parkway Interchange

08-SBD-215 - PM 11.35 to 11.95

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San Bernardino, CA

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Executive Summary

The San Bernardino County Transportation Authority (SBCTA), in cooperation with the California Department of Transportation (Caltrans) and the City of San Bernardino (City), are proposing to improve the Interstate 215 (I-215)/University Parkway Interchange (Project) in the City of San Bernardino, California. Two alternatives are being evaluated; these two alternatives include Alternative 1 (No Build) and Alternative 2 (Diverging Diamond Interchange [DDI]).

Alternative 2 (DDI) would provide operational improvements to traffic flow associated with the I-215/University Parkway Interchange. The existing undercrossing would remain in place. This concept would improve all four legs of the current interchange and improve directional movement through the system. Using the DDI system, the interchange would allow more efficient left-turn and right-turn movements at all ramp terminals. Improvements would generally occur within previously disturbed soils in the area of the existing interchange and would not require the disturbance of adjacent building structures. No widening would be required for the I-215 bridge structure and Right of Way (ROW) impacts would be limited to temporary construction easements, and permanent curb, gutter and driveway improvements along University Parkway. No transmission towers are located within the Project limits.

The two Alternatives being analyzed in this report were selected based on the results of the University Parkway at Interstate 215 Interchange Traffic Engineering Performance Assessment (TEPA). The TEPA analyzed three Alternatives: No Build Alternative, southbound loop on-ramp Configuration, and Diverging Diamond Interchange (DDI). The TEPA analyses concluded that in 2040, the loop on-ramp alternative would provide mitigation to operational deficiencies at the intersection of the University Parkway at the southbound on-ramp in the a.m. and p.m. peak hours. The DDI alternative would provide mitigation to all operational deficiencies at the four study area intersections in both the a.m. and p.m. peak hours.

This report analyzed the following conditions: Existing (2017), Opening Year (2020) No Build and Build conditions, and Horizon Year (2040) No Build and Build conditions. The report provided evaluation and assessment of eleven study intersections, six freeway mainline segments, and four freeway ramps within the study area.

The results of the traffic analysis indicate that all study intersections and freeway mainline segments are forecasted to operate at Level of Service (LOS) D or better under the Opening Year 2020 Build conditions except for the intersection at North Varsity Avenue and North State Street/University Parkway which is expected to operate at LOS E during the morning and afternoon peak hours. Under the Horizon Year 2040 Build conditions, three of the study intersections, and two freeway segments are forecast to operate at LOS E or F. The results of the freeway mainline and ramp analysis indicate that the impacts to the freeway system are a result of future traffic demand exceeding the capacity along the I-215 and are consistent under Build and No Build conditions (See **Table E-1**, **Table E-2**, and **Table E-3**).

The intersection, freeway ramps, and freeway segments that are forecasted to operate at LOS E or F under Opening Year (2020) Build conditions and Horizon Year (2040) Build conditions are summarized below.

Intersection Analysis

Opening Year (2020) Build Conditions:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)

Horizon Year (2040) Build Conditions:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- Driveway 3 & University Parkway (AM and PM Peak Hours)
- I-215 NB Off-Ramp & University Parkway (AM Peak Hour)

Freeway Ramp Analysis

Opening Year (2020) Conditions:

- Southbound University Parkway Off-Ramp (AM Peak Hour)

Horizon Year (2040) Conditions:

- Southbound University Parkway Off-Ramp (AM and PM Peak Hours)

Freeway Mainline Analysis

Horizon Year (2040) Conditions:

- I-215 Northbound (NB) South of University Parkway On-Ramp (PM Peak Hour)
 I-215 Southbound (SB) South of University Parkway On-Ramp (AM and PM Peak Hours)

It should be noted that under the Opening Year (2020) and Horizon Year (2040) Build conditions, the proposed Project would not alter the ramps junction area and freeway mainline within the study area; hence, the LOS results for freeway ramps and mainline would be identical to the No Build conditions analysis.

In summary, the results of the analysis presented in this report (operational LOS) show that the implementation of Alternative 2 (DDI) would maintain or improve traffic operations when compared to Alternative 1 (No Build) at University Parkway and the I-215 interchange.

The traffic operational analysis in this report does not include the future I-215/Pepper-Linden-Campus Interchange in forecasts accounting for the highest 2040 volumes in the case that this proposed interchange is never constructed. The result of the analysis presented in this report represents the worst case scenario for traffic operations along University Parkway.

Table E-1 summarizes level of service (LOS) and delay for intersections and driveways within the study area for all conditions analyzed. Table E-2 summarizes freeway mainline LOS and density to quantitatively evaluate the results for all conditions analyzed. Table E-3 summarizes ramp LOS and density to quantitatively evaluate the results for all conditions analyzed.

Table E-1. Summary of Intersection LOS

No.	Intersection (N/S & E/W)		Existing		ALTERNATIVE 1 - No Build				ALTERNATIVE 2 -DDI			
			2017		2020		2040		2020		2040	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	North Varsity Avenue/North State Street & University Parkway	LOS	F	E	F	E	F	F	E	E	F	F
		Delay (Sec)	87.7	60.5	124.8	62.8	265	160	57.6	63.6	171.6	131.6
2	I-215 NB Ramp & University Parkway	LOS	E	F	F	F	F	F	A	A	D	D
		Delay (Sec)	76	92.7	104.5	120.2	207.5	197.5	8.1	7	49.3	49.1
3	I-215 SB Ramps & University Parkway	LOS	D	E	E	F	F	F	C	B	C	C
		Delay (Sec)	38.3	58.1	65.9	85.2	211.5	327.8	25	18.2	25	28.3
4	Hallmark Parkway & University Parkway	LOS	C	D	C	D	D	D	C	C	C	D
		Delay (Sec)	26.0	39.6	28.2	41	51.3	49.9	22.1	29.5	28	39.9
5	Driveway 1 & University Parkway	LOS	B	D	B	C	C	C	B	B	C	C
		Delay (Sec)	13.3	16.4	14	17.7	18	21.8	13.4	14	17.2	16.4
6	Driveway 2 & University Parkway	LOS	C	D	C	C	C	C	N/A	N/A	N/A	N/A
		Delay (Sec)	15.2	15.6	16.2	16.7	22.4	20.4	N/A	N/A	N/A	N/A
7	Driveway 3 & University Parkway	LOS	C	C	D	D	F	F	D	D	F	F
		Delay (Sec)	23.3	23.1	26.7	25.9	156.6	102.4	27.4	27.4	131.3	95.2
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	B	C	E	D
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	18.5	22.6	73.3	53.1
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	B	B	B	B
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	11.6	13.4	18.4	17.5
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	A	A	B	B
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	5.1	6.4	10.5	15.2
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	1.7	1.6	3.7	3.4

Table E-2. Summary of Freeway Mainline LOS Results

Freeway Segment ¹	Existing (2017)				Opening Year (2020) No Build/Build				Horizon Year (2040) No Build/Build			
	AM		PM		AM		PM		AM		PM	
	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS
Northbound												
North of University Pkwy On-Ramp	12.7	B	28.2	D	16.2	B	33.3	D	14.9	B	32.8	D
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	11.6	B	26.4	D	14.6	B	30.9	D	13.2	B	29.0	D
South of University Pkwy Off-Ramp	15.9	B	23.3	C	18.4	C	26.8	D	25.2	C	36.9	E
Southbound												
North of University Pkwy Off-Ramp	29.2	D	16.0	B	34.4	D	22.3	C	32.3	D	24.7	C
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	27.3	D	14.8	B	32.1	D	20.1	C	28.8	D	20.0	C
South of University Pkwy On-Ramp	29.2	D	21.2	C	29.2	D	26.5	D	50.5	F	36.5	E

¹ The freeway segments were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition basic freeway segment analysis.

Freeway LOS is based on density (cars/mile/lane).

Table E-3. Summary of Freeway Ramp LOS

Ramp/Segment Capacity	Existing (2017)				Opening Year (2020) No Build/Build				Horizon Year (2040) No Build/Build			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS
Northbound												
University Pkwy On-Ramp	14.4	B	27.9	C	15.5	B	30.1	D	13.7	B	28.3	D
University Pkwy Off-Ramp ^a	16.0	B	23.4	C	16.9	B	24.7	C	23.3	C	32.4	D
Southbound												
University Pkwy Off-Ramp	34.4	D	22.3	C	35.5	E	24.1	C	48.8	F	38.0	E
University Pkwy On-Ramp ^b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

^a Major diverge area; Highway Capacity Manual (HCM) 2010 Edition methodology (Exhibit 13-19) applied for analysis.

^b Single-lane addition/drop; Highway Capacity Manual (HCM) 2010 Edition methodology (Page 13-18) applied for analysis. The upstream and downstream freeway segments are analyzed as basic freeway segments and no separate merge or diverge analysis is performed.

The freeway ramp junctions were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition merge or diverge ramp-freeway junction analysis.

Freeway ramp junction LOS is based on density (cars/mile/lane).

N/A - not applicable

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1 Introduction

This section describes the purpose of this study, study area, and report organization.

1.1 Study Purpose

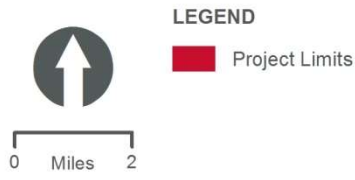
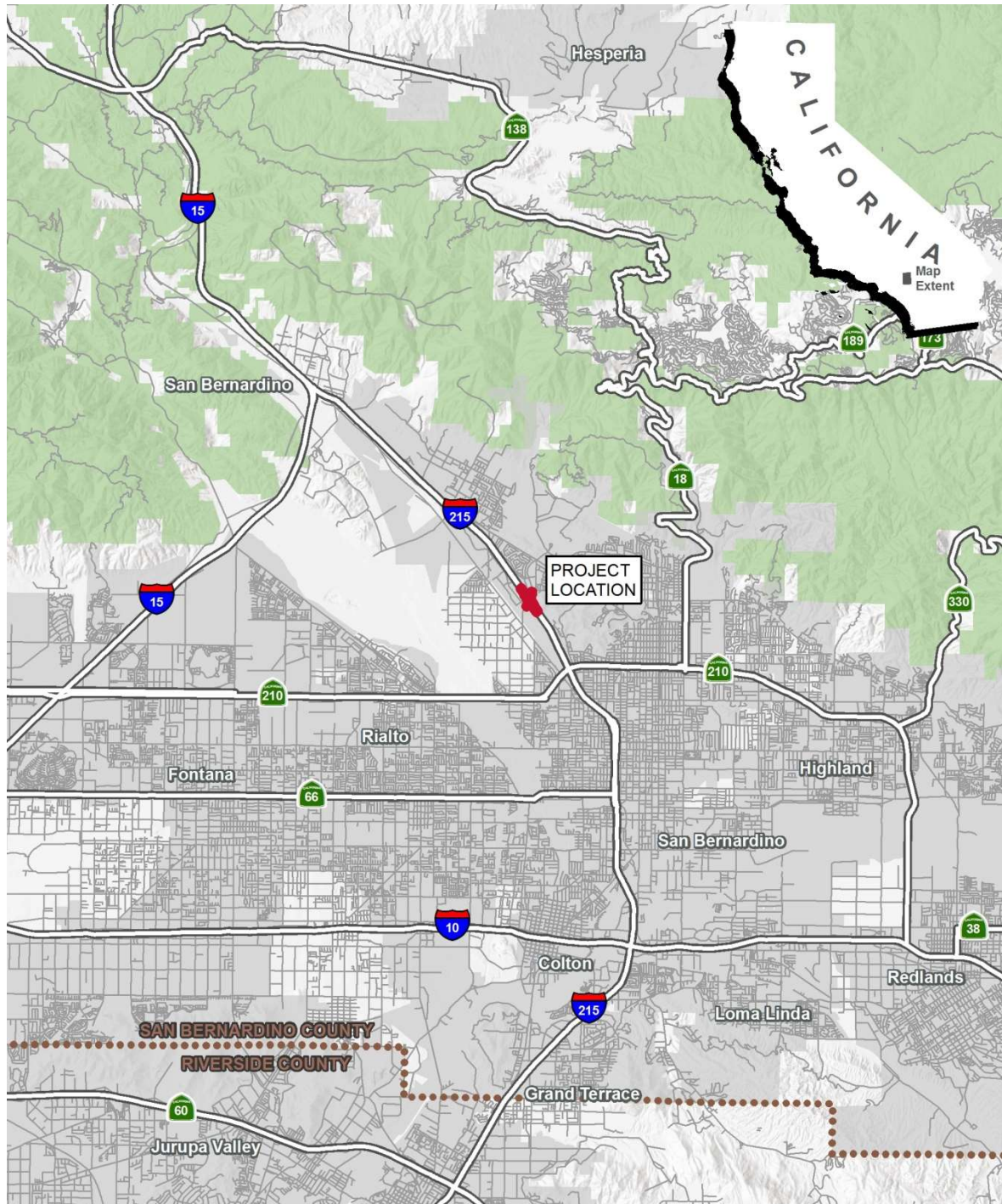
The San Bernardino County Transportation Authority (SBCTA), in cooperation with the California Department of Transportation (Caltrans) and the City of San Bernardino (City), propose improvements to the Interstate 215 (I-215)/University Parkway Interchange (Project) in the City of San Bernardino, California. The proposed Project would improve freeway access and local traffic operations by modifying the existing undercrossing interchange from a tight diamond interchange to a diverging diamond interchange (DDI).

The purpose of the proposed Project is to plan for the projected regional population growth, California State University, San Bernardino (CSUSB) enrollment increases, and increased traffic demands at the existing I-215/University Parkway Interchange. The Project proposes to reconfigure the interchanges to improve traffic operations. The objectives of the Project are to:

- Support anticipated regional growth and proposed local-area projects;
- Relieve congestion by providing improved signalized intersection operational efficiency through the interchange area; and
- Improve vehicular, bicycle and pedestrian access through the freeway ramp intersections.

The purpose of this Traffic Operations Analysis Report (TOAR) is to provide traffic related information relative to existing and future conditions—with and without the proposed Project. **Figure 1-1** shows the regional location and Project vicinity.

Figure 1-1. Regional Location and Project Vicinity



1.2 Study Area and Project Background

The Project Study Report – Project Development Study (PSR-PDS) was completed by the City of San Bernardino and approved by the California Department of Transportation (Caltrans) in October 2016. The TOAR will provide the analysis necessary to inform the geometric design of the interchange and provide data for the environmental impact analysis. This traffic operations analysis will also support the appropriate environmental technical studies for this Project. Caltrans is the lead agency for the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) compliance.

The University Parkway (Pkw) Interchange is located on Interstate 215 (I-215) at Post Mile 11.63, approximately 1.6 miles north of the State Route 210 (SR-210)/I-215 Freeway Interchange and about 2.5 miles south of the Palm Avenue Interchange.

The study area contains seven study intersections along University Parkway (between Hallmark Parkway and Varsity/State Street) under the existing conditions and I-215 freeway mainline segments and ramps (from SR-210/I-215 Freeway Interchange and the Palm Avenue Interchange). Under future year build conditions, four study intersections will be added due to specific DDI feature and the intersection at Driveway 2 and University Parkway will be eliminated. The study area will also include adjacent driveways within 500 feet west of the interchange that might be impacted by the proposed design. **Figure 1-2** shows the study intersections and driveways.

Study Intersections/Driveways:

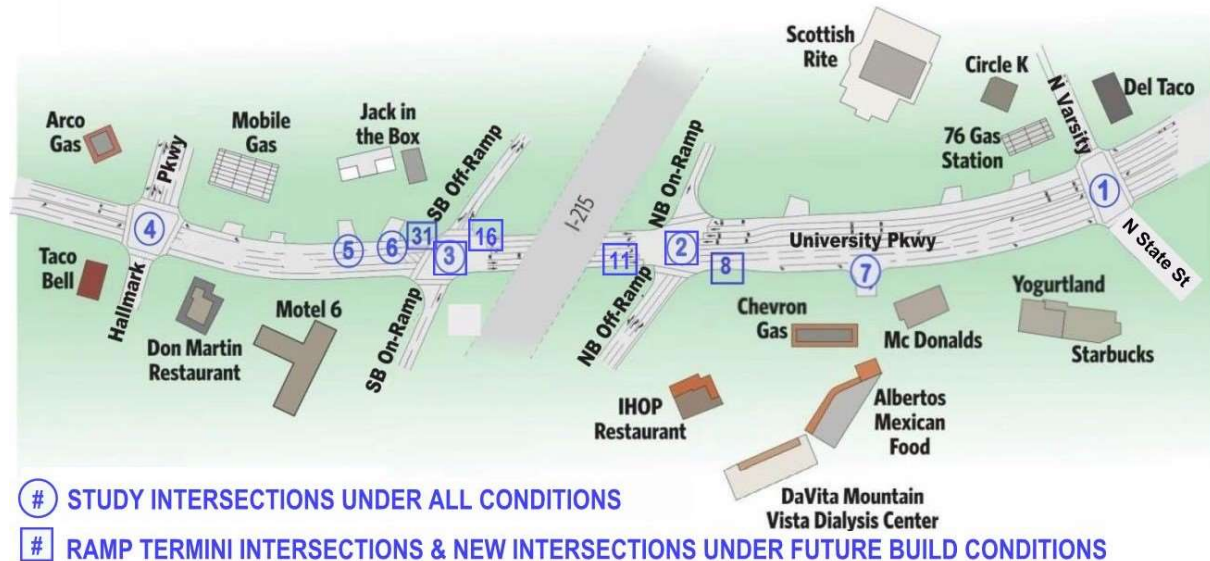
1. North Varsity Avenue / North State Street & University Parkway
2. I-215 northbound (NB) Ramps & University Parkway
3. I-215 southbound (SB) Ramps & University Parkway
4. Hallmark Parkway & University Parkway
5. Driveway 1 & University Parkway
6. Driveway 2 & University Parkway (Eliminated in the future build conditions)
7. Driveway 3 & University Parkway
8. I-215 northbound Off-ramp Right-turn Movement & University Parkway (Future intersection under build conditions)
11. I-215 northbound Off-ramp Left-turn Movement & University Parkway (Future intersection under build conditions)
16. I-215 southbound Off-ramp Left-turn Movement & University Parkway (Future intersection under build conditions)
31. I-215 southbound Off-ramp Right-turn Movement & University Parkway (Future intersection under build conditions)

Study Freeway Mainline/Ramp Facilities

- Northbound/Southbound I-215 Mainline between SR- 210 / I-215 Freeway Interchange and Palm Avenue

- Northbound I-215 On-Ramp from University Parkway
- Northbound I-215 Off-Ramp to University Parkway
- Southbound I-215 On-Ramp from University Parkway
- Southbound I-215 Off-Ramp from University Parkway

Figure 1-2. Study Area



1.3 Report Organization

Following this introduction chapter, this report is organized into the following chapters:

- 2.0 Existing Conditions – This chapter describes the existing traffic network within the study area and summarize operational deficiencies for existing traffic conditions including accident analysis.
- 3.0 Traffic Volume Forecasts – This chapter describes the projected long-range future traffic conditions based on the future forecasts for the Opening Year (2020) and Horizon Year (2040).
- 4.0 Traffic Operation Analysis – This chapter describes the methodologies and standards utilized to analyze existing and future traffic conditions and provide analysis results for Existing (2017), Opening Year (2020) and Horizon Year (2040) conditions.
- 5.0 Summary and Conclusion – This chapter summarizes the overall study results and findings.

2 Existing Conditions

This section describes key roadway segments and intersections; reports existing daily roadway and peak hour intersection traffic volume information, and summarizes existing operational deficiencies.

2.1 Existing Roadway Network

Interstate 215 – is a 54.5-mile-long north-south interstate highway with a southern terminus in the City of Murrieta at I-15 and northern terminus in the City of San Bernardino at I-15. I-215 is an auxiliary route of I-15.

University Parkway – is a six-lane east-west major arterial with a northern terminus at California State University, San Bernardino and southern terminus south of Nolan Street. University Parkway serves as the main access road to California State University San Bernardino. Commercial and residential land uses can be found along University Parkway.

Hallmark Parkway – is a 4-lane secondary arterial with a southern terminus at Ostrem Way and northern terminus north of Lexington Way. Within the study area, land uses along Hallmark Parkway include industrial and commercial.

North State Street – is a 2-lane north-south collector with a northern terminus at Sheridian Drive and southern terminus at University Parkway. Within the study area, North State Street provides access to residential land uses.

North Varsity Street – is a 2-lane north-south facility with a northern terminus at College Avenue and southern terminus at University Parkway. North Varsity provides access to commercial and residential land uses.

2.2 Existing Volumes

Existing traffic counts at the driveways, roadway segments and freeway facilities were collected in Spring (March 3-8, 2017) when CSUSB and other schools were in session and are used in the development of future forecasts. Counts were collected for morning (AM) and afternoon (PM) peak periods during Tuesday, Wednesday and Thursday when appropriate. Traffic counts from previous studies were used as appropriate. California Department of Transportation (Caltrans) Performance Measurement System (PeMS) data have been used to collect freeway counts for the same days of the week for freeway analysis. Daily traffic data was also collected to confirm the peak hours of the day and identify operational characteristics of the roadway along University Parkway.

Freeway and Ramp Volume

Existing freeway mainline and ramp counts were extracted from PeMS. Freeway traffic volumes under the Existing (2017) conditions are shown in **Figure 2-1** and summarized in **Table 2-1** and **Table 2-2**.

Intersection Turning Movement Volume

Intersection peak hour turning movement volumes were developed from available traffic counts from previous studies and traffic counts collected in Spring 2017 at the driveways, roadway segments and freeway facilities. Traffic count data are provided in **Appendix A**.

Intersection peak hour turning movement volumes under Existing (2017) conditions are shown in Figure 2-1 and summarized in **Table 2-3**.

Table 2-1. Existing (2017) I-215 Freeway Mainline/Ramp AM/PM Peak Hour Volumes

Freeway Segment	Segment Type	AM Peak Hour	PM Peak Hour
Northbound			
North of University Pkwy On-Ramp	Basic	1,435	2,945
University Pkwy On-Ramp	Ramp	125	180
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	Basic	1,310	2,765
University Pkwy Off-Ramp	Ramp	2,015	2,100
South of University Pkwy Off-Ramp	Basic	3,325	4,865
Southbound			
North of University Pkwy Off-Ramp	Basic	3,180	1,955
University Pkwy Off-Ramp	Ramp	165	145
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	Basic	3,015	1,810
University Pkwy On-Ramp	Ramp	1,755	1,795
South of University Pkwy On-Ramp	Basic	4,770	3,605

Note: Volumes do not include Passenger Car Equivalents (PCE)

Table 2-2. Existing (2017) I-215 Freeway Mainline/Ramp Average Daily Traffic (ADT)

Freeway Segment	Existing 2017 ADT	AM Peak Hour Directional Split Percentage (NB/SB)	PM Peak Hour Directional Split Percentage (NB/SB)
North of University Pkwy On-Ramp	56,000	55/45	43/57
South of University Pkwy Off-Ramp	76,000	55/45	43/57
NB University Pkwy On-Ramp	5,200	n/a	n/a
NB University Pkwy Off-Ramp	16,000	n/a	n/a
SB University Pkwy On-Ramp	18,000	n/a	n/a
SB University Pkwy Off-Ramp	4,000	n/a	n/a

Note: NB=Northbound, SB=Southbound



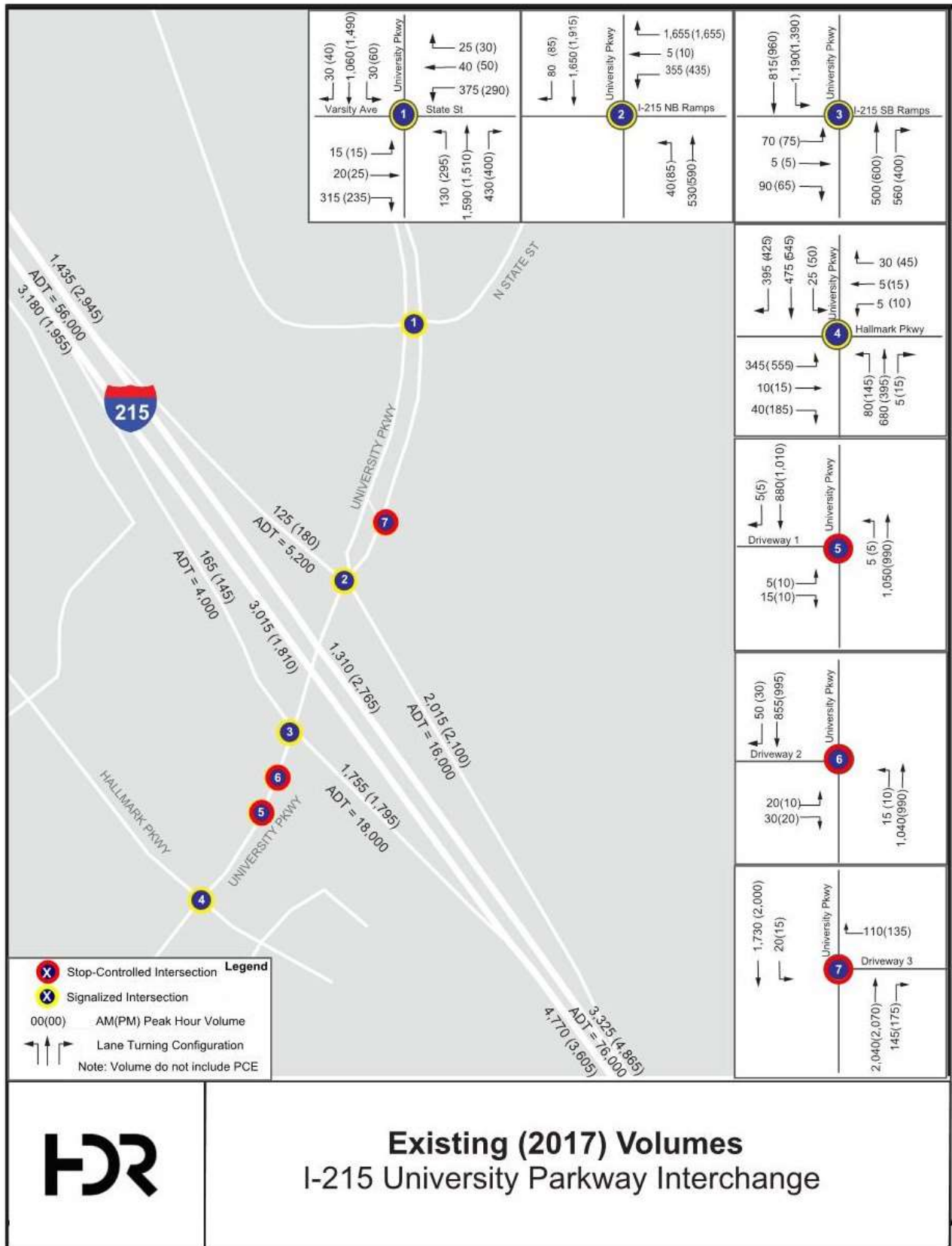
Table 2-3. Existing (2017) Intersection AM/PM Peak Hour Volumes

AM Peak Hour													
No.	Intersection (N/S & E/W)	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	North Varsity Avenue/North State Street & University Parkway	375	40	25	15	20	315	130	1,590	430	30	1,060	30
2	I-215 NB Ramps & University Parkway	355	5	1,655	0	0	0	40	530	0	0	1,650	80
3	I-215 SB Ramps & University Parkway	0	0	0	70	5	90	0	500	560	1,190	815	0
4	Hallmark Parkway & University Parkway	5	5	30	345	10	40	80	680	5	25	475	395
5	Driveway 1 & University Parkway	0	0	0	5	0	15	5	1,050	0	0	880	5
6	Driveway 2 & University Parkway	0	0	0	20	0	30	15	1,040	0	0	855	50
7	Driveway 3 & University Parkway	0	0	110	0	0	0	0	2,040	145	20	1,730	0
PM Peak Hour													
1	North Varsity Avenue/North State Street & University Parkway	290	50	30	15	25	235	295	1,510	400	60	1,490	40
2	I-215 NB Ramps & University Parkway	435	10	1,655	0	0	0	85	590	0	0	1,915	85
3	I-215 SB Ramps & University Parkway	0	0	0	75	5	65	0	600	400	1,390	960	0
4	Hallmark Parkway & University Parkway	10	15	45	555	15	185	145	395	15	50	545	425
5	Driveway 1 & University Parkway	0	0	0	10	0	10	5	990	0	0	1,010	5
6	Driveway 2 & University Parkway	0	0	0	10	0	20	10	990	0	0	995	30
7	Driveway 3 & University Parkway	0	0	135	0	0	0	0	2,070	175	15	2,000	0

Note: Volumes do not include Passenger Car Equivalents (PCE)

NBL=Northbound left; NBT=Northbound through; NBR=Northbound right; SBL=Southbound left; SBT=Southbound through; SBR=Southbound right
EBL=Eastbound left; EBT=Eastbound through; EBR=Eastbound right; WBL=Westbound left; WBT= Westbound through; WBR= Westbound right

Figure 2-1. Existing (2017) Volumes



2.3 Accident Analysis

Traffic accident data was assembled from Caltrans' Traffic Accident and Surveillance Analysis Systems (TASAS) for a 36 month period, from September 2012 through August 2015.

Table 2-4 and **Table 2-5** provides a summary of Caltrans' TASAS Table B- Selective Accident Rate Calculation (Table B). Table B provides actual and average accident rates for highways, ramps, and intersections. TASAS Selective Accident Retrieval (TSAR) provides a summary of type of accident by location. TSAR data for the study area can be found in **Table 2-6** and **Table 2-7**. Accident data for the study area was also collected from Statewide Integrated Traffic Records System (SWITRS) for a 36 month period from September 2012 through August 2015 (**Table 2-8**).

As shown in Table 2-4, accident rates for the fatal accidents along the northbound and southbound I-215 mainline (PM 10.050 to 14.091) are higher compared to the statewide average accident rate. As shown in Table 2-5, the accident rates for the total number of accidents at I-215 northbound University Parkway On-Ramp (PM 11.816) and Off-Ramp (PM 11.443) are higher than the average statewide accident rate.

As shown Table 2-6, I-215 northbound On/Off-Ramps (PM 11.816/11.443) account for the largest amount of accidents that have occurred at University Parkway Off-Ramp, 87.5% of which have been identified as rear-ends. For the freeway mainline, similar to freeway ramps, majority of the type of accidents that occurred are identified as rear-ends (Table 2-7). For both the freeway mainline and ramps, the primary collision factor of the accidents is due to unsafe speed.

Along University Parkway, the intersections of North Varsity Avenue/North State Street and University Parkway and I-215 NB Ramps and University Parkway account for the largest amount of accidents within the study area. As shown in Table 2-8, majority of the type of accidents that occurred are identified as rear-ends and the primary collision factor of the accidents was are due to unsafe speed. It should be noted that there are no reported pedestrian and bike accidents in the SWITRS traffic accident data.

Table 2-4. I-215 Mainline TASAS Accident Data Summary

PM (post mile)	Location	Accident Rates					
		Actual			Average		
		Fatal	F+I	Total	Fatal	F+I	Total
<i>I-215 Northbound</i>							
PM 10.050-14.091	JCT RTE 210 to Palm Avenue	0.007	0.14	0.5	0.004	0.22	0.69
<i>I-215 Southbound</i>							
PM 10.050-14.091	Palm Avenue to JCT RTE 210	0.015	0.27	0.52	0.004	0.22	0.69

Source: Caltrans District 8 TASAS Table B (September 2012 to August 2015)

Notes: the accident rate is the number of accidents per million vehicle-miles.

Bold indicates an actual accident rate that is higher than the average accident rate for the ramp.

Table 2-5. I-215 Freeway Ramp TASAS Accident Data Summary

PM (post mile)	Location	Accident Rates					
		Actual			Average		
		Fatal	F+I	Total	Fatal	F+I	Total
<i>I-215 Northbound</i>							
11.443	University Parkway Off-Ramp	0	0.63	1.37	0.003	0.35	1.01
11.816	University Parkway On-Ramp	0	0.18	1.05	0.002	0.22	0.63
<i>I-215 Southbound</i>							
11.458	University Parkway On-Ramp	0	0.1	0.56	0.002	0.22	0.63
11.857	University Parkway Off-Ramp	0	0	0.69	0.003	0.35	1.01

Source: Caltrans District 8 TASAS Table B (September 2012 to August 2015)

Notes: the accident rate is the number of accidents per million vehicle-miles.

Bold indicates an actual accident rate that is higher than the average accident rate for the ramp.



Table 2-6. I-215 Freeway Ramp Type of Accident

PM (post mile)	Location	Accident Type	Head-on	Sideswipe	Rear End	Broadside	Hit Object	Overturn	Auto-pedestrian	Other	Not Stated	Invalid	TOTAL
I-215 Northbound													
11.443	University Parkway Off-Ramp	Percentage	0.0%	4.2%	87.5%	4.2%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	100%
11.816	University Parkway On-Ramp	Percentage	0.0%	16.7%	16.7%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100%
I-215 Southbound													
11.458	University Parkway On-Ramp	Percentage	0.0%	63.6%	27.3%	9.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%
11.857	University Parkway Off-Ramp	Percentage	0.0%	0.0%	66.7%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100%

Source: Caltrans District 8 TASAS Selective Accident Retrieval (TSAR) (September 2012 to August 2015)

Bold indicates most occurring accident

Blue Bold indicates second most occurring accident

Table 2-7. Freeway Mainline Type of Accident for I-215

PM (post mile)	Location	Accident Type	Head-on	Sideswipe	Rear End	Broadside	Hit Object	Overturn	Auto-pedestrian	Other	Not Stated	Invalid	TOTAL
I-215 Northbound													
10.05 to 14.09	JCT RTE 210 to Palm Avenue	Percentage	0.0%	17.9%	43.3%	1.5%	32.8%	3.0%	1.5%	0.0%	0.0%	0.0%	100%
I-215 Southbound													
10.05 to 14.09	Palm Avenue to JCT RTE 210	Percentage	0.0%	14.5%	29.0%	2.9%	37.7%	13.0%	1.4%	1.4%	0.0%	0.0%	100%

Source: Caltrans District 8 TASAS Selective Accident Retrieval (TSAR) (September 2012 to August 2015)

Bold indicates most occurring accident

Blue Bold indicates second most occurring accident

Table 2-8. SWITRS Type of Accident for University Parkway

Primary Road	Accident Type	Head-on	Sideswipe	Rear End	Broadside	Hit Object	Overturn	Auto-pedestrian	Other	Not Stated	Invalid	TOTAL
North Varsity Ave/North State St & University Pkwy	<i>Percentage</i>	0.0%	12.5%	25.0%	25.0%	25.0%	0.0%	12.5%	0.0%	0.0%	0.0%	100%
Hallmark Pkwy & University Pkwy	<i>Percentage</i>	0.0%	0.0%	66.7%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100%
NB 215 & University Pkwy	<i>Percentage</i>	0.0%	0.0%	77.8%	0.0%	22.2%	0.0%	0.0%	0.0%	0.0%	0.0%	100%
SB 215 & University Pkwy	<i>Percentage</i>	0.0%	40.0%	40.0%	0.0%	0.0%	20.0%	0.0%	0.0%	0.0%	0.0%	100%

Source: Statewide Integrated Traffic Records System (SWITRS) (September 2012 to August 2015)

Bold indicates most occurring accident

Blue Bold indicates second most occurring accident

2.4 Existing Deficiencies

Sustained growth and development that has characterized this study area over the last two decades has resulted in increased commuter traffic. This increased traffic has generated traffic demands that are forecasted to exceed the existing capacity of the facilities which have resulted in severe congestion and operational breakdown of the University Parkway interchange. These poor operating conditions are expected to further worsen without any implementation of improvements.

The following transportation deficiencies have been identified within the Project Area:

- Poor Intersection Level of Service

Extensive commercial and industrial developments, as well as the expansion of CSUSB, which is expected to increase its student population from 15,000 to 25,000 in the next 10 years, have contributed to the growth in the Project area. Existing (2017) conditions indicates that both the northbound and southbound ramps intersections currently operate at LOS E or F during PM peak hours.

- Queuing

Existing inadequate queuing capacity at the southbound entrance ramp have resulted in severe congestion and the operational breakdown of the interchange. These operating conditions are expected to improve with the proposed widening at the interchange ramps as part of the Build Alternative.

- Safety

I-215 northbound On/Off-Ramps account for the largest amount of accidents with accident rates higher than average statewide rates. Among all accidents have occurred at University Parkway Off-Ramp, 87.5% of which have been identified as rear-ends. The primary collision factor of the accidents is due to unsafe speed. The Build Alternative will improve traffic operations at the ramp termini and alleviate congestion and queue at the interchange ramps. Safety benefits with the implementation of the proposed Build Alternative are summarized below.

The Highway Safety Manual (HSM) contains a Crash Modification Factors (CMF) for converting a diamond to DDI interchange. The existing condition is a diamond interchange, and the CMF predicts a 59% reduction in total crashes (standard error +/- 3%) and a 41% reduction in fatal/severe injury crashes (standard error +/- 3%) with the conversion of the base condition to a DDI under the Build Alternative.

The proposed Build Alternative would reduce the number of conflict points from 26 (conventional diamond interchange) to 14 for DDI. It would also reduce speed through the interchange from crossover geometry and reverse curves as well as reduction in speed differential on southbound and northbound entrance ramps.

It should be noted that there are currently no reported pedestrian or bicycle accidents in the study area. Also, it is forecasted that pedestrian and bicycle traffic are projected to be maintained or projected with very low growth; therefore, pedestrian and bicycle conflicts will be maintained within the study area.

- Non-motorized infrastructure

There is continuity of sidewalk along University Parkway between Hallmark Parkway and North Varsity Avenue/North State Street; however, there is currently no dedicated bicycle infrastructure within the Project Limits. The existing Class II bike lane begins/ends just east of the intersection of North Varsity Avenue/North State Street and University Parkway. The proposed Build Alternative will provide continuity and improvement for bike and pedestrian access within the study area. Pedestrian and bicycle benefits with the implementation of the proposed Build Alternative are summarized below.

Bicycles can be accommodated through the I-215 Ramp Termini intersections in two ways with the proposed Build (DDI) alternative. Bicyclists may choose to take the shoulder/lane and travel through the DDI as a vehicle or travel on the pedestrian facilities which allow bicyclists to leave the roadway and navigate through the core of the DDI in the same manner as a pedestrian. The Build alternative proposes to provide a pedestrian pathway between the SB ramps and NB ramps. For further visual enhancement, green paint may be used to designate bike lanes when appropriate.

The build alternative also shows potential pedestrian improvements that can be added with the Project to improve pedestrian access across and along University Parkway. At-grade pedestrian and bike crossings can be provided to allow access between the north and south sides of University Parkway.

It should be noted that currently there is a low volume of pedestrian and bicycle traffic (crossing at the intersection approaches) occurring in either the AM or PM peak hours at the University Parkway at I-215 ramps and North Varsity Avenue/North State Street intersections (see Appendix A). It is forecasted that pedestrian and bicycle traffic will slightly increase as the student population on the CSUSB campus rises and local land uses provide services for the students. The alternative design will address this demand.

3 Traffic Volume Forecasts

This chapter describes the alternatives under consideration and the methodology for performing traffic forecasts and the traffic volumes projected for Year 2020 and 2040 conditions at key roadway segments and intersections.

3.1 Project Alternatives

Alternative 1: No Build – This alternative would maintain the facility as is and therefore traffic operation would not be improved.

Alternative 2: Diverging Diamond Interchange (DDI) – Replacement of the existing University Parkway tight diamond interchange configuration with a DDI configuration. The existing undercrossing would remain in place. This concept would improve all four legs of the current interchange and improve directional movement through the system. Using the DDI system, the interchange would allow more efficient left-turn and right-turn movements at all ramp terminals. Preliminary design geometrics are provided in **Appendix E**.

3.2 Traffic Forecasting Methodology

The land use and roadway improvement assumptions contained in the Transportation Demand Forecasting (TDF) model were reviewed and modified to develop the traffic forecasts. Forecasts were prepared for the I-215 mainline and ramps and the study intersections for the Project.

Horizon Year 2040 traffic volumes were developed using the San Bernardino County Transportation Analysis Model (SBTAM) travel demand model base and forecast year model volumes. SBTAM is the sub-regional model which is consistent with the 2016 Southern California Association of Governments (SCAG) Regional Transportation Plan (RTP) Model. The SCAG model has a base year of 2012 and a forecast year of 2040. SBTAM is the sub-regional modeling tool that SBCTA utilizes for forecasting purposes and SBTAM was updated to be consistent with the 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) input data for San Bernardino County. In addition, SBTAM was updated to be consistent with the CSUSB Master Plan and adjustments include the following:

- Employment assignment in adjacent traffic analysis zone;
- Network revisions including additional centroid connectors in the CSUSB zone;
- Origin-Destination (O-D) trip matrices to be consistent with future student enrollment and campus employment per CSUSB Master Plan.

SBCTA provided AM peak period, PM peak period and daily traffic volume model plots that are included in **Appendix B**.

Future Year Model

Future traffic forecasts at the study intersections and freeway facilities under the Opening Year 2020 and Horizon Year 2040 was developed utilizing SBTAM and adjusted

consistent with methodologies delineated in the National Cooperative Highway Research Program Report (NCHRP) 255 published by the Transportation Research Board (TRB). The Base Year (2012) and Future Year (2040) SBTAM models were used to calculate the annual growth at study facilities, which will be applied to existing traffic counts using the difference method (Existing Counts + Model Growth) or using the furness method (using approach and departure growth to adjust intersection forecasts) to generate 2040 and interim year volumes. The adjusted forecasts was balanced along the corridor to ensure that vehicles do not “disappear” in the Synchro simulation model. In order to balance the volumes, conservation of flow will be applied beginning with the upstream volumes and accounting for any trips entering or exiting the corridor through the study area. Additionally, since the forecasts will produce 2040 projections, linear interpolation will be used to develop the opening year 2020 traffic projections.

The balanced forecast for each scenario was compared to existing traffic counts and one another to ensure the reasonableness of the forecasts. The proposed forecasts was provided to Caltrans for review and approval prior to completing our analysis for design year and opening year conditions as part of the Project Approval/Environmental Document (PA/ED) process.

SBTAM provided 2040 forecasts for with and without project conditions. The 2040 baseline roadway network assumptions are consistent with the RTP/SCS project list and included the following projects in the vicinity of the project study area that could impact study area traffic forecasts:

- I-215 HOV lanes each direction between SR 210 and I-15;
- I-215/Pepper-Linden-Campus Future Interchange (New interchange north of University Parkway) – It is currently in the 2016 RTP but is not identified in the network for the SBTAM modeling. Including the Pepper-Linden interchange in the model would not result in a worst case scenario for traffic projections at the University Parkway interchange for future forecast volumes. CSUSB and local traffic would be distributed between the two interchanges thus reducing traffic demand at University Parkway. However, funding does not currently exist to environmentally clear and construct the Pepper/Linden interchange and Measure I is unlikely to provide funding prior to the project opening year listed in the RTP.

The traffic operational analysis in this report does not include the future interchange in forecasts allowing for the highest 2040 volumes in case the future interchange is never constructed. The analysis provided an assessment of the level of impacts this future facility will have on the operation of University interchange.

3.3 2020 and 2040 Traffic Volumes

Intersection Turning Movement Volume

Intersection peak hour turning movement volumes were developed from available traffic counts from previous studies and existing traffic counts collected in Spring 2017 at the driveways, roadway segments and freeway facilities. The intersection post-processing procedure is used to develop future peak hour intersection turning movement forecasts. Opening Year 2020 traffic volumes were interpolated between existing count volumes and 2040 forecast volumes. A comparison table of forecast traffic volumes has been included in **Appendix C**.

Under future years 2020 and 2040 No Build conditions, there are a total of seven study intersections (#1 through #7) as listed in Section 1.2. Under future years 2020 and 2040 Build conditions, ramp intersections #2 and #3 were revised to provide only eastbound and westbound through movement due to specific DDI lane configuration. Additionally, four more study intersections, #8, #11, #16, and #31, are added to provide the off ramp approaches at the two ramp intersections. Combined intersections #2, #8, and #11 serve all the approaches for the northbound I-215 ramp intersection. Similarly, combined intersection #3, #16, and #31 serve all the approaches for the southbound I-215 ramp intersection.

Intersection peak hour turning movement volumes under the Opening Year 2020, and Horizon Year 2040 are displayed in **Figure 3-1**, **Figure 3-2**, **Figure 3-3**, and **Figure 3-4** and summarized in **Table 3-1** and **Table 3-2**, respectively.

Freeway and Ramp Volume

Existing freeway mainline and ramp counts were extracted from PeMS. Horizon Year 2040 freeway volumes were developed based on SBTAM travel demand model base and forecast year model volumes. Opening Year 2020 traffic volumes were interpolated between existing count volumes and 2040 forecast volumes.

Freeway traffic volumes under the Opening Year 2020, and Horizon Year 2040 are summarized in **Table 3-3**, **Table 3-4**, and **Table 3-5**, respectively.

It should be noted that 2020 and 2040 volumes under No Build and Build conditions are identical since the geometrics at the interchange would not impact traffic patterns and the demand at the interchange would remain consistent between Alternatives. The volumes in Table 3-1, Table 3-2, Table 3-3, Table 3-4, and Table 3-5 are for both build and no build conditions.

Table 3-1. Opening Year (2020) Intersection AM/PM Peak Hour Volumes

<i>AM Peak Hour</i>													
No.	Intersection (N/S & E/W)	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	North Varsity Avenue/North State Street & University Parkway	390	50	30	20	30	320	135	1,755	435	30	1,145	30
2	I-215 NB Ramps & University Parkway	365	5	1,750	N/A	N/A	N/A	50	610	N/A	N/A	1,740	95
3	I-215 SB Ramps & University Parkway	N/A	N/A	N/A	95	10	110	N/A	565	630	1,235	870	N/A
4	Hallmark Parkway & University Parkway	5	5	35	380	15	45	90	775	10	30	510	430
5	Driveway 1 & University Parkway	N/A	N/A	N/A	5	N/A	15	5	1,185	N/A	N/A	955	5
6	Driveway 2 & University Parkway	N/A	N/A	N/A	20	N/A	30	15	1,175	N/A	N/A	930	50
7	Driveway 3 & University Parkway	N/A	N/A	110	N/A	N/A	N/A	N/A	2,215	145	20	1,835	N/A
<i>PM Peak Hour</i>													
1	North Varsity Avenue/North State Street & University Parkway	295	75	35	15	35	240	300	1,635	415	65	1,640	45
2	I-215 NB Ramps & University Parkway	435	15	1,720	N/A	N/A	N/A	110	670	N/A	N/A	2,050	110
3	I-215 SB Ramps & University Parkway	N/A	N/A	N/A	115	10	90	N/A	665	410	1,465	1,020	N/A
4	Hallmark Parkway & University Parkway	15	20	50	585	15	200	150	435	20	55	610	440
5	Driveway 1 & University Parkway	N/A	N/A	N/A	10	N/A	10	5	1,065	N/A	N/A	1,095	5
6	Driveway 2 & University Parkway	N/A	N/A	N/A	10	N/A	20	10	1,065	N/A	N/A	1,080	30
7	Driveway 3 & University Parkway	N/A	N/A	135	N/A	N/A	N/A	N/A	2,215	175	15	2,160	N/A

Note: Volumes do not include Passenger Car Equivalents (PCE)
N/A=Not Applicable

Table 3-2. Horizon Year (2040) Intersection AM/PM Peak Hour Volumes

<i>AM Peak Hour</i>													
No.	Intersection (N/S & E/W)	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	North Varsity Avenue/North State Street & University Parkway	400	55	40	25	35	335	150	3,075	465	35	1,585	35
2	I-215 NB Ramps & University Parkway	425	10	2,510	N/A	N/A	N/A	95	1,215	N/A	N/A	2,160	140
3	I-215 SB Ramps & University Parkway	N/A	N/A	N/A	295	10	195	N/A	1,015	640	1,410	1,175	N/A
4	Hallmark Parkway & University Parkway	10	10	50	435	20	55	130	1,165	15	60	730	570
5	Driveway 1 & University Parkway	N/A	N/A	N/A	5	N/A	15	5	1,645	N/A	N/A	1,345	5
6	Driveway 2 & University Parkway	N/A	N/A	N/A	20	N/A	30	15	1,635	N/A	N/A	1,320	50
7	Driveway 3 & University Parkway	N/A	N/A	110	N/A	N/A	N/A	N/A	3,580	145	20	2,300	N/A
<i>PM Peak Hour</i>													
1	North Varsity Avenue/North State Street & University Parkway	300	80	40	20	40	250	320	2,710	505	80	2,310	50
2	I-215 NB Ramps & University Parkway	445	25	2,315	N/A	N/A	N/A	275	1,260	N/A	N/A	2,600	245
3	I-215 SB Ramps & University Parkway	N/A	N/A	N/A	470	15	190	N/A	1,065	420	1,860	1,185	N/A
4	Hallmark Parkway & University Parkway	25	25	100	735	20	285	175	645	25	75	790	505
5	Driveway 1 & University Parkway	N/A	N/A	N/A	10	N/A	10	5	1,475	N/A	N/A	1,360	5
6	Driveway 2 & University Parkway	N/A	N/A	N/A	10	N/A	20	10	1,475	N/A	N/A	1,345	30
7	Driveway 3 & University Parkway	N/A	N/A	135	N/A	N/A	N/A	N/A	3,400	175	15	2,845	N/A

Note: Volumes do not include Passenger Car Equivalents (PCE)
N/A=Not Applicable

Table 3-3. Opening Year (2020) I-215 Freeway Mainline/Ramp AM/PM Peak Hour Volumes

Freeway Segment	Segment Type	AM Peak Hour	PM Peak Hour
<i>Northbound</i>			
North of University Pkwy On-Ramp	Basic	1,550	3,195
University Pkwy On-Ramp	Ramp	150	235
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	Basic	1,400	2,960
University Pkwy Off-Ramp	Ramp	2,120	2,170
South of University Pkwy Off-Ramp	Basic	3,520	5,130
<i>Southbound</i>			
North of University Pkwy Off-Ramp	Basic	3,290	2,140
University Pkwy Off-Ramp	Ramp	215	215
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	Basic	3,075	1,925
University Pkwy On-Ramp	Ramp	1,875	1,885
South of University Pkwy On-Ramp	Basic	4,950	3,810

Note: Volumes do not include Passenger Car Equivalent (PCE)

Table 3-4. Horizon Year (2040) I-215 Freeway Mainline/Ramp AM/PM Peak Hour Volumes

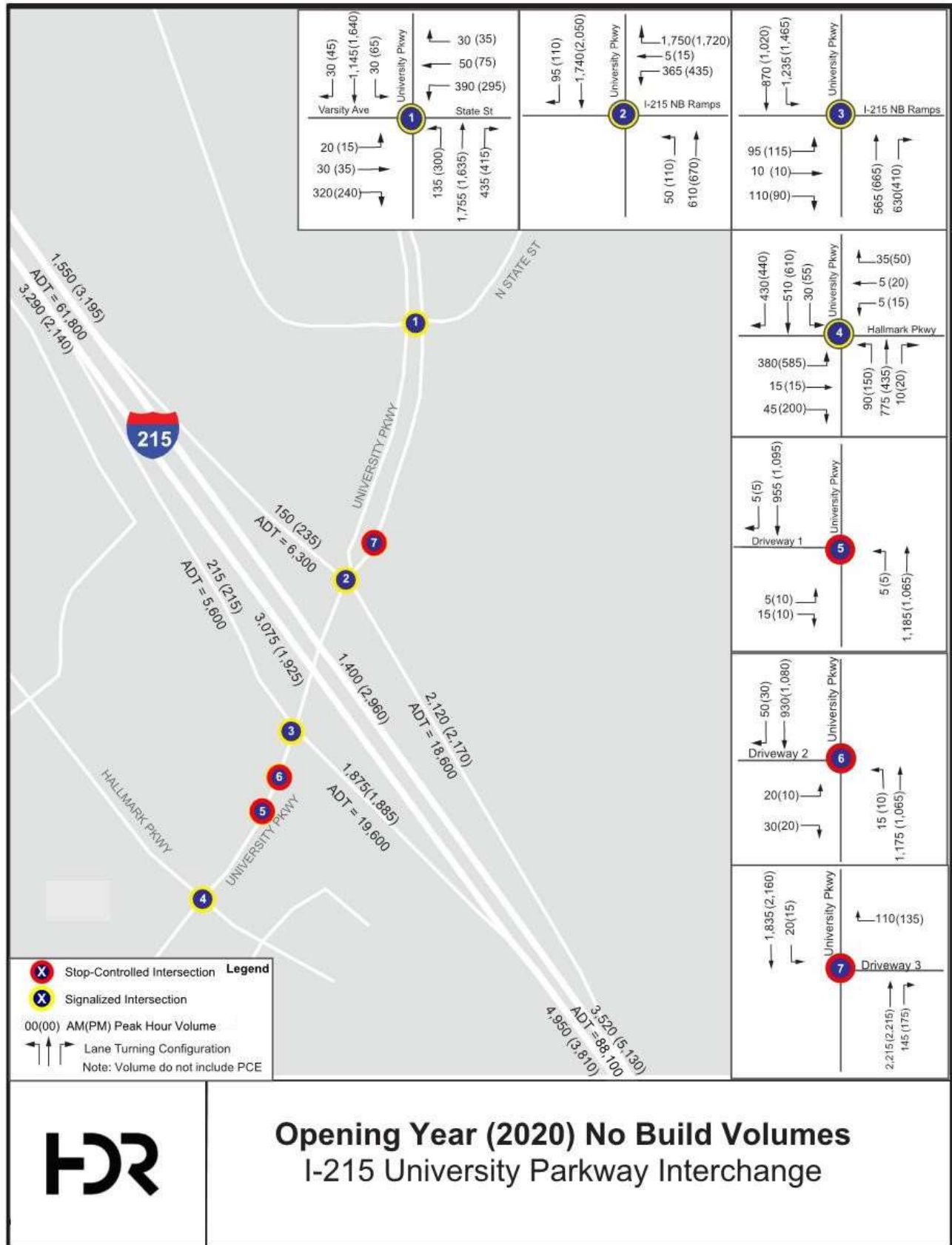
Freeway Segment	Segment Type	AM Peak Hour	PM Peak Hour
Northbound			
North of University Pkwy On-Ramp	Basic	2,140	4,720
University Pkwy On-Ramp	Ramp	245	545
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	Basic	1,895	4,175
University Pkwy Off-Ramp	Ramp	2,945	2,785
South of University Pkwy Off-Ramp	Basic	4,840	6,960
Southbound			
North of University Pkwy Off-Ramp	Basic	4,640	3,550
University Pkwy Off-Ramp	Ramp	500	675
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	Basic	4,140	2,875
University Pkwy On-Ramp	Ramp	2,060	2,295
South of University Pkwy On-Ramp	Basic	6,200	5,170

Note: Volumes do not include Passenger Car Equivalents (PCE)

Table 3-5. I-215 Freeway Mainline/Ramp Average Daily Traffic (ADT)

Freeway Segment	Opening Year 2020 ADT	Horizon Year 2040 ADT
North of University Pkwy Interchange	61,800	93,900
South of University Pkwy Interchange	88,100	121,500
NB University Pkwy On-Ramp	6,300	13,000
NB University Pkwy Off-Ramp	18,600	33,700
SB University Pkwy On-Ramp	19,600	27,200
SB University Pkwy Off-Ramp	5,600	20,300

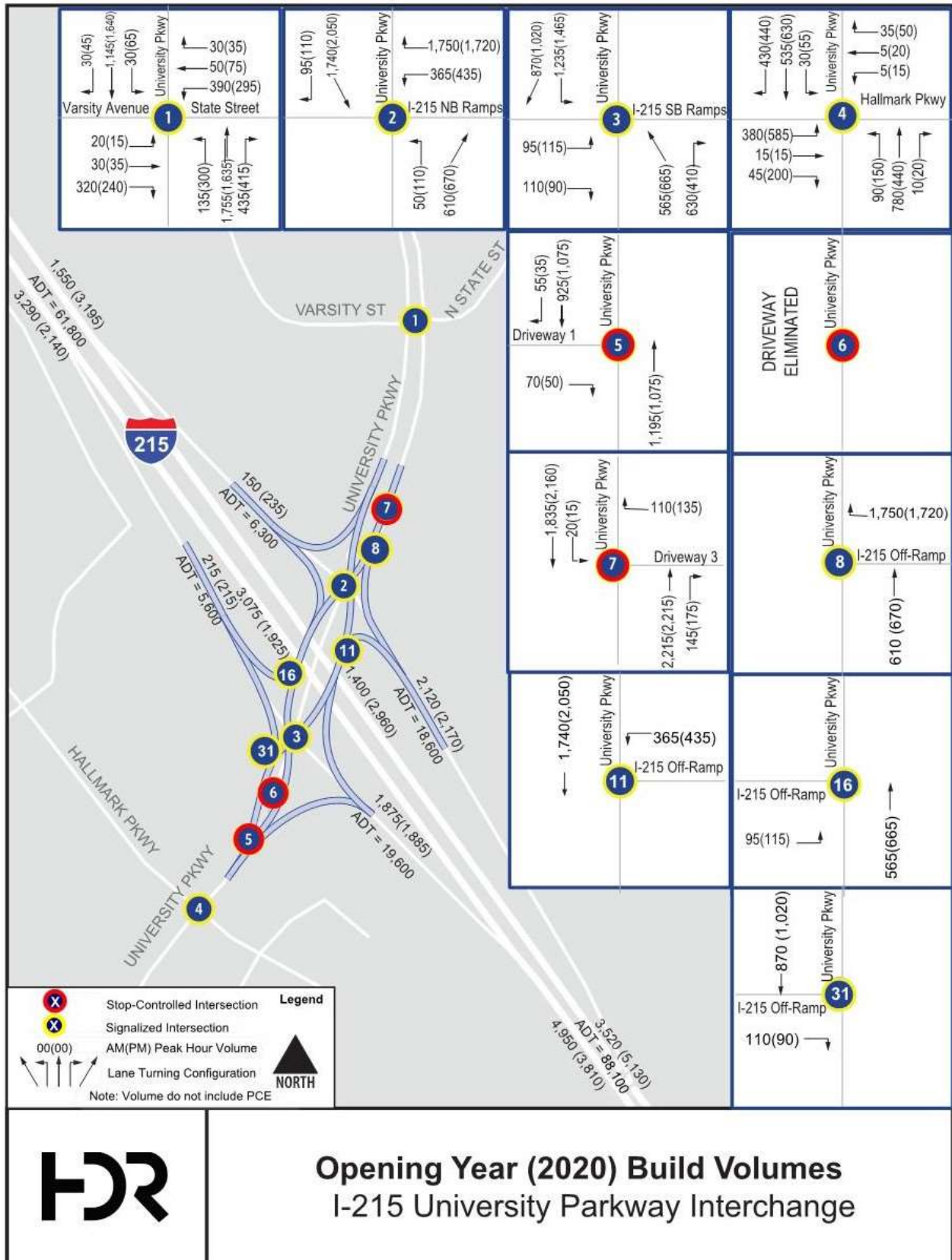
Figure 3-1. Opening Year (2020) Volumes No Build Conditions





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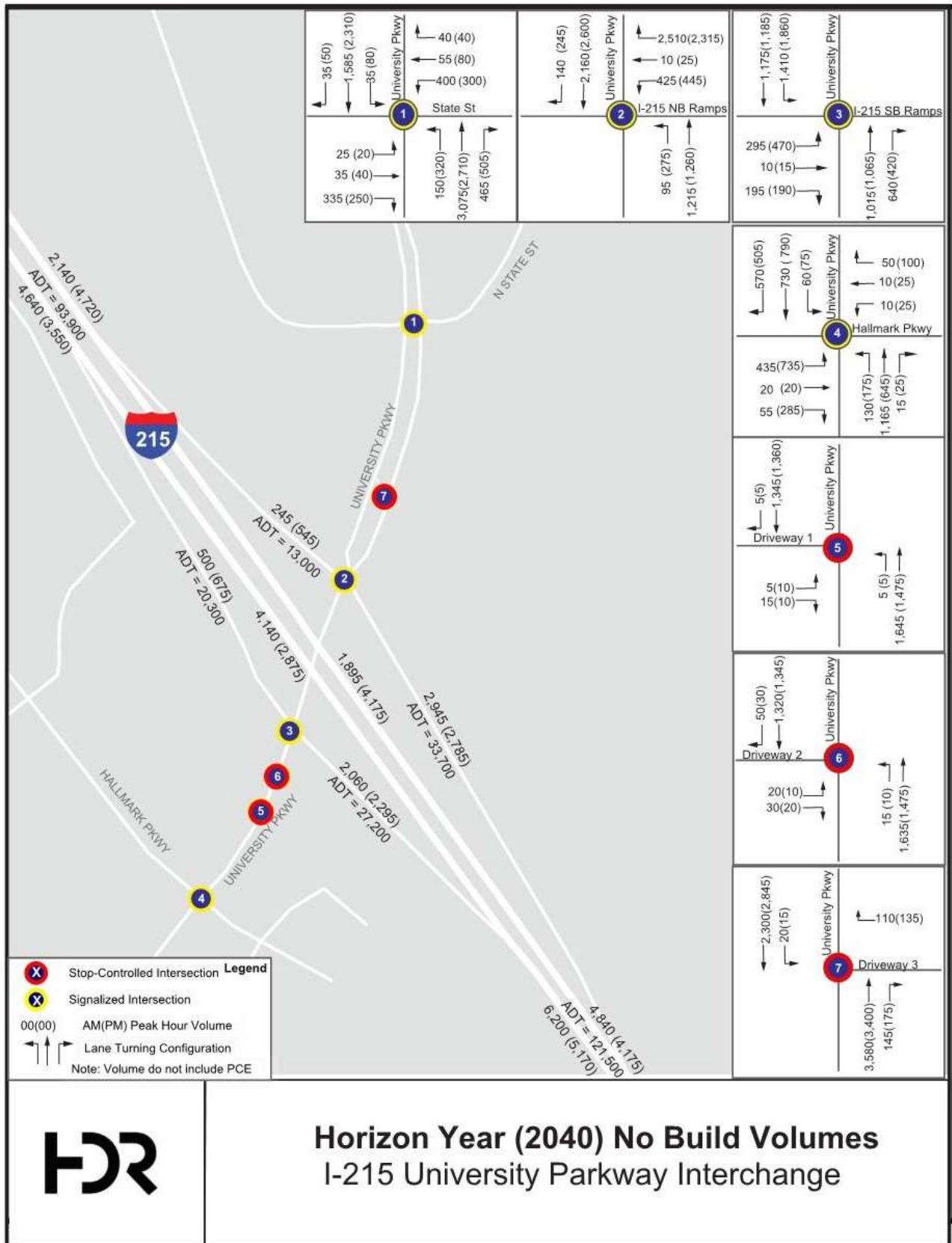
Figure 3-2. Opening Year (2020) Volumes Build Conditions





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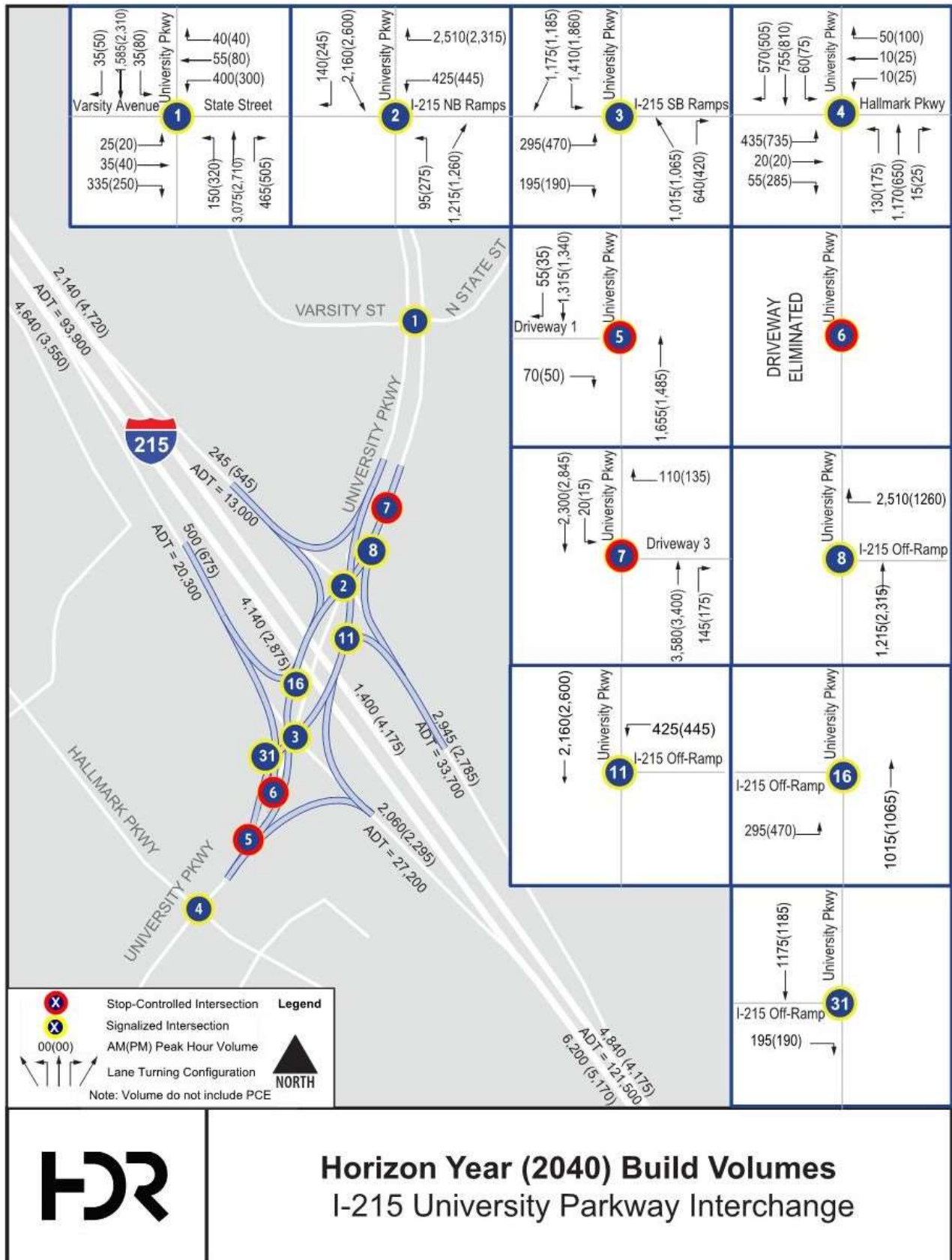
Figure 3-3. Horizon Year (2040) Volumes No Build Conditions





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Figure 3-4. Horizon Year (2040) Volumes Build Conditions



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4 Traffic Operations Analysis

This chapter provides a description of the traffic operation analysis methodology and projected year 2020 and 2040 traffic conditions with and without Project. The analysis scenarios include:

- Year 2020 No Build Conditions
- Year 2020 Build Conditions
- Year 2040 No Build Conditions
- Year 2040 Build Conditions

4.1 Analysis Methodology

All traffic analyses documented in this report were performed in accordance to Caltrans District 8 guidance. Detailed information on intersection analysis methodologies, standards and thresholds are discussed in this section.

4.1.1 Highway and Intersection Capacity Standards

The following sections present the level of service standards and thresholds used in the analysis of transportation network performance. Level of Service is a qualitative measure used to describe the driver's experience within a traffic stream in terms of speed, freedom to maneuver, traffic interruptions and comfort. A letter grade from A through F is used to define LOS levels and is based on density (passenger cars/mile/lane) calculation of freeway mainlines and ramps. For this Project, the target level of service is LOS D or better per the City of San Bernardino General Plan.

4.1.2 Basic Freeway Segment Analysis

Traffic analysis for basic freeway segments was performed using methodologies reported in the Highway Capacity Manual (HCM). The Highway Capacity Software (HCS) version 6.70 was used to analyze the freeway mainline study segments using the output of LOS, with secondary outputs for density and speed. **Table 4-1** presents the LOS thresholds for the basic freeway analysis segments conducted in this study.

Although the primary performance measure for the freeway mainline segments is LOS, volume-to-capacity (v/c) ratios for freeway segments are also calculated for evaluation. V/C ratios are planning level metrics to compare the degrees of congestion under LOS F conditions since the HCM density method does not provide a density value under heavily congested LOS F conditions. The capacities assumed for general purpose and auxiliary lanes are 2,400 and 1,200 passenger cars per hour per lane (pc/hr/ln), respectively.

Table 4-1. Freeway Segment Thresholds

Level of Service (LOS)	Freeway Segment Density Range (passenger car/mile/lane)
A	0-11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	>45

Source: Highway Capacity Manual 2010

Note: Volume-to-capacity ratio greater than or equal to 1 indicate actual or potential breakdown.

4.1.3 Freeway Ramps and Ramp Junction Analysis

Traffic analysis for ramps and ramp junction was performed using methodologies reported in HCM 2010. HCS version 6.70 was used to analyze merge and diverge areas with LOS as the primary output, with secondary outputs for density and speed. **Table 4-2** presents the merge and diverge areas LOS thresholds used in this study.

Table 4-2. Merge and Diverge Areas Level of Service Threshold

Level of Service (LOS)	Density Range (passenger car/mile/lane)
A	≤ 10
B	10 – 20
C	20 – 28
D	28 – 35
E	> 35
F	Demand exceeds capacity

Source: Highway Capacity Manual 2010

Note: Volume-to-capacity ratio greater than or equal to 1 indicate actual or potential breakdown.

4.1.4 Intersection Level of Service Standards and Thresholds

This section presents the methodologies used to perform peak hour intersection capacity analyses for signalized and unsignalized intersections.

Signalized Intersection Analysis

As a result of the limitation with National Electrical Manufacturing Association (NEMA) phasing in Synchro software version 10.0, intersections with non-standard NEMA

phasing cannot be evaluated using the HCM 2010 methodologies; therefore, the analysis of signalized intersections utilized the operational analysis procedure as outlined in the 2000 HCM. This method defines LOS in terms of delay, or more specifically, average stopped delay per vehicle. Delay is a measure of driver and/or passenger discomfort, frustration, fuel consumption and lost travel time. This technique uses 1,900 vehicles per hour per lane (VPHPL) as the maximum saturation volume of an intersection. This saturation volume is adjusted to account for lane width, on-street parking, pedestrians, traffic composition (i.e., percentage trucks) and shared lane movements (i.e. through and right-turn movements originating from the same lane). The Level of Service thresholds used for this technique are described in **Table 4-3**.

Table 4-3. Signalized Intersection Level of Service Thresholds

Average Stopped Delay Per Vehicle (seconds)	Level of Service (LOS) Characteristics
<10.0	<i>LOS A</i> describes operations with very low delay. This occurs when progression is extremely favorable, and most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
10.1 – 20.0	<i>LOS B</i> describes operations with generally good progression and/or short cycle lengths. More vehicles stop than for <i>LOS A</i> , causing higher levels of average delay.
20.1 – 35.0	<i>LOS C</i> describes operations with higher delays, which may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
35.1 – 55.0	<i>LOS D</i> describes operations with high delay, resulting from some combination of unfavorable progression; long cycle lengths, or high volumes. The influence of congestion becomes more noticeable, and individual cycle failures are noticeable.
55.1 – 80.0	<i>LOS E</i> is considered the limit of acceptable delay. Individual cycle failures are frequent occurrences.
>80.0	<i>LOS F</i> describes a condition of excessively high delay, considered unacceptable to most drivers. This condition often occurs when arrival flow rates exceed the <i>LOS D</i> capacity of the intersection. Poor progression and long cycle lengths may also be major contributing causes to such delay.

Source: Highway Capacity Manual 2000

Note: Volume-to-capacity ratio greater than or equal to 1 indicate actual or potential breakdown.

Unsignalized Intersection Analysis

Unsignalized intersections, including two-way and all-way stop controlled intersections were analyzed using the 2000 HCM (Section 10) unsignalized intersection analysis methodology. The LOS for a two-way stop controlled (TWSC) intersection is determined by the computed or measured control delay and is defined for each minor movement **Table 4-4** summarizes the level of service thresholds utilized for unsignalized intersection analyses.

Table 4-4. Unsignalized Intersection Level of Service Thresholds

Average Control Delay (sec/veh)	Level of Service (LOS)
≤10	A
>10 and ≤15	B
>15 and ≤25	C
>25 and ≤35	D
>35 and ≤50	E
>50	F

Source: Highway Capacity Manual 2000

Note: Volume-to-capacity ratio greater than or equal to 1 indicate actual or potential breakdown.

Signalized Interchange Analysis

The analysis of signalized interchange utilized the operational analysis procedure as outlined in the 2010 HCM (Section 22) and is consistent with the operational analysis methodology per the Federal Highway Administration (FHWA) Diverging Diamond Interchange Informational Guide. This method defines LOS based on the operational performance of O-D demands through the interchange. The LOS for each O-D is based on the three criteria:

- Total average control delay (average stopped delay per vehicle) by that demand as it travels through the interchange;
- Worst case V/C ratio for any of the lane groups that contain this O-D; and
- Worst case Queue-to-storage ratio (RQ) for any of the lane groups that contain this O-D

Delay is a measure of driver and/or passenger discomfort, frustration, fuel consumption and lost travel time. Since intersections with non-standard NEMA phasing cannot be evaluated using the HCM 2010 methodologies, the movement control delay were extracted from the Synchro calculation output results.

The Level of Service thresholds used for this technique are described in **Table 4-5**. The values presented in Table 4-5 are 1.5 times more than those for signalized intersections since some of the O-D movements would travel through two or more intersections as oppose to a single intersection. Also, LOS F is defined to occur when either the volume-to-capacity ratio or the average queue-to-storage ratio (RQ) for any lane groups that contain this O-D exceed the value of 1.

Table 4-5. Signalized Interchange Level of Service Threshold

Average Control Delay (sec/veh)	v/c <1 and RQ<1 for Every Group Lane	v/c>1 for Any Lane Group	RQ >1 for Any Lane Group
≤15	A	F	F
>15-30	B	F	F
>30-55	C	F	F

Table 4-5. Signalized Interchange Level of Service Threshold

Average Control Delay (sec/veh)	v/c <1 and RQ<1 for Every Group Lane	v/c>1 for Any Lane Group	RQ >1 for Any Lane Group
>55-85	D	F	F
>85-120	E	F	F
>120	F	F	F

Source: Highway Capacity Manual 2010

Note: Volume-to-capacity ratio greater than or equal to 1 indicate actual or potential breakdown.

4.1.5 Intersection Queue Analysis

Queuing analyses was conducted for intersection conditions for existing and all future Build Alternatives. The queuing analysis compares the minimum required storage lengths to the storage lengths provided for the analyzed intersections. The minimum storage required is determined by the longest 95th percentile queue identified in the AM or PM peak hours.

The minimum required storage lengths are based on the 95th percentile queue lengths as calculated in the Synchro worksheets. Synchro reports the 95th percentile queue length for a single lane of a lane group (highest queue length considering all lanes of the lane group) instead of the total queue length of all lanes in that lane group.

Storage Lengths

The provided storage lengths for an intersection are measured from the limit line to the end of the bay taper for turn movements. For on-ramps, the provided storage lengths are measured from the crosswalk to the limit line for ramp metering. This storage length is associated with the Ramp Metering Analysis.

For off-ramps, the provided storage lengths are measured from the off-ramp exit gore point to the crosswalk if it is a continuous lane. If turn lane (left or right) pockets are provided at the end of the off-ramp, then the provided storage lengths are measured from the stop line to the end of the bay taper for that turn lane.

Ramp Metering

Ramp metering analyses were conducted for ramp metering conditions for future Build scenarios. The ramp metering analysis spreadsheets were set up to consider (morning and evening) peak hour conditions. The highest peak hour volume for each ramp was used for the analysis. Inputs for each ramp analysis included number of lanes, average vehicle length (29 feet), and the ramp storage length. Based on the latest Caltrans Ramp Metering Design Manual design guidance, for new or reconstructed entrance ramp, the minimum storage length should be designed based on seven percent (7%) of the peak hour demand for the design year.

4.2 Existing 2017 Traffic Conditions

This section presents the traffic operational analysis for Existing (2017) traffic conditions. The Synchro worksheets for intersection analysis under Existing (2017) conditions are contained in **Appendix D**. The HCS worksheets for freeway, ramps, and interchange analysis under Existing (2017) conditions analysis are contained in **Appendix E**.

4.2.1 Existing 2017 Analysis

Intersection Analysis

Table 4-6 displays intersection LOS and average vehicle delay results for AM and PM peak hours. As shown in Table 4-6, under the Existing (2017) conditions, all intersections are operating at LOS D or better with the exception of the following intersections that are operating at LOS of E or F:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- I-215 NB Ramps & University Parkway (AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (PM Peak Hour)

Intersection Queuing Analysis

Table 4-7 displays intersection queuing results for the intersections under Existing (2017) conditions. As shown in Table 4-7, adequate storage is provided for all intersections with the exceptions of the following:

- North Varsity Avenue/North State Street & University Parkway - eastbound and northbound left turn lanes
- I-215 SB Ramps & University Parkway - eastbound through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Table 4-6. Existing (2017) Intersection LOS Results

No.	Intersection (N/S & E/W)	AM Peak Hour		PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
1	North Varsity Avenue/North State Street & University Parkway	87.7	F	60.5	E
2	I-215 NB Ramps & University Parkway	76.0	E	92.7	F
3	I-215 SB Ramps & University Parkway	38.3	D	58.1	E
4	Hallmark Parkway & University Parkway	26.0	C	39.6	D
5	Driveway 1 & University Parkway	13.3	B	16.4	D
6	Driveway 2 & University Parkway	15.2	C	15.6	D
7	Driveway 3 & University Parkway	23.3	C	23.1	C

Delay in seconds

Table 4-7. Existing (2017) Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
1	North Varsity Avenue/North State Street & University Pkwy	EBL	327	160	No
		EBT	493	770	Yes
		EBR	72	400	Yes
		WBL	108	150	Yes
		WBT	501	730	Yes
		WBR	14	400	Yes
		NBL	522	100	No
		NBT	57	500	Yes
		SBL	21	112	Yes
		SBT	66	1,000	Yes
2	I-215 NB Ramps & University Parkway	EBL	75	300	Yes
		EBT	255	305	Yes
		WBT	683	770	Yes
		WBR	38	105	Yes
		NBL	N/A	N/A	N/A
		NBT	381	650	Yes
		NBR	875	1,375	Yes
3	I-215 SB Ramps & University Parkway	EBT	564	485	No
		WBL	90	300	Yes
		WBT	86	305	Yes
		SBL	N/A	N/A	N/A
		SBT	93	1,475	Yes
		SBR	43	280	Yes
4	Hallmark Parkway & University Parkway	EBL	205	170	No
		EBT	319	1,180	Yes
		WBL	47	85	Yes
		WBT	293	485	Yes
		WBR	64	150	Yes
		NBL	21	60	Yes
		NBT	45	160	Yes
		SBL	350	120	No
		SBT	361	720	Yes
		SBR	57	120	Yes
5	Driveway 1 & University Parkway	EBL	25	115	Yes
		SBL	25	50	Yes

Table 4-7. Existing (2017) Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
6	Driveway 2 & University Parkway	EBL	25	180	Yes
		SBL	25	50	Yes
7	Driveway 3 & University Parkway	EBR	25	135	Yes
		WBL	25	100	Yes
		NBR	25	100	Yes

N/A - not applicable

Freeway Ramp Analysis

Table 4-8 displays Existing (2017) LOS for freeway ramps within the study area. As shown in Table 4-8, all freeway ramps are operating at LOS D or better. It should be noted that southbound I-215 University Parkway On-Ramp merge onto the freeway mainline as a single-lane addition; therefore, per HCM 2010 methodology, the upstream and downstream freeway segments are analyzed as basic freeway segments and no separate merge or diverge analysis is performed.

Table 4-8. Existing (2017) Freeway Ramp LOS Results

No. of Lanes ¹	Ramp/Segment Capacity ²	AM Peak Hour				PM Peak Hour			
		Ramp	Ramp Junction ³			Ramp	Ramp Junction ³		
		Traffic Volume ²	Density	V/C	LOS	Traffic Volume ²	Density	V/C	LOS
Northbound									
1	University Pkwy On-Ramp	125	14.4	0.08	B	180	27.9	0.12	C
2	University Pkwy Off-Ramp ^a	2,015	16.0	0.67	B	2,100	23.4	0.70	C
Southbound									
1	University Pkwy Off-Ramp	165	34.4	0.11	D	145	22.3	0.10	C
1	University Pkwy On-Ramp ^b	1,755	N/A	N/A	N/A	1,795	N/A	1.20	N/A

¹ Number of lanes on the ramp at the gore point (off-ramp) or 6-foot point (on-ramp).

² Peak hour traffic volumes are shown in vehicles per hour (vph).

³ The freeway ramp junctions were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition merge or diverge ramp-freeway junction analysis. Freeway ramp junction LOS is based on density (cars/mile/lane).

^a Major diverge area; Highway Capacity Manual (HCM) 2010 Edition methodology (Exhibit 13-19) applied for analysis.

^b Single-lane addition/drop; Highway Capacity Manual (HCM) 2010 Edition methodology (Page 13-18) applied for analysis.

Freeway Mainline Analysis

Table 4-9 displays existing (2017) freeway mainline LOS and density results for northbound and southbound segments of I-215 within the study area. As shown in Table 4-9, all freeway segments are operating at LOS D or better.

Table 4-9. Existing (2017) Freeway Mainline LOS Results

Freeway Segment ¹	# of Lanes	AM Peak Hour				PM Peak Hour			
		General Purpose Lanes				General Purpose Lanes			
		Traffic Volume ²	HCM Results ¹			Traffic Volume ²	HCM Results ¹		
			Density	V/C	LOS ³		Density	V/C	LOS ³
Northbound									
North of University Pkwy On-Ramp	2	1,435	12.7	0.30	B	2,945	28.2	0.61	D
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	2	1,310	11.6	0.27	B	2,765	26.4	0.58	D
South of University Pkwy Off-Ramp	4	3,325	15.9	0.40	B	4,865	23.3	0.58	C
Southbound									
North of University Pkwy Off-Ramp	2	3,180	29.2	0.66	D	1,955	16.0	0.41	B
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	2	3,015	27.3	0.63	D	1,810	14.8	0.38	B
South of University Pkwy On-Ramp	3	4,770	29.2	0.80	D	3,605	21.2	0.60	C

1 The freeway segments were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition basic freeway segment analysis.

2 Peak hour traffic volumes are shown in vehicles per hour (vph).

3 Density = Passenger car/mile/lane

4.3 Opening Year 2020 Traffic Conditions

This section presents the LOS analysis for Opening Year 2020 traffic conditions. The Synchro worksheets for intersection analysis under Opening Year (2020) conditions are contained in Appendix D. The HCS worksheets for freeway, ramps, and interchange analysis under Opening Year 2020 conditions are contained in Appendix E.

4.3.1 Opening Year 2020 No Build Analysis

Intersection Analysis

Table 4-10 displays the intersection LOS and average delay results for AM and PM peak hours. As shown in Table 4-10, under Opening Year (2020) No Build conditions, all intersections are forecasted to operate at LOS D or better with the exception of the following intersections that are forecasted to operate at LOS of E or F:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- I-215 NB Ramps & University Parkway (AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (AM and PM Peak Hours)

Table 4-10. Opening Year (2020) No Build Intersection LOS Results

No.	Intersection (N/S & E/W)	AM Peak Hour		PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
1	North Varsity Avenue/North State Street & University Parkway	124.8	F	62.8	E
2	I-215 NB Ramps & University Parkway	104.5	F	120.2	F
3	I-215 SB Ramps & University Parkway	65.9	E	85.2	F
4	Hallmark Parkway & University Parkway	28.2	C	41.0	D
5	Driveway 1 & University Parkway	14.0	B	17.7	C
6	Driveway 2 & University Parkway	16.2	C	16.7	C
7	Driveway 3 & University Parkway	26.7	D	25.9	D

Delay in seconds

Intersection Queuing Analysis

Table 4-11 displays intersection queuing results for intersections under Opening Year (2020) No Build conditions. As shown in Table 4-11, adequate storage is forecasted to be provided for all intersections with the exceptions of the following:

- North Varsity Avenue/North State Street & University Parkway - eastbound and northbound left turn lanes
- I-215 SB Ramps & University Parkway - eastbound through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Table 4-11. Opening Year (2020) No Build Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
1	North Varsity Avenue/North State Street & University Pkwy	EBL	314	160	No
		EBT	524	770	Yes
		EBR	79	400	Yes
		WBL	117	150	Yes
		WBT	580	730	Yes
		WBR	17	400	Yes
		NBL	547	100	No
		NBT	82	500	Yes
		SBL	22	112	Yes
2	I-215 NB Ramps & University Parkway	SBT	74	1,000	Yes
		EBL	89	300	Yes
		EBT	247	305	Yes
		WBT	748	770	Yes
		WBR	50	105	Yes
		NBL	N/A	N/A	N/A
		NBT	385	650	Yes
3	I-215 SB Ramps & University Parkway	NBR	970	1,375	Yes
		EBT	620	485	No
		WBL	82	300	Yes
		WBT	93	305	Yes
		SBL	N/A	N/A	N/A
		SBT	136	1,475	Yes
4	Hallmark Parkway & University Parkway	SBR	48	280	Yes
		EBL	213	170	No
		EBT	394	1,180	Yes
		WBL	47	85	Yes
		WBT	335	485	Yes
		WBR	74	150	Yes
		NBL	27	60	Yes
		NBT	51	160	Yes
		SBL	377	120	No
		SBT	387	720	Yes
5	Driveway 1 & University Parkway	SBR	58	120	Yes
		EBL	25	115	Yes
		SBL	25	50	Yes

Table 4-11. Opening Year (2020) No Build Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
6	Driveway 2 & University Parkway	EBL	25	180	Yes
		SBL	25	50	Yes
7	Driveway 3 & University Parkway	EBR	25	135	Yes
		WBL	25	100	Yes
		NBR	25	100	Yes

N/A - not applicable

Freeway Ramp Analysis

Table 4-12 presents LOS for freeway ramps within the study area under Opening Year (2020) No Build and Build Conditions. The Opening Year (2020) No Build and Build analysis indicates that ramps within the study area are forecasted to operate at acceptable LOS D or better with the exception of the following:

- Southbound University Parkway Off-Ramp (AM Peak Hour)

It should be noted that southbound I-215 University Parkway on-ramp merge onto the freeway mainline as a single-lane addition; therefore, per HCM 2010 methodology, the upstream and downstream freeway segments are analyzed as basic freeway segments and no separate merge or diverge analysis is performed.

Also, note that under the Opening Year (2020) Build conditions, the proposed Project would not alter the ramps within the study area; hence, the LOS results for freeway ramps would be identical to the No Build conditions analysis.

Table 4-12. Opening Year (2020) No Build/Build Freeway Ramp LOS Results

No. of Lanes ¹	Ramp/Segment Capacity ²	AM Peak Hour				PM Peak Hour			
		Ramp	Ramp Junction ³			Ramp	Ramp Junction ³		
		Traffic Volume ₂	Density	V/C	LOS	Traffic Volume _{e2}	Density	V/C	LOS
Northbound									
1	University Pkwy On-Ramp	150	15.5	0.10	B	235	30.1	0.16	D
2	University Pkwy Off-Ramp ^a	2,120	16.9	0.71	B	2,170	24.7	0.72	C
Southbound									
1	University Pkwy Off-Ramp	215	35.5	0.14	E	215	24.1	0.14	C
1	University Pkwy On-Ramp ^b	1,875	N/A	N/A	N/A	1,885	N/A	N/A	N/A

¹ Number of lanes on the ramp at the gore point (off-ramp) or 6-foot point (on-ramp).

² Peak hour traffic volumes are shown in vehicles per hour (vph).

³ The freeway ramp junctions were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition merge or diverge ramp-freeway junction analysis. Freeway ramp junction LOS is based on density (cars/mile/lane).

^a Major diverge area; Highway Capacity Manual (HCM) 2010 Edition methodology (Exhibit 13-19) applied for analysis.

^b Single-lane addition/drop; Highway Capacity Manual (HCM) 2010 Edition methodology (Page 13-18) applied for analysis. The upstream and downstream freeway segments are analyzed as basic freeway segments and no separate merge or diverge analysis is performed.

N/A - not applicable

Freeway Mainline Analysis

Table 4-13 displays the freeway mainline LOS and density results under Opening Year (2020) No Build and Build conditions. As shown in Table 4-13, under the Opening Year 2020 No Build and Build conditions, all freeway segments are forecasted to operate at LOS D or better.

It should be noted that under the Opening Year (2020) Build conditions, the proposed Project would not alter the freeway mainline within the study area; hence, the LOS results for freeway mainline would be identical to the No Build conditions analysis.

Table 4-13. Opening Year (2020) No Build/Build Freeway Mainline LOS Results

Freeway Segment ¹	# of Lanes	AM Peak Hour				PM Peak Hour			
		General Purpose Lanes				General Purpose Lanes			
		Traffic Volume ²	HCM Results ¹			Traffic Volume ²	HCM Results ¹		
			Density ³	V/C	LOS		Density ³	V/C	LOS
Northbound									
North of University Pkwy On-Ramp	2	1,550	16.2	0.32	B	3,195	33.3	0.67	D
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	2	1,400	14.6	0.29	B	2,960	30.9	0.62	D
South of University Pkwy Off-Ramp	4	3,520	18.4	0.42	C	5,130	26.8	0.61	D
Southbound									
North of University Pkwy Off-Ramp	2	3,290	34.4	0.69	D	2,140	22.3	0.45	C
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	2	3,075	32.1	0.64	D	1,925	20.1	0.40	C
South of University Pkwy On-Ramp	3	4,950	29.2	0.83	D	3,810	26.5	0.64	D

¹ The freeway segments were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition basic freeway segment analysis.

² Peak hour traffic volumes are shown in vehicles per hour (vph).

³ Density = Passenger car/mile/lane

4.3.2 Opening Year 2020 Build Analysis

Intersection Analysis

Table 4-14 presents the intersection LOS results under Opening Year (2020) Build conditions. As shown in Table 4-14, all of the study intersections are forecast to operate at LOS D or better during the AM and PM peak hours with the exception of the following:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)

Compared to the No Build conditions, I-215 NB and SB Ramps improved from LOS E or F to LOS D or better during both AM and PM Peak Hours.

Intersection Queuing Analysis

Table 4-15 displays intersection queuing results for intersections under Opening Year (2020) Build conditions. As shown in Table 4-15, adequate storage is forecasted to be provided for all intersections under the Opening Year (2020) Build Analysis with the exception of the following:

- North Varsity Avenue/North State Street & University Parkway - northbound and eastbound left turn lanes, and eastbound through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Compared to the No Build conditions, adequate storage is forecasted to be provided for both the I-215 NB and SB Ramps intersections.

Ramp Metering Analysis

Table 4-16 displays ramp metering results for the I-215 NB and SB On-Ramps under Opening Year (2020) Build conditions. As shown, adequate storage is provided for I-215 NB On-Ramp with one GP plus one HOV lane and with two GP lanes; however, adequate storage is not provided for I-215 SB On-Ramp with two GP plus one HOV lane and with three GP lanes. The standard on-ramp lane configuration would require a future HOV lane per Caltrans Ramp Metering Design Manual; however, any deviation from the design standards would need a design exception.

Signalized Interchange Analysis

This section of the report presents the DDI interchange operations analysis results for 2020 Build conditions for each O-D through the interchange. **Table 4-17** summarizes the interchange analysis results for 2020 Build conditions. As shown in Table 4-17, the all O-D movements are forecasted to operate at LOS D or better.

Note that this analysis show each movement traveling through two intersections; therefore, the delay and queuing results are greater compared to traveling through a single intersections and are considered the worst case scenario for traffic operations along University Parkway interchange.

It should be noted that the traffic operational analysis in this report does not include the proposed I-215/Pepper-Linden-Campus Interchange in future forecasts allowing for the highest 2040 volumes in the case that this proposed interchange is never constructed.

The result of the analysis presented in this report represents the worst case scenario for traffic operations along University Parkway interchange.

Freeway Ramp Analysis

Under the Opening Year (2020) Build conditions, the proposed Project would not alter the ramps within the study area; hence, the LOS results for freeway ramps would be identical to the No Build conditions analysis as shown in Table 4-12.

Freeway Mainline Analysis

Under the Opening Year (2020) Build conditions, the proposed Project would not alter the freeway mainline within the study area; hence, the LOS results for the freeway mainline would be identical to the No Build condition analysis as shown in Table 4-13.

Table 4-14. Opening Year (2020) Intersection LOS Results Comparison

No.	Intersection (N/S & E/W)	AM Peak					PM Peak				
		Opening Year (2020) No Build		Opening Year (2020) Build		Delta	Opening Year (2020) No Build		Opening Year (2020) Build		Delta
		Delay	LOS	Delay	LOS	Delay	Delay	LOS	Delay	LOS	Delay
1	North Varsity Avenue/North State Street & University Parkway	124.8	F	57.6	E	-67.2	62.8	E	63.6	E	0.8
2	I-215 NB Ramp & University Parkway	104.5	F	8.1	A	-96.4	120.2	F	7	A	-113.2
3	I-215 SB Ramps & University Parkway	65.9	E	25	C	-40.9	85.2	F	18.2	B	-67
4	Hallmark Parkway & University Parkway	28.2	C	22.1	C	-6.1	41	D	29.5	C	-11.5
5	Driveway 1 & University Parkway	14	B	13.4	B	-0.6	17.7	C	14	B	-3.7
6	Driveway 2 & University Parkway	16.2	C	N/A	N/A	N/A	16.7	C	N/A	N/A	N/A
7	Driveway 3 & University Parkway	26.7	D	27.4	D	0.7	25.9	D	27.4	D	1.5
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	N/A	N/A	18.5	B	N/A	N/A	N/A	22.6	C	N/A
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	N/A	N/A	11.6	B	N/A	N/A	N/A	13.4	B	N/A
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	N/A	N/A	5.1	A	N/A	N/A	N/A	5.4	A	N/A
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	N/A	N/A	1.7	A	N/A	N/A	N/A	1.6	A	N/A

Delay in seconds; Delta = Build Condition Delay – No Build Condition Delay
N/A - not applicable

Table 4-15. Opening Year (2020) Build Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
1	North Varsity Avenue/North State Street & University Parkway	EBL	335	160	No
		EBT	697	690	No
		EBR	97	415	Yes
		WBL	114	150	Yes
		WBT	598	730	Yes
		WBR	13	400	Yes
		NBL	579	100	No
		NBT	87	500	Yes
		SBL	24	112	Yes
		SBT	98	1,000	Yes
2	I-215 NB Ramps & University Parkway	EBT	234	455	Yes
		WBT	146	690	Yes
3	I-215 SB Ramps & University Parkway	EBT	207	450	Yes
		WBT	321	455	Yes
4	Hallmark Parkway & University Parkway	EBL	208	170	No
		EBT	289	1,180	Yes
		WBL	89	90	Yes
		WBT	165	455	Yes
		WBR	25	120	Yes
		NBL	33	60	Yes
		NBT	61	160	Yes
		SBL	368	120	No
		SBT	355	720	Yes
		SBR	58	120	Yes
5	Driveway 1 & University Parkway	EBL	25	90	Yes
		SBL	25	50	Yes
6	Driveway 2 & University Parkway	SBL	N/A	N/A	N/A
7	Driveway 3 & University Parkway	EBR	25	80	Yes
		WBL	25	100	Yes
		NBR	62	100	Yes
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	NBR	660	1,490	Yes
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	NBL	494	690	Yes
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	SBL	98	1,435	Yes
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	SBR	86	305	Yes

Table 4-16. Opening Year (2020) Build On-Ramp Queuing Results

No	Location	2020 Volume (DDI)	Proposed # of GP Lanes	Proposed # of HOV Lane	Min GP Storage Length (ft)	Min HOV Storage Length (ft)	Min Storage Length Required (ft)	Provided Storage (ft)	Storage Adequate?
AM Peak Hour									
2	I-215 NB University Parkway On-Ramp	150	1	1	259	46	259	640	Yes
		150	2	0	129	N/A	129	640	Yes
3	I-215 SB University Parkway On-Ramp	1,875	2	1	1,618	571	1,618	750	No
		1,875	3	0	1,269	N/A	1,269	750	No
PM Peak Hour									
2	I-215 NB University Parkway On-Ramp	235	1	1	405	72	405	640	Yes
		235	2	0	203	N/A	203	640	Yes
3	I-215 SB University Parkway On-Ramp	1,885	2	1	1,626	574	1,626	750	No
		1,885	3	0	1,276	N/A	1,276	750	No



Table 4-17. Opening Year (2020) Build Signalized Interchange LOS Results

2020 AM Peak Hour								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	Control Delay (s)	--	--	--	--	16.9	6.8
		Volume-to-Capacity (v/c)	--	--	--	--	0.56	0.61
		Queue Storage Ratio (RQ)	--	--	--	--	0.21	0.21
		v/c >1?	--	--	--	--	No	No
		RQ >1?	--	--	--	--	No	No
		LOS	--	--	--	--	B	A
3	I-215 SB Ramps & University Parkway	Control Delay (s)	--	--	--	--	15.9	32.9
		Volume-to-Capacity (v/c)	--	--	--	--	0.31	0.7
		Queue Storage Ratio (RQ)	--	--	--	--	0.46	0.71
		v/c >1?	--	--	--	--	No	No
		RQ >1?	--	--	--	--	No	No
		LOS	--	--	--	--	B	C
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	26.1	--	--	--	--
		Volume-to-Capacity (v/c)	--	0.86	--	--	--	--
		Queue Storage Ratio (RQ)	--	0.42	--	--	--	--
		v/c >1?	--	No	--	--	--	--
		RQ >1?	--	No	--	--	--	--
		LOS	--	B	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	64.5	--	--	--	--	--
		Volume-to-Capacity (v/c)	0.88	--	--	--	--	--
		Queue Storage Ratio (RQ)	0.61	--	--	--	--	--
		v/c >1?	No	--	--	--	--	--
		RQ >1?	No	--	--	--	--	--
		LOS	D	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	--	--	30.8	--	--	--
		Volume-to-Capacity (v/c)	--	--	0.19	--	--	--
		Queue Storage Ratio (RQ)	--	--	0.06	--	--	--
		v/c >1?	--	--	No	--	--	--
		RQ >1?	--	--	No	--	--	--
		LOS	--	--	C	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	--	--	15.3	--	--
		Volume-to-Capacity (v/c)	--	--	--	0.13	--	--
		Queue Storage Ratio (RQ)	--	--	--	0.28	--	--
		v/c >1?	--	--	--	No	--	--
		RQ >1?	--	--	--	No	--	--
		LOS	--	--	--	B	--	--

Table 4-17. Opening Year (2020) Build Signalized Interchange LOS Results

2020 PM Peak Hour								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	Control Delay (s)	--	--	--	--	14.3	8.5
		Volume-to-Capacity (v/c)	--	--	--	--	0.55	0.78
		Queue Storage Ratio (RQ)	--	--	--	--	0.51	0.14
		v/c >1?	--	--	--	--	No	No
		RQ >1?	--	--	--	--	No	No
		LOS	--	--	--	--	A	A
3	I-215 SB Ramps & University Parkway	Control Delay (s)	--	--	--	--	15.3	22.9
		Volume-to-Capacity (v/c)	--	--	--	--	0.44	0.65
		Queue Storage Ratio (RQ)	--	--	--	--	0.34	0.66
		v/c >1?	--	--	--	--	No	No
		RQ >1?	--	--	--	--	No	No
		LOS	--	--	--	--	A	B
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	32.2	--	--	--	--
		Volume-to-Capacity (v/c)	--	0.92	--	--	--	--
		Queue Storage Ratio (RQ)	--	0.44	--	--	--	--
		v/c >1?	--	No	--	--	--	--
		RQ >1?	--	No	--	--	--	--
		LOS	--	C	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	63.5	--	--	--	--	--
		Volume-to-Capacity (v/c)	0.92	--	--	--	--	--
		Queue Storage Ratio (RQ)	0.7	--	--	--	--	--
		v/c >1?	No	--	--	--	--	--
		RQ >1?	No	--	--	--	--	--
		LOS	D	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	--	--	26	--	--	--
		Volume-to-Capacity (v/c)	--	--	0.21	--	--	--
		Queue Storage Ratio (RQ)	--	--	0.07	--	--	--
		v/c >1?	--	--	No	--	--	--
		RQ >1?	--	--	No	--	--	--
		LOS	--	--	B	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	--	--	20.5	--	--
		Volume-to-Capacity (v/c)	--	--	--	0.13	--	--
		Queue Storage Ratio (RQ)	--	--	--	0.27	--	--
		v/c >1?	--	--	--	No	--	--
		RQ >1?	--	--	--	No	--	--
		LOS	--	--	--	B	--	--

-- not applicable

4.4 Horizon Year 2040 Traffic Conditions

This section presents the LOS analysis for Horizon Year 2040 traffic conditions. The Synchro worksheets for intersection analysis under Horizon Year 2040 conditions are contained in Appendix D. The HCS worksheets for freeway, ramps, and interchange analysis under Horizon Year 2040 conditions are contained in Appendix E.

4.4.1 Horizon Year 2040 No Build Analysis

Intersection Analysis

Table 4-18 displays the LOS and average delay results for AM and PM peak hours. As shown on Table 4-18, under Horizon Year (2040) No Build conditions, all intersections are forecasted to operate at LOS D or better with the exception of the following intersections that are forecasted to operate at LOS of F:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- I-215 NB Ramps & University Parkway (AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (AM and PM Peak Hours)
- Driveway 3 & University Parkway (AM and PM Peak Hours)

Table 4-18. Horizon Year (2040) No Build Intersection LOS Results

No.	Intersection (N/S & E/W)	AM Peak Hour		PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
1	North Varsity Avenue/North State Street & University Parkway	265.0	F	160.0	F
2	I-215 NB Ramps & University Parkway	207.5	F	197.5	F
3	I-215 SB Ramps & University Parkway	211.5	F	327.8	F
4	Hallmark Parkway & University Parkway	51.3	D	49.9	D
5	Driveway 1 & University Parkway	18.0	C	21.8	C
6	Driveway 2 & University Parkway	22.4	C	20.4	C
7	Driveway 3 & University Parkway	156.6	F	102.4	F

Delay in seconds

Intersection Queuing Analysis

Table 4-19 displays intersection queuing results for intersections under Horizon Year (2040) No Build conditions. As shown in Table 4-19, adequate storage is forecasted to be provided for all intersections with the exceptions of the following:

- North Varsity Avenue/North State Street & University Parkway - northbound and eastbound left turn lanes, and westbound through lanes
- I-215 NB Ramps & University Parkway - northbound right turn lanes
- I-215 SB Ramps & University Parkway - eastbound through lanes, and westbound left turn and through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Table 4-19. Horizon Year (2040) No Build Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
1	North Varsity Avenue/North State Street & University Pkwy	EBL	175	160	No
		EBT	634	770	Yes
		EBR	45	400	Yes
		WBL	142	150	Yes
		WBT	906	730	No
		WBR	21	400	Yes
		NBL	536	100	No
		NBT	87	500	Yes
		SBL	25	112	Yes
		SBT	77	1,000	Yes
2	I-215 NB Ramps & University Parkway	EBL	158	300	Yes
		EBT	175	305	Yes
		WBT	126	770	Yes
		WBR	1	105	Yes
		NBL	N/A	N/A	N/A
		NBT	615	650	Yes
		NBR	1,481	1,375	No
3	I-215 SB Ramps & University Parkway	EBT	715	485	No
		WBL	854	300	No
		WBT	360	305	No
		SBL	N/A	N/A	N/A
		SBT	640	1,475	Yes
		SBR	134	280	Yes

Table 4-19. Horizon Year (2040) No Build Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
4	Hallmark Parkway & University Parkway	EBL	247	170	No
		EBT	656	1,180	Yes
		WBL	61	85	Yes
		WBT	344	485	Yes
		WBR	41	150	Yes
		NBL	36	60	Yes
		NBT	64	160	Yes
		SBL	489	120	No
		SBT	501	720	Yes
		SBR	69	120	Yes
5	Driveway 1 & University Parkway	EBL	25	115	Yes
		SBL	25	50	Yes
6	Driveway 2 & University Parkway	EBL	25	180	Yes
		SBL	25	50	Yes
7	Driveway 3 & University Parkway	EBR	25	135	Yes
		WBL	45	100	Yes
		NBR	25	100	Yes

N/A - not applicable

Freeway Ramp Analysis

Table 4-20 presents LOS for freeway ramps within the study area under Horizon Year (2040) No Build and Build Conditions. The Horizon Year (2040) No Build and Build analysis indicates that ramps within the study area are forecasted to operate at acceptable LOS D or better with the exception of the following:

- Southbound University Parkway Off-Ramp (AM and PM Peak Hours)

It should be noted that southbound I-215 University Parkway On-Ramp merge onto the freeway mainline as a single-lane addition; therefore, per HCM 2010 methodology, the upstream and downstream freeway segments are analyzed as basic freeway segments and no separate merge or diverge analysis is performed.

Also, note that under the Horizon Year (2040) Build conditions, the proposed Project would not alter the ramps within the study area; hence, the LOS results for freeway ramps would be identical to the No Build conditions analysis.

Freeway Mainline Analysis

Table 4-21 lists the freeway mainline LOS and density results under Horizon Year (2040) No Build and Build conditions. As shown in Table 4-21 under the Horizon Year (2040) No Build and Build conditions, the freeway segments are forecasted to operate at LOS D or better with the exception of the following:

- I-215 Northbound South of University Parkway On-Ramp (PM Peak Hour)
- I-215 Southbound South of University Parkway On-Ramp (AM and PM Peak Hours)

It should be noted that under the Horizon Year (2040) Build conditions, the proposed Project would not alter the freeway mainline within the study area; hence, the LOS results for freeway mainline would be identical to the No Build conditions analysis.



Table 4-20. Horizon Year (2040) No Build/Build Freeway Ramp LOS Results

No. of Lanes ¹	Ramp/Segment Capacity ²	AM Peak Hour				PM Peak Hour			
		Ramp	Ramp Junction ³			Ramp	Ramp Junction ³		
		Traffic Volume ₂	Density	V/C	LOS	Traffic Volume ₂	Density	V/C	LOS
Northbound									
1	University Pkwy On-Ramp	245	13.7	0.16	B	545	28.3	0.36	D
2	University Pkwy Off-Ramp ^a	2,945	23.3	0.98	C	2,785	32.4	0.93	D
Southbound									
1	University Pkwy Off-Ramp	500	48.8	0.33	F	675	38.0	0.45	E
1	University Pkwy On-Ramp ^b	2,060	N/A	N/A	N/A	2,295	N/A	N/A	N/A

¹ Number of lanes on the ramp at the gore point (off-ramp) or 6-foot point (on-ramp).

² Peak hour traffic volumes are shown in vehicles per hour (vph).

³ The freeway ramp junctions were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition merge or diverge ramp-freeway junction analysis. Freeway ramp junction LOS is based on density (cars/mile/lane).

^a Major diverge area; Highway Capacity Manual (HCM) 2010 Edition methodology (Exhibit 13-19) applied for analysis.

^b Single-lane addition/drop; Highway Capacity Manual (HCM) 2010 Edition methodology (Page 13-18) applied for analysis. The upstream and downstream freeway segments are analyzed as basic freeway segments and no separate merge or diverge analysis is performed.

N/A - not applicable

Table 4-21. Horizon Year (2040) No Build/Build Freeway Mainline LOS Results

Freeway Segment ¹	# of Lanes	AM Peak Hour				PM Peak Hour			
		General Purpose Lanes				General Purpose Lanes			
		Traffic Volume ²	HCM Results ¹			Traffic Volume ²	HCM Results ¹		
			Density ³	V/C	LOS		Density ³	V/C	LOS
Northbound									
North of University Pkwy On-Ramp	3	2,140	14.9	0.30	B	4,720	32.8	0.66	D
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	3	1,895	13.2	0.26	B	4,175	29.0	0.58	D
South of University Pkwy Off-Ramp	4	4,840	25.2	0.58	C	6,960	36.9	0.83	E
Southbound									
North of University Pkwy Off-Ramp	3	4,640	32.3	0.64	D	3,550	24.7	0.49	C
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	3	4,140	28.8	0.58	D	2,875	20.0	0.40	C
South of University Pkwy On-Ramp	3	6,200	50.5	1.03	F	5,170	36.5	0.86	E

¹ The freeway segments were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition basic freeway segment analysis.

² Peak hour traffic volumes are shown in vehicles per hour (vph).

³ Density = Passenger car/mile/lane

4.4.2 Horizon Year 2040 Build Analysis

Intersection Analysis

Table 4-22 presents LOS and average delay results for AM and PM peak hours. As shown in Table 4-22, under Horizon Year (2040) Build conditions, all intersections are forecasted to operate at LOS D or better with the exception of the following intersections that are forecasted to operate at LOS E or F:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- Driveway 3 & University Parkway (AM and PM Peak Hours)
- I-215 NB Off-Ramp & University Parkway (AM Peak Hour)

Compared to the No Build conditions, the overall intersection delay decreased for the intersection at North Varsity Avenue/North State Street & University Parkway and Driveway 3 & University Parkway. Also, the I-215 NB and SB Ramps improved from LOS E or F to LOS D or better during both AM and PM peak hours.

Intersection Queuing Analysis

Table 4-23 displays intersection queuing results for intersections under Horizon Year (2040) Build conditions. As shown in Table 4-23, adequate storage is forecasted to be provided for all intersections under the Opening Year (2040) Build Analysis with the exception of the following:

- North Varsity Avenue/North State Street & University Parkway - northbound left turn lanes, eastbound and westbound through and left turn lanes
- I-215 NB Ramps & University Parkway - eastbound through lanes
- I-215 SB Ramps & University Parkway - westbound through lanes
- Hallmark Parkway & University Parkway - eastbound, westbound, and southbound left turn lanes
- Driveway 3 & University Parkway - northbound right turn lanes

Compared to the No Build conditions, adequate storage is forecasted to be provided for both the I-215 NB and SB Off-Ramps.

Ramp Metering Analysis

Table 4-24 displays ramp metering results for the I-215 NB and SB On-Ramps under Horizon Year (2040) Build conditions. As shown, adequate storage is not provided for SB On-Ramps with two General Purpose (GP) lanes plus one High Occupancy Vehicle (HOV) lane and with three GP lanes. Adequate storage is not provided for NB On-Ramp with one GP plus one HOV lane; however, adequate storage is provided with two GP lanes. The standard on-ramp lane configuration would require a future HOV lane per Caltrans Ramp Metering Design Manual; however, any deviation from the design manual would need a design exception.

Signalized Interchange Analysis

This section of the report presents the DDI interchange operations analysis results for 2040 Build conditions for each O-D through the interchange. Northbound and southbound ramp terminals were illustrated separately. summarizes the interchange analysis results for 2040 Build conditions. As shown in , the following O-D movements are forecasted to operate at LOS F:

- I-215 NB Ramps & University Parkway (Northbound Left and Right - AM and PM Peak Hours; Eastbound Through - AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (Westbound Through - AM and PM Peak Hours)

The above mentioned O-D movements are forecasted to operate at a delay of more than 120 seconds, demand exceeding capacity with a volume-to-capacity ratio greater than 1, and queue spillback onto adjacent intersections with a queue storage ratio greater than 1. It should be noted that this analysis show each movement traveling through two intersections; therefore, the delay and queuing results are greater compared to traveling through a single intersection and are considered the worst case scenario for traffic operations along University Parkway interchange.

Additional design year failure analysis was conducted for the Build conditions (Alternative 2 - DDI). Under the Build conditions (Alternative 2 - DDI), the forecasted design failure of the project at I-215 NB Off-Ramp & University Parkway is Year 2033 or approximately thirteen years after Opening Year 2020.

It should be noted that the traffic operational analysis in this report does not include the proposed I-215/Pepper-Linden-Campus Interchange in future forecasts allowing for the highest 2040 volumes in the case that this proposed interchange is never constructed. The result of the analysis presented in this report represents the worst case scenario for traffic operations along University Parkway interchange.

Freeway Ramp Analysis

Under the Horizon Year (2040) Build conditions, the proposed Project would not alter the ramps within the study area; hence, the LOS results for freeway ramps would be identical to the No Build conditions analysis as shown in Table 4-20.

Freeway Mainline Analysis

Under the Horizon Year (2040) Build conditions, the proposed Project would not alter the freeway mainline within the study area; hence, the LOS results for the freeway mainline would be identical to the No Build condition analysis as shown in Table 4-21.

Table 4-22. Horizon Year (2040) Intersection Comparison LOS Results

No.	Intersection (N/S & E/W)	AM Peak					PM Peak				
		Horizon Year (2040) No Build		Horizon Year (2040) Build		Delta	Horizon Year (2040) No Build		Horizon Year (2040) Build		Delta
		Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay
1	North Varsity Avenue/North State Street & University Parkway	265	F	171.6	F	-93.4	160	F	131.6	F	-28.4
2	I-215 NB Ramp & University Parkway	207.5	F	49.3	D	-158.2	197.5	F	49.1	D	-148.4
3	I-215 SB Ramps & University Parkway	211.5	F	25	C	-186.5	327.8	F	28.3	C	-299.5
4	Hallmark Parkway & University Parkway	51.3	D	28	C	-23.3	49.9	D	39.9	D	-10
5	Driveway 1 & University Parkway	18	C	17.2	C	-0.8	21.8	C	16.4	C	-5.4
6	Driveway 2 & University Parkway	22.4	C	N/A	N/A	N/A	20.4	C	N/A	N/A	N/A
7	Driveway 3 & University Parkway	156.6	F	131.3	F	-25.3	102.4	F	95.2	F	-7.2
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	N/A	N/A	73.3	E	N/A	N/A	N/A	53.1	D	N/A
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	N/A	N/A	18.4	B	N/A	N/A	N/A	17.5	B	N/A
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	N/A	N/A	10.5	B	N/A	N/A	N/A	15.2	B	N/A
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	N/A	N/A	3.7	A	N/A	N/A	N/A	3.4	A	N/A

Delay in seconds; Delta = Build Condition Delay – No Build Condition Delay
N/A - not applicable

Table 4-23. Horizon Year (2040) Build Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Minimum Storage Required (ft)	Provided Storage	Storage Adequate?
1	North Varsity Avenue/North State Street & University Parkway	EBL	426	160	No
		EBT	1,427	690	No
		EBR	169	415	Yes
		WBL	220	150	No
		WBT	1,173	730	No
		WBR	20	400	Yes
		NBL	793	100	No
		NBT	126	500	Yes
		SBL	36	112	Yes
		SBT	208	1,000	Yes
2	I-215 NB Ramps & University Parkway	EBT	960	455	No
		WBT	221	690	Yes
3	I-215 SB Ramps & University Parkway	EBT	448	450	Yes
		WBT	615	455	No
4	Hallmark Parkway & University Parkway	EBL	298	170	No
		EBT	572	1,180	Yes
		WBL	141	90	No
		WBT	327	455	Yes
		WBR	40	120	Yes
		NBL	57	60	Yes
		NBT	95	160	Yes
		SBL	580	120	No
		SBT	561	720	Yes
5	Driveway 1 & University Parkway	EBL	25	90	Yes
		SBL	25	50	Yes
6	Driveway 2 & University Parkway	SBL	N/A	N/A	N/A
7	Driveway 3 & University Parkway	EBR	25	80	Yes
		WBL	40	100	Yes
		NBR	163	100	No
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	NBR	1,440	1,490	Yes
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	NBL	706	710	Yes
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	SBL	513	1,435	Yes
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	SBR	188	305	Yes



Table 4-24. Horizon Year (2040) Build On-Ramp Queuing Results

No.	Location	2040 Volume (DDI)	Proposed # of GP Lanes	Proposed # of HOV Lane	Min GP Storage Length (ft)	Min HOV Storage Length (ft)	Min Storage Length Required (ft)	Provided Storage (ft)	Storage Adequate?
AM Peak Hour									
2	I-215 NB University Parkway On-Ramp	245	1	1	423	75	423	640	Yes
		245	2	0	211	N/A	211	640	Yes
3	I-215 SB University Parkway On-Ramp	2,060	2	1	1,777	627	1,777	750	No
		2,060	3	0	1,394	N/A	1,394	750	No
PM Peak Hour									
2	I-215 NB University Parkway On-Ramp	545	1	1	940	166	940	640	No
		545	2	0	470	N/A	470	640	Yes
3	I-215 SB University Parkway On-Ramp	2,295	2	1	1,980	699	1,980	750	No
		2,295	3	0	1,553	N/A	1,553	750	No

Table 4-25. Horizon Year (2040) Build Signalized Interchange LOS Results

2040 AM Peak Hour								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	Control Delay (s)	--	--	--	--	126.3	8.7
		Volume-to-Capacity (v/c)	--	--	--	--	1.18	0.71
		Queue Storage Ratio (RQ)	--	--	--	--	2.01	0.32
		v/c >1?	--	--	--	--	Yes	No
		RQ >1?	--	--	--	--	Yes	No
		LOS	--	--	--	--	F	A
3	I-215 SB Ramps & University Parkway	Control Delay (s)	--	--	--	--	31.4	24.5
		Volume-to-Capacity (v/c)	--	--	--	--	0.64	0.75
		Queue Storage Ratio (RQ)	--	--	--	--	1	1.04
		v/c >1?	--	--	--	--	No	No
		RQ >1?	--	--	--	--	No	Yes
		LOS	--	--	--	--	B	F
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	108.7	--	--	--	--
		Volume-to-Capacity (v/c)	--	1.17	--	--	--	--
		Queue Storage Ratio (RQ)	--	0.97	--	--	--	--
		v/c >1?	--	Yes	--	--	--	--
		RQ >1?	--	No	--	--	--	--
		LOS	--	F	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	104.1	--	--	--	--	--
		Volume-to-Capacity (v/c)	1.03	--	--	--	--	--
		Queue Storage Ratio (RQ)	0.96	--	--	--	--	--
		v/c >1?	Yes	--	--	--	--	--
		RQ >1?	No	--	--	--	--	--
		LOS	F	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	--	--	37.9	--	--	--
		Volume-to-Capacity (v/c)	--	--	0.47	--	--	--
		Queue Storage Ratio (RQ)	--	--	0.21	--	--	--
		v/c >1?	--	--	No	--	--	--
		RQ >1?	--	--	No	--	--	--
		LOS	--	--	C	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	--	--	26.2	--	--
		Volume-to-Capacity (v/c)	--	--	--	0.27	--	--
		Queue Storage Ratio (RQ)	--	--	--	0.62	--	--
		v/c >1?	--	--	--	No	--	--
		RQ >1?	--	--	--	No	--	--
		LOS	--	--	--	B	--	--



Table 4-25. Horizon Year (2040) Build Signalized Interchange LOS Results

2040 PM Peak Hour								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	Control Delay (s)	--	--	--	--	132.5	14.4
		Volume-to-Capacity (v/c)	--	--	--	--	1.17	0.88
		Queue Storage Ratio (RQ)	--	--	--	--	2.11	0.11
		v/c >1?	--	--	--	--	Yes	No
		RQ >1?	--	--	--	--	Yes	No
		LOS	--	--	--	--	F	A
3	I-215 SB Ramps & University Parkway	Control Delay (s)	--	--	--	--	41.9	37.5
		Volume-to-Capacity (v/c)	--	--	--	--	0.65	0.79
		Queue Storage Ratio (RQ)	--	--	--	--	0.75	1.35
		v/c >1?	--	--	--	--	No	No
		RQ >1?	--	--	--	--	No	Yes
		LOS	--	--	--	--	B	F
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	81.8	--	--	--	--
		Volume-to-Capacity (v/c)	--	1.1	--	--	--	--
		Queue Storage Ratio (RQ)	--	0.86	--	--	--	--
		v/c >1?	--	Yes	--	--	--	--
		RQ >1?	--	No	--	--	--	--
		LOS	--	F	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	100.3	--	--	--	--	--
		Volume-to-Capacity (v/c)	1.02	--	--	--	--	--
		Queue Storage Ratio (RQ)	0.99	--	--	--	--	--
		v/c >1?	Yes	--	--	--	--	--
		RQ >1?	No	--	--	--	--	--
		LOS	F	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	Control Delay (s)	--	--	50.6	--	--	--
		Volume-to-Capacity (v/c)	--	--	0.72	--	--	--
		Queue Storage Ratio (RQ)	--	--	0.36	--	--	--
		v/c >1?	--	--	No	--	--	--
		RQ >1?	--	--	No	--	--	--
		LOS	--	--	C	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	Control Delay (s)	--	--	--	24.8	--	--
		Volume-to-Capacity (v/c)	--	--	--	0.26	--	--
		Queue Storage Ratio (RQ)	--	--	--	0.6	--	--
		v/c >1?	--	--	--	No	--	--
		RQ >1?	--	--	--	No	--	--
		LOS	--	--	--	B	--	--

-- not applicable

4.5 Intersection Control Evaluation

Caltrans Traffic Operations Policy Directive (TOPD) #13-02 establishes a performance-based evaluation process to identify viable and practical access alternatives for State Highways. The Interchange Evaluation Review process requires that the Caltrans District 8 Intersection Control Evaluation (ICE) Coordinator, Caltrans Design Coordinator, Design Liaison, the Headquarter Traffic Liaison, and the FHWA Transportation Engineer review and approve the analysis of each interchange concept and provide input on the traffic control configuration. This policy supplements Caltrans Manual on Uniform Traffic Control Devices (MUTCD) warrants and engineering study requirements pertaining to the use of a menu of traffic control options for intersections. The goal of this process is to make the decision to implement the most efficient intersection control system or strategy at each interchange. In addition, this process aims to consider innovative traffic control measures such as Single Point Urban Interchange (SPUI), Diverging Diamond Interchanges, Roundabouts, and other measures that reduce the amount of signalized intersections being implemented. There also is an increased emphasis on pedestrian and bike access and safety.

The evaluation provided in this report follows the latest Caltrans ICE Process Information Guide which follows a two-step process that includes a screening assessment followed by design and analysis. The TEPA that was completed in October 2016 analyzed numerous intersection control configurations for the I-215 at University Parkway Interchange Project and identified two viable alternatives to improve intersections control access and capacity. These included:

1. Addition of a westbound loop on-ramp to southbound I-215;
2. Reconfiguration of the existing tight diamond interchange as a DDI.

The TEPA prepared in the PSR included analysis of operating conditions of the two alternatives including analysis of the level of service conditions at the Project intersections. As such, the TEPA provided documentation mandated by Caltrans to meet Step 1 of the process which screened out the loop on-ramp alternative from further consideration due to cost and environmental impacts.

After further review, a Value Analysis (VA) Study Report was undertaken in the PSR phase to define any potential improvements that should be considered. The value analysis addressed the ICE requirements in the following manner:

Existing Deficiencies

This Project was initiated at the request of the City of San Bernardino to address the traffic congestion from the east side of the I-215 and University Parkway Interchange that is heading to the Southbound I-215 On-Ramp. The original concept of adding a loop on-ramp for westbound University Parkway to southbound I-215 has significant right-of-way impacts with the Wal-Mart and Jack in the Box businesses in that area. The T.Y. Lin International Group developed a concept for a direct connector from westbound University Parkway to southbound I-215. This concept was rejected by Caltrans due to the stopping sight distance concerns along the ramp alignment and operational issues related to the University Parkway and North Varsity Avenue Intersection.

Even with the concerns expressed by Caltrans, the baseline for the VA Study was the direct connector on-ramp configuration. The cost estimate for that alternative was \$24,833,480.

The purpose of the Project is to reconfigure the interchange in order to improve southbound on-ramp movements and relieve local congestion for traffic heading westbound on University Parkway toward the interchange. This congestion is caused by a large portion of this traffic accessing the southbound I-215 On-Ramp. The following information was provided as part of the deficiencies analysis provided to the VA Team:

Complete funding for the Project is still being pursued by the City, but it is not currently available. The Project will likely have to be built with a limited amount of construction funds and will require an efficient design that minimizes structure impacts.

There is a large amount of development that constricts the potential Project improvements and creates increased traffic volumes. The CSUSB campus is a major traffic generator that has a master plan to increase enrollment to 30,000 students. Congestion associated with development has raised issues of being able to provide emergency services to the west side of the freeway.

- Current ramp design is at an 8% grade with limited sight distance issues; if vehicles stop on a hill, restarts may be difficult.
- Left turns for trucks from I-215 onto westbound University Parkway require a wide swing.
- One of the goals of the design is to minimize impacts to local business, as well as right-of-way acquisition and bridge widening.
- Need to maintain traffic flow during construction to minimize temporary impacts.
- Scottish Rite Center has an access gate/driveway to University Parkway that they currently do not use. (Primary access to this site is provided from the driveway located on North Varsity Avenue.)

Context Sensitive Elements

This interchange provides access to residential areas as well as industrial land uses (with Heavy Duty Truck Traffic) and the CSUSB campus. While the interchange must provide adequate capacity, it must also be developed to provide mobility for a wide variety of users including trucks, passenger cars, bicycles, and pedestrians. The design improvements must consider these users and provide multi-modal mobility for the area. In that context, the interchange needs to be designed to avoid significant environmental impacts and needs to be acceptable to all stakeholders. Many of the proposed alternatives did not meet these context sensitive needs.

Traffic Volumes

Opening Year and Horizon Year forecasts have been provided in Section 3 of this TOAR. These projected volumes indicate that there will be a significant increase in volumes due to development of the CSUSB campus that is more significant than other built out areas of the City.

The selected design must be capable of handling these significant volumes while being context sensitive.

Options Screening

The VA Study Report identified and evaluated ten potential alternatives to determine which of them would provide the most potential benefits at the least cost. The results of the VA Study were presented as individual alternatives to the original concept. The VA alternative documents in this section were presented as written by the team during the VA Study. They represent the VA team's findings during the VA Study.

Each alternative consists of a summary of the original concept, a description of the suggested change, a listing of its advantages and disadvantages, a cost comparison, change in performance, and a brief narrative comparing the original design with the alternative (see **Table 4-26**). Sketches, calculations, and performance attribute ratings are also presented. The cost comparisons reflect a comparable level of detail that was listed in the preliminary PSR estimate.

Table 4-26. Summary of Value Analysis Alternatives

Alt. No.	Alternative Title	Potential Initial Savings	Potential Performance Change	Validated Initial Cost Savings	Validated Performance Change
1.1	Restripe Existing University Parkway for Triple Left to Southbound On-Ramp	\$21,860,000	+1%	Rejected	Rejected
1.2	Construct Single-Point Urban Interchange	\$1,486,000	+10%	Rejected	Rejected
1.3	Relocate the Northbound On-Ramp Access to North Varsity Avenue (Hook Ramp)	\$20,601,000	-7%	Rejected	Rejected
1.4	Relocate the Northbound On- and Off-Ramps to Access Off of North Varsity Avenue (Hook Ramps)	\$14,659,000	-2%	Rejected	Rejected
1.5	Reduce Ramp Grade by Locating Entrance on North Varsity Avenue Along the North Boundary of the Scottish Rite Center	(\$3,270,000)	-4%	Rejected	Rejected
1.6	Replace Direct Access Bridge with Loop Access at the Northwest Corner	\$14,749,000	-1%	\$15,021,000	+4%
2.0	Modify Radii at Ramps to Improve Left Turns and Add a Right-Turn Lane at the Southbound On- Ramp to Increase Capacity	(\$415,000)	+10%	Rejected	Rejected
3.0	Lengthen Existing I-215 Bridge to Provide More Lanes on University Parkway	\$14,271,000	-9%	Rejected	Rejected
4.0	Construct a Half Interchange at the Planned Campus Parkway (Pepper Linden) Interchange	(\$11,967,000)	+4%	Rejected	Rejected
5.0	Close Both Driveways from Gas Station to Access Ramp Closer to North Varsity Avenue	(\$1,367,000)	+5%	Rejected	Rejected

Performance Analysis

The alternatives generated by the VA team were carefully evaluated along with the original concepts, and project-specific attributes were applied to each concept to assure an objective evaluation. The VA team used the paired comparison method to prioritize the key performance attributes for this Project including the following:

1. Mainline Operations
2. Construction Impacts
3. Project Schedule
4. Phased Constructability
5. Local Operations
6. Environmental Impacts
7. Maintainability

The VA team enlisted the assistance of the stakeholders and designers (when available) to develop these attributes so that the evaluation would reflect their specific requirements. The VA team, as a group, generated and evaluated ideas on how to perform the various functions. The list was grouped by function or major Project element. The VA team compared each of the ideas with the original concept for each of the performance attribute to determine whether it was better than, equal to, or worse than the original concept. The VA team reached a consensus on the ranking of the idea. High-ranked ideas would be developed further; low-ranked ones would be dropped from further consideration.

At the end of this evaluation, the VA team decided that the only alternatives that warranted further consideration was 1) the southbound loop on-ramp in the northwest quadrant and 2) the concept of a DDI that maintained the existing bridge overcrossing. These two alternatives were evaluated in the PSR phase before the DDI was identified as the only feasible alternative.

Step 2 Recommendations

The TOAR analysis addressed performance with respect to safety, mobility, and cost for a reasonable range of practical configuration and control alternatives. The district has developed a unique procedure and outline to implement this process. The analysis considered the work that had been performed as part of the PSR-PDS and subsequent Value Analysis Study Report (dated October 2009). The approach used the PSR efforts as a starting point including the interchange options that were reviewed with Caltrans as part of the PSR contract.

As required by Caltrans, Caltrans State-Highway study intersections were evaluated in accordance with the ICE policy for State Highway intersections. The ICE policy requires that control alternatives be evaluated and compared for level of service and performance. The following State-Highway controlled intersections are required to be evaluated in accordance with ICE:

- I-215 NB Ramps & University Parkway

- I-215 SB Ramps & University Parkway

After review and analysis of the PSR/PDS, TEPA, and Value Analysis Study Report, it was determined that the only alternative that met need and purpose within the available construction funding was the DDI alternative. Therefore, to be consistent with previous study findings SBCTA has elected to carry the no build and the DDI as the Project build alternatives through the environmental process for Project approval and environmental document clearance.

5 Summary and Conclusion

This section summarizes the analysis results and findings presented in previous sections of this report. The analysis was performed for intersections, freeway ramps and mainlines within the study area under Existing (2017), Opening Year (2020) No Build and Build conditions, Horizon Year (2040) No Build and Build conditions. The purpose of this analysis was to identify and refine study intersection elements of the build alternative, assess the relative congestion relief benefits of the build alternative, and identify any traffic congestion impacts created by the build alternative.

This report provides a complete documentation of traffic volumes and associated traffic operation analyses during the morning and the evening peak hours within the Project study area for the following:

- Intersection and Interchange operations
- Freeway mainline
- Merge and diverge areas
- On- and Off-Ramp locations
- Ramp meter operations

The objective of this section is to provide a comparison of the Build conditions (Alternative 2 - DDI) against the No-Build (Alternative 1) conditions to illustrate whether the Project meets its identified objectives as defined in the Project Need and Purpose. The proposed Project is intended to maintain acceptable levels of traffic operations at University Parkway and I-215 interchange, while providing safe and efficient local circulation and traffic operations through Horizon Year 2040.

In summary, the results of the analysis presented in this report (operational LOS) show that the implementation of the Alternative 2 (DDI) would provide efficient traffic operations when compared to Alternative 1 (No Build) at University Parkway and I-215 interchange under future traffic conditions. Future traffic volumes provide a worst-case scenario for operations if no further transportation improvements are implemented in the area.

Intersection Analysis

Table 5-1 summarizes the intersection LOS and average vehicle delay for all conditions analyzed. The intersections that are either currently or forecasted to operate at LOS E or F under Existing (2017), Opening Year (2020) No Build and Build conditions, Horizon Year (2040) No Build and Build conditions are summarized below.

Existing (2017) Conditions:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- I-215 NB Ramps & University Parkway (AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (PM Peak Hour)

Opening Year (2020) No Build Conditions:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- I-215 NB Ramps & University Parkway (AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (AM and PM Peak Hours)

Opening Year (2020) Build conditions:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)

Horizon Year (2040) No Build Conditions:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- I-215 NB Ramps & University Parkway (AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (AM and PM Peak Hours)
- Driveway 3 & University Parkway (AM and PM Peak Hours)

Horizon Year (2040) Build Conditions:

- North Varsity Avenue/North State Street & University Parkway (AM and PM Peak Hours)
- Driveway 3 & University Parkway (AM and PM Peak Hours)
- I-215 NB Off-Ramp & University Parkway (AM Peak Hour)

Additional design year failure analysis was conducted for the Build conditions (Alternative 2 - DDI). Under the Build conditions (Alternative 2 - DDI), the forecasted design failure of the project at I-215 NB Off-Ramp & University Parkway is Year 2033 or approximately thirteen years after Opening Year 2020.

Overall, compared to the No Build conditions, the intersections are forecasted to operate with an improvement and reduction in average delay under the future Build Conditions. To further improve operations at North Varsity Avenue/North State Street & University Parkway under the Build conditions, the following mitigation measures are recommended as a separate project by other.

- Provide dual northbound left turn lanes (From North State Street to University Parkway).
- Provide dual eastbound left turn lanes (From University Parkway to North Varsity Avenue).
- Provide an additional through lane for both eastbound and westbound approaches resulting in total four through lanes in each direction.

It should be noted that the recommended mitigation measures should consider physical and design constraints. Also, these recommended mitigation measures are out of the project scope and should be included as a separate project by other. The intersection of North Varsity Avenue/North State Street & University Parkway is forecasted to operate at

unacceptable LOS E or F under future year No Build conditions; therefore, it is a pre-existing condition that is not impacted by the reconstruction of University Parkway interchange.

These mitigation measures would need to be coordinated with the City and any improvements would be implemented as a separate City project since it is a local circulation issue that needs to be implemented at a local level.

Intersection Queuing Analysis

Table 5-2 summarizes the intersection queuing analysis for the study intersections. The information presented represents a worst case scenario in that the 95 percentile queue length is being reported for the highest hour for the highest lane or lane group. The purpose of this analysis is to identify areas of concern, particularly those queues which have the potential to back up onto the adjacent intersections during the peak hour. The intersections that are either currently or forecasted not to provide adequate storage under Existing (2017), Opening Year (2020) No Build and Build conditions, Horizon Year (2040) No Build and Build conditions are summarized below.

Existing (2017) Conditions:

- North Varsity Avenue/North State Street & University Parkway - eastbound and northbound left turn lanes
- I-215 SB Ramps & University Parkway - eastbound through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Opening Year (2020) No Build Conditions:

- North Varsity Avenue/North State Street & University Parkway - eastbound and northbound left turn lanes
- I-215 SB Ramps & University Parkway - eastbound through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Opening Year (2020) Build Conditions:

- North Varsity Avenue/North State Street & University Parkway - northbound and eastbound left turn lanes, and eastbound through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Horizon Year (2040) No Build Conditions:

- North Varsity Avenue/North State Street & University Parkway - northbound and eastbound left turn lanes, and westbound through lanes
- I-215 NB Ramps & University Parkway - northbound right turn lanes
- I-215 SB Ramps & University Parkway - eastbound through lanes, and westbound left turn and through lanes
- Hallmark Parkway & University Parkway - eastbound and southbound left turn lanes

Horizon Year (2040) Build Conditions:

- North Varsity Avenue/North State Street & University Parkway - northbound left turn lanes, eastbound and westbound through and left turn lanes
- I-215 NB Ramps & University Parkway - eastbound through lanes
- I-215 SB Ramps & University Parkway - westbound through lanes
- Hallmark Parkway & University Parkway - eastbound, westbound, and southbound left turn lanes
- Driveway 3 & University Parkway - northbound right turn lanes

Overall, compared to the No Build conditions, the intersections are forecasted to operate with an improvement and reduction in queuing under the future Build Conditions. To further improve queuing at North Varsity Avenue/North State Street & University Parkway under the Build conditions, the following mitigation measures are recommended as a separate project by other.

- Provide dual northbound left turn lanes (From North State Street to University Parkway).
- Provide dual eastbound left turn lanes (From University Parkway to North Varsity Avenue).
- Provide an additional through lane for both eastbound and westbound approaches resulting in total four through lanes in each direction.

It should be noted that the recommended mitigation measures should consider physical and design constraints. Also, these recommended mitigation measures are out of the project scope and should be included as a separate project by other. The queuing analysis results indicate several intersections are forecasted to operate with inadequate storage under future year No Build conditions; therefore, it is a pre-existing condition that is not impacted by the reconstruction of University Parkway interchange.

These mitigation measures would need to be coordinated with the City and any improvements would be implemented as a separate City project since it is a local circulation issue that needs to be implemented at a local level.

Freeway Ramp Analysis

Table 5-3 summarizes the freeway ramp analysis for the I-215 at University Parkway interchange. The freeway ramps that are forecasted to operate at LOS E or F under Opening Year (2020) and Horizon Year (2040) conditions are summarized below. As discussed in the previous sections, the proposed Project would not modify the I-215 freeway ramps junction locations; hence, the LOS results would be identical under future year No Build and Build conditions.

Opening Year (2020) Conditions:

- Southbound University Parkway Off-Ramp (AM Peak Hour)

Horizon Year (2040) Conditions:

- Southbound University Parkway Off-Ramp (AM and PM Peak Hours)

Freeway Mainline Analysis

As shown in **Table 5-4** summarizes the freeway mainline analysis for the I-215 freeway just north and south of University Parkway interchange. The freeway segments that are forecasted to operate at LOS E or F under Horizon Year (2040) conditions are summarized below. As discussed in the previous sections, the proposed Project would not modify the I-215 freeway mainline; hence, the LOS results would be identical under future year No Build and Build conditions.

Horizon Year (2040) Conditions:

- I-215 Northbound South of University Parkway Off-Ramp (PM Peak Hour)
- I-215 Southbound South of University Parkway On-Ramp (AM and PM Peak Hours)

Ramp Metering Analysis

Table 5-5 summarizes the ramp metering analysis for the I-215 NB and SB On-Ramps. The purpose of this analysis is to identify areas of concern, particularly those queues which have the potential to back up onto University Parkway during the peak hour. The on-ramps that are forecasted not to provide adequate storage under Opening Year (2020) Build conditions and Horizon Year (2040) Build conditions are summarized below.

Opening Year (2020) Build Conditions:

- I-215 SB On-Ramp (AM and PM Peak Hours)

Horizon Year (2040) Build Conditions:

- I-215 NB On-Ramp (PM Peak Hour)
- I-215 SB On-Ramp (AM and PM Peak Hours)

During the implementation of ramp metering at the freeway on-ramps under the Build conditions, the following mitigation measures are recommended.

- Increase the meter rates to accommodate the required projected maximum queue.
- Exclude HOV lane at both I-215 NB and SB On-Ramps. With the implementation of this mitigation measure, the I-215 SB On-Ramp minimum storage required is reduced by approximately 22% or 1,553 feet under the Horizon Year (2040) Build conditions. Also, the I-215 NB on-ramp minimum storage required is reduced by approximately 50% or 470 feet under the Horizon Year (2040) Build conditions.

Due to physical and design constraints, additional storages are not expected to be provided at locations where the required storage is not met and the maximum meter rate is utilized. A higher meter rate may allow more throughput, but would generally cause turbulence at the merge area and increase congestion to the mainline freeway.

The standard on-ramp lane configuration would require a future HOV lane per Caltrans Ramp Metering Design Manual; however, any deviation from the design manual would need a design exception.

Signalized Interchange Analysis

Table 5-6 summarizes the I-215 signalized interchange under the 2020 and 2040 Build Conditions.

Under 2040 Build Conditions, the following DDI interchange O-D movements are forecasted to operate at LOS F:

- I-215 NB Ramps & University Parkway (Northbound Left and Right - AM and PM Peak Hours; Eastbound Through - AM and PM Peak Hours)
- I-215 SB Ramps & University Parkway (Westbound Through - AM and PM Peak Hours)

As show in Table 5-6, the eastbound O-D movements at I-215 NB Ramps are forecasted to operate at LOS F as a result of demand exceeding capacity and queue exceeding storage. However, at the eastbound approaches where the required capacity and storage is not met, it is concluded that there are no feasible improvements recommended. This is generally a result of physical and design constraints that limits additional capacity and storage. One of the major physical constraint is the existing undercrossing would remain in place and the geometric design is limited within the existing footprint.

It should be noted that this signalized interchange analysis show each movement traveling through two intersections; therefore, the delay and queuing results are greater compared to traveling through a single intersections. In addition, the future I-215/Pepper-Linden-Campus Interchange is not included in forecast; therefore, the forecasted results presented are considered the worst case scenario for traffic operations along University Parkway interchange since the highest 2040 volumes are utilized.

Conclusion

Analysis of the Build Alternative shows that traffic operations along University Parkway will improve (reducing delays and congestion) compared to No Build conditions. The traffic operations analysis indicates that acceptable operations could be restored throughout most of the study area and maintained through 2040, by undertaking basic lane widening, reconfiguring the existing interchanges to a DDI, as defined under Build Alternative.

The traffic operational analysis in this report does not include the future I-215/Pepper-Linden-Campus Interchange in forecasts allowing for the highest 2040 volumes in the case that this proposed interchange is never constructed. The result of the analysis presented in this report represents the worst case scenario for traffic operations along University Parkway.



Table 5-1. Summary of Intersection LOS

No.	Intersection (N/S & E/W)		Existing		ALTERNATIVE 1 - No Build				ALTERNATIVE 2 -DDI			
			2017		2020		2040		2020		2040	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	North Varsity Avenue/North State Street & University Parkway	LOS	F	E	F	E	F	F	E	E	F	F
		Delay (Sec)	87.7	60.5	124.8	62.8	265	160	57.6	63.6	171.6	131.6
2	I-215 NB Ramp & University Parkway	LOS	E	F	F	F	F	F	A	A	D	D
		Delay (Sec)	76	92.7	104.5	120.2	207.5	197.5	8.1	7	49.3	49.1
3	I-215 SB Ramps & University Parkway	LOS	D	E	E	F	F	F	C	B	C	C
		Delay (Sec)	38.3	58.1	65.9	85.2	211.5	327.8	25	18.2	25	28.3
4	Hallmark Parkway & University Parkway	LOS	C	D	C	D	D	D	C	C	C	D
		Delay (Sec)	26.0	39.6	28.2	41	51.3	49.9	22.1	29.5	28	39.9
5	Driveway 1 & University Parkway	LOS	B	D	B	C	C	C	B	B	C	C
		Delay (Sec)	13.3	16.4	14	17.7	18	21.8	13.4	14	17.2	16.4
6	Driveway 2 & University Parkway	LOS	C	D	C	C	C	C	N/A	N/A	N/A	N/A
		Delay (Sec)	15.2	15.6	16.2	16.7	22.4	20.4	N/A	N/A	N/A	N/A
7	Driveway 3 & University Parkway	LOS	C	C	D	D	F	F	D	D	F	F
		Delay (Sec)	23.3	23.1	26.7	25.9	156.6	102.4	27.4	27.4	131.3	95.2
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	B	C	E	D
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	18.5	22.6	73.3	53.1
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	B	B	B	B
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	11.6	13.4	18.4	17.5
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	A	A	B	B
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	5.1	6.4	10.5	15.2
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	LOS	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	A
		Delay (Sec)	N/A	N/A	N/A	N/A	N/A	N/A	1.7	1.6	3.7	3.4

Table 5-2. Summary of Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Existing (2017) Storage Adequate?	Opening Year (2020) No Build Storage Adequate?	Opening Year (2020) Build Storage Adequate?	Horizon Year (2040) No Build Storage Adequate?	Horizon Year (2040) Build Storage Adequate?
1	North Varsity Avenue/North State Street & University Pkwy	EBL	No	No	No	No	No
		EBT	Yes	Yes	No	Yes	No
		EBR	Yes	Yes	Yes	Yes	Yes
		WBL	Yes	Yes	Yes	Yes	No
		WBT	Yes	Yes	Yes	No	No
		WBR	Yes	Yes	Yes	Yes	Yes
		NBL	No	No	No	No	No
		NBT	Yes	Yes	Yes	Yes	Yes
		SBL	Yes	Yes	Yes	Yes	Yes
		SBT	Yes	Yes	Yes	Yes	Yes
2	I-215 NB Ramps & University Parkway	EBL	Yes	Yes	N/A	Yes	N/A
		EBT	Yes	Yes	Yes	Yes	No
		WBT	Yes	Yes	Yes	Yes	Yes
		WBR	Yes	Yes	N/A	Yes	N/A
		NBT	Yes	Yes	N/A	Yes	N/A
3	I-215 SB Ramps & University Parkway	EBT	No	No	Yes	No	Yes
		WBL	Yes	Yes	N/A	No	N/A
		WBT	Yes	Yes	Yes	No	No
		SBT	Yes	Yes	N/A	Yes	N/A
4	Hallmark Parkway & University Parkway	EBL	No	No	No	No	No
		EBT	Yes	Yes	Yes	Yes	Yes
		WBL	Yes	Yes	Yes	Yes	No
		WBT	Yes	Yes	Yes	Yes	Yes
		WBR	Yes	Yes	Yes	Yes	Yes
		NBL	Yes	Yes	Yes	Yes	Yes
		NBT	Yes	Yes	Yes	Yes	Yes
		SBL	No	No	No	No	No
		SBT	Yes	Yes	Yes	Yes	Yes
		SBR	Yes	Yes	Yes	Yes	Yes
5	Driveway 1 & University Parkway	EBL	Yes	Yes	Yes	Yes	Yes
		SBL	Yes	Yes	Yes	Yes	Yes
6	Driveway 2 & University Parkway	EBL	Yes	Yes	N/A	Yes	N/A
		SBL	Yes	Yes	N/A	Yes	N/A



Table 5-2. Summary of Intersection Queuing Results

No.	Intersection (N/S & E/W)	Movement	Existing (2017) Storage Adequate?	Opening Year (2020) No Build Storage Adequate?	Opening Year (2020) Build Storage Adequate?	Horizon Year (2040) No Build Storage Adequate?	Horizon Year (2040) Build Storage Adequate?
7	Driveway 3 & University Parkway	EBR	Yes	Yes	Yes	Yes	Yes
		WBL	Yes	Yes	Yes	Yes	Yes
		NBR	Yes	Yes	Yes	Yes	No
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	NBR	Yes	Yes	Yes	No	Yes
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	NBL	N/A	N/A	Yes	N/A	Yes
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	SBL	N/A	N/A	Yes	N/A	Yes
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	SBR	Yes	Yes	Yes	Yes	Yes

N/A - not applicable

Table 5-3. Summary of Freeway Ramp LOS

Ramp/Segment Capacity ¹	Existing (2017)				Opening Year (2020)				Horizon Year (2040)			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS
Northbound												
University Pkwy On-Ramp	14.4	B	27.9	C	15.5	B	30.1	D	13.7	B	28.3	D
University Pkwy Off-Ramp ^a	16.0	B	23.4	C	16.9	B	24.7	C	23.3	C	32.4	D
Southbound												
University Pkwy Off-Ramp	34.4	D	22.3	C	35.5	E	24.1	C	48.8	F	38.0	E
University Pkwy On-Ramp ^b	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

^a Major diverge area; Highway Capacity Manual (HCM) 2010 Edition methodology (Exhibit 13-19) applied for analysis.

^b Single-lane addition/drop; Highway Capacity Manual (HCM) 2010 Edition methodology (Page 13-18) applied for analysis. The upstream and downstream freeway segments are analyzed as basic freeway segments and no separate merge or diverge analysis is performed.

¹ The freeway ramp junctions were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition merge or diverge ramp-freeway junction analysis. Freeway ramp junction LOS is based on density (cars/mile/lane).

N/A - not applicable

Table 5-4. Summary of Freeway Mainline LOS Results

Freeway Segment ¹	Existing (2017)				Opening Year (2020)				Horizon Year (2040)			
	AM		PM		AM		PM		AM		PM	
	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS
Northbound												
North of University Pkwy On-Ramp	12.7	B	28.2	D	16.2	B	33.3	D	14.9	B	32.8	D
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	11.6	B	26.4	D	14.6	B	30.9	D	13.2	B	29.0	D
South of University Pkwy Off-Ramp	15.9	B	23.3	C	18.4	C	26.8	D	25.2	C	36.9	E
Southbound												
North of University Pkwy Off-Ramp	29.2	D	16.0	B	34.4	D	22.3	C	32.3	D	24.7	C
Between University Pkwy Off-Ramp and University Pkwy On-Ramp	27.3	D	14.8	B	32.1	D	20.1	C	28.8	D	20.0	C
South of University Pkwy On-Ramp	29.2	D	21.2	C	29.2	D	26.5	D	50.5	F	36.5	E

¹ The freeway segments were analyzed based on the Highway Capacity Manual (HCM) 2010 Edition basic freeway segment analysis.

Freeway LOS is based on density (cars/mile/lane).

Table 5-5. Summary of On-Ramp Queuing Results

No.	Location	Prop. No. of GP Lane	Prop. No. of HOV Lane	Opening Year (2020) Build Storage Adequate?	Horizon Year (2040) Build Storage Adequate?
<i>AM Peak Hour</i>					
2	I-215 NB University Parkway On-Ramp	1	1	Yes	Yes
		2	0	Yes	Yes
3	I-215 SB University Parkway On-Ramp	2	1	No	No
		3	0	No	No
<i>PM Peak Hour</i>					
2	I-215 NB University Parkway On-Ramp	1	1	Yes	No
		2	0	Yes	Yes
3	I-215 SB University Parkway On-Ramp	2	1	No	No
		3	0	No	No

Table 5-6. Summary of Signalized Interchange LOS Results

<i>Opening Year 2020 Build AM Peak Hour</i>								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	LOS	--	--	--	--	B	A
3	I-215 SB Ramps & University Parkway	LOS	--	--	--	--	B	C
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	LOS	--	B	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	LOS	D	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	LOS	--	--	C	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	LOS	--	--	--	B	--	--
<i>Horizon Year 2040 Build AM Peak Hour</i>								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	LOS	--	--	--	--	F	A
3	I-215 SB Ramps & University Parkway	LOS	--	--	--	--	B	F
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	LOS	--	F	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	LOS	F	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	LOS	--	--	C	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	LOS	--	--	--	B	--	--
<i>Opening Year 2020 Build PM Peak Hour</i>								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	LOS	--	--	--	--	A	A
3	I-215 SB Ramps & University Parkway	LOS	--	--	--	--	A	B
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	LOS	--	C	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	LOS	D	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	LOS	--	--	B	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	LOS	--	--	--	B	--	--
<i>Horizon Year 2040 Build PM Peak Hour</i>								
No.	Intersection (N/S & E/W)	LOS Criteria	NBL	NBR	SBL	SBR	EBT	WBT
2	I-215 NB Ramps & University Parkway	LOS	--	--	--	--	F	A
3	I-215 SB Ramps & University Parkway	LOS	--	--	--	--	B	F
8	I-215 NB Off-Ramp Right-turn Movement & University Parkway	LOS	--	F	--	--	--	--
11	I-215 NB Off-Ramp Left-turn Movement & University Parkway	LOS	F	--	--	--	--	--
16	I-215 SB Off-Ramp Left-turn Movement & University Parkway	LOS	--	--	C	--	--	--
31	I-215 SB Off-Ramp Right-turn Movement & University Parkway	LOS	--	--	--	B	--	--

-- not applicable

6 References

Board of Trustees of the California State University

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Transportation Research Board

2000 Highway Capacity Manual (HCM)

Transportation Research Board

2010 Highway Capacity Manual (HCM)



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Appendix A. Traffic Counts

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: Historical

Day: Tuesday

City: San Bernardino

Date: 3/15/2016

AM

NS/EW Streets:	Hallmark Pkwy		Hallmark Pkwy			University Pkwy			University Pkwy			TOTAL	
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
7:00 AM	1	0	1	36	0	15	15	102	2	4	54	64	294
7:15 AM	4	2	10	55	3	9	24	101	1	6	79	65	359
7:30 AM	0	1	5	48	2	11	22	113	2	2	99	83	388
7:45 AM	0	0	5	57	0	7	14	106	0	4	101	88	382
8:00 AM	0	0	3	51	1	10	19	99	1	5	68	63	320
8:15 AM	1	0	6	50	0	11	23	91	3	3	82	67	337
8:30 AM	4	2	3	52	1	14	26	84	0	3	78	67	334
8:45 AM	2	0	6	56	1	18	20	89	2	11	87	86	378
TOTAL VOLUMES :	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
APPROACH %'s :	21.43%	8.93%	69.64%	79.72%	1.57%	18.70%	17.00%	81.86%	1.15%	2.99%	51.06%	45.94%	2792
PEAK HR START TIME :	7:15 AM												TOTAL
PEAK HR VOL :	4	3	23	211	6	37	79	419	4	17	347	299	1449
PEAK HR FACTOR :	0.469			0.948			0.916			0.859			0.934

CONTROL : Signalized

UTURNS			
NB	SB	EB	WB
0	0	3	1
0	0	8	0
0	0	4	1
0	0	4	1
0	0	5	0
0	0	4	0
0	0	4	0
0	0	4	0
NB	SB	EB	WB
0	0	38	3

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: Historical

Day: Tuesday

City: San Bernardino

Date: 3/15/2016

PM

NS/EW Streets:	Hallmark Pkwy			Hallmark Pkwy			University Pkwy			University Pkwy			TOTAL
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
	1	1	0	1.5	0.5	1	1	2	0	1	2	1	
4:00 PM	2	4	9	139	6	35	33	105	2	15	128	78	556
4:15 PM	0	2	8	134	1	42	38	95	2	8	100	85	515
4:30 PM	4	2	9	143	4	62	40	95	2	6	107	95	569
4:45 PM	4	4	13	120	3	42	31	81	5	11	105	93	512
5:00 PM	4	2	18	115	2	27	34	110	2	19	102	89	524
5:15 PM	4	3	10	104	3	31	34	87	3	13	92	106	490
5:30 PM	3	3	9	118	8	39	28	116	3	11	98	122	558
5:45 PM	3	5	11	102	2	26	42	104	1	18	118	69	501
TOTAL VOLUMES :	24	25	87	975	29	304	280	793	20	101	850	737	4225
APPROACH %'s :	17.65%	18.38%	63.97%	74.54%	2.22%	23.24%	25.62%	72.55%	1.83%	5.98%	50.36%	43.66%	
PEAK HR START TIME :	400 PM												TOTAL
PEAK HR VOL :	10	12	39	536	14	181	142	376	11	40	440	351	2152
PEAK HR FACTOR :	0.726			0.874			0.945			0.940			0.946

UTURNS			
NB	SB	EB	WB
0	0	1	1
0	0	3	0
0	0	0	0
0	0	2	0
0	0	2	1
0	0	4	2
0	0	2	0
0	0	4	2
0	0	4	2
0	0	18	6

CONTROL : Signalized

ITM Peak Hour Summary

Prepared by:

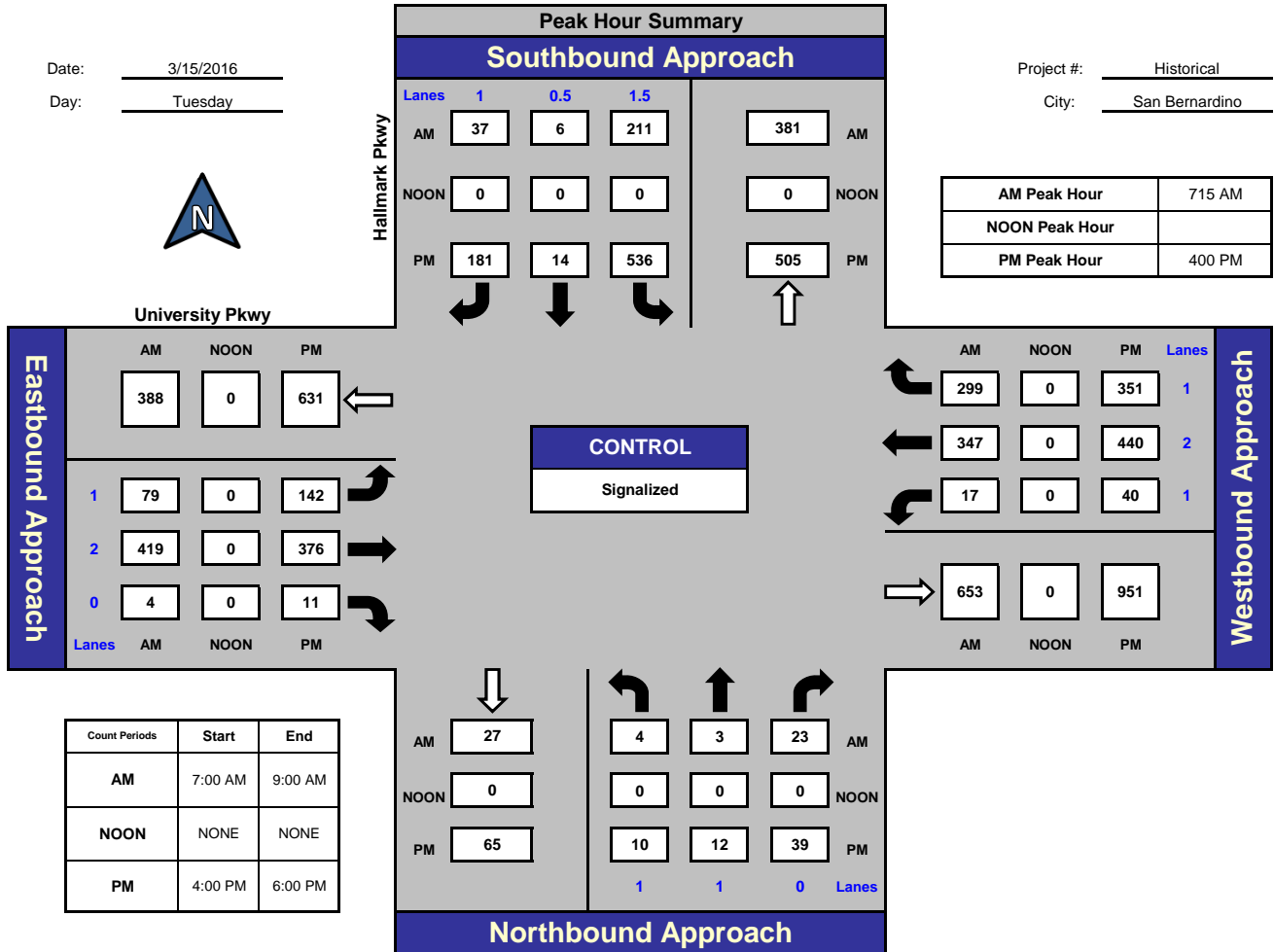


National Data & Surveying Services

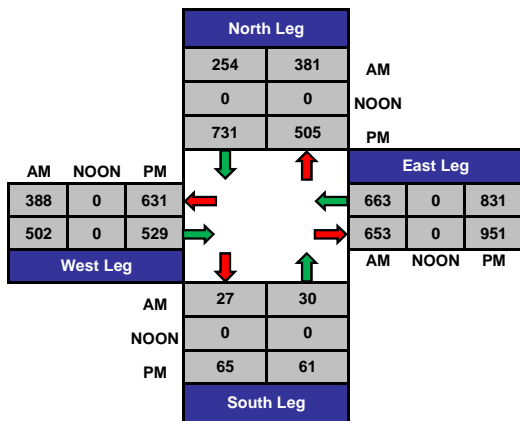
Hallmark Pkwy and University Pkwy, San Bernardino

Date: 3/15/2016
Day: Tuesday

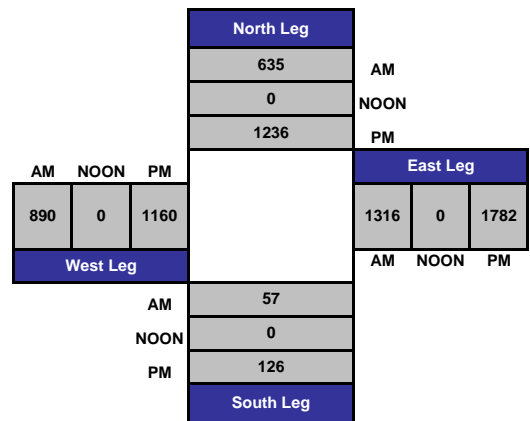
Project #: Historical
City: San Bernardino



Total Ins & Outs



Total Volume Per Leg



Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: Historical

Day: Tuesday

City: San Bernardino

Date: 3/15/2016

NS/EW Streets:	AM												TOTAL
	I-215 NB Ramps			I-215 SB Ramps			University Pkwy			University Pkwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
	0.5	0.5	2	0	0	0	1	2	0	0	3	1	
7:00 AM	60	0	201	0	0	0	4	68	0	0	304	22	659
7:15 AM	75	0	292	0	0	0	11	103	0	0	350	27	858
7:30 AM	79	2	464	0	0	0	9	111	0	0	365	26	1056
7:45 AM	112	1	495	0	0	0	6	118	0	0	325	13	1070
8:00 AM	57	2	314	0	0	0	3	96	0	0	259	5	736
8:15 AM	76	1	265	0	0	0	7	93	0	0	278	17	737
8:30 AM	68	0	273	0	0	0	9	75	0	0	265	20	710
8:45 AM	85	0	289	0	0	0	8	84	0	0	309	12	787
TOTAL VOLUMES :	612	6	2593	0	0	0	57	748	0	0	2455	142	6613
APPROACH %'s :	19.06%	0.19%	80.75%	#DIV/0!	#DIV/0!	#DIV/0!	7.08%	92.92%	0.00%	0.00%	94.53%	5.47%	
PEAK HR START TIME :	7:15 AM												TOTAL
PEAK HR VOL :	323	5	1565	0	0	0	29	428	0	0	1299	71	3720
PEAK HR FACTOR :	0.778			0.000			0.921			0.876			0.869

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

CONTROL : Signalized

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: Historical

Day: Tuesday

City: San Bernardino

Date: 3/15/2016

PM

NS/EW Streets:	I-215 NB Ramps			I-215 SB Ramps			University Pkwy			University Pkwy			TOTAL
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
	0.5	0.5	2	0	0	0	1	2	0	0	3	1	
4:00 PM	82	0	335	0	0	0	14	132	0	0	479	30	1072
4:15 PM	80	1	294	0	0	0	16	134	0	0	380	26	931
4:30 PM	103	0	330	0	0	0	12	120	0	0	337	20	922
4:45 PM	113	1	356	0	0	0	9	126	0	0	309	19	933
5:00 PM	95	0	348	0	0	0	14	146	0	0	392	24	1019
5:15 PM	104	1	439	0	0	0	13	134	0	0	391	17	1099
5:30 PM	132	6	522	0	0	0	8	158	0	0	408	12	1246
5:45 PM	102	3	499	0	0	0	9	155	0	0	420	18	1206
TOTAL VOLUMES :	811	12	3123	0	0	0	95	1105	0	0	3116	166	8428
APPROACH %'s :	20.55%	0.30%	79.14%	#DIV/0!	#DIV/0!	#DIV/0!	7.92%	92.08%	0.00%	0.00%	94.94%	5.06%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	433	10	1808	0	0	0	44	593	0	0	1611	71	4570
PEAK HR FACTOR :	0.853			0.000			0.959			0.960			0.917

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

CONTROL : Signalized

ITM Peak Hour Summary

Prepared by:



National Data & Surveying Services

I-215 NB Ramps and University Pkwy, San Bernardino

Date: 3/15/2016

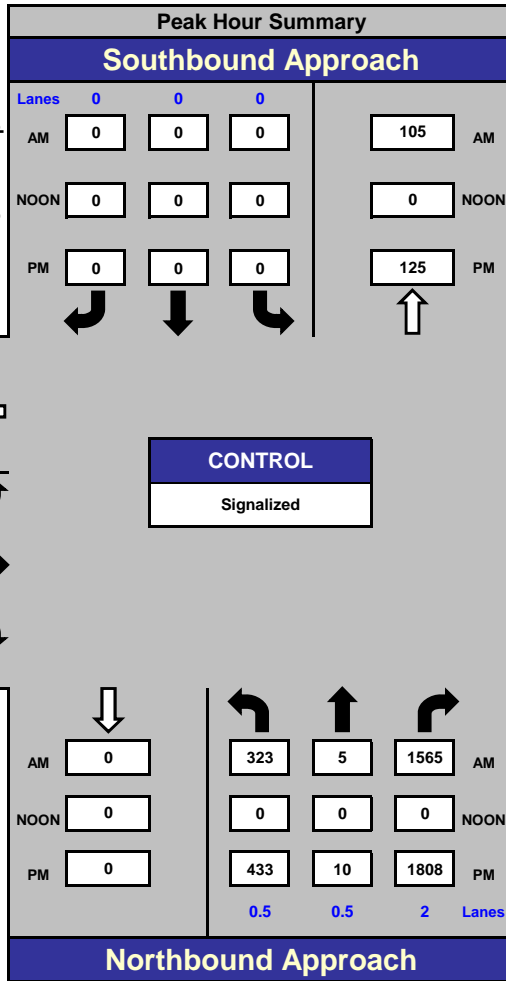
Day: Tuesday

Project #: Historical

City: San Bernardino



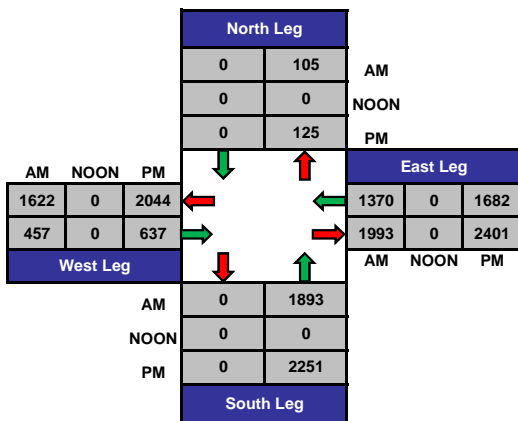
University Pkwy



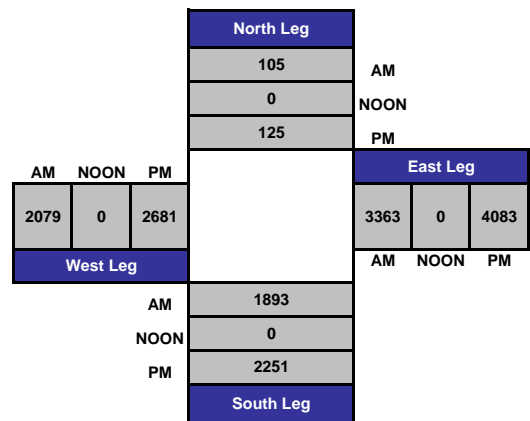
AM Peak Hour	715 AM
NOON Peak Hour	
PM Peak Hour	500 PM

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	NONE	NONE
PM	4:00 PM	6:00 PM

Total Ins & Outs



Total Volume Per Leg



Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: Historical

Day: Tuesday

City: San Bernardino

Date: 3/15/2016

AM													
NS/EW Streets:	I-215 SB Ramps			I-215 SB Ramps			University Pkwy			University Pkwy			TOTAL
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
7:00 AM	0	0	0	7	2	20	0	65	73	250	109	0	526
7:15 AM	0	0	0	14	1	14	0	103	72	279	151	0	634
7:30 AM	0	0	0	20	0	20	0	100	76	278	175	0	669
7:45 AM	0	0	0	19	1	18	0	106	70	260	179	0	653
8:00 AM	0	0	0	20	2	22	0	77	76	201	120	0	518
8:15 AM	0	0	0	13	2	14	0	85	67	197	152	0	530
8:30 AM	0	0	0	13	0	15	0	73	65	200	137	0	503
8:45 AM	0	0	0	12	1	19	0	80	79	210	178	0	579
TOTAL VOLUMES :	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
APPROACH %'s :	#DIV/0!	#DIV/0!	#DIV/0!	43.87%	3.35%	52.79%	0.00%	54.38%	45.62%	60.96%	39.04%	0.00%	4612
PEAK HR START TIME :	7:00 AM												TOTAL
PEAK HR VOL :	0	0	0	60	4	72	0	374	291	1067	614	0	2482
PEAK HR FACTOR :	0.000			0.850			0.945			0.928			0.928

CONTROL : Signalized

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: Historical

Day: Tuesday

City: San Bernardino

Date: 3/15/2016

NS/EW Streets:	PM												TOTAL
	I-215 SB Ramps			I-215 SB Ramps			University Pkwy			University Pkwy			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
	0	0	0	0.5	0.5	1	0	2	0	2	1	0	
4:00 PM	0	0	0	15	2	14	0	130	132	345	197	0	835
4:15 PM	0	0	0	16	0	14	0	142	115	259	195	0	741
4:30 PM	0	0	0	19	1	14	0	109	126	274	203	0	746
4:45 PM	0	0	0	15	1	8	0	118	112	227	202	0	683
5:00 PM	0	0	0	20	2	21	0	142	91	286	194	0	756
5:15 PM	0	0	0	13	1	11	0	135	92	300	209	0	761
5:30 PM	0	0	0	18	0	19	0	147	93	304	232	0	813
5:45 PM	0	0	0	20	0	14	0	140	87	313	194	0	768
TOTAL VOLUMES :	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
APPROACH %'s :	#DIV/0!	#DIV/0!	#DIV/0!	52.71%	2.71%	44.57%	0.00%	55.63%	44.37%	58.67%	41.33%	0.00%	6103
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	0	0	0	71	3	65	0	564	363	1203	829	0	3098
PEAK HR FACTOR :	0.000			0.808			0.966			0.948			0.953

CONTROL : Signalized

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

ITM Peak Hour Summary

Prepared by:



National Data & Surveying Services

I-215 SB Ramps and University Pkwy, San Bernardino

Date: 3/15/2016

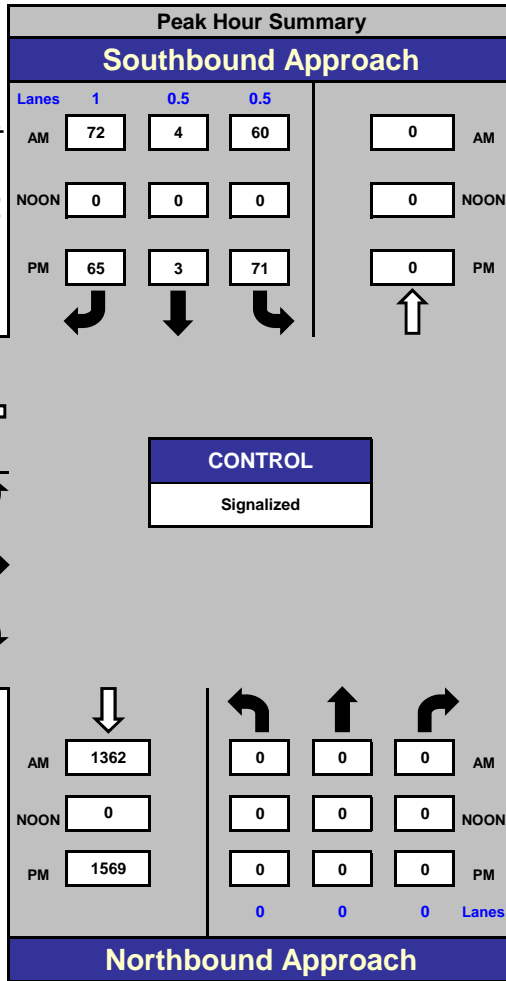
Day: Tuesday

Project #: Historical

City: San Bernardino



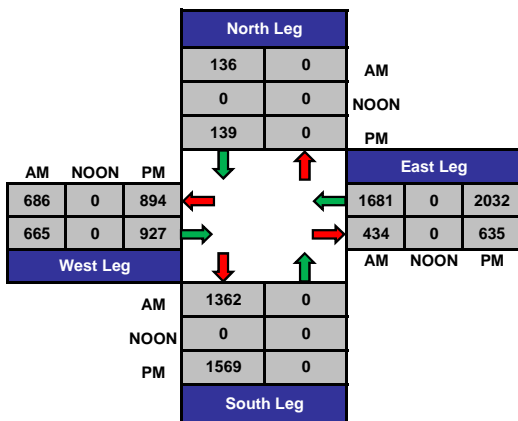
University Pkwy



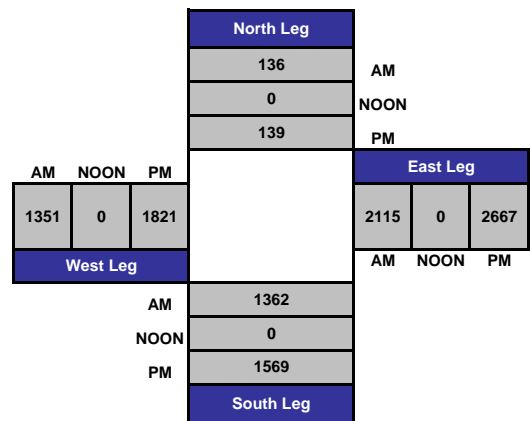
AM Peak Hour	700 AM
NOON Peak Hour	
PM Peak Hour	500 PM

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	NONE	NONE
PM	4:00 PM	6:00 PM

Total Ins & Outs



Total Volume Per Leg



Intersection Turning Movement

Prepared by:
National Data & Surveying Services

Project ID: 15-6172-011

Day: Tuesday

City: Muscoy

Date: 10/20/2015

AM

NS/EW Streets:	University Pkwy		University Pkwy			N State St			N State St			TOTAL	
	NORTHBOUND		SOUTHBOUND			EASTBOUND			WESTBOUND				
LANES:	NL 1	NT 3	NR 1	SL 1	ST 3	SR 1	EL 1	ET 1	ER 0	WL 1	WT 1	WR 0	
7:00 AM	19	248	62	3	146	4	0	6	64	72	14	4	642
7:15 AM	30	424	81	6	223	11	3	4	70	68	12	7	939
7:30 AM	24	497	113	8	228	10	6	5	62	76	6	7	1042
7:45 AM	36	412	150	10	192	4	1	6	58	67	12	4	952
8:00 AM	36	257	85	3	146	3	1	3	42	67	7	5	655
8:15 AM	36	245	61	4	151	6	6	7	44	59	7	2	628
8:30 AM	43	306	80	10	157	5	2	7	52	68	11	2	743
8:45 AM	47	279	55	10	166	2	3	1	37	87	19	7	713
TOTAL VOLUMES :	271	2668	687	54	1409	45	22	39	429	564	88	38	6314
APPROACH %'s :	7.47%	73.58%	18.95%	3.58%	93.44%	2.98%	4.49%	7.96%	87.55%	81.74%	12.75%	5.51%	
PEAK HR START TIME :	7:15 AM												
PEAK HR VOL :	126	1590	429	27	789	28	11	18	232	278	37	23	3588
PEAK HR FACTOR :	0.846		0.858			0.847			0.949			0.861	

UTURNS			
NB	SB	EB	WB
5	0	0	0
11	0	0	0
10	0	0	0
7	0	0	0
15	0	0	0
12	0	0	0
16	0	0	0
19	0	0	0
NB	SB	EB	WB
95	0	0	0

CONTROL : Signalized

Intersection Turning Movement

Prepared by:
National Data & Surveying Services

Project ID: 15-6172-011

Day: Tuesday

City: Muscoy

Date: 10/20/2015

PM

NS/EW Streets:	University Pkwy			University Pkwy			N State St			N State St			TOTAL
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL 1	NT 3	NR 1	SL 1	ST 3	SR 1	EL 1	ET 1	ER 0	WL 1	WT 1	WR 0	
4:00 PM	54	288	93	16	362	15	6	17	52	31	36	7	977
4:15 PM	81	319	99	16	267	4	6	9	63	52	18	4	938
4:30 PM	48	264	91	11	262	3	6	7	45	61	14	3	815
4:45 PM	61	305	94	9	258	4	4	9	58	64	12	11	889
5:00 PM	91	301	83	14	291	11	4	5	58	58	4	5	925
5:15 PM	67	341	104	18	325	10	3	10	40	65	17	7	1008
5:30 PM	58	435	107	14	358	10	5	6	51	65	10	8	1127
5:45 PM	77	429	106	14	338	7	3	4	54	65	16	7	1120
TOTAL VOLUMES :	537	2682	777	112	2462	64	37	67	421	461	127	52	7799
APPROACH %'s :	13.44%	67.12%	19.44%	4.25%	93.33%	2.43%	7.05%	12.76%	80.19%	72.03%	19.84%	8.13%	
PEAK HR START TIME :	500 PM												TOTAL
PEAK HR VOL :	293	1506	400	60	1313	38	15	25	203	253	47	27	4180
PEAK HR FACTOR :	0.898			0.923			0.907			0.919			0.927

UTURNS			
NB	SB	EB	WB
13	0	0	0
9	0	0	0
8	1	0	0
13	0	0	0
24	0	0	0
8	0	0	0
14	0	0	0
15	0	0	0
NB	SB	EB	WB
104	1	0	0

CONTROL : Signalized

PREPARED BY NATIONAL DATA & SURVEYING SERVICES

PROJECT#: 15-6172-011
 N/S Street: University Pkwy
 E/W Street: N State St
 DATE: 10/20/2015
 CITY: Muscoy

DAY: Tuesday

A M

PEDESTRIANS

T I M E	NORTH LEG		SOUTH LEG		EAST LEG		WEST LEG	
	EB	WB	EB	WB	NB	SB	NB	SB
7:00 AM	0	0	0	0	0	0	0	2
7:15 AM	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0
8:00 AM	0	0	1	0	0	0	0	1
8:15 AM	0	1	0	1	0	0	2	0
8:30 AM	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	2	0	0	0
TOTALS	0	1	1	1	2	0	2	3

BIKES

T I M E	NB			SB			EB			WB		
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	0	0	0	0	0	0	0	0	0	0

P M

PEDESTRIANS

T I M E	NORTH LEG		SOUTH LEG		EAST LEG		WEST LEG	
	EB	WB	EB	WB	NB	SB	NB	SB
4:00 PM	0	0	1	0	0	0	0	0
4:15 PM	1	2	0	0	0	0	0	1
4:30 PM	2	0	2	0	0	1	0	0
4:45 PM	0	2	0	0	0	0	0	1
5:00 PM	0	1	1	0	0	0	0	3
5:15 PM	0	0	0	0	0	0	1	0
5:30 PM	1	3	2	1	0	0	0	0
5:45 PM	3	0	1	2	0	1	0	1
TOTALS	7	8	7	3	0	2	1	6

BIKES

T I M E	NB			SB			EB			WB		
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	1	0	0	0	0	0	1	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	1	0	0	0	0	0	0	0
TOTALS	0	0	1	0	1	0	0	0	1	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 17-6039-001

Day: Wednesday

City: San Bernardino

Date: 3/8/2017

AM														
NS/EW Streets:	University Pkwy			University Pkwy			Dwy 1			Dwy 1				
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND				
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	
7:00 AM	2	0	0	0	0	11	4	0	1	0	0	0	18	
7:15 AM	5	0	0	0	0	9	1	0	8	0	0	0	23	
7:30 AM	3	0	0	0	0	15	5	0	9	0	0	0	32	
7:45 AM	3	0	0	0	0	11	4	0	8	0	0	0	28	
8:00 AM	3	0	0	0	0	7	4	0	2	0	0	0	16	
8:15 AM	3	0	0	0	0	8	3	0	6	0	0	0	20	
8:30 AM	2	0	0	0	0	3	1	0	5	0	0	0	11	
8:45 AM	5	0	0	0	0	10	1	0	7	0	0	0	23	
TOTAL VOLUMES :	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	
APPROACH %'s :	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%	35.21%	0.00%	64.79%	#DIV/0!	#DIV/0!	#DIV/0!	171	
PEAK HR START TIME :	7:00 AM													TOTAL
PEAK HR VOL :	13	0	0	0	0	46	16	0	26	0	0	0	101	
PEAK HR FACTOR :	0.650			0.767			0.750			0.000			0.789	

CONTROL : No Control

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 17-6039-001

Day: Wednesday

City: San Bernardino

Date: 3/8/2017

PM

NS/EW Streets:	University Pkwy			University Pkwy			Dwy 1			Dwy 1			TOTAL	
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND				
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR		
4:00 PM	0	0	0	0	0	6	0	0	8	0	0	0	14	
4:15 PM	1	0	0	0	0	8	1	0	5	0	0	0	15	
4:30 PM	1	0	0	0	0	7	0	0	2	0	0	0	10	
4:45 PM	0	0	0	0	0	5	0	0	4	0	0	0	9	
5:00 PM	2	0	0	0	0	7	0	0	4	0	0	0	13	
5:15 PM	3	0	0	0	0	5	3	0	4	0	0	0	15	
5:30 PM	2	0	0	0	0	8	3	0	6	0	0	0	19	
5:45 PM	2	0	0	0	0	8	1	0	5	0	0	0	16	
TOTAL VOLUMES :	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	
APPROACH %'s :	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%	17.39%	0.00%	82.61%	#DIV/0!	#DIV/0!	#DIV/0!	111	
PEAK HR START TIME :	500 PM													TOTAL
PEAK HR VOL :	9	0	0	0	0	28	7	0	19	0	0	0	63	
PEAK HR FACTOR :	0.750			0.875			0.722			0.000			0.829	

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

CONTROL : No Control

ITM Peak Hour Summary

Prepared by:



National Data & Surveying Services

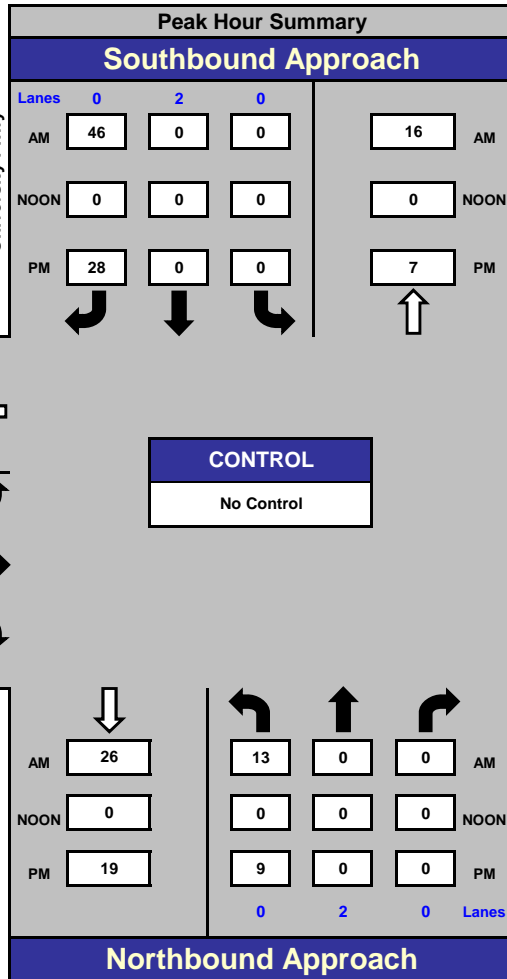
University Pkwy and Dwy 1, San Bernardino

Date: 3/8/2017

Day: Wednesday

Project #: 17-6039-001

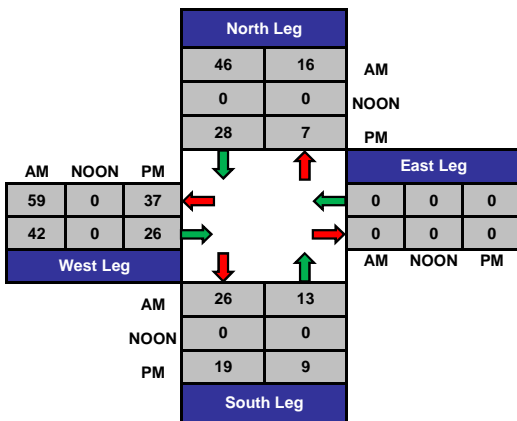
City: San Bernardino



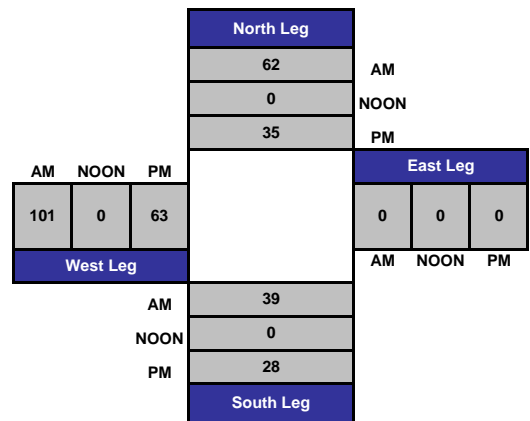
AM Peak Hour	700 AM
NOON Peak Hour	
PM Peak Hour	500 PM

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	NONE	NONE
PM	4:00 PM	6:00 PM

Total Ins & Outs



Total Volume Per Leg



Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 17-6039-002

Day: Wednesday

City: San Bernardino

Date: 3/8/2017

AM														
NS/EW Streets:	University Pkwy			University Pkwy			Dwy 2			Dwy 2				
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND				
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	
7:00 AM	0	0	0	0	0	0	5	0	1	0	0	0	6	
7:15 AM	1	0	0	0	0	0	2	0	4	0	0	0	7	
7:30 AM	0	0	0	0	0	1	2	0	0	0	0	0	3	
7:45 AM	2	0	0	0	0	0	0	0	2	0	0	0	4	
8:00 AM	0	0	0	0	0	1	0	0	2	0	0	0	3	
8:15 AM	1	0	0	0	0	1	3	0	3	0	0	0	8	
8:30 AM	1	0	0	0	0	1	1	0	4	0	0	0	7	
8:45 AM	3	0	0	0	0	0	0	0	2	0	0	0	5	
TOTAL VOLUMES :	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	
APPROACH %'s :	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%	41.94%	0.00%	58.06%	#DIV/0!	#DIV/0!	#DIV/0!	43	
PEAK HR START TIME :	800 AM													TOTAL
PEAK HR VOL :	5	0	0	0	0	3	4	0	11	0	0	0	23	
PEAK HR FACTOR :	0.417			0.750			0.625			0.000			0.719	

CONTROL : No Control

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 17-6039-002

Day: Wednesday

City: San Bernardino

Date: 3/8/2017

PM

NS/EW Streets:	University Pkwy		University Pkwy			Dwy 2			Dwy 2			TOTAL	
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
4:00 PM	2	0	0	0	0	1	0	0	0	0	0	0	3
4:15 PM	1	0	0	0	0	0	0	0	6	0	0	0	7
4:30 PM	0	0	0	0	0	0	0	0	5	0	0	0	5
4:45 PM	0	0	0	0	0	0	1	0	1	0	0	0	2
5:00 PM	0	0	0	0	0	3	2	0	0	0	0	0	5
5:15 PM	1	0	0	0	0	1	1	0	2	0	0	0	5
5:30 PM	2	0	0	0	0	0	1	0	1	0	0	0	4
5:45 PM	2	0	0	0	0	0	2	0	3	0	0	0	7
TOTAL VOLUMES :	8	0	0	0	0	5	7	0	18	0	0	0	38
APPROACH %'s :	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%	28.00%	0.00%	72.00%	#DIV/0!	#DIV/0!	#DIV/0!	
PEAK HR START TIME :	500 PM												
PEAK HR VOL :	5	0	0	0	0	4	6	0	6	0	0	0	21
PEAK HR FACTOR :	0.625			0.333			0.600			0.000			0.750

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

CONTROL : No Control

ITM Peak Hour Summary

Prepared by:



National Data & Surveying Services

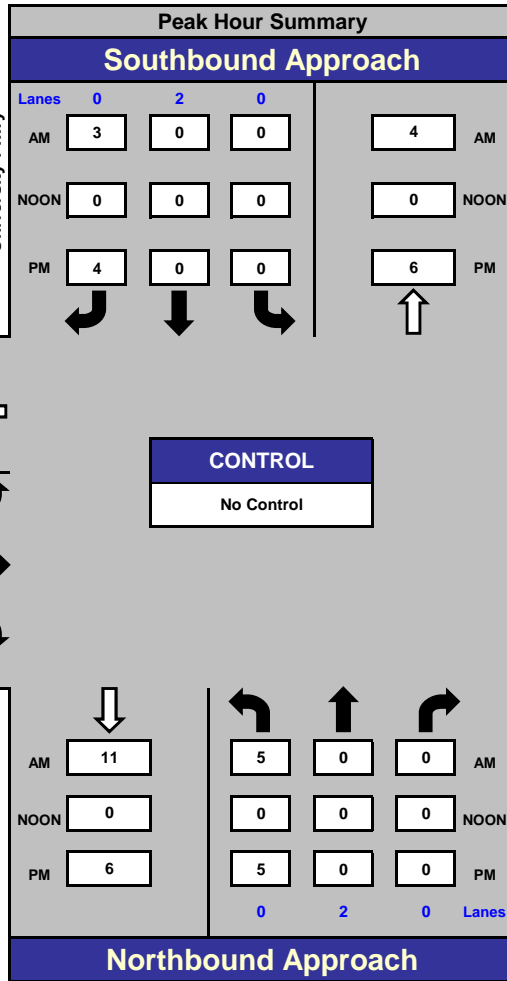
University Pkwy and Dwy 2, San Bernardino

Date: 3/8/2017

Day: Wednesday

Project #: 17-6039-002

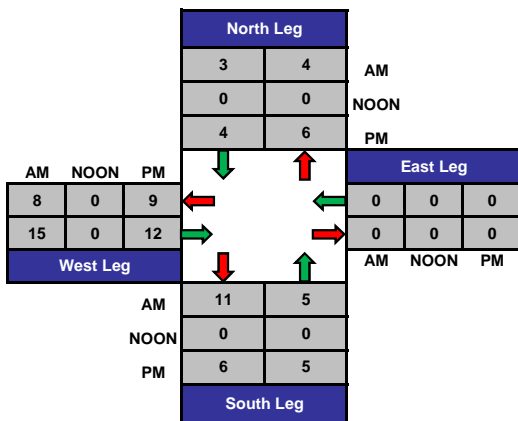
City: San Bernardino



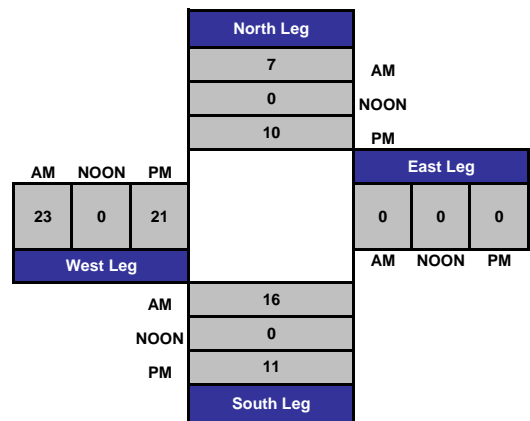
AM Peak Hour	800 AM
NOON Peak Hour	
PM Peak Hour	500 PM

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	NONE	NONE
PM	4:00 PM	6:00 PM

Total Ins & Outs



Total Volume Per Leg



Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 17-6039-003

Day: Wednesday

City: San Bernardino

Date: 3/8/2017

AM														
NS/EW Streets:	University Pkwy			University Pkwy			Dwy 3			Dwy 3				
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND				
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	
7:00 AM	0	0	38	3	0	0	0	0	0	0	0	21	62	
7:15 AM	0	0	45	1	0	0	0	0	0	0	0	31	77	
7:30 AM	0	0	32	4	0	0	0	0	0	0	0	32	68	
7:45 AM	0	0	29	3	0	0	0	0	0	0	0	18	50	
8:00 AM	0	0	32	2	0	0	0	0	0	0	0	25	59	
8:15 AM	0	0	42	3	0	0	0	0	0	0	0	17	62	
8:30 AM	0	0	38	6	0	0	0	0	0	0	0	38	82	
8:45 AM	0	0	32	7	0	0	0	0	0	0	0	27	66	
TOTAL VOLUMES :	0	0	288	29	0	0	0	0	0	0	0	209	526	
APPROACH %'s :	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%	#DIV/0!	#DIV/0!	#DIV/0!	0.00%	0.00%	100.00%		
PEAK HR START TIME :	800 AM													TOTAL
PEAK HR VOL :	0	0	144	18	0	0	0	0	0	0	0	107	269	
PEAK HR FACTOR :	0.857			0.643			0.000			0.704			0.820	

CONTROL : 1-Way Stop(WB)

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 17-6039-003

Day: Wednesday

City: San Bernardino

Date: 3/8/2017

PM

NS/EW Streets:	University Pkwy			University Pkwy			Dwy 3			Dwy 3			TOTAL	
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND				
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR		
4:00 PM	0	0	41	1	0	0	0	0	0	0	0	37	79	
4:15 PM	0	0	43	7	0	0	0	0	0	0	0	37	87	
4:30 PM	0	0	35	4	0	0	0	0	0	0	0	24	63	
4:45 PM	0	0	36	7	0	0	0	0	0	0	0	28	71	
5:00 PM	0	0	32	3	0	0	0	0	0	0	0	27	62	
5:15 PM	0	0	46	6	0	0	0	0	0	0	0	34	86	
5:30 PM	0	0	51	3	0	0	0	0	0	0	0	38	92	
5:45 PM	0	0	42	1	0	0	0	0	0	0	0	34	77	
TOTAL VOLUMES :	0	0	326	32	0	0	0	0	0	0	0	259	617	
APPROACH %'s :	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%	#DIV/0!	#DIV/0!	#DIV/0!	0.00%	0.00%	100.00%		
PEAK HR START TIME :	500 PM													TOTAL
PEAK HR VOL :	0	0	171	13	0	0	0	0	0	0	0	133	317	
PEAK HR FACTOR :	0.838			0.542			0.000			0.875			0.861	

CONTROL : 1-Way Stop(WB)

UTURNS			
NB	SB	EB	WB

NB	SB	EB	WB
0	0	0	0

ITM Peak Hour Summary

Prepared by:

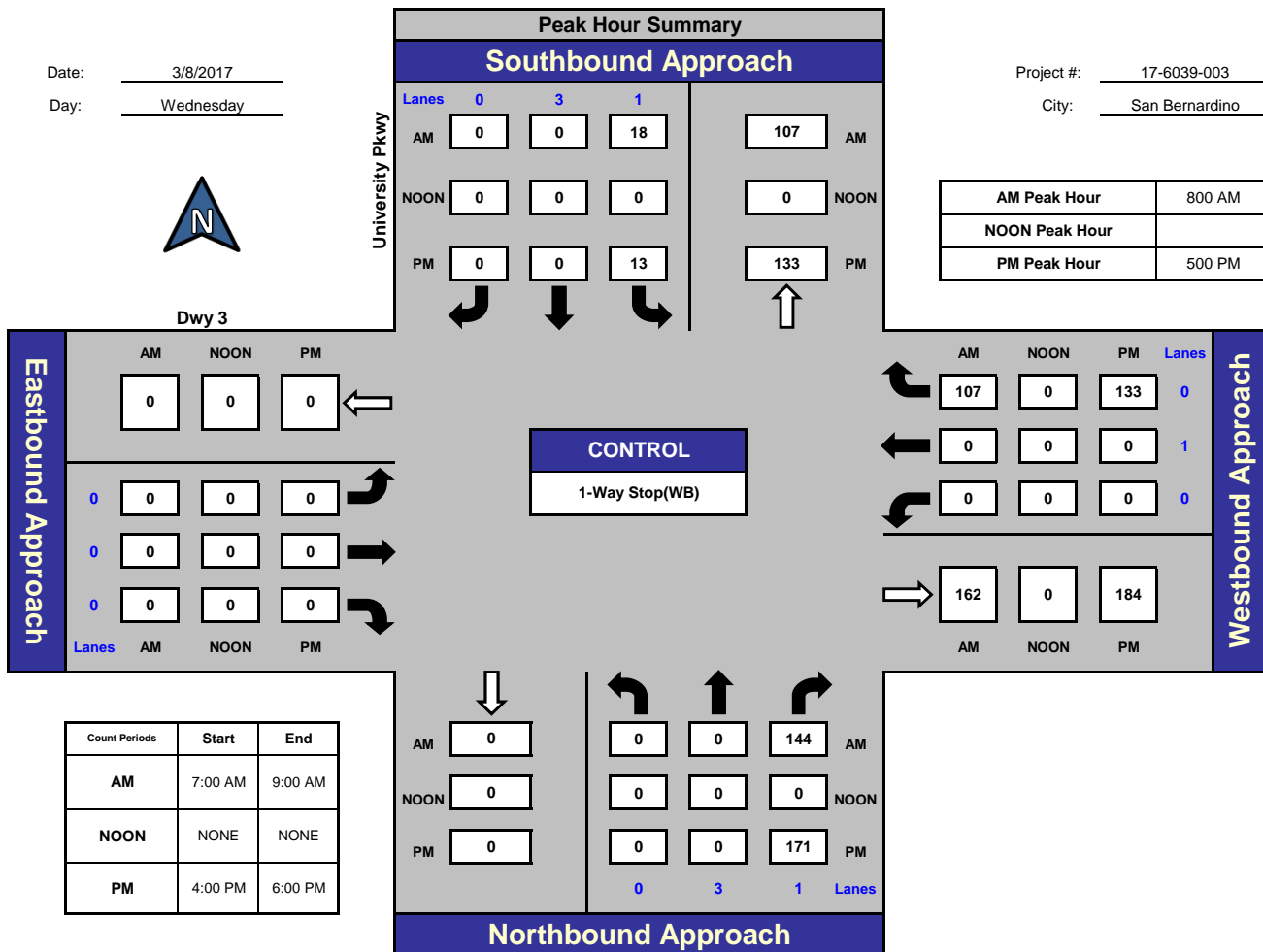


National Data & Surveying Services

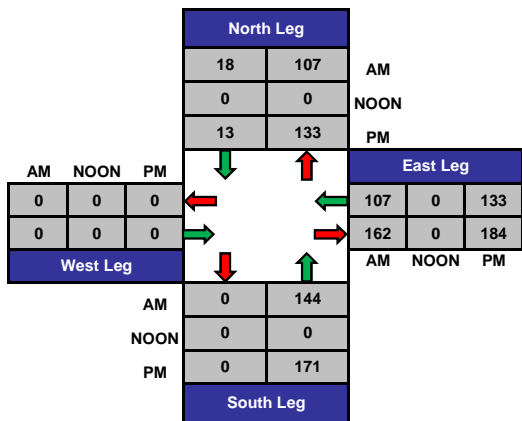
University Pkwy and Dwy 3, San Bernardino

Date: 3/8/2017
Day: Wednesday

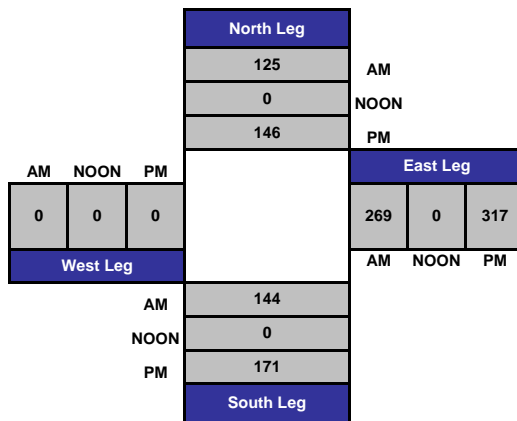
Project #: 17-6039-003
City: San Bernardino



Total Ins & Outs



Total Volume Per Leg



NATIONAL DATA & SURVEYING SERVICES

Axle Count

Project # 07-3280-006Class

Location: University Pkwy & I-215 NB Ramps City: San Bernardino Date: 09/25/2007 Day: TUESDAY

LANES:

		NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR
7:00	CARS	15	104	0	0	313	27	0	0	0	53	0	214
	2-axle	2	3			7					2		6
	3-axle					5							1
	4-axle												
	5-axle +	6				2					5		2
7:15	CARS	9	151	0	0	333	38	0	0	0	77	0	362
	2-axle	1	2			3	2				8		7
	3-axle		1			2					2		2
	4-axle												
	5-axle +	7				4					7		6
7:30	CARS	8	131	0	0	348	36	0	0	0	105	0	443
	2-axle		4			7	1				2		6
	3-axle	2	2			5					1		1
	4-axle												
	5-axle +	5				2					4		2
7:45	CARS	7	101	0	0	218	33	0	0	0	104	0	306
	2-axle	2	4			6					4		4
	3-axle	1	2			2					2		1
	4-axle												
	5-axle +	5				4					6		2
8:00	CARS	6	103	0	0	204	31	0	0	0	90	0	332
	2-axle	2	2			6	3				2		4
	3-axle		3			4					4		2
	4-axle												
	5-axle +	4	3			2					5		2
8:15	CARS	9	115	0	0	201	29	0	0	0	87	0	345
	2-axle	2	2			4					3		5
	3-axle		2			2					2		
	4-axle					1					1		
	5-axle +	6	4			3					3		2
8:30	CARS	5	130	0	0	211	25	0	0	0	79	0	362
	2-axle	1	2			4	3				7		6
	3-axle		1			2					2		2
	4-axle												
	5-axle +	4	6			6					3		1
8:45	CARS	8	138	0	0	232	30	0	0	0	93	0	321
	2-axle	2	4			10	2				7		10
	3-axle		2			2							
	4-axle		1										
	5-axle +	5				4					3		2

MOVEMENT TOTALS

CARS	67	973	0	0	2060	249	0	0	0	688	0	2685
2-axle	12	23	0	0	47	11	0	0	0	35	0	48
3-axle	3	13	0	0	24	0	0	0	0	13	0	9
4-axle	0	1	0	0	1	0	0	0	0	1	0	0
5-axle +	42	13	0	0	27	0	0	0	0	36	0	19
TOTALS	124	1023	0	0	2159	260	0	0	0	773	0	2761
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR

PM Peak Hr Begins at: 715 AM

PEAK VOLUMES =	59	509	0	0	1150	144	0	0	0	423	0	1482
PEAK HR. FACTOR:		0.830			0.811			0.000			0.844	

CONTROL: Signalized

NATIONAL DATA & SURVEYING SERVICES

Axle Count

Project # 07-3280-006Class

Location: University Pkwy & I-215 NB Ramps City: San Bernardino Date: 09/25/2007 Day: TUESDAY

LANES:

		NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR
16:00	CARS	16	181	0	0	413	77	0	0	0	112	1	290
	2-axle		2			4					4		1
	3-axle		1			2					2		
	4-axle												
	5-axle +					1					1		
16:15	CARS	17	153	0	0	311	45	0	0	0	61	2	273
	2-axle		3			2					4		2
	3-axle												
	4-axle												
	5-axle +										2		5
16:30	CARS	18	147	0	0	262	47	0	0	0	52	0	258
	2-axle		3			3					2		3
	3-axle										3		
	4-axle												
	5-axle +					1					2		
16:45	CARS	21	145	0	0	319	48	0	0	0	51	0	249
	2-axle		2			2					5		1
	3-axle		1								2		
	4-axle												
	5-axle +										1		1
17:00	CARS	22	163	0	0	348	52	0	0	0	77	0	257
	2-axle	2	4			3	1				6		3
	3-axle										4		
	4-axle												
	5-axle +										1		2
17:15	CARS	11	179	0	0	337	41	0	0	0	68	0	236
	2-axle		5			2					2		3
	3-axle										2		
	4-axle												
	5-axle +												
17:30	CARS	13	176	0	0	346	49	0	0	0	64	0	229
	2-axle		2			4	1				3		1
	3-axle										2		2
	4-axle												
	5-axle +		1										
17:45	CARS	16	190	0	0	324	52	0	0	0	58	0	240
	2-axle		3			2	2				2		2
	3-axle					1					4		
	4-axle												
	5-axle +					1					1		

MOVEMENT TOTALS

CARS	134	1334	0	0	2660	411	0	0	0	543	3	2032
2-axle	2	24	0	0	22	4	0	0	0	28	0	16
3-axle	0	2	0	0	3	0	0	0	0	19	0	2
4-axle	0	0	0	0	0	0	0	0	0	0	0	0
5-axle +	0	1	0	0	3	0	0	0	0	8	0	8
TOTALS	136	1361	0	0	2688	415	0	0	0	598	3	2058
	<i>NL</i>	<i>NT</i>	<i>NR</i>	<i>SL</i>	<i>ST</i>	<i>SR</i>	<i>EL</i>	<i>ET</i>	<i>ER</i>	<i>WL</i>	<i>WT</i>	<i>WR</i>

PM Peak Hr Begins at: 1600 PM

PEAK VOLUMES =	72	638	0	0	1320	217	0	0	0	304	3	1083
PEAK HR. FACTOR:	0.888		0.773		0.000		0.845					

CONTROL: Signalized

NATIONAL DATA & SURVEYING SERVICES

Axle Count

Project # 07-3280-007Class

Location: University Pkwy & I-215 SB Ramps City: San Bernardino Date: 09/25/2007 Day: TUESDAY

LANES:

		NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR
7:00	CARS	0	96	53	259	101	0	29	0	5	0	0	0
	2-axle		4	2	2	6		1		1			
	3-axle			1	1	4							
	4-axle												
	5-axle +		4	2	1	5		2					
7:15	CARS	0	131	57	275	121	0	35	0	7	0	0	0
	2-axle		2	4	3	7		1		1			
	3-axle		1	2	2	2							
	4-axle												
	5-axle +				4	7		1		1			
7:30	CARS	0	115	64	298	160	0	29	0	11	0	0	0
	2-axle		2	5	2	8		2		3			
	3-axle		4		1	4							
	4-axle												
	5-axle +		4	4	2	4		1					
7:45	CARS	0	81	70	203	129	0	30	0	14	0	0	0
	2-axle		2	5	5	6		3		2			
	3-axle		4	3	2	2							
	4-axle												
	5-axle +		5	2	4	5				4			
8:00	CARS	0	68	65	174	115	0	32	0	13	0	0	0
	2-axle		2	2	4	4		2		1			
	3-axle		3	2	2	4							
	4-axle												
	5-axle +		6	2	4	3		1		6			
8:15	CARS	0	79	62	179	114	0	35	0	11	0	0	0
	2-axle		3	3	3	4		1		2			
	3-axle		2	3	2	2							
	4-axle					2							
	5-axle +		7	2	4	2		3		4			
8:30	CARS	0	99	60	172	113	0	34	0	10	0	0	0
	2-axle		2	2	4	6		1		2			
	3-axle		1	4	2	2		1					
	4-axle					1							
	5-axle +		8	1	4	3		2		4			
8:45	CARS	0	100	56	184	132	0	54	0	22	0	0	0
	2-axle		4	3	9	8		2		2			
	3-axle		2	1		2							
	4-axle												
	5-axle +		3	3	3	4		2		6			

MOVEMENT TOTALS

CARS	0	769	487	1744	985	0	278	0	93	0	0	0
2-axle	0	21	26	32	49	0	13	0	14	0	0	0
3-axle	0	17	16	12	22	0	1	0	0	0	0	0
4-axle	0	0	0	0	3	0	0	0	0	0	0	0
5-axle +	0	37	16	26	33	0	12	0	25	0	0	0
TOTALS	0	844	545	1814	1092	0	304	0	132	0	0	0
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR

PM Peak Hr Begins at: 700 AM

PEAK VOLUMES =	0	455	274	1064	571	0	134	0	49	0	0	0
PEAK HR. FACTOR:		0.920		0.853			0.863			0.000		

CONTROL: Signalized

NATIONAL DATA & SURVEYING SERVICES

Axle Count

Project # 07-3280-007Class

Location: University Pkwy & I-215 SB Ramps City: San Bernardino Date: 09/25/2007 Day: TUESDAY

LANES:

		NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR
16:00	CARS	0	169	121	261	254	0	26	0	20	0	0	0
	2-axle		2	2	4	1		1		1			
	3-axle		1		2	1							
	4-axle												
	5-axle +			2									
16:15	CARS	0	160	133	229	189	0	19	0	17	0	0	0
	2-axle		3	3	4	2							
	3-axle												
	4-axle												
	5-axle +			1									
16:30	CARS	0	152	140	218	132	0	21	0	23	0	0	0
	2-axle		2	1	2	2		1					
	3-axle			2									
	4-axle												
	5-axle +												
16:45	CARS	0	148	127	234	134	0	24	0	15	0	0	0
	2-axle		2	2	4	3				1			
	3-axle		1			1							
	4-axle												
	5-axle +			2	1								
17:00	CARS	0	153	129	251	165	0	28	0	13	0	0	0
	2-axle		4	2	5	5		2					
	3-axle												
	4-axle												
	5-axle +			2	1								
17:15	CARS	0	173	79	190	193	0	25	0	22	0	0	0
	2-axle		4	2	4	3		1					
	3-axle												
	4-axle												
	5-axle +												
17:30	CARS	0	143	86	180	211	0	34	1	20	0	0	0
	2-axle		2	2	4	2							
	3-axle				2								
	4-axle												
	5-axle +		1	1	1								
17:45	CARS	0	176	60	144	219	0	27	0	20	0	0	0
	2-axle		3	1	3	2							
	3-axle				3								
	4-axle												
	5-axle +			1	1								

MOVEMENT TOTALS

CARS	0	1274	875	1707	1497	0	204	1	150	0	0	0
2-axle	0	22	15	30	20	0	5	0	2	0	0	0
3-axle	0	2	2	7	2	0	0	0	0	0	0	0
4-axle	0	0	0	0	0	0	0	0	0	0	0	0
5-axle +	0	1	9	4	0	0	0	0	0	0	0	0
TOTALS	0	1299	901	1748	1519	0	209	1	152	0	0	0
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR

PM Peak Hr Begins at: 1600 PM

PEAK VOLUMES =	0	640	536	959	719	0	92	0	77	0	0	0
PEAK HR. FACTOR:		0.980		0.802			0.880			0.000		

CONTROL: Signalized

VOLUME

University Pkwy Bet. I-215 NB Ramps & State St/Varsity Ave

Day: Tuesday
Date: 3/7/2017City: San Bernardino
Project #: CA17_6038_001

DAILY TOTALS					NB	SB	EB	WB	Total		
					27,237	27,020	0	0	54,257		
AM Period	NB	SB	EB	WB	TOTAL	PM Period	NB	SB	EB	WB	TOTAL
00:00	70	60			130	12:00	381	478			859
00:15	81	47			128	12:15	313	373			686
00:30	59	43			102	12:30	367	372			739
00:45	53	263	45	195	98	12:45	338	1399	353	1576	691
01:00	50	37			87	13:00	366	378			744
01:15	39	33			72	13:15	395	393			788
01:30	41	33			74	13:30	503	465			968
01:45	24	154	22	125	46	13:45	502	1766	520	1756	1022
02:00	31	25			56	14:00	362	537			899
02:15	30	25			55	14:15	364	443			807
02:30	26	25			51	14:30	400	400			800
02:45	32	119	29	104	61	14:45	412	1538	417	1797	829
03:00	23	32			55	15:00	440	362			802
03:15	19	39			58	15:15	488	409			897
03:30	21	67			88	15:30	543	480			1023
03:45	35	98	63	201	98	15:45	514	1985	576	1827	1090
04:00	19	64			83	16:00	423	531			954
04:15	29	91			120	16:15	384	472			856
04:30	27	131			158	16:30	392	422			814
04:45	61	136	112	398	173	16:45	465	1664	377	1802	842
05:00	52	98			150	17:00	533	436			969
05:15	83	138			221	17:15	544	419			963
05:30	77	178			255	17:30	621	455			1076
05:45	104	316	187	601	291	17:45	576	2274	533	1843	1109
06:00	103	159			262	18:00	460	499			959
06:15	139	211			350	18:15	430	437			867
06:30	170	317			487	18:30	373	384			757
06:45	234	646	320	1007	554	18:45	340	1603	401	1721	741
07:00	279	378			657	19:00	354	342			696
07:15	437	404			841	19:15	384	314			698
07:30	559	414			973	19:30	392	399			791
07:45	632	1907	358	1554	990	19:45	356	1486	463	1518	819
08:00	452	296			748	20:00	275	433			708
08:15	379	352			731	20:15	306	298			604
08:30	350	346			696	20:30	264	328			592
08:45	349	1530	351	1345	700	20:45	267	1112	267	1326	534
09:00	334	314			648	21:00	260	319			579
09:15	499	285			784	21:15	274	300			574
09:30	621	329			950	21:30	248	284			532
09:45	596	2050	385	1313	981	21:45	225	1007	301	1204	526
10:00	366	349			715	22:00	178	226			404
10:15	303	284			587	22:15	199	175			374
10:30	320	291			611	22:30	163	144			307
10:45	299	1288	252	1176	551	22:45	137	677	128	673	265
11:00	374	308			682	23:00	133	121			254
11:15	402	360			762	23:15	111	87			198
11:30	504	402			906	23:30	103	75			178
11:45	486	1766	528	1598	1014	23:45	106	453	77	360	183
TOTALS	10273	9617			19890	TOTALS	16964	17403			34367
SPLIT %	51.6%	48.4%			36.7%	SPLIT %	49.4%	50.6%			63.3%

DAILY TOTALS					NB	SB	EB	WB	Total
					27,237	27,020	0	0	54,257
AM Peak Hour	09:15	11:30			07:15	PM Peak Hour	17:00	15:30	17:00
AM Pk Volume	2082	1781			3552	PM Pk Volume	2274	2059	4117
Pk Hr Factor	0.838	0.843			0.897	Pk Hr Factor	0.915	0.894	0.928
7 - 9 Volume	3437	2899	0	0	6336	4 - 6 Volume	3938	3645	7583
7 - 9 Peak Hour	07:15	07:00			07:15	4 - 6 Peak Hour	17:00	17:00	17:00
7 - 9 Pk Volume	2080	1554	0	0	3552	4 - 6 Pk Volume	2274	1843	4117
Pk Hr Factor	0.823	0.938	0.000	0.000	0.897	Pk Hr Factor	0.915	0.864	0.928

VOLUME

University Pkwy Bet. I-215 NB Ramps & State St/Varsity Ave

Day: Wednesday
Date: 3/8/2017City: San Bernardino
Project #: CA17_6038_001

DAILY TOTALS					NB	SB	EB	WB	Total		
					27,473	26,563	0	0	54,036		
AM Period	NB	SB	EB	WB	TOTAL	PM Period	NB	SB	EB	WB	TOTAL
00:00	92	50			142	12:00	357	494			851
00:15	73	50			123	12:15	369	402			771
00:30	63	40			103	12:30	417	346			763
00:45	55	283	42	182	97	12:45	365	1508	356	1598	721
01:00	59	30			89	13:00	404	406			810
01:15	43	27			70	13:15	385	484			869
01:30	47	36			83	13:30	381	462			843
01:45	42	191	18	111	60	13:45	406	1576	414	1766	820
02:00	45	29			74	14:00	390	415			805
02:15	45	34			79	14:15	402	391			793
02:30	36	28			64	14:30	373	513			886
02:45	36	162	32	123	68	14:45	415	1580	513	1832	928
03:00	36	41			77	15:00	395	457			852
03:15	28	47			75	15:15	471	412			883
03:30	28	67			95	15:30	507	508			1015
03:45	52	144	79	234	131	15:45	495	1868	526	1903	1021
04:00	27	71			98	16:00	441	533			974
04:15	33	92			125	16:15	459	429			888
04:30	43	105			148	16:30	423	384			807
04:45	64	167	120	388	184	16:45	464	1787	338	1684	802
05:00	45	93			138	17:00	459	424			883
05:15	58	152			210	17:15	532	412			944
05:30	77	178			255	17:30	594	437			1031
05:45	90	270	179	602	269	17:45	551	2136	506	1779	1057
06:00	112	175			287	18:00	435	510			945
06:15	135	218			353	18:15	408	458			866
06:30	189	305			494	18:30	364	386			750
06:45	180	616	356	1054	536	18:45	407	1614	346	1700	753
07:00	275	362			637	19:00	362	370			732
07:15	386	381			767	19:15	345	336			681
07:30	538	430			968	19:30	361	382			743
07:45	544	1743	336	1509	880	19:45	317	1385	445	1533	762
08:00	465	282			747	20:00	331	406			737
08:15	397	308			705	20:15	243	281			524
08:30	428	356			784	20:30	263	259			522
08:45	545	1835	338	1284	883	20:45	300	1137	322	1268	622
09:00	568	294			862	21:00	308	276			584
09:15	431	311			742	21:15	309	351			660
09:30	383	285			668	21:30	227	331			558
09:45	381	1763	260	1150	641	21:45	239	1083	253	1211	492
10:00	374	254			628	22:00	203	209			412
10:15	480	262			742	22:15	193	154			347
10:30	455	401			856	22:30	148	130			278
10:45	336	1645	327	1244	663	22:45	151	695	143	636	294
11:00	334	308			642	23:00	133	108			241
11:15	438	306			744	23:15	137	100			237
11:30	516	306			822	23:30	112	71			183
11:45	492	1780	484	1404	976	23:45	123	505	89	368	212
TOTALS	10599	9285			19884	TOTALS	16874	17278			34152
SPLIT %	53.3%	46.7%			36.8%	SPLIT %	49.4%	50.6%			63.2%

DAILY TOTALS					NB	SB	EB	WB	Total
					27,473	26,563	0	0	54,036
AM Peak Hour	08:30	11:45			11:30	PM Peak Hour	17:00	15:30	17:15
AM Pk Volume	1972	1726			3420	PM Pk Volume	2136	1996	3977
Pk Hr Factor	0.868	0.873			0.876	Pk Hr Factor	0.899	0.936	0.941
7 - 9 Volume	3578	2793	0	0	6371	4 - 6 Volume	3923	3463	7386
7 - 9 Peak Hour	07:30	07:00			07:15	4 - 6 Peak Hour	17:00	17:00	17:00
7 - 9 Pk Volume	1944	1509	0	0	3362	4 - 6 Pk Volume	2136	1779	3915
Pk Hr Factor	0.893	0.877	0.000	0.000	0.868	Pk Hr Factor	0.899	0.879	0.926

VOLUME

University Pkwy Bet. I-215 NB Ramps & State St/Varsity Ave

Day: Thursday
Date: 3/9/2017

City: San Bernardino
Project #: CA17_6038_001

DAILY TOTALS				NB	SB	EB	WB	Total
				26,998	26,550	0	0	53,548

AM Period	NB	SB	EB	WB	TOTAL	PM Period	NB	SB	EB	WB	TOTAL
00:00	96	88			184	12:00	388	499			887
00:15	100	67			167	12:15	384	378			762
00:30	95	79			174	12:30	357	368			725
00:45	73	364	52	286	125 650	12:45	372	1501	389	1634	761 3135
01:00	68	32			100	13:00	357	340			697
01:15	61	35			96	13:15	409	430			839
01:30	54	37			91	13:30	475	439			914
01:45	55	238	31	135	86 373	13:45	442	1683	532	1741	974 3424
02:00	43	30			73	14:00	378	494			872
02:15	45	33			78	14:15	367	401			768
02:30	44	31			75	14:30	397	388			785
02:45	34	166	31	125	65 291	14:45	386	1528	389	1672	775 3200
03:00	27	46			73	15:00	422	390			812
03:15	43	55			98	15:15	479	362			841
03:30	29	66			95	15:30	536	476			1012
03:45	46	145	67	234	113 379	15:45	521	1958	540	1768	1061 3726
04:00	26	82			108	16:00	441	504			945
04:15	25	86			111	16:15	417	433			850
04:30	50	140			190	16:30	439	365			804
04:45	53	154	109	417	162 571	16:45	449	1746	398	1700	847 3446
05:00	43	110			153	17:00	438	440			878
05:15	79	154			233	17:15	507	447			954
05:30	90	174			264	17:30	564	451			1015
05:45	110	322	189	627	299 949	17:45	556	2065	508	1846	1064 3911
06:00	117	169			286	18:00	463	522			985
06:15	152	230			382	18:15	436	456			892
06:30	174	299			473	18:30	433	358			791
06:45	227	670	346	1044	573 1714	18:45	395	1727	338	1674	733 3401
07:00	260	361			621	19:00	376	358			734
07:15	373	389			762	19:15	376	369			745
07:30	114	374			488	19:30	377	406			783
07:45	279	1026	363	1487	642 2513	19:45	373	1502	469	1602	842 3104
08:00	560	252			812	20:00	280	436			716
08:15	407	286			693	20:15	259	347			606
08:30	372	277			649	20:30	307	285			592
08:45	402	1741	332	1147	734 2888	20:45	287	1133	202	1270	489 2403
09:00	371	247			618	21:00	256	320			576
09:15	451	299			750	21:15	266	322			588
09:30	626	313			939	21:30	215	320			535
09:45	608	2056	348	1207	956 3263	21:45	211	948	297	1259	508 2207
10:00	379	320			699	22:00	202	257			459
10:15	311	264			575	22:15	164	179			343
10:30	304	268			572	22:30	192	168			360
10:45	322	1316	249	1101	571 2417	22:45	140	698	130	734	270 1432
11:00	382	305			687	23:00	142	115			257
11:15	433	340			773	23:15	120	97			217
11:30	524	374			898	23:30	122	69			191
11:45	496	1835	468	1487	964 3322	23:45	92	476	72	353	164 829
TOTALS	10033	9297			19330	TOTALS	16965	17253			34218
SPLIT %	51.9%	48.1%			36.1%	SPLIT %	49.6%	50.4%			63.9%

DAILY TOTALS				NB	SB	EB	WB	Total
				26,998	26,550	0	0	53,548

AM Peak Hour	09:15	11:30			11:15	PM Peak Hour	17:15	15:30			17:15
AM Pk Volume	2064	1719			3522	PM Pk Volume	2090	1953			4018
Pk Hr Factor	0.824	0.861			0.913	Pk Hr Factor	0.926	0.904			0.944
7 - 9 Volume	2767	2634	0	0	5401	4 - 6 Volume	3811	3546	0	0	7357
7 - 9 Peak Hour	08:00	07:00			08:00	4 - 6 Peak Hour	17:00	17:00			17:00
7 - 9 Pk Volume	1741	1487	0	0	2888	4 - 6 Pk Volume	2065	1846	0	0	3911
Pk Hr Factor	0.777	0.956	0.000	0.000	0.889	Pk Hr Factor	0.915	0.908	0.000	0.000	0.919

VOLUME

University Pkwy Bet. I-215 SB Ramps & Hallmark Pkwy

Day: Tuesday
Date: 3/7/2017

City: San Bernardino
Project #: CA17_6038_002

DAILY TOTALS					NB	SB	EB	WB	Total		
					16,165	15,038	0	0	31,203		
AM Period	NB	SB	EB	WB	TOTAL	PM Period	NB	SB	EB	WB	TOTAL
00:00	62	30			92	12:00	227	255			482
00:15	48	31			79	12:15	235	239			474
00:30	37	38			75	12:30	272	232			504
00:45	41	188	25	124	66	312	245	979	211	937	456
01:00	49	24			73	13:00	249	231			480
01:15	35	39			74	13:15	264	208			472
01:30	38	31			69	13:30	269	240			509
01:45	21	143	33	127	54	270	246	1028	236	915	482
02:00	40	25			65	14:00	285	205			490
02:15	35	31			66	14:15	275	243			518
02:30	41	33			74	14:30	367	218			585
02:45	40	156	36	125	76	281	307	1234	233	899	540
03:00	27	21			48	15:00	306	229			535
03:15	16	36			52	15:15	319	231			550
03:30	53	62			115	15:30	330	221			551
03:45	33	129	104	223	137	352	310	1265	305	986	615
04:00	35	88			123	16:00	269	262			531
04:15	42	72			114	16:15	298	234			532
04:30	51	86			137	16:30	260	251			511
04:45	69	197	126	372	195	569	314	1141	258	1005	572
05:00	80	112			192	17:00	322	255			577
05:15	81	116			197	17:15	281	245			526
05:30	94	145			239	17:30	260	270			530
05:45	93	348	190	563	283	911	256	1119	275	1045	531
06:00	100	105			205	18:00	276	265			541
06:15	97	122			219	18:15	274	220			494
06:30	144	147			291	18:30	243	223			466
06:45	156	497	173	547	329	1044	205	998	249	957	454
07:00	159	129			288	19:00	216	212			428
07:15	216	203			419	19:15	190	202			392
07:30	224	193			417	19:30	179	188			367
07:45	199	798	202	727	401	1525	194	779	182	784	376
08:00	181	173			354	20:00	160	178			338
08:15	155	177			332	20:15	170	137			307
08:30	173	182			355	20:30	160	159			319
08:45	173	682	171	703	344	1385	145	635	165	639	310
09:00	160	156			316	21:00	160	139			299
09:15	230	165			395	21:15	183	155			338
09:30	221	152			373	21:30	147	146			293
09:45	225	836	167	640	392	1476	136	626	159	599	295
10:00	182	187			369	22:00	118	93			211
10:15	181	175			356	22:15	104	99			203
10:30	208	189			397	22:30	139	85			224
10:45	179	750	167	718	346	1468	81	442	78	355	159
11:00	237	203			440	23:00	81	64			145
11:15	188	174			362	23:15	73	59			132
11:30	283	197			480	23:30	53	57			110
11:45	215	923	243	817	458	1740	65	272	51	231	116
TOTALS	5647	5686			11333	TOTALS	10518	9352			19870
SPLIT %	49.8%	50.2%			36.3%	SPLIT %	52.9%	47.1%			63.7%

DAILY TOTALS					NB	SB	EB	WB	Total
					16,165	15,038	0	0	31,203
AM Peak Hour	11:30	11:45			11:45	PM Peak Hour	14:30	17:15	15:00
AM Pk Volume	960	969			1918	PM Pk Volume	1299	1055	2251
Pk Hr Factor	0.848	0.950			0.951	Pk Hr Factor	0.885	0.959	0.915
7 - 9 Volume	1480	1430	0	0	2910	4 - 6 Volume	2260	2050	4310
7 - 9 Peak Hour	07:15	07:15			07:15	4 - 6 Peak Hour	16:15	17:00	16:45
7 - 9 Pk Volume	820	771	0	0	1591	4 - 6 Pk Volume	1194	1045	2205
Pk Hr Factor	0.915	0.950	0.000	0.000	0.949	Pk Hr Factor	0.927	0.950	0.955

VOLUME

University Pkwy Bet. I-215 SB Ramps & Hallmark Pkwy

Day: Wednesday
Date: 3/8/2017

City: San Bernardino
Project #: CA17_6038_002

DAILY TOTALS					NB	SB	EB	WB	Total		
					16,700	15,572	0	0	32,272		
AM Period	NB	SB	EB	WB	TOTAL	PM Period	NB	SB	EB	WB	TOTAL
00:00	56	32			88	12:00	251	259			510
00:15	53	28			81	12:15	298	252			550
00:30	39	34			73	12:30	326	247			573
00:45	34	182	21	115	55	12:45	309	1184	217	975	526
01:00	53	36			89	13:00	278	227			505
01:15	35	21			56	13:15	272	232			504
01:30	26	27			53	13:30	279	239			518
01:45	17	131	39	123	56	13:45	284	1113	257	955	541
02:00	30	40			70	14:00	254	202			456
02:15	24	40			64	14:15	277	212			489
02:30	45	34			79	14:30	309	264			573
02:45	32	131	61	175	93	14:45	344	1184	253	931	597
03:00	32	27			59	15:00	302	231			533
03:15	36	40			76	15:15	273	228			501
03:30	43	61			104	15:30	341	229			570
03:45	46	157	115	243	161	15:45	318	1234	270	958	588
04:00	38	82			120	16:00	343	259			602
04:15	61	62			123	16:15	286	268			554
04:30	74	88			162	16:30	323	250			573
04:45	80	253	128	360	208	16:45	255	1207	222	999	477
05:00	77	84			161	17:00	291	205			496
05:15	74	145			219	17:15	259	235			494
05:30	95	122			217	17:30	227	218			445
05:45	118	364	203	554	321	17:45	222	999	239	897	461
06:00	88	102			190	18:00	231	268			499
06:15	88	124			212	18:15	187	284			471
06:30	157	142			299	18:30	190	273			463
06:45	142	475	209	577	351	18:45	246	854	299	1124	545
07:00	168	129			297	19:00	195	268			463
07:15	234	206			440	19:15	190	210			400
07:30	188	192			380	19:30	204	171			375
07:45	219	809	212	739	431	19:45	191	780	177	826	368
08:00	164	178			342	20:00	161	197			358
08:15	200	186			386	20:15	139	131			270
08:30	200	206			406	20:30	167	160			327
08:45	251	815	216	786	467	20:45	234	701	180	668	414
09:00	187	178			365	21:00	280	140			420
09:15	156	211			367	21:15	261	162			423
09:30	200	178			378	21:30	174	138			312
09:45	215	758	161	728	376	21:45	136	851	155	595	291
10:00	227	184			411	22:00	90	124			214
10:15	203	173			376	22:15	93	102			195
10:30	219	202			421	22:30	137	82			219
10:45	186	835	198	757	384	22:45	85	405	87	395	172
11:00	225	201			426	23:00	88	65			153
11:15	234	218			452	23:15	69	62			131
11:30	252	205			457	23:30	88	44			132
11:45	249	960	237	861	486	23:45	73	318	60	231	133
TOTALS	5870	6018			11888	TOTALS	10830	9554			20384
SPLIT %	49.4%	50.6%			36.8%	SPLIT %	53.1%	46.9%			63.2%

DAILY TOTALS					NB	SB	EB	WB	Total
					16,700	15,572	0	0	32,272
AM Peak Hour	11:45	11:45			11:45	PM Peak Hour	15:30	18:00	15:45
AM Pk Volume	1124	995			2119	PM Pk Volume	1288	1124	2317
Pk Hr Factor	0.862	0.960			0.925	Pk Hr Factor	0.939	0.940	0.962
7 - 9 Volume	1624	1525	0	0	3149	4 - 6 Volume	2206	1896	4102
7 - 9 Peak Hour	08:00	07:15			08:00	4 - 6 Peak Hour	16:00	16:00	16:00
7 - 9 Pk Volume	815	788	0	0	1601	4 - 6 Pk Volume	1207	999	2206
Pk Hr Factor	0.812	0.929	0.000	0.000	0.857	Pk Hr Factor	0.880	0.932	0.916

VOLUME

University Pkwy Bet. I-215 SB Ramps & Hallmark Pkwy

Day: Thursday
Date: 3/9/2017

City: San Bernardino
Project #: CA17_6038_002

DAILY TOTALS				NB	SB	EB	WB	Total
				15,749	14,874	0	0	30,623

AM Period	NB	SB	EB	WB	TOTAL	PM Period	NB	SB	EB	WB	TOTAL
00:00	67	47			114	12:00	254	239			493
00:15	68	41			109	12:15	203	215			418
00:30	62	51			113	12:30	251	207			458
00:45	29	226	49	188	78 414	12:45	249	957	241	902	490 1859
01:00	53	35			88	13:00	210	222			432
01:15	37	40			77	13:15	273	224			497
01:30	41	44			85	13:30	278	239			517
01:45	36	167	41	160	77 327	13:45	263	1024	258	943	521 1967
02:00	49	40			89	14:00	243	214			457
02:15	31	53			84	14:15	291	227			518
02:30	34	49			83	14:30	310	215			525
02:45	22	136	33	175	55 311	14:45	316	1160	236	892	552 2052
03:00	36	39			75	15:00	269	253			522
03:15	69	38			107	15:15	274	204			478
03:30	49	58			107	15:30	336	210			546
03:45	44	198	129	264	173 462	15:45	324	1203	249	916	573 2119
04:00	55	67			122	16:00	260	251			511
04:15	64	54			118	16:15	237	246			483
04:30	66	88			154	16:30	303	210			513
04:45	76	261	123	332	199 593	16:45	234	1034	205	912	439 1946
05:00	59	85			144	17:00	268	218			486
05:15	87	126			213	17:15	266	201			467
05:30	103	129			232	17:30	280	232			512
05:45	94	343	202	542	296 885	17:45	230	1044	256	907	486 1951
06:00	105	89			194	18:00	215	237			452
06:15	99	154			253	18:15	207	253			460
06:30	155	150			305	18:30	224	218			442
06:45	169	528	192	585	361 1113	18:45	240	886	200	908	440 1794
07:00	197	147			344	19:00	232	188			420
07:15	174	184			358	19:15	187	206			393
07:30	191	183			374	19:30	194	167			361
07:45	197	759	166	680	363 1439	19:45	152	765	177	738	329 1503
08:00	198	173			371	20:00	153	181			334
08:15	187	182			369	20:15	127	166			293
08:30	192	175			367	20:30	177	174			351
08:45	203	780	197	727	400 1507	20:45	131	588	147	668	278 1256
09:00	176	151			327	21:00	170	136			306
09:15	190	154			344	21:15	151	163			314
09:30	208	186			394	21:30	132	137			269
09:45	232	806	170	661	402 1467	21:45	106	559	152	588	258 1147
10:00	175	161			336	22:00	96	101			197
10:15	162	174			336	22:15	100	112			212
10:30	185	164			349	22:30	154	98			252
10:45	215	737	177	676	392 1413	22:45	94	444	86	397	180 841
11:00	230	186			416	23:00	90	59			149
11:15	194	230			424	23:15	63	72			135
11:30	233	221			454	23:30	91	59			150
11:45	200	857	240	877	440 1734	23:45	43	287	46	236	89 523
TOTALS	5798	5867			11665	TOTALS	9951	9007			18958
SPLIT %	49.7%	50.3%			38.1%	SPLIT %	52.5%	47.5%			61.9%

DAILY TOTALS				NB	SB	EB	WB	Total
				15,749	14,874	0	0	30,623

AM Peak Hour	11:45	11:15	11:15	PM Peak Hour	15:00	17:30	15:00
AM Pk Volume	908	930	1811	PM Pk Volume	1203	978	2119
Pk Hr Factor	0.894	0.969	0.918	Pk Hr Factor	0.895	0.955	0.925
7 - 9 Volume	1539	1407	2946	4 - 6 Volume	2078	1819	3897
7 - 9 Peak Hour	08:00	08:00	08:00	4 - 6 Peak Hour	16:30	16:00	17:00
7 - 9 Pk Volume	780	727	1507	4 - 6 Pk Volume	1071	912	1951
Pk Hr Factor	0.961	0.923	0.942	Pk Hr Factor	0.884	0.908	0.953

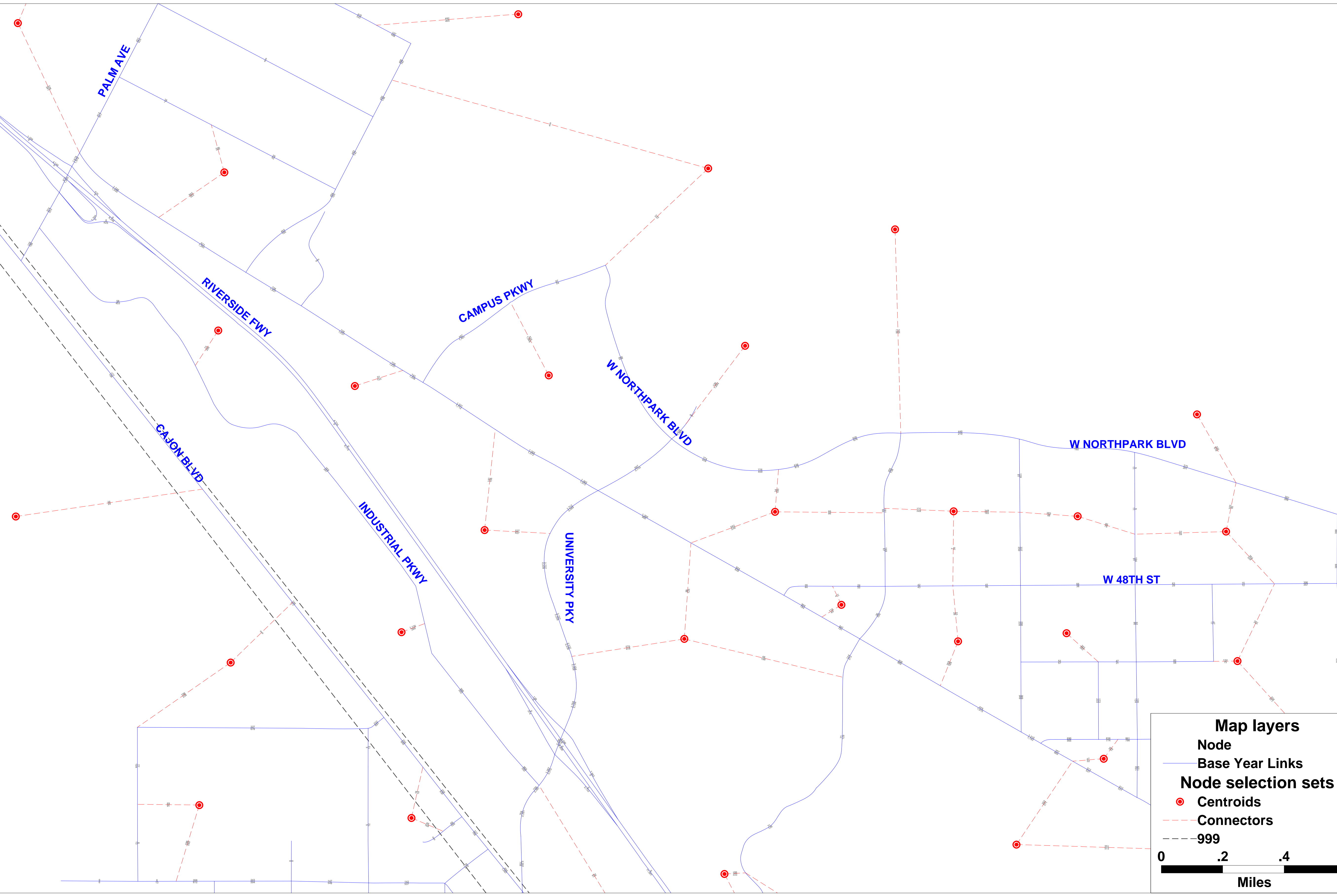
2016 Daily Truck Traffic

RTE	DIST	CNTY	POST MILE	L E G	DESCRIPTION	VEHICLE	TRUCK	TRUCK	TRUCK			AADT	TOTAL	%	TRUCK		AADT	EAL	YEAR
						AADT	AADT	% TOT	By	Axle	By	Axle	2-WAY	VER/					
						TOTAL	TOTAL	VEH	2	3	4	5+	2	3	4	5+	(1000)	EST	
215	08	SBD	7.183	B	SAN BERNARDINO, JCT. RTE. 66 WEST	125000	8625	6.90	3717	1208	328	3372	43.10	14	4	39	1453	84E	
215	08	SBD	7.183	A	SAN BERNARDINO, JCT. RTE. 66 WEST	125000	8375	6.70	3618	1164	327	3266	43.20	14	4	39	1409	84E	
215	08	SBD	8.603	B	SAN BERNARDINO, JCT. RTE. 259 NORTH	115000	8510	7.40	3676	1183	332	3319	43.20	14	4	39	1431	84E	
215	08	SBD	8.603	A	SAN BERNARDINO, JCT. RTE. 259 NORTH	65000	7865	12.10	1573	1400	417	4475	20.00	18	5	57	1789	84E	
215	08	SBD	9.364	B	SAN BERNARDINO, HIGHLAND AVE	63000	6678	10.60	1529	915	327	3907	22.90	14	5	59	1534	84E	
215	08	SBD	9.364	A	SAN BERNARDINO, HIGHLAND AVE	58000	6148	10.60	2035	510	203	3400	33.10	8	3	55	1321	84E	
215	08	SBD	11.634	A	UNIVERSITY PARKWAY	61000	5569	9.13	2273	384	178	2734	40.82	7	3	49	1084	04V	
215	08	SBD	14.091	A	PALM AVE	61000	5569	9.13	2273	384	178	2734	40.82	7	3	49	1084	04V	
215	08	SBD	17.753	B	JCT. RTE. 15	55000	5049	9.18	1699	295	111	2944	33.65	6	2	58	1119	04E	
216	06	TUL	R0	A	VISALIA, JCT. RTE. 198	15700	1099	7.00	802	132	55	110	73.00	12	5	10	86	14E	
216	06	TUL	R0.99	B	LOVERS LANE	11300	791	7.00	577	95	40	79	73.00	12	5	10	62	14E	
216	06	TUL	1.96	A	LOVERS LANE	13800	966	7.00	618	135	97	116	64.00	14	10	12	88	14E	
216	06	TUL	2.46	A	MACAULIFF AVE, RD 144	3800	266	7.00	173	37	19	37	65.08	14	7	14	25	14V	
216	06	TUL	11.732	B	AVE 344	4000	252	6.29	172	27	17	36	68.22	11	7	14	23	14V	
216	06	TUL	11.732	A	AVE 344	4600	323	7.00	213	45	23	42	66.00	14	7	13	29	14E	
216	06	TUL	14.006	B	WOODLAKE, JCT. RTE. 245	5700	456	8.00	228	114	50	64	50.00	25	11	14	48	14V	
216	06	TUL	14.006	A	WOODLAKE, JCT. RTE. 245	4750	409	8.59	204	108	48	49	50.00	26	12	12	41	14V	



Appendix B. Model Plots

SBTAM 2012
CSUSB Area
AM Peak Period



Map layers

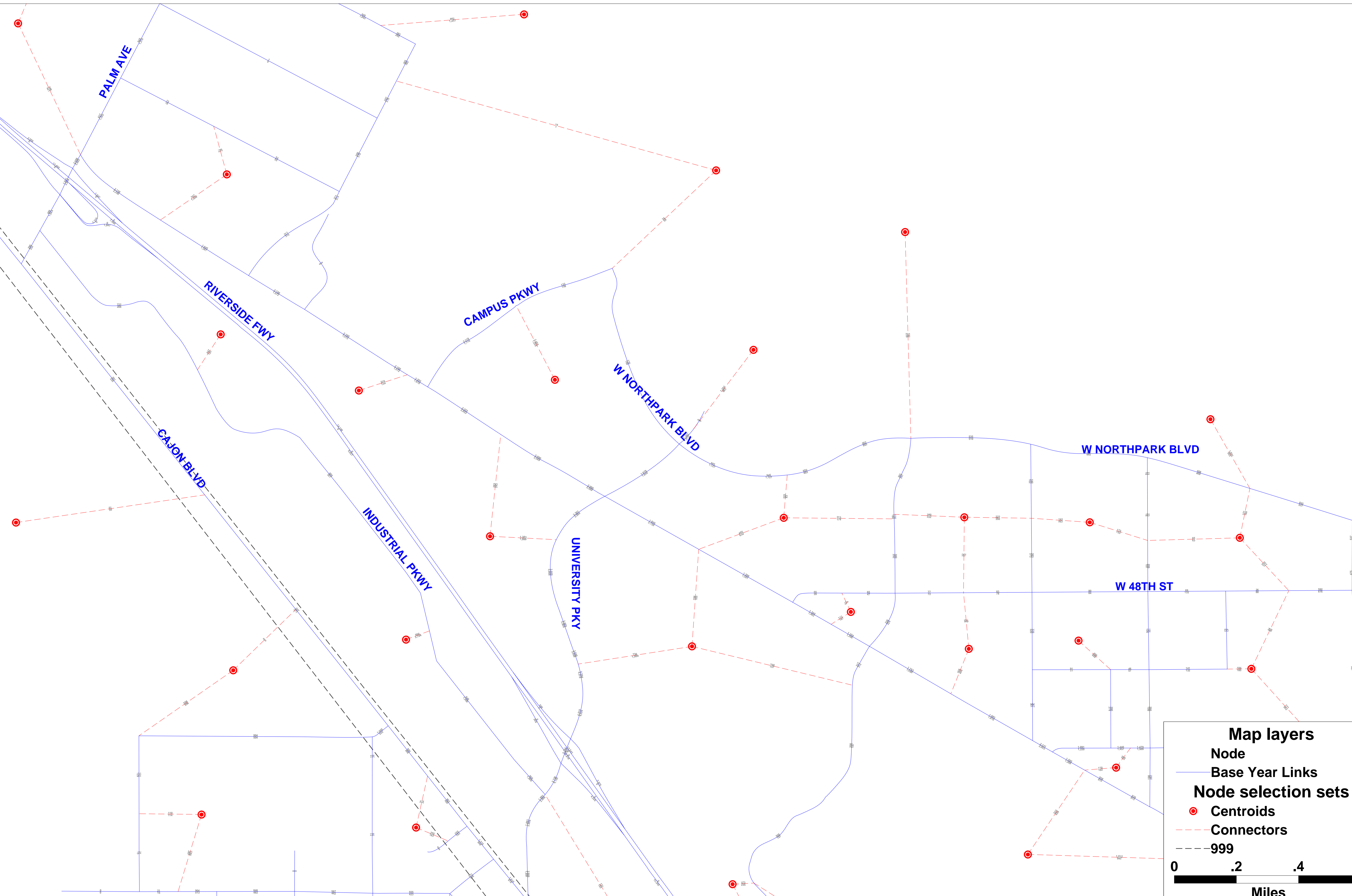
- Node
- Base Year Links

Node selection sets

- Centroids
- Connectors
- 999

0 .2 .4 .6
Miles

SBTAM 2012
CSUSB Area
PM Peak Period



Map layers

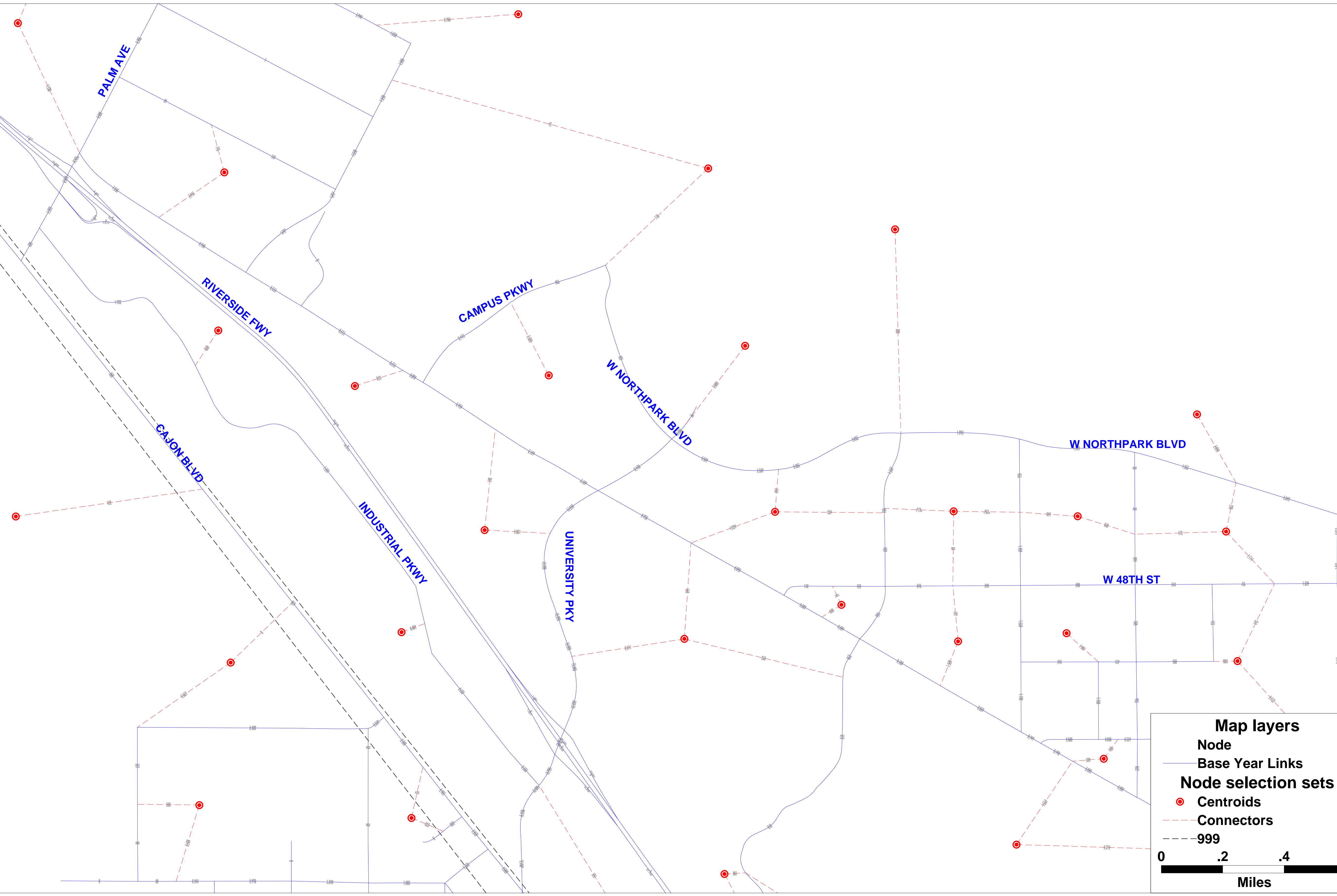
- Node
- Base Year Links

Node selection sets

- Centroids
- Connectors
- 999

0 .2 .4 .6
Miles

SBTAM 2012
CSUSB Area
Daily Flow



Map layers

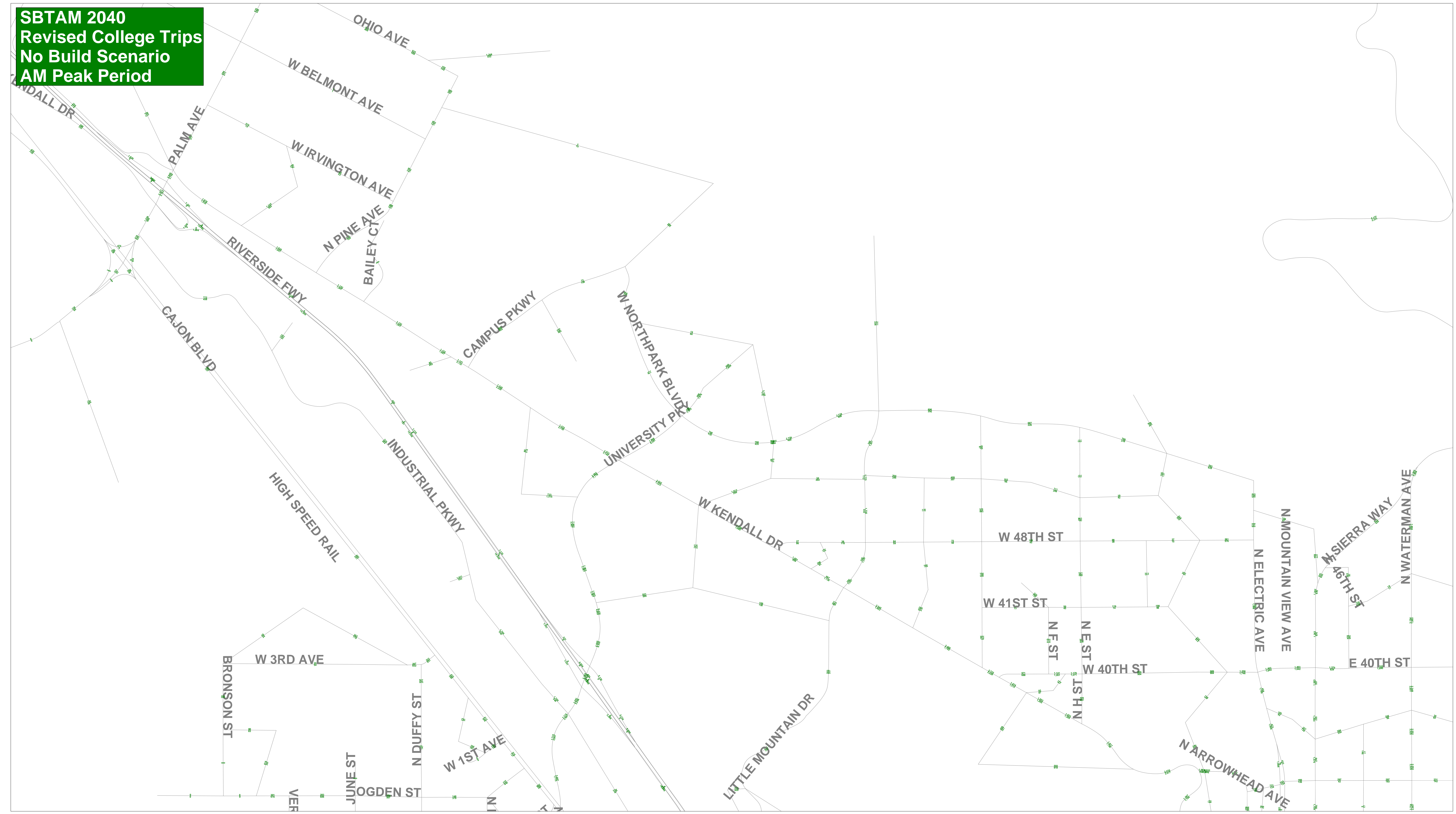
- Node
- Base Year Links

Node selection sets

- Centroids
- Connectors
- 999

0 .2 .4 .6
Miles

SBTAM 2040
Revised College Trips
No Build Scenario
AM Peak Period



SBTAM 2040
Revised College Trips
No Build Scenario
PM Peak Period



Appendix C. Forecast Traffic Volumes Table

I-215 University Interchange Project 2040 AM/PM Peak Hour Intersection Volumes

2017 => 2020 Balanced

Node	Intersection	2017 AM Peak Hour												2020 AM BALANCED Peak Hour												Delta Comparison												Percentage Comparison											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound														
		L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R			
1	University Parkway & Varsity Avenue/State Street	130	1,590	430	30	1,060	30	15	20	315	375	40	25	135	1,790	435	30	1,125	30	20	30	320	390	50	30	5	200	5	0	65	0	5	10	5	15	10	5	4%	13%	1%	0%	6%	0%	33%	50%	2%	4%	25%	20%
2	University Parkway & I-215 NB Ramps	40	530	0	0	1,650	80	0	0	0	355	5	1,655	135	610	0	0	1,740	95	0	0	0	365	5	1,750	10	80	0	0	90	15	0	0	0	10	0	95	25%	15%	0%	0%	5%	19%	0%	0%	0%	4%	3%	6%
3	University Parkway & I-215 SB Ramps	0	500	560	1,190	815	0	70	5	90	0	0	0	0	565	630	1,235	870	0	95	10	110	0	0	0	0	65	70	45	55	0	25	5	20	0	0	0	0%	13%	13%	4%	7%	0%	36%	100%	22%	0%	0%	0%
4	University Parkway & Hallmark Parkway	80	680	5	25	475	395	345	10	40	5	5	30	90	780	10	30	520	430	380	15	45	5	5	35	10	100	5	5	45	35	35	5	5	0	0	5	13%	15%	100%	20%	9%	9%	10%	50%	13%	0%	0%	17%

Node	Intersection	2017 PM Peak Hour												2020 PM BALANCED Peak Hour												Delta Comparison												Percentage Comparison											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound														
		L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R			
1	University Parkway & Varsity Avenue/State Street	295	1,510	400	60	1,490	40	15	25	235	290	50	30	300	1,675	415	65	1,625	45	15	35	240	295	75	35	5	165	15	5	135	5	0	10	5	5	25	5	2%	11%	4%	8%	9%	13%	0%	40%	2%	2%	50%	17%
2	University Parkway & I-215 NB Ramps	85	590	0	0	1,915	85	0	0	0	435	10	1,655	110	670	0	0	2,050	110	0	0	0	435	15	1,720	25	80	0	0	135	25	0	0	0	0	5	65	29%	14%	0%	0%	7%	29%	0%	0%	0%	0%	50%	4%
3	University Parkway & I-215 SB Ramps	0	600	400	1,390	960	0	75	5	65	0	0	0	0	665	410	1,465	1,020	0	115	10	90	0	0	0	0	65	10	75	60	0	40	5	25	0	0	0	0%	11%	3%	5%	6%	0%	53%	100%	38%	0%	0%	0%
4	University Parkway & Hallmark Parkway	145	395	15	50	545	425	555	15	185	10	15	45	150	440	20	55	615	440	585	15	200	15	20	50	5	45	5	5	70	15	30	0	15	5	5	5	3%	11%	33%	10%	13%	4%	5%	0%	8%	50%	33%	11%

2020 => 2040 Balanced

Node	Intersection	2020 AM Peak Hour												2040 AM BALANCED Peak Hour												Delta Comparison												Percentage Comparison											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound														
		L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R						
1	University Parkway & Varsity Avenue/State Street	135	1,790	435	30	1,125	30	20	30	320	390	50	30	150	3,110	465	35	1,565	35	25	35	335	400	55	40	15	1320	30	5	440	5	5	5	15	10	5	10	11%	74%	7%	17%	39%	17%	25%	17%	5%	3%	10%	33%
2	University Parkway & I-215 NB Ramps	50	610	0	0	1,740	95	0	0	0	365	5	1,750	95	1,215	0	0	2,160	140	0	0	0	425	10	2,510	45	605	0	0	420	45	0	0	0	60	5	760	90%	99%	0%	0%	24%	47%	0%	0%	0%	16%	100%	43%
3	University Parkway & I-215 SB Ramps	0	565	630	1,235	870	0	95	10	110	0	0	0	0	1,015	640	1,410	1,175	0	295	10	195	0	0	0	0	450	10	175	305	0	200	0	85	0	0	0	0%	80%	2%	14%	35%	0%	211%	0%	77%	0%	0%	0%
4	University Parkway & Hallmark Parkway	90	780	10	30	520	430	380	15	45	5	5	35	130	1,170	15	60	740	570	435	20	55	10	10	50	40	390	5	30	220	140	55	5	10	5	5	15	44%	50%	50%	100%	42%	33%	14%	33%	22%	100%	100%	43%

Node	Intersection	2020 PM Peak Hour												2040 PM BALANCED Peak Hour												Delta Comparison												Percentage Comparison											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound														
		L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R						
1	University Parkway & Varsity Avenue/State Street	300	1,675	415	65	1,625	45	15	35	240	295	75	35	320	2,750	505	80	2,295	50	20	40	250	300	80	40	20	1075	90	15	670	5	5	5	10	5	5	5	7%	64%	22%	23%	41%	11%	33%	14%	4%	2%	7%	14%
2	University Parkway & I-215 NB Ramps	110	670	0	0	2,050	110	0	0	0	435	15	1,720	275	1,260	0	0	2,600	245	0	0	0	445	25	2,315	165	590	0	0	550	135	0	0	0	10	10	595	150%	88%	0%	0%	27%	123%	0%	0%	0%	2%	67%	35%
3	University Parkway & I-215 SB Ramps	0	665	410	1,465	1,020	0	115	10	90	0	0	0	0	1,065	420	1,860	1,185	0	470	15	190	0	0	0	0	400	10	395	165	0	355	5	100	0	0	0	0%	60%	2%	27%	16%	0%	309%	50%	111%	0%	0%	0%
4	University Parkway & Hallmark Parkway	150	440	20	55	615	440	585	15	200	15	20	50	175	650	25	75	795	505	735	20	285	25	25	100	25	210	5	20	180	65	150	5	85	10	5	50	17%	48%	25%	36%	29%	15%	26%	33%	43%	67%	25%	100%

2017 => 2040 Balanced

Node	Intersection	2017 AM Peak Hour												2040 AM BALANCED Peak Hour												Delta Comparison												Percentage Comparison											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound														
		L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R						
1	University Parkway & Varsity Avenue/State Street	130	1,590	430	30	1,060	30	15	20	315	375	40	25	150	3,110	465	35	1,565	35	25	35	335	400	55	40	20	1520	35	5	505	5	10	15	20	25	15	15	15%	96%	8%	17%	48%	17%	67%	75%	6%	7%	38%	60%
2	University Parkway & I-215 NB Ramps	40	530	0	0	1,650	80	0	0	0	355	5	1,655	95	1,215	0	0	2,160	140	0	0	0	425	10	2,510	55	685	0	0	510	60	0	0	0	70	5	855	138%	129%	0%	0%	31%	75%	0%	0%	0%	20%	100%	52%
3	University Parkway & I-215 SB Ramps	0	500	560	1,190	815	0	70	5	90	0	0	0	0	1,015	640	1,410	1,175	0	295	10	195	0	0	0	0	515	80	220	360	0	225	5	105	0	0	0	0%	103%	14%	18%	44%	0%	321%	100%	117%	0%	0%	0%
4	University Parkway & Hallmark Parkway	80	680	5	25	475	395	345	10	40	5	5	30	130	1,170	15	60	740	570	435	20	55	10	10	50	50	490	10	35	265	175	90	10	15	5	5	20	63%	72%	200%	140%	56%	44%	26%	100%	38%	100%	100%	67%

Node	Intersection	2017 PM Peak Hour												2040 PM BALANCED Peak Hour												Delta Comparison												Percentage Comparison											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound														
		L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R									
1	University Parkway & Varsity Avenue/State Street	295	1,510	400	60	1,490	40	15	25	235	290	50	30	320	2,750	505	80	2,295	50	20	40	250	300	80	40	25	1240	105	20	805	10	5	15	15	10	30	10	8%	82%	26%	33%	54%	25%	33%	60%	6%	3%	60%	33%
2	University Parkway & I-215 NB Ramps	85	590	0	0	1,915	85	0	0	0	435	10	1,655	275	1,260	0	0	2,600	245	0	0	0	445	25	2,315	190	670	0	0	685	160	0	0	0	10	15	660	224%	114%	0%	0%	36%	188%	0%	0%	0%	2%	150%	40%
3	University Parkway & I-215 SB Ramps	0	600	400	1,390	960	0	75	5	65	0	0	0	0	1,065	420	1,860	1,185	0	470	15	190	0	0	0	0	465	20	470	225	0	395	10	125	0	0	0	0%	78%	5%	34%	23%	0%	527%	200%	192%	0%	0%	0%
4	University Parkway & Hallmark Parkway	145	395	15	50	545	425	555	15	185	10	15	45	175	650	25	75	795																															

I-215 Freeway Mainline Segment Average Daily Traffic (ADT) and Vehicle Miles Travelled (VMT)															
Freeway Segment	ADT			Daily VMT			Truck %	Truck AADT Total % By Axle				% Truck AADT By Axle			
	Truck ADT	Non-Truck	Total ADT	Truck Daily	Non-Truck	Total Daily		2	3	4	5+	2	3	4	5+
Existing Year (2017) Conditions															
<i>North of University Parkway Ramps</i>	5,113	50,887	56,000	11,632	115,768	127,400	9.13%	2,085	360	155	2,505	40.82%	7.00%	3.00%	49.00%
<i>South of University Parkway Ramps</i>	6,939	69,061	76,000	9,666	96,202	105,868	9.13%	2,085	360	155	2,505	40.82%	7.00%	3.00%	49.00%
Opening Year (2020) Conditions															
<i>North of University Parkway Ramps</i>	5,642	56,158	61,800	12,836	127,759	140,595	9.13%	2,085	360	155	2,505	40.82%	7.00%	3.00%	49.00%
<i>South of University Parkway Ramps</i>	8,044	80,056	88,100	11,205	111,519	122,724	9.13%	2,085	360	155	2,505	40.82%	7.00%	3.00%	49.00%
Horizon Year (2040) Conditions															
<i>North of University Parkway Ramps</i>	8,491	84,509	93,000	19,317	192,258	211,575	9.13%	2,085	360	155	2,505	40.82%	7.00%	3.00%	49.00%
<i>South of University Parkway Ramps</i>	11,093	110,407	121,500	15,452	153,797	169,249	9.13%	2,085	360	155	2,505	40.82%	7.00%	3.00%	49.00%

Source: 2016 Annual Average Daily Truck Traffic on the California State Highway System






























Appendix D. Synchro Worksheet

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 				
Traffic Volume (vph)	130	1590	430	30	1060	30	375	40	25	15	20	315
Future Volume (vph)	130	1590	430	30	1060	30	375	40	25	15	20	315
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	8.5	8.5		6.5	6.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.86	
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)	1676	4818	1500	1676	4818	1500	1676	1664		1676	1516	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.37	1.00		0.71	1.00	
Satd. Flow (perm)	1676	4818	1500	1676	4818	1500	654	1664		1249	1516	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	151	1849	500	35	1233	35	436	47	29	17	23	366
RTOR Reduction (vph)	0	0	269	0	0	26	0	19	0	0	233	0
Lane Group Flow (vph)	151	1849	231	35	1233	9	436	57	0	17	156	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8				4
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	17.7	36.7	36.7	5.1	24.1	24.1	35.2	35.2		35.2	35.2	
Effective Green, g (s)	15.7	33.7	33.7	3.1	23.1	23.1	30.7	30.7		32.7	32.7	
Actuated g/C Ratio	0.17	0.37	0.37	0.03	0.26	0.26	0.34	0.34		0.36	0.36	
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	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)	292	1804	561	57	1236	385	223	567		453	550	
v/s Ratio Prot	0.09	c0.38		0.02	c0.26			0.03				0.10
v/s Ratio Perm			0.15			0.01	c0.67			0.01		
v/c Ratio	0.52	1.02	0.41	0.61	1.00	0.02	1.96	0.10		0.04	0.28	
Uniform Delay, d1	33.7	28.1	20.8	42.9	33.4	25.0	29.6	20.2		18.5	20.3	
Progression Factor	1.10	1.12	1.62	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	21.7	1.1	18.0	25.0	0.1	445.8	0.1		0.0	0.3	
Delay (s)	37.8	53.3	34.9	60.9	58.5	25.1	475.4	20.3		18.5	20.6	
Level of Service	D	D	C	E	E	C	F	C		B	C	
Approach Delay (s)		48.7			57.6			407.8			20.5	
Approach LOS		D			E			F			C	

Intersection Summary























HCM 2000 Control Delay	87.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.50		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	22.5
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: 215 NB Off Ramp/215 NB On Ramp & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			  				 			
Traffic Volume (vph)	40	530	0	0	1650	80	355	5	1655	0	0	0
Future Volume (vph)	40	530	0	0	1650	80	355	5	1655	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.5	7.5			7.5	7.5		6.5	6.5			
Lane Util. Factor	1.00	0.95			0.91	1.00		1.00	0.88			
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)	1676	3353			4818	1500		1682	2640			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1676	3353			4818	1500		1682	2640			
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	45	596	0	0	1854	90	399	6	1860	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	58	0	0	51	0	0	0
Lane Group Flow (vph)	45	596	0	0	1854	32	0	405	1809	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	custom			
Protected Phases	5	2			6			8	18			
Permitted Phases						6	8					
Actuated Green, G (s)	10.0	20.7			30.0	30.0		34.3	58.1			
Effective Green, g (s)	8.0	18.9			28.2	28.2		33.3	57.1			
Actuated g/C Ratio	0.09	0.21			0.31	0.31		0.37	0.63			
Clearance Time (s)	4.5	5.7			5.7	5.7		5.5				
Vehicle Extension (s)	2.0	2.0			2.0	2.0		3.5				
Lane Grp Cap (vph)	148	704			1509	470		622	1674			
v/s Ratio Prot	0.03	c0.18			c0.38				c0.69			
v/s Ratio Perm						0.02		0.24				
v/c Ratio	0.30	0.85			1.23	0.07		0.65	1.08			
Uniform Delay, d1	38.4	34.2			30.9	21.7		23.5	16.4			
Progression Factor	0.87	0.51			0.50	0.23		1.00	1.00			
Incremental Delay, d2	3.0	7.2			104.5	0.1		2.6	47.4			
Delay (s)	36.2	24.5			120.0	5.1		26.1	63.8			
Level of Service	D	C			F	A		C	E			
Approach Delay (s)		25.3			114.7			57.1			0.0	
Approach LOS		C			F			E			A	

Intersection Summary





















HCM 2000 Control Delay	76.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	146.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: 215 SB On Ramp/215 SB Off Ramp & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 							 	
Traffic Volume (vph)	0	500	560	1190	815	0	0	0	0	70	5	90
Future Volume (vph)	0	500	560	1190	815	0	0	0	0	70	5	90
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		7.5		6.5	7.5						6.5	6.5
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						0.96	1.00
Satd. Flow (prot)		3087		3252	1765						1686	1500
Flt Permitted		1.00		0.95	1.00						0.96	1.00
Satd. Flow (perm)		3087		3252	1765						1686	1500
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)	0	538	602	1280	876	0	0	0	0	75	5	97
RTOR Reduction (vph)	0	196	0	0	0	0	0	0	0	0	0	90
Lane Group Flow (vph)	0	944	0	1280	876	0	0	0	0	0	80	7
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases										4		4
Actuated Green, G (s)		32.7		36.0	72.2						7.8	7.8
Effective Green, g (s)		29.7		33.0	69.2						6.8	6.8
Actuated g/C Ratio		0.33		0.37	0.77						0.08	0.08
Clearance Time (s)		4.5		3.5	4.5						5.5	5.5
Vehicle Extension (s)		2.0		2.0	2.0						2.0	2.0
Lane Grp Cap (vph)		1018		1192	1357						127	113
v/s Ratio Prot		c0.31		c0.39	0.50							
v/s Ratio Perm											0.05	0.00
v/c Ratio		0.93		1.07	0.65						0.63	0.06
Uniform Delay, d1		29.1		28.5	4.8						40.4	38.6
Progression Factor		1.30		0.35	1.87						1.00	1.00
Incremental Delay, d2		14.2		35.1	0.2						6.9	0.1
Delay (s)		52.1		45.2	9.2						47.2	38.7
Level of Service		D		D	A						D	D
Approach Delay (s)		52.1			30.6			0.0			42.6	
Approach LOS		D			C			A			D	

Intersection Summary



























HCM 2000 Control Delay	38.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	146.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

03/05/2018











												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	80	680	5	25	475	395	5	5	30	345	10	40
Future Volume (vph)	80	680	5	25	475	395	5	5	30	345	10	40
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	7.5		6.0	7.5	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.87		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (prot)	1676	3350		1676	3353	1500	1676	1535		1593	1601	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (perm)	1676	3350		1676	3353	1500	1676	1535		1593	1601	1500
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	739	5	27	516	429	5	5	33	375	11	43
RTOR Reduction (vph)	0	1	0	0	0	183	0	31	0	0	0	36
Lane Group Flow (vph)	87	743	0	27	516	246	5	7	0	191	195	7
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	11.4	45.5		4.1	38.2	55.7	6.9	6.9		17.5	17.5	17.5
Effective Green, g (s)	8.4	43.0		1.1	35.7	51.7	4.9	4.4		15.5	15.0	15.0
Actuated g/C Ratio	0.09	0.48		0.01	0.40	0.57	0.05	0.05		0.17	0.17	0.17
Clearance Time (s)	3.0	5.0		3.0	5.0	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)	156	1600		20	1330	861	91	75		274	266	250
v/s Ratio Prot	c0.05	c0.22		0.02	c0.15	0.05	0.00	c0.00		0.12	c0.12	
v/s Ratio Perm						0.12						0.00
v/c Ratio	0.56	0.46		1.35	0.39	0.29	0.05	0.09		0.70	0.73	0.03
Uniform Delay, d1	39.0	15.8		44.5	19.4	9.8	40.4	40.9		35.0	35.6	31.4
Progression Factor	1.00	1.00		1.11	0.94	0.81	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.3	1.0		306.7	0.7	0.2	0.3	0.5		7.5	10.0	0.0
Delay (s)	43.3	16.7		355.9	19.0	8.1	40.6	41.4		42.5	45.6	31.4
Level of Service	D	B		F	B	A	D	D		D	D	C
Approach Delay (s)		19.5			23.5			41.3			42.8	
Approach LOS		B			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			26.0	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			90.0	Sum of lost time (s)				26.5				
Intersection Capacity Utilization			57.0%	ICU Level of Service				B				
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy














03/05/2018

						
Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	5	1050	880	5	5	15
Future Volume (Veh/h)	5	1050	880	5	5	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1141	957	5	5	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		274	296			
pX, platoon unblocked					0.85	
vC, conflicting volume	962				1540	481
vC1, stage 1 conf vol					960	
vC2, stage 2 conf vol					580	
vCu, unblocked vol	962				1292	481
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	97
cM capacity (veh/h)	711				309	531
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SE 1
Volume Total	5	570	570	638	324	21
Volume Left	5	0	0	0	0	5
Volume Right	0	0	0	0	5	16
cSH	711	1700	1700	1700	1700	453
Volume to Capacity	0.01	0.34	0.34	0.38	0.19	0.05
Queue Length 95th (ft)	1	0	0	0	0	4
Control Delay (s)	10.1	0.0	0.0	0.0	0.0	13.3
Lane LOS	B					B
Approach Delay (s)	0.0			0.0		13.3
Approach LOS						B
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			40.6%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: University Pkwy
















03/05/2018

						
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		 	 		 	
Traffic Volume (veh/h)	15	1040	855	50	20	30
Future Volume (Veh/h)	15	1040	855	50	20	30
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	1130	929	54	22	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		378	192			
pX, platoon unblocked					0.86	
vC, conflicting volume	983				1553	492
vC1, stage 1 conf vol					956	
vC2, stage 2 conf vol					597	
vCu, unblocked vol	983				1311	492
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				93	94
cM capacity (veh/h)	698				307	523
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SE 1
Volume Total	16	565	565	619	364	55
Volume Left	16	0	0	0	0	22
Volume Right	0	0	0	0	54	33
cSH	698	1700	1700	1700	1700	408
Volume to Capacity	0.02	0.33	0.33	0.36	0.21	0.13
Queue Length 95th (ft)	2	0	0	0	0	12
Control Delay (s)	10.3	0.0	0.0	0.0	0.0	15.2
Lane LOS	B					C
Approach Delay (s)	0.1			0.0		15.2
Approach LOS						C
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			40.3%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

7: University Pkwy & McDonalds




























03/05/2018

										
Movement	WBL	WBR	NBT	NBR	SBL	SBT				
Lane Configurations			  			  				
Traffic Volume (veh/h)	0	110	2040	145	20	1730				
Future Volume (Veh/h)	0	110	2040	145	20	1730				
Sign Control	Stop		Free			Free				
Grade	0%		0%			0%				
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				
Hourly flow rate (vph)	0	120	2217	158	22	1880				
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type	None					None				
Median storage (veh)										
Upstream signal (ft)	344					495				
pX, platoon unblocked	0.80	0.92			0.92					
vC, conflicting volume	2888	739			2375					
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	1845	427			2199					
tC, single (s)	6.8	6.9			4.1					
tC, 2 stage (s)										
tF (s)	3.5	3.3			2.2					
p0 queue free %	100	77			90					
cM capacity (veh/h)	48	532			218					
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4	
Volume Total	120	739	739	739	158	22	627	627	627	
Volume Left	0	0	0	0	0	22	0	0	0	
Volume Right	120	0	0	0	158	0	0	0	0	
cSH	532	1700	1700	1700	1700	218	1700	1700	1700	
Volume to Capacity	0.23	0.43	0.43	0.43	0.09	0.10	0.37	0.37	0.37	
Queue Length 95th (ft)	22	0	0	0	0	8	0	0	0	
Control Delay (s)	13.7	0.0	0.0	0.0	0.0	23.3	0.0	0.0	0.0	
Lane LOS	B					C				
Approach Delay (s)	13.7	0.0				0.3				
Approach LOS	B									
Intersection Summary										
Average Delay			0.5							
Intersection Capacity Utilization			58.8%		ICU Level of Service				B	
Analysis Period (min)			15							

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

03/05/2018























													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		  			  			 					
Traffic Volume (vph)	295	1510	400	60	1490	40	290	50	30	15	25	235	
Future Volume (vph)	295	1510	400	60	1490	40	290	50	30	15	25	235	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	8.5	8.5		6.5	6.5		
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00		
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.86		
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)	1676	4818	1500	1676	4818	1500	1676	1666		1676	1526		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.42	1.00		0.70	1.00		
Satd. Flow (perm)	1676	4818	1500	1676	4818	1500	745	1666		1237	1526		
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)	317	1624	430	65	1602	43	312	54	32	16	27	253	
RTOR Reduction (vph)	0	0	227	0	0	25	0	24	0	0	185	0	
Lane Group Flow (vph)	317	1624	203	65	1602	18	312	62	0	16	95	0	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA		
Protected Phases	5	2		1	6			8				4	
Permitted Phases			2			6	8			4			
Actuated Green, G (s)	15.8	50.3	50.3	7.4	41.9	41.9	29.3	29.3		29.3	29.3		
Effective Green, g (s)	13.8	47.3	47.3	5.4	40.9	40.9	24.8	24.8		26.8	26.8		
Actuated g/C Ratio	0.14	0.47	0.47	0.05	0.41	0.41	0.25	0.25		0.27	0.27		
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	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	2278	709	90	1970	613	184	413		331	408		
v/s Ratio Prot	c0.19	0.34		0.04	c0.33			0.04			0.06		
v/s Ratio Perm			0.14			0.01	c0.42			0.01			
v/c Ratio	1.37	0.71	0.29	0.72	0.81	0.03	1.70	0.15		0.05	0.23		
Uniform Delay, d1	43.1	21.0	16.1	46.6	26.2	17.7	37.6	29.4		27.1	28.6		
Progression Factor	0.95	0.89	0.82	1.00	1.00	1.00	1.00	1.00		1.00	1.00		
Incremental Delay, d2	181.3	1.0	0.5	24.7	3.8	0.1	335.3	0.2		0.1	0.3		
Delay (s)	222.4	19.6	13.7	71.2	30.0	17.8	372.9	29.5		27.2	28.9		
Level of Service	F	B	B	E	C	B	F	C		C	C		
Approach Delay (s)		45.7			31.2			298.7			28.8		
Approach LOS		D			C			F			C		
Intersection Summary													
HCM 2000 Control Delay			60.5	HCM 2000 Level of Service						E			
HCM 2000 Volume to Capacity ratio			1.21										
Actuated Cycle Length (s)			100.0	Sum of lost time (s)						22.5			
Intersection Capacity Utilization			103.8%	ICU Level of Service						G			
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: 215 NB Off Ramp/215 NB On Ramp & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			  				 			
Traffic Volume (vph)	85	590	0	0	1915	85	435	10	1655	0	0	0
Future Volume (vph)	85	590	0	0	1915	85	435	10	1655	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.5	7.5			7.5	7.5		6.5	6.5			
Lane Util. Factor	1.00	0.95			0.91	1.00		1.00	0.88			
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)	1676	3353			4818	1500		1683	2640			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1676	3353			4818	1500		1683	2640			
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)	91	634	0	0	2059	91	468	11	1780	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	58	0	0	56	0	0	0
Lane Group Flow (vph)	91	634	0	0	2059	33	0	479	1724	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	custom			
Protected Phases	5	2			6			8	18			
Permitted Phases						6	8					
Actuated Green, G (s)	9.0	23.9			35.3	35.3		40.0	64.9			
Effective Green, g (s)	7.0	22.1			33.5	33.5		39.0	63.9			
Actuated g/C Ratio	0.07	0.22			0.34	0.34		0.39	0.64			
Clearance Time (s)	4.5	5.7			5.7	5.7		5.5				
Vehicle Extension (s)	2.0	2.0			2.0	2.0		3.5				
Lane Grp Cap (vph)	117	741			1614	502		656	1686			
v/s Ratio Prot	0.05	0.19			c0.43				c0.65			
v/s Ratio Perm						0.02		0.28				
v/c Ratio	0.78	0.86			1.28	0.07		0.73	1.02			
Uniform Delay, d1	45.7	37.4			33.2	22.6		26.0	18.1			
Progression Factor	1.26	0.78			1.22	1.96		1.00	1.00			
Incremental Delay, d2	23.4	7.0			126.9	0.1		4.3	27.8			
Delay (s)	81.2	36.2			167.7	44.6		30.3	45.9			
Level of Service	F	D			F	D		C	D			
Approach Delay (s)		41.8			162.5			42.6			0.0	
Approach LOS		D			F			D			A	

Intersection Summary






















HCM 2000 Control Delay	92.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	149.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: 215 SB On Ramp/215 SB Off Ramp & University Pkwy

03/05/2018



























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 							 	 
Traffic Volume (vph)	0	600	400	1390	960	0	0	0	0	75	5	65
Future Volume (vph)	0	600	400	1390	960	0	0	0	0	75	5	65
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		7.5		6.5	7.5						6.5	6.5
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						0.96	1.00
Satd. Flow (prot)		3152		3252	1765						1685	1500
Flt Permitted		1.00		0.95	1.00						0.96	1.00
Satd. Flow (perm)		3152		3252	1765						1685	1500
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)	0	638	426	1479	1021	0	0	0	0	80	5	69
RTOR Reduction (vph)	0	101	0	0	0	0	0	0	0	0	0	63
Lane Group Flow (vph)	0	963	0	1479	1021	0	0	0	0	0	85	6
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases										4		4
Actuated Green, G (s)		35.0		40.0	79.5						9.3	9.3
Effective Green, g (s)		33.2		38.0	77.7						8.3	8.3
Actuated g/C Ratio		0.33		0.38	0.78						0.08	0.08
Clearance Time (s)		5.7		4.5	5.7						5.5	5.5
Vehicle Extension (s)		2.0		2.0	2.0						2.0	2.0
Lane Grp Cap (vph)		1046		1235	1371						139	124
v/s Ratio Prot		c0.31		c0.45	0.58							
v/s Ratio Perm											0.05	0.00
v/c Ratio		0.92		1.20	0.74						0.61	0.05
Uniform Delay, d1		32.1		31.0	5.9						44.3	42.2
Progression Factor		1.17		0.29	1.68						1.00	1.00
Incremental Delay, d2		12.1		89.7	0.3						5.5	0.1
Delay (s)		49.6		98.6	10.3						49.8	42.3
Level of Service		D		F	B						D	D
Approach Delay (s)		49.6			62.5			0.0			46.4	
Approach LOS		D			E			A			D	
Intersection Summary												
HCM 2000 Control Delay			58.1			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			20.5			
Intersection Capacity Utilization			149.1%			ICU Level of Service			H			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	145	395	15	50	545	425	10	15	45	555	15	185
Future Volume (vph)	145	395	15	50	545	425	10	15	45	555	15	185
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	7.5		6.0	7.5	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (prot)	1676	3335		1676	3353	1500	1676	1565		1593	1601	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (perm)	1676	3335		1676	3353	1500	1676	1565		1593	1601	1500
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	429	16	54	592	462	11	16	49	603	16	201
RTOR Reduction (vph)	0	2	0	0	0	197	0	46	0	0	0	157
Lane Group Flow (vph)	158	443	0	54	592	265	11	19	0	308	311	44
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	14.2	43.9		7.5	37.2	61.4	8.4	8.4		24.2	24.2	24.2
Effective Green, g (s)	11.2	41.4		4.5	34.7	57.4	6.4	5.9		22.2	21.7	21.7
Actuated g/C Ratio	0.11	0.41		0.04	0.35	0.57	0.06	0.06		0.22	0.22	0.22
Clearance Time (s)	3.0	5.0		3.0	5.0	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)	187	1380		75	1163	861	107	92		353	347	325
v/s Ratio Prot	c0.09	0.13		0.03	c0.18	0.07	0.01	c0.01		0.19	c0.19	
v/s Ratio Perm						0.11						0.03
v/c Ratio	0.84	0.32		0.72	0.51	0.31	0.10	0.21		0.87	0.90	0.13
Uniform Delay, d1	43.5	19.8		47.1	25.9	11.0	44.1	44.8		37.5	38.1	31.6
Progression Factor	1.00	1.00		1.10	1.15	2.64	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	27.9	0.6		21.9	1.2	0.2	0.4	1.1		20.4	24.3	0.2
Delay (s)	71.4	20.4		73.9	30.9	29.3	44.5	45.9		57.9	62.3	31.8
Level of Service	E	C		E	C	C	D	D		E	E	C
Approach Delay (s)		33.8			32.3			45.7			53.2	
Approach LOS		C			C			D			D	

Intersection Summary















HCM 2000 Control Delay	39.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	26.5
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy











03/05/2018

						
Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations		 	 		 	
Traffic Volume (veh/h)	5	990	1010	5	10	10
Future Volume (Veh/h)	5	990	1010	5	10	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1076	1098	5	11	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		302	269			
pX, platoon unblocked					0.92	
vC, conflicting volume	1103				1648	552
vC1, stage 1 conf vol					1100	
vC2, stage 2 conf vol					548	
vCu, unblocked vol	1103				1526	552
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				96	98
cM capacity (veh/h)	629				260	478
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SE 1
Volume Total	5	538	538	732	371	22
Volume Left	5	0	0	0	0	11
Volume Right	0	0	0	0	5	11
cSH	629	1700	1700	1700	1700	337
Volume to Capacity	0.01	0.32	0.32	0.43	0.22	0.07
Queue Length 95th (ft)	1	0	0	0	0	5
Control Delay (s)	10.8	0.0	0.0	0.0	0.0	16.4
Lane LOS	B					C
Approach Delay (s)	0.0			0.0		16.4
Approach LOS						C
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			39.6%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: University Pkwy
















03/05/2018

						
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	10	990	995	30	10	20
Future Volume (Veh/h)	10	990	995	30	10	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	1076	1082	33	11	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	None			
Median storage (veh)		2				
Upstream signal (ft)		405	166			
pX, platoon unblocked					0.92	
vC, conflicting volume	1115				1658	558
vC1, stage 1 conf vol					1098	
vC2, stage 2 conf vol					560	
vCu, unblocked vol	1115				1541	558
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	95
cM capacity (veh/h)	622				259	473
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SE 1
Volume Total	11	538	538	721	394	33
Volume Left	11	0	0	0	0	11
Volume Right	0	0	0	0	33	22
cSH	622	1700	1700	1700	1700	371
Volume to Capacity	0.02	0.32	0.32	0.42	0.23	0.09
Queue Length 95th (ft)	1	0	0	0	0	7
Control Delay (s)	10.9	0.0	0.0	0.0	0.0	15.6
Lane LOS	B					C
Approach Delay (s)	0.1			0.0		15.6
Approach LOS						C
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			40.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

7: University Pkwy & McDonalds





























03/05/2018

										
Movement	WBL	WBR	NBT	NBR	SBL	SBT				
Lane Configurations			  			  				
Traffic Volume (veh/h)	0	135	2070	175	15	2000				
Future Volume (Veh/h)	0	135	2070	175	15	2000				
Sign Control	Stop		Free			Free				
Grade	0%		0%			0%				
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				
Hourly flow rate (vph)	0	147	2250	190	16	2174				
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type	None					None				
Median storage (veh)										
Upstream signal (ft)	344					495				
pX, platoon unblocked	0.77	0.88			0.88					
vC, conflicting volume	3007	750			2440					
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	1515	244			2162					
tC, single (s)	6.8	6.9			4.1					
tC, 2 stage (s)										
tF (s)	3.5	3.3			2.2					
p0 queue free %	100	78			93					
cM capacity (veh/h)	78	667			215					
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4	
Volume Total	147	750	750	750	190	16	725	725	725	
Volume Left	0	0	0	0	0	16	0	0	0	
Volume Right	147	0	0	0	190	0	0	0	0	
cSH	667	1700	1700	1700	1700	215	1700	1700	1700	
Volume to Capacity	0.22	0.44	0.44	0.44	0.11	0.07	0.43	0.43	0.43	
Queue Length 95th (ft)	21	0	0	0	0	6	0	0	0	
Control Delay (s)	11.9	0.0	0.0	0.0	0.0	23.1	0.0	0.0	0.0	
Lane LOS	B					C				
Approach Delay (s)	11.9	0.0				0.2				
Approach LOS	B									
Intersection Summary										
Average Delay			0.4							
Intersection Capacity Utilization			61.0%		ICU Level of Service			B		
Analysis Period (min)	15									

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

03/05/2018























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  							
Traffic Volume (vph)	135	1755	435	30	1145	30	390	50	30	20	30	320
Future Volume (vph)	135	1755	435	30	1145	30	390	50	30	20	30	320
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	8.5	8.5		6.5	6.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.86	
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)	1676	4818	1500	1676	4818	1500	1676	1665		1676	1523	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.36	1.00		0.70	1.00	
Satd. Flow (perm)	1676	4818	1500	1676	4818	1500	637	1665		1230	1523	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	157	2041	506	35	1331	35	453	58	35	23	35	372
RTOR Reduction (vph)	0	0	252	0	0	26	0	23	0	0	232	0
Lane Group Flow (vph)	157	2041	254	35	1331	9	453	70	0	23	175	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8				4
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	17.6	35.5	35.5	5.1	23.0	23.0	36.4	36.4		36.4	36.4	
Effective Green, g (s)	15.6	32.5	32.5	3.1	22.0	22.0	31.9	31.9		33.9	33.9	
Actuated g/C Ratio	0.17	0.36	0.36	0.03	0.24	0.24	0.35	0.35		0.38	0.38	
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	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)	290	1739	541	57	1177	366	225	590		463	573	
v/s Ratio Prot	0.09	c0.42		0.02	c0.28			0.04				0.12
v/s Ratio Perm			0.17			0.01	c0.71			0.02		
v/c Ratio	0.54	1.17	0.47	0.61	1.13	0.02	2.01	0.12		0.05	0.31	
Uniform Delay, d1	33.9	28.8	22.1	42.9	34.0	25.8	29.1	19.6		17.8	19.8	
Progression Factor	1.12	1.15	1.57	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	80.4	1.0	18.0	70.0	0.1	471.4	0.1		0.0	0.3	
Delay (s)	38.7	113.4	35.7	60.9	104.0	26.0	500.4	19.7		17.9	20.1	
Level of Service	D	F	D	E	F	C	F	B		B	C	
Approach Delay (s)		94.5			101.0			418.5			19.9	
Approach LOS		F			F			F			B	
Intersection Summary												
HCM 2000 Control Delay			124.8	HCM 2000 Level of Service						F		
HCM 2000 Volume to Capacity ratio			1.62									
Actuated Cycle Length (s)			90.0	Sum of lost time (s)						22.5		
Intersection Capacity Utilization			108.6%	ICU Level of Service						G		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: 215 NB Off Ramp/215 NB On Ramp & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			  				 			
Traffic Volume (vph)	50	610	0	0	1740	95	365	5	1750	0	0	0
Future Volume (vph)	50	610	0	0	1740	95	365	5	1750	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.5	7.5			7.5	7.5		6.5	6.5			
Lane Util. Factor	1.00	0.95			0.91	1.00		1.00	0.88			
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)	1676	3353			4818	1500		1682	2640			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1676	3353			4818	1500		1682	2640			
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	56	685	0	0	1955	107	410	6	1966	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	58	0	0	36	0	0	0
Lane Group Flow (vph)	56	685	0	0	1955	49	0	416	1930	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	custom			
Protected Phases	5	2			6			8	18			
Permitted Phases						6	8					
Actuated Green, G (s)	10.0	23.1			30.0	30.0		34.3	55.7			
Effective Green, g (s)	8.0	21.3			28.2	28.2		33.3	54.7			
Actuated g/C Ratio	0.09	0.24			0.31	0.31		0.37	0.61			
Clearance Time (s)	4.5	5.7			5.7	5.7		5.5				
Vehicle Extension (s)	2.0	2.0			2.0	2.0		3.5				
Lane Grp Cap (vph)	148	793			1509	470		622	1604			
v/s Ratio Prot	0.03	c0.20			c0.41				c0.73			
v/s Ratio Perm						0.03		0.25				
v/c Ratio	0.38	0.86			1.30	0.10		0.67	1.20			
Uniform Delay, d1	38.7	33.0			30.9	21.9		23.7	17.6			
Progression Factor	0.88	0.46			0.47	0.22		1.00	1.00			
Incremental Delay, d2	1.7	3.1			133.5	0.0		2.8	97.7			
Delay (s)	35.7	18.3			147.9	4.9		26.6	115.3			
Level of Service	D	B			F	A		C	F			
Approach Delay (s)		19.6			140.5			99.8			0.0	
Approach LOS		B			F			F			A	

Intersection Summary





















HCM 2000 Control Delay	104.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	156.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: 215 SB On Ramp/215 SB Off Ramp & University Pkwy

03/05/2018



























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 							 	
Traffic Volume (vph)	0	565	630	1235	870	0	0	0	0	95	10	110
Future Volume (vph)	0	565	630	1235	870	0	0	0	0	95	10	110
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		7.5		6.5	7.5						6.5	6.5
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						0.96	1.00
Satd. Flow (prot)		3088		3252	1765						1688	1500
Flt Permitted		1.00		0.95	1.00						0.96	1.00
Satd. Flow (perm)		3088		3252	1765						1688	1500
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)	0	608	677	1328	935	0	0	0	0	102	11	118
RTOR Reduction (vph)	0	192	0	0	0	0	0	0	0	0	0	106
Lane Group Flow (vph)	0	1093	0	1328	935	0	0	0	0	0	113	12
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases										4		4
Actuated Green, G (s)		30.4		36.0	69.9						10.1	10.1
Effective Green, g (s)		27.4		33.0	66.9						9.1	9.1
Actuated g/C Ratio		0.30		0.37	0.74						0.10	0.10
Clearance Time (s)		4.5		3.5	4.5						5.5	5.5
Vehicle Extension (s)		2.0		2.0	2.0						2.0	2.0
Lane Grp Cap (vph)		940		1192	1311						170	151
v/s Ratio Prot		c0.35		c0.41	0.53							
v/s Ratio Perm											0.07	0.01
v/c Ratio		1.16		1.11	0.71						0.66	0.08
Uniform Delay, d1		31.3		28.5	6.3						39.0	36.7
Progression Factor		0.95		0.35	1.84						1.00	1.00
Incremental Delay, d2		83.4		52.6	0.3						7.4	0.1
Delay (s)		113.0		62.6	11.9						46.3	36.7
Level of Service		F		E	B						D	D
Approach Delay (s)		113.0			41.6			0.0			41.4	
Approach LOS		F			D			A			D	
Intersection Summary												
HCM 2000 Control Delay			65.9			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.07									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			20.5			
Intersection Capacity Utilization			156.8%			ICU Level of Service			H			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

03/05/2018














												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	90	775	10	30	510	430	5	5	35	380	15	45
Future Volume (vph)	90	775	10	30	510	430	5	5	35	380	15	45
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	7.5		6.0	7.5	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.87		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00
Satd. Flow (prot)	1676	3346		1676	3353	1500	1676	1531		1593	1602	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00
Satd. Flow (perm)	1676	3346		1676	3353	1500	1676	1531		1593	1602	1500
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	842	11	33	554	467	5	5	38	413	16	49
RTOR Reduction (vph)	0	1	0	0	0	209	0	36	0	0	0	40
Lane Group Flow (vph)	98	852	0	33	554	258	5	7	0	211	218	9
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	13.4	41.6		7.3	35.5	53.7	6.9	6.9		18.2	18.2	18.2
Effective Green, g (s)	10.4	39.1		4.3	33.0	49.7	4.9	4.4		16.2	15.7	15.7
Actuated g/C Ratio	0.12	0.43		0.05	0.37	0.55	0.05	0.05		0.18	0.17	0.17
Clearance Time (s)	3.0	5.0		3.0	5.0	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)	193	1453		80	1229	828	91	74		286	279	261
v/s Ratio Prot	0.06	c0.25		0.02	c0.17	0.06	0.00	c0.00		0.13	c0.14	
v/s Ratio Perm						0.12						0.01
v/c Ratio	0.51	0.59		0.41	0.45	0.31	0.05	0.09		0.74	0.78	0.03
Uniform Delay, d1	37.4	19.3		41.6	21.6	10.9	40.4	40.9		34.9	35.5	30.8
Progression Factor	1.00	1.00		1.07	0.86	2.66	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.1	1.7		2.6	0.9	0.2	0.3	0.5		9.5	13.2	0.1
Delay (s)	39.5	21.1		47.4	19.6	29.2	40.6	41.4		44.4	48.8	30.9
Level of Service	D	C		D	B	C	D	D		D	D	C
Approach Delay (s)		23.0			24.7			41.4			45.0	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			28.2	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.62									
Actuated Cycle Length (s)			90.0	Sum of lost time (s)				26.5				
Intersection Capacity Utilization			61.1%	ICU Level of Service				B				
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy











03/05/2018

						
Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations		 	 			 
Traffic Volume (veh/h)	5	1185	955	5	5	15
Future Volume (Veh/h)	5	1185	955	5	5	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1288	1038	5	5	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		275	294			
pX, platoon unblocked					0.81	
vC, conflicting volume	1043				1694	522
vC1, stage 1 conf vol					1040	
vC2, stage 2 conf vol					654	
vCu, unblocked vol	1043				1388	522
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	97
cM capacity (veh/h)	663				281	500
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SE 1
Volume Total	5	644	644	692	351	21
Volume Left	5	0	0	0	0	5
Volume Right	0	0	0	0	5	16
cSH	663	1700	1700	1700	1700	422
Volume to Capacity	0.01	0.38	0.38	0.41	0.21	0.05
Queue Length 95th (ft)	1	0	0	0	0	4
Control Delay (s)	10.5	0.0	0.0	0.0	0.0	14.0
Lane LOS	B					B
Approach Delay (s)	0.0			0.0		14.0
Approach LOS						B
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			44.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
















6: University Pkwy

03/05/2018

						
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	15	1175	930	50	20	30
Future Volume (Veh/h)	15	1175	930	50	20	30
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	1277	1011	54	22	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		377	192			
pX, platoon unblocked					0.81	
vC, conflicting volume	1065				1708	532
vC1, stage 1 conf vol					1038	
vC2, stage 2 conf vol					670	
vCu, unblocked vol	1065				1408	532
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				92	93
cM capacity (veh/h)	650				280	492
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SE 1
Volume Total	16	638	638	674	391	55
Volume Left	16	0	0	0	0	22
Volume Right	0	0	0	0	54	33
cSH	650	1700	1700	1700	1700	377
Volume to Capacity	0.02	0.38	0.38	0.40	0.23	0.15
Queue Length 95th (ft)	2	0	0	0	0	13
Control Delay (s)	10.7	0.0	0.0	0.0	0.0	16.2
Lane LOS	B					C
Approach Delay (s)	0.1			0.0		16.2
Approach LOS						C
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			44.3%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 7: University Pkwy & McDonalds




























03/05/2018

										
Movement	WBL	WBR	NBT	NBR	SBL	SBT				
Lane Configurations			  			  				
Traffic Volume (veh/h)	0	110	2215	145	20	1835				
Future Volume (Veh/h)	0	110	2215	145	20	1835				
Sign Control	Stop		Free			Free				
Grade	0%		0%			0%				
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				
Hourly flow rate (vph)	0	120	2408	158	22	1995				
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type	None					None				
Median storage (veh)										
Upstream signal (ft)	344					495				
pX, platoon unblocked	0.83	0.89			0.89					
vC, conflicting volume	3117	803			2566					
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	1905	335			2321					
tC, single (s)	6.8	6.9			4.1					
tC, 2 stage (s)										
tF (s)	3.5	3.3			2.2					
p0 queue free %	100	80			88					
cM capacity (veh/h)	44	587			188					
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4	
Volume Total	120	803	803	803	158	22	665	665	665	
Volume Left	0	0	0	0	0	22	0	0	0	
Volume Right	120	0	0	0	158	0	0	0	0	
cSH	587	1700	1700	1700	1700	188	1700	1700	1700	
Volume to Capacity	0.20	0.47	0.47	0.47	0.09	0.12	0.39	0.39	0.39	
Queue Length 95th (ft)	19	0	0	0	0	10	0	0	0	
Control Delay (s)	12.7	0.0	0.0	0.0	0.0	26.7	0.0	0.0	0.0	
Lane LOS	B					D				
Approach Delay (s)	12.7	0.0				0.3				
Approach LOS	B									
Intersection Summary										
Average Delay			0.4							
Intersection Capacity Utilization			62.4%		ICU Level of Service			B		
Analysis Period (min)			15							

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

03/05/2018























													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		  			  			 					
Traffic Volume (vph)	300	1635	415	65	1640	45	295	75	35	15	35	240	
Future Volume (vph)	300	1635	415	65	1640	45	295	75	35	15	35	240	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	8.5	8.5		6.5	6.5		
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00		
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.87		
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)	1676	4818	1500	1676	4818	1500	1676	1680		1676	1534		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.40	1.00		0.68	1.00		
Satd. Flow (perm)	1676	4818	1500	1676	4818	1500	713	1680		1201	1534		
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)	323	1758	446	70	1763	48	317	81	38	16	38	258	
RTOR Reduction (vph)	0	0	234	0	0	29	0	19	0	0	187	0	
Lane Group Flow (vph)	323	1758	212	70	1763	19	317	100	0	16	109	0	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA		
Protected Phases	5	2		1	6			8				4	
Permitted Phases			2			6	8			4			
Actuated Green, G (s)	15.8	49.3	49.3	7.6	41.1	41.1	30.1	30.1		30.1	30.1		
Effective Green, g (s)	13.8	46.3	46.3	5.6	40.1	40.1	25.6	25.6		27.6	27.6		
Actuated g/C Ratio	0.14	0.46	0.46	0.06	0.40	0.40	0.26	0.26		0.28	0.28		
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	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	2230	694	93	1932	601	182	430		331	423		
v/s Ratio Prot	c0.19	0.36		0.04	c0.37			0.06			0.07		
v/s Ratio Perm			0.14			0.01	c0.44			0.01			
v/c Ratio	1.40	0.79	0.31	0.75	0.91	0.03	1.74	0.23		0.05	0.26		
Uniform Delay, d1	43.1	22.7	16.8	46.5	28.3	18.2	37.2	29.4		26.6	28.2		
Progression Factor	0.93	0.87	0.71	1.00	1.00	1.00	1.00	1.00		1.00	1.00		
Incremental Delay, d2	189.3	1.2	0.4	28.6	8.1	0.1	355.6	0.3		0.1	0.3		
Delay (s)	229.4	21.0	12.3	75.1	36.4	18.3	392.8	29.7		26.6	28.5		
Level of Service	F	C	B	E	D	B	F	C		C	C		
Approach Delay (s)		46.1			37.3			293.7			28.4		
Approach LOS		D			D			F			C		
Intersection Summary													
HCM 2000 Control Delay			62.8	HCM 2000 Level of Service						E			
HCM 2000 Volume to Capacity ratio			1.29										
Actuated Cycle Length (s)			100.0	Sum of lost time (s)						22.5			
Intersection Capacity Utilization			108.3%	ICU Level of Service						G			
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: 215 NB Off Ramp/215 NB On Ramp & University Pkwy

03/05/2018





















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			  				 				
Traffic Volume (vph)	110	670	0	0	2050	110	435	15	1720	0	0	0	
Future Volume (vph)	110	670	0	0	2050	110	435	15	1720	0	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	
Total Lost time (s)	6.5	7.5			7.5	7.5		6.5	6.5				
Lane Util. Factor	1.00	0.95			0.91	1.00		1.00	0.88				
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)	1676	3353			4818	1500		1683	2640				
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00				
Satd. Flow (perm)	1676	3353			4818	1500		1683	2640				
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)	118	720	0	0	2204	118	468	16	1849	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	58	0	0	42	0	0	0	
Lane Group Flow (vph)	118	720	0	0	2204	60	0	484	1807	0	0	0	
Turn Type	Prot	NA			NA	Perm	Perm	NA	custom				
Protected Phases	5	2			6			8	18				
Permitted Phases						6	8						
Actuated Green, G (s)	9.0	26.6			35.3	35.3		40.0	62.2				
Effective Green, g (s)	7.0	24.8			33.5	33.5		39.0	61.2				
Actuated g/C Ratio	0.07	0.25			0.34	0.34		0.39	0.61				
Clearance Time (s)	4.5	5.7			5.7	5.7		5.5					
Vehicle Extension (s)	2.0	2.0			2.0	2.0		3.5					
Lane Grp Cap (vph)	117	831			1614	502		656	1615				
v/s Ratio Prot	0.07	0.21			c0.46				c0.68				
v/s Ratio Perm						0.04		0.29					
v/c Ratio	1.01	0.87			1.37	0.12		0.74	1.12				
Uniform Delay, d1	46.5	36.0			33.2	23.0		26.1	19.4				
Progression Factor	1.26	0.79			1.21	1.56		1.00	1.00				
Incremental Delay, d2	42.6	3.2			166.3	0.2		4.5	62.5				
Delay (s)	101.2	31.5			206.4	36.1		30.6	81.9				
Level of Service	F	C			F	D		C	F				
Approach Delay (s)		41.3			197.8			71.3			0.0		
Approach LOS		D			F			E			A		
Intersection Summary													
HCM 2000 Control Delay			120.2									HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio			1.37										
Actuated Cycle Length (s)			100.0									Sum of lost time (s)	20.5
Intersection Capacity Utilization			157.5%									ICU Level of Service	H
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: 215 SB On Ramp/215 SB Off Ramp & University Pkwy

03/05/2018



























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 							 	
Traffic Volume (vph)	0	665	410	1465	1020	0	0	0	0	115	10	90
Future Volume (vph)	0	665	410	1465	1020	0	0	0	0	115	10	90
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		7.5		6.5	7.5						6.5	6.5
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						0.96	1.00
Satd. Flow (prot)		3161		3252	1765						1687	1500
Flt Permitted		1.00		0.95	1.00						0.96	1.00
Satd. Flow (perm)		3161		3252	1765						1687	1500
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)	0	707	436	1559	1085	0	0	0	0	122	11	96
RTOR Reduction (vph)	0	87	0	0	0	0	0	0	0	0	0	85
Lane Group Flow (vph)	0	1056	0	1559	1085	0	0	0	0	0	133	11
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases										4		4
Actuated Green, G (s)		31.9		40.0	76.4						12.4	12.4
Effective Green, g (s)		30.1		38.0	74.6						11.4	11.4
Actuated g/C Ratio		0.30		0.38	0.75						0.11	0.11
Clearance Time (s)		5.7		4.5	5.7						5.5	5.5
Vehicle Extension (s)		2.0		2.0	2.0						2.0	2.0
Lane Grp Cap (vph)		951		1235	1316						192	171
v/s Ratio Prot		c0.33		c0.48	0.61							
v/s Ratio Perm											0.08	0.01
v/c Ratio		1.11		1.26	0.82						0.69	0.06
Uniform Delay, d1		35.0		31.0	8.4						42.6	39.5
Progression Factor		1.19		0.27	1.65						1.00	1.00
Incremental Delay, d2		61.5		118.7	0.6						8.4	0.1
Delay (s)		103.1		127.2	14.4						51.0	39.6
Level of Service		F		F	B						D	D
Approach Delay (s)		103.1			80.9			0.0			46.2	
Approach LOS		F			F			A			D	
Intersection Summary												
HCM 2000 Control Delay			85.2			HCM 2000 Level of Service		F				
HCM 2000 Volume to Capacity ratio			1.12									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		20.5				
Intersection Capacity Utilization			157.5%			ICU Level of Service		H				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	150	435	20	55	610	440	15	20	50	585	15	200
Future Volume (vph)	150	435	20	55	610	440	15	20	50	585	15	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	7.5		6.0	7.5	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Flt	1.00	0.99		1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (prot)	1676	3331		1676	3353	1500	1676	1577		1593	1600	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (perm)	1676	3331		1676	3353	1500	1676	1577		1593	1600	1500
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	163	473	22	60	663	478	16	22	54	636	16	217
RTOR Reduction (vph)	0	2	0	0	0	206	0	51	0	0	0	169
Lane Group Flow (vph)	163	493	0	60	663	272	16	25	0	324	328	48
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	14.4	43.1		7.7	36.4	61.0	8.6	8.6		24.6	24.6	24.6
Effective Green, g (s)	11.4	40.6		4.7	33.9	57.0	6.6	6.1		22.6	22.1	22.1
Actuated g/C Ratio	0.11	0.41		0.05	0.34	0.57	0.07	0.06		0.23	0.22	0.22
Clearance Time (s)	3.0	5.0		3.0	5.0	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)	191	1352		78	1136	855	110	96		360	353	331
v/s Ratio Prot	c0.10	0.15		0.04	c0.20	0.07	0.01	c0.02		0.20	c0.20	
v/s Ratio Perm						0.11						0.03
v/c Ratio	0.85	0.36		0.77	0.58	0.32	0.15	0.26		0.90	0.93	0.14
Uniform Delay, d1	43.5	20.7		47.1	27.2	11.3	44.0	44.8		37.6	38.2	31.3
Progression Factor	1.00	1.00		1.14	1.13	2.49	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	29.0	0.8		25.1	1.4	0.1	0.6	1.5		24.5	30.0	0.2
Delay (s)	72.5	21.5		78.9	32.1	28.3	44.7	46.3		62.1	68.2	31.5
Level of Service	E	C		E	C	C	D	D		E	E	C
Approach Delay (s)		34.1			32.9			46.0			56.8	
Approach LOS		C			C			D			E	

Intersection Summary












HCM 2000 Control Delay	41.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	26.5
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy











03/05/2018

						
Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	5	1065	1095	5	10	10
Future Volume (Veh/h)	5	1065	1095	5	10	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1158	1190	5	11	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		305	266			
pX, platoon unblocked					0.90	
vC, conflicting volume	1195				1782	598
vC1, stage 1 conf vol					1192	
vC2, stage 2 conf vol					589	
vCu, unblocked vol	1195				1651	598
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				95	98
cM capacity (veh/h)	580				233	446
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SE 1
Volume Total	5	579	579	793	402	22
Volume Left	5	0	0	0	0	11
Volume Right	0	0	0	0	5	11
cSH	580	1700	1700	1700	1700	306
Volume to Capacity	0.01	0.34	0.34	0.47	0.24	0.07
Queue Length 95th (ft)	1	0	0	0	0	6
Control Delay (s)	11.3	0.0	0.0	0.0	0.0	17.7
Lane LOS	B					C
Approach Delay (s)	0.0			0.0		17.7
Approach LOS						C
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			42.1%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: University Pkwy

03/05/2018

						
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	10	1065	1080	30	10	20
Future Volume (Veh/h)	10	1065	1080	30	10	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	1158	1174	33	11	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	None			
Median storage (veh)		2				
Upstream signal (ft)		405	166			
pX, platoon unblocked					0.91	
vC, conflicting volume	1207				1792	604
vC1, stage 1 conf vol					1190	
vC2, stage 2 conf vol					601	
vCu, unblocked vol	1207				1666	604
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	95
cM capacity (veh/h)	574				232	442
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SE 1
Volume Total	11	579	579	783	424	33
Volume Left	11	0	0	0	0	11
Volume Right	0	0	0	0	33	22
cSH	574	1700	1700	1700	1700	340
Volume to Capacity	0.02	0.34	0.34	0.46	0.25	0.10
Queue Length 95th (ft)	1	0	0	0	0	8
Control Delay (s)	11.4	0.0	0.0	0.0	0.0	16.7
Lane LOS	B					C
Approach Delay (s)	0.1			0.0		16.7
Approach LOS						C
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			42.5%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

7: University Pkwy & McDonalds

03/05/2018



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↑↑↑	↗	↖	↑↑↑
Traffic Volume (veh/h)	0	135	2215	175	15	2160
Future Volume (Veh/h)	0	135	2215	175	15	2160
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	147	2408	190	16	2348
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			344			495
pX, platoon unblocked	0.73	0.85			0.85	
vC, conflicting volume	3223	803			2598	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1400	172			2273	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	80			92	
cM capacity (veh/h)	88	719			189	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	147	803	803	803	190	16	783	783	783
Volume Left	0	0	0	0	0	16	0	0	0
Volume Right	147	0	0	0	190	0	0	0	0
cSH	719	1700	1700	1700	1700	189	1700	1700	1700
Volume to Capacity	0.20	0.47	0.47	0.47	0.11	0.08	0.46	0.46	0.46
Queue Length 95th (ft)	19	0	0	0	0	7	0	0	0
Control Delay (s)	11.3	0.0	0.0	0.0	0.0	25.9	0.0	0.0	0.0
Lane LOS	B					D			
Approach Delay (s)	11.3	0.0				0.2			
Approach LOS	B								

Intersection Summary									
Average Delay			0.4						
Intersection Capacity Utilization			64.0%		ICU Level of Service				B
Analysis Period (min)			15						

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

2020 AM DDI Alternative

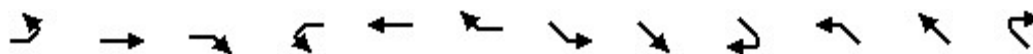
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	135	1755	435	30	1145	30	390	50	30	20	30	320
Future Volume (vph)	135	1755	435	30	1145	30	390	50	30	20	30	320
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	6.5	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.86	
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)	1676	5085	1583	1676	5085	1583	1676	1758		1676	1608	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.44	1.00		0.70	1.00	
Satd. Flow (perm)	1676	5085	1583	1676	5085	1583	774	1758		1238	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)	142	1847	458	32	1205	32	411	53	32	21	32	337
RTOR Reduction (vph)	0	0	297	0	0	23	0	17	0	0	160	0
Lane Group Flow (vph)	142	1847	161	32	1205	9	411	68	0	21	209	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8				4
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	15.6	44.3	44.3	4.7	35.4	35.4	56.5	56.5		56.5	56.5	
Effective Green, g (s)	13.6	42.3	42.3	2.7	33.4	33.4	54.5	54.5		54.5	54.5	
Actuated g/C Ratio	0.11	0.35	0.35	0.02	0.28	0.28	0.45	0.45		0.45	0.45	
Clearance Time (s)	4.0	6.0	6.0	4.0	4.0	4.0	4.5	4.5		4.5	4.5	
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)	189	1792	558	37	1415	440	351	798		562	730	
v/s Ratio Prot	0.08	c0.36		0.02	c0.24			0.04			0.13	
v/s Ratio Perm			0.10			0.01	c0.53			0.02		
v/c Ratio	0.75	1.03	0.29	0.86	0.85	0.02	1.17	0.08		0.04	0.29	
Uniform Delay, d1	51.6	38.9	28.0	58.5	41.0	31.4	32.8	18.6		18.2	20.5	
Progression Factor	0.92	0.88	1.14	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	12.0	26.9	1.0	94.6	6.6	0.1	103.1	0.0		0.0	0.2	
Delay (s)	59.4	61.1	32.9	153.0	47.6	31.5	135.9	18.6		18.2	20.8	
Level of Service	E	E	C	F	D	C	F	B		B	C	
Approach Delay (s)		55.7			49.8			115.8			20.6	
Approach LOS		E			D			F			C	
Intersection Summary												
HCM 2000 Control Delay			57.6									E
HCM 2000 Volume to Capacity ratio			1.13									
Actuated Cycle Length (s)			120.0							20.5		
Intersection Capacity Utilization			105.6%									G
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: University Pkwy

2020 AM DDI Alternative



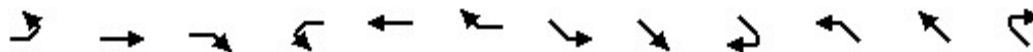
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations					↑↑↑			↑↑				
Traffic Volume (vph)	0	0	0	0	1740	0	0	610	0	0	0	0
Future Volume (vph)	0	0	0	0	1740	0	0	610	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0				
Lane Util. Factor					0.91			0.95				
Frt					1.00			1.00				
Flt Protected					1.00			1.00				
Satd. Flow (prot)					5085			3539				
Flt Permitted					1.00			1.00				
Satd. Flow (perm)					5085			3539				
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	0	0	0	1832	0	0	642	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1832	0	0	642	0	0	0	0
Turn Type					NA			NA				
Protected Phases					2			4 3				
Permitted Phases												
Actuated Green, G (s)					71.3			38.7				
Effective Green, g (s)					71.3			38.7				
Actuated g/C Ratio					0.59			0.32				
Clearance Time (s)					5.0							
Vehicle Extension (s)					3.0							
Lane Grp Cap (vph)					3021			1141				
v/s Ratio Prot					c0.36			c0.18				
v/s Ratio Perm												
v/c Ratio					0.61			0.56				
Uniform Delay, d1					15.4			33.6				
Progression Factor					0.32			0.45				
Incremental Delay, d2					0.5			0.6				
Delay (s)					5.4			15.6				
Level of Service					A			B				
Approach Delay (s)		0.0			5.4			15.6			0.0	
Approach LOS		A			A			B			A	
Intersection Summary												
HCM 2000 Control Delay			8.1		HCM 2000 Level of Service					A		
HCM 2000 Volume to Capacity ratio			0.62									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)					15.0		
Intersection Capacity Utilization			58.8%		ICU Level of Service					B		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: University Pkwy & 215 SB Ramp Crossover

2020 AM DDI Alternative

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑↑									↑↑	
Traffic Volume (vph)	0	565	0	0	0	0	0	0	0	0	870	0
Future Volume (vph)	0	565	0	0	0	0	0	0	0	0	870	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0									5.0	
Lane Util. Factor		0.95									0.95	
Frt		1.00									1.00	
Flt Protected		1.00									1.00	
Satd. Flow (prot)		3539									3539	
Flt Permitted		1.00									1.00	
Satd. Flow (perm)		3539									3539	
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	595	0	0	0	0	0	0	0	0	916	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	595	0	0	0	0	0	0	0	0	916	0
Turn Type		NA									NA	
Protected Phases		2									4 3	
Permitted Phases												
Actuated Green, G (s)		65.5									44.5	
Effective Green, g (s)		65.5									44.5	
Actuated g/C Ratio		0.55									0.37	
Clearance Time (s)		5.0										
Vehicle Extension (s)		3.0										
Lane Grp Cap (vph)		1931									1312	
v/s Ratio Prot		c0.17									c0.26	
v/s Ratio Perm												
v/c Ratio		0.31									0.70	
Uniform Delay, d1		14.9									32.0	
Progression Factor		0.93									0.97	
Incremental Delay, d2		0.4									1.2	
Delay (s)		14.1									32.1	
Level of Service		B									C	
Approach Delay (s)		14.1			0.0			0.0			32.1	
Approach LOS		B			A			A			C	
Intersection Summary												
HCM 2000 Control Delay			25.0									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			120.0								15.0	Sum of lost time (s)
Intersection Capacity Utilization			48.0%									ICU Level of Service A
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

2020 AM DDI Alternative

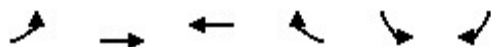
													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	90	780	10	30	535	430	5	5	35	380	15	45	
Future Volume (vph)	90	780	10	30	535	430	5	5	35	380	15	45	
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900	
Total Lost time (s)	6.0	7.0		6.0	7.0	6.0	6.0	6.0		6.0	6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.87		1.00	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	
Satd. Flow (prot)	1676	3532		1676	3539	1583	1676	1617		1593	1692	1583	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	
Satd. Flow (perm)	1676	3532		1676	3539	1583	1676	1617		1593	1692	1583	
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)	95	821	11	32	563	453	5	5	37	400	16	47	
RTOR Reduction (vph)	0	0	0	0	0	153	0	36	0	0	0	39	
Lane Group Flow (vph)	95	832	0	32	563	300	5	6	0	208	208	8	
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm	
Protected Phases	5	2		1	6	4	3	3		4	4		
Permitted Phases						6						4	
Actuated Green, G (s)	13.9	69.8		4.7	60.6	83.4	5.7	5.7		22.8	22.8	22.8	
Effective Green, g (s)	11.9	67.8		2.7	58.6	79.4	3.7	3.7		20.8	20.8	20.8	
Actuated g/C Ratio	0.10	0.56		0.02	0.49	0.66	0.03	0.03		0.17	0.17	0.17	
Clearance Time (s)	4.0	5.0		4.0	5.0	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)	166	1995		37	1728	1126	51	49		276	293	274	
v/s Ratio Prot	c0.06	c0.24		0.02	0.16	0.05	0.00	c0.00		c0.13	0.12		
v/s Ratio Perm						0.14						0.01	
v/c Ratio	0.57	0.42		0.86	0.33	0.27	0.10	0.13		0.75	0.71	0.03	
Uniform Delay, d1	51.6	14.9		58.5	18.7	8.3	56.5	56.6		47.2	46.8	41.2	
Progression Factor	1.00	1.00		1.05	0.30	0.07	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	4.7	0.6		93.7	0.5	0.1	0.8	1.2		11.1	7.7	0.0	
Delay (s)	56.3	15.5		155.0	6.1	0.7	57.4	57.7		58.2	54.4	41.3	
Level of Service	E	B		F	A	A	E	E		E	D	D	
Approach Delay (s)		19.7			8.3			57.7			54.8		
Approach LOS		B			A			E			D		
Intersection Summary													
HCM 2000 Control Delay	22.1			HCM 2000 Level of Service					C				
HCM 2000 Volume to Capacity ratio	0.52												
Actuated Cycle Length (s)	120.0			Sum of lost time (s)					25.0				
Intersection Capacity Utilization	61.3%			ICU Level of Service					B				
Analysis Period (min)	15												

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy

2020 AM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↑
Traffic Volume (veh/h)	0	1195	925	55	0	70
Future Volume (Veh/h)	0	1195	925	55	0	70
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)	0	1258	974	58	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)		405	325			
pX, platoon unblocked					0.87	
vC, conflicting volume	1032				1632	516
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1032				1422	516
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	85
cM capacity (veh/h)	669				110	504
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	629	629	649	383	74	
Volume Left	0	0	0	0	0	
Volume Right	0	0	0	58	74	
cSH	1700	1700	1700	1700	504	
Volume to Capacity	0.37	0.37	0.38	0.23	0.15	
Queue Length 95th (ft)	0	0	0	0	13	
Control Delay (s)	0.0	0.0	0.0	0.0	13.4	
Lane LOS						B
Approach Delay (s)	0.0	0.0		13.4		
Approach LOS						B
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			38.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

7: McDonalds & University Pkwy

2020 AM DDI Alternative

	→	↘	↙	←	↖	↗					
Movement	EBT	EBR	WBL	WBT	NBL	NBR					
Lane Configurations	↑↑↑	↑	↘	↑↑↑		↘					
Traffic Volume (veh/h)	2215	145	20	1835	0	110					
Future Volume (Veh/h)	2215	145	20	1835	0	110					
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)	2332	153	21	1932	0	116					
Pedestrians											
Lane Width (ft)											
Walking Speed (ft/s)											
Percent Blockage											
Right turn flare (veh)											
Median type	None			None							
Median storage (veh)											
Upstream signal (ft)	519			516							
pX, platoon unblocked					0.78						
vC, conflicting volume				2485		3018		777			
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol				2485		2601		777			
tC, single (s)				4.1		6.8		6.9			
tC, 2 stage (s)											
tF (s)				2.2		3.5		3.3			
p0 queue free %				88		100		66			
cM capacity (veh/h)				182		14		339			
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	WB 4	NB 1		
Volume Total	777	777	777	153	21	644	644	644	116		
Volume Left	0	0	0	0	21	0	0	0	0		
Volume Right	0	0	0	153	0	0	0	0	116		
cSH	1700	1700	1700	1700	182	1700	1700	1700	339		
Volume to Capacity	0.46	0.46	0.46	0.09	0.12	0.38	0.38	0.38	0.34		
Queue Length 95th (ft)	0	0	0	0	10	0	0	0	37		
Control Delay (s)	0.0	0.0	0.0	0.0	27.4	0.0	0.0	0.0	21.0		
Lane LOS					D			C			
Approach Delay (s)	0.0			0.3			21.0				
Approach LOS								C			
Intersection Summary											
Average Delay				0.7							
Intersection Capacity Utilization				59.6%		ICU Level of Service			B		
Analysis Period (min)				15							

HCM Signalized Intersection Capacity Analysis
 8: 215 NB Off Ramp & University Pkwy

2020 AM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↑↑					↑↑↑↑
Traffic Volume (vph)	610	0	0	0	0	1750
Future Volume (vph)	610	0	0	0	0	1750
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					5.0
Lane Util. Factor	0.95					0.76
Frt	1.00					0.85
Flt Protected	1.00					1.00
Satd. Flow (prot)	3539					3610
Flt Permitted	1.00					1.00
Satd. Flow (perm)	3539					3610
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	642	0	0	0	0	1842
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	642	0	0	0	0	1842
Turn Type	NA					Prot
Protected Phases	Free!					2!
Permitted Phases						
Actuated Green, G (s)	120.0					71.3
Effective Green, g (s)	120.0					71.3
Actuated g/C Ratio	1.00					0.59
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	3539					2144
v/s Ratio Prot	0.18					c0.51
v/s Ratio Perm						
v/c Ratio	0.18					0.86
Uniform Delay, d1	0.0					20.2
Progression Factor	1.00					1.00
Incremental Delay, d2	0.1					4.8
Delay (s)	0.1					24.9
Level of Service	A					C
Approach Delay (s)	0.1			0.0	24.9	
Approach LOS	A			A	C	

Intersection Summary

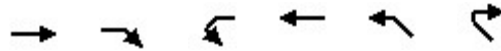
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: 215 NB Off Ramp & University Pkwy

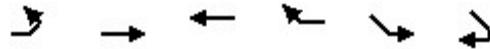
2020 AM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations				↑↑↑	↑	
Traffic Volume (vph)	0	0	0	1740	365	0
Future Volume (vph)	0	0	0	1740	365	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5085	1770	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5085	1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	1832	384	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	1832	384	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				71.3	29.7	
Effective Green, g (s)				71.3	29.7	
Actuated g/C Ratio				0.59	0.25	
Clearance Time (s)				5.0	5.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				3021	438	
v/s Ratio Prot				c0.36	c0.22	
v/s Ratio Perm						
v/c Ratio				0.61	0.88	
Uniform Delay, d1				15.4	43.4	
Progression Factor				0.03	1.00	
Incremental Delay, d2				0.7	17.6	
Delay (s)				1.2	61.0	
Level of Service				A	E	
Approach Delay (s)	0.0			1.2	61.0	
Approach LOS	A			A	E	
Intersection Summary						
HCM 2000 Control Delay			11.6	HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio			0.66			
Actuated Cycle Length (s)			120.0	Sum of lost time (s)	15.0	
Intersection Capacity Utilization			90.7%	ICU Level of Service	E	
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 16: 215 SB Ramp Crossover/University Pkwy & 215 SB Off Ramp

2020 AM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑			↓	
Traffic Volume (vph)	0	565	0	0	95	0
Future Volume (vph)	0	565	0	0	95	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3539			1770	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3539			1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	595	0	0	100	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	595	0	0	100	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		65.5			35.5	
Effective Green, g (s)		65.5			35.5	
Actuated g/C Ratio		0.55			0.30	
Clearance Time (s)		5.0			5.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		1931			523	
v/s Ratio Prot		c0.17			c0.06	
v/s Ratio Perm						
v/c Ratio		0.31			0.19	
Uniform Delay, d1		14.9			31.5	
Progression Factor		0.01			1.00	
Incremental Delay, d2		0.4			0.2	
Delay (s)		0.6			31.7	
Level of Service		A			C	
Approach Delay (s)		0.6	0.0		31.7	
Approach LOS		A	A		C	

Intersection Summary

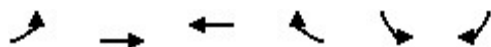
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	29.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

31: 215 SB Ramp Crossover & 215 SB Off Ramp (SB)

2020 AM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑			↑
Traffic Volume (vph)	0	0	870	0	0	110
Future Volume (vph)	0	0	870	0	0	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0			5.0
Lane Util. Factor			0.95			1.00
Frt			1.00			0.86
Flt Protected			1.00			1.00
Satd. Flow (prot)			3539			1611
Flt Permitted			1.00			1.00
Satd. Flow (perm)			3539			1611
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	916	0	0	116
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	916	0	0	116
Turn Type			NA			Prot
Protected Phases			Free!			2!
Permitted Phases						
Actuated Green, G (s)			120.0			65.5
Effective Green, g (s)			120.0			65.5
Actuated g/C Ratio			1.00			0.55
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)			3539			879
v/s Ratio Prot			0.26			0.07
v/s Ratio Perm						
v/c Ratio			0.26			0.13
Uniform Delay, d1			0.0			13.3
Progression Factor			1.00			1.00
Incremental Delay, d2			0.2			0.3
Delay (s)			0.2			13.6
Level of Service			A			B
Approach Delay (s)		0.0	0.2		13.6	
Approach LOS		A	A		B	
Intersection Summary						
HCM 2000 Control Delay			1.7		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.30			
Actuated Cycle Length (s)			120.0		Sum of lost time (s)	15.0
Intersection Capacity Utilization			48.0%		ICU Level of Service	A
Analysis Period (min)			15			
! Phase conflict between lane groups.						
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

2020 PM DDI Alternative

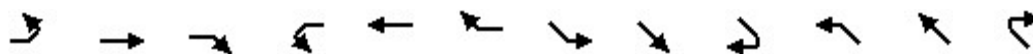
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	300	1635	415	65	1640	45	295	75	35	15	35	240
Future Volume (vph)	300	1635	415	65	1640	45	295	75	35	15	35	240
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	6.5	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.87	
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)	1676	5085	1583	1676	5085	1583	1676	1774		1676	1619	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.47	1.00		0.68	1.00	
Satd. Flow (perm)	1676	5085	1583	1676	5085	1583	831	1774		1204	1619	
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)	316	1721	437	68	1726	47	311	79	37	16	37	253
RTOR Reduction (vph)	0	0	253	0	0	33	0	15	0	0	165	0
Lane Group Flow (vph)	316	1721	184	68	1726	14	311	101	0	16	125	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8				4
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	21.8	48.3	48.3	7.1	35.6	35.6	40.1	40.1		40.1	40.1	
Effective Green, g (s)	19.8	46.3	46.3	5.1	33.6	33.6	38.1	38.1		38.1	38.1	
Actuated g/C Ratio	0.18	0.42	0.42	0.05	0.31	0.31	0.35	0.35		0.35	0.35	
Clearance Time (s)	4.0	6.0	6.0	4.0	4.0	4.0	4.5	4.5		4.5	4.5	
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)	301	2140	666	77	1553	483	287	614		417	560	
v/s Ratio Prot	c0.19	0.34		0.04	c0.34			0.06			0.08	
v/s Ratio Perm			0.12			0.01	c0.37			0.01		
v/c Ratio	1.05	0.80	0.28	0.88	1.11	0.03	1.08	0.16		0.04	0.22	
Uniform Delay, d1	45.1	27.9	20.9	52.2	38.2	26.8	36.0	24.9		23.8	25.5	
Progression Factor	0.94	0.94	1.70	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	57.9	2.4	0.7	64.2	59.8	0.1	77.2	0.1		0.0	0.2	
Delay (s)	100.2	28.7	36.2	116.4	98.0	26.9	113.2	25.0		23.9	25.7	
Level of Service	F	C	D	F	F	C	F	C		C	C	
Approach Delay (s)		39.2			96.9			89.2			25.6	
Approach LOS		D			F			F			C	
Intersection Summary												
HCM 2000 Control Delay			63.6									E
HCM 2000 Volume to Capacity ratio			1.11									
Actuated Cycle Length (s)			110.0							20.5		
Intersection Capacity Utilization			104.0%									G
ICU Level of Service												
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: University Pkwy

2020 PM DDI Alternative



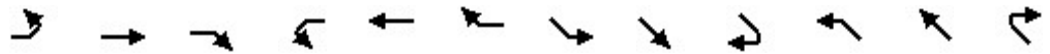
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations					↑↑↑			↑↑				
Traffic Volume (vph)	0	0	0	0	2050	0	0	670	0	0	0	0
Future Volume (vph)	0	0	0	0	2050	0	0	670	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0			5.0				
Lane Util. Factor					0.91			0.95				
Frt					1.00			1.00				
Flt Protected					1.00			1.00				
Satd. Flow (prot)					5085			3539				
Flt Permitted					1.00			1.00				
Satd. Flow (perm)					5085			3539				
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	0	0	0	2158	0	0	705	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2158	0	0	705	0	0	0	0
Turn Type					NA			NA				
Protected Phases					2			4 3				
Permitted Phases												
Actuated Green, G (s)					60.0			40.0				
Effective Green, g (s)					60.0			40.0				
Actuated g/C Ratio					0.55			0.36				
Clearance Time (s)					5.0							
Vehicle Extension (s)					3.0							
Lane Grp Cap (vph)					2773			1286				
v/s Ratio Prot					c0.42			c0.20				
v/s Ratio Perm												
v/c Ratio					0.78			0.55				
Uniform Delay, d1					19.7			27.8				
Progression Factor					0.24			0.45				
Incremental Delay, d2					0.2			0.5				
Delay (s)					5.0			13.1				
Level of Service					A			B				
Approach Delay (s)		0.0			5.0			13.1			0.0	
Approach LOS		A			A			B			A	
Intersection Summary												
HCM 2000 Control Delay			7.0		HCM 2000 Level of Service					A		
HCM 2000 Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			110.0		Sum of lost time (s)					15.0		
Intersection Capacity Utilization			66.5%		ICU Level of Service					C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: University Pkwy & 215 SB Ramp Crossover

2020 PM DDI Alternative





























Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR	
Lane Configurations		↑↑									↑↑		
Traffic Volume (vph)	0	665	0	0	0	0	0	0	0	0	1020	0	
Future Volume (vph)	0	665	0	0	0	0	0	0	0	0	1020	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		5.0									5.0		
Lane Util. Factor		0.95									0.95		
Frt		1.00									1.00		
Flt Protected		1.00									1.00		
Satd. Flow (prot)		3539									3539		
Flt Permitted		1.00									1.00		
Satd. Flow (perm)		3539									3539		
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	700	0	0	0	0	0	0	0	0	1074	0	
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	0	700	0	0	0	0	0	0	0	0	1074	0	
Turn Type		NA									NA		
Protected Phases		2									4 3		
Permitted Phases													
Actuated Green, G (s)		49.0									51.0		
Effective Green, g (s)		49.0									51.0		
Actuated g/C Ratio		0.45									0.46		
Clearance Time (s)		5.0											
Vehicle Extension (s)		3.0											
Lane Grp Cap (vph)		1576									1640		
v/s Ratio Prot		c0.20									c0.30		
v/s Ratio Perm													
v/c Ratio		0.44									0.65		
Uniform Delay, d1		21.1									22.7		
Progression Factor		0.51									0.97		
Incremental Delay, d2		0.8									0.5		
Delay (s)		11.6									22.5		
Level of Service		B									C		
Approach Delay (s)		11.6			0.0			0.0			22.5		
Approach LOS		B			A			A			C		
Intersection Summary													
HCM 2000 Control Delay			18.2		HCM 2000 Level of Service							B	
HCM 2000 Volume to Capacity ratio			0.58										
Actuated Cycle Length (s)			110.0		Sum of lost time (s)						15.0		
Intersection Capacity Utilization			54.9%		ICU Level of Service						A		
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

2020 PM DDI Alternative

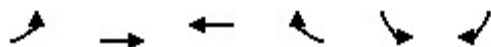
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (vph)	150	440	20	55	630	440	15	20	50	585	15	200
Future Volume (vph)	150	440	20	55	630	440	15	20	50	585	15	200
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	6.0	7.0		6.0	7.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (prot)	1676	3516		1676	3539	1583	1676	1663		1593	1689	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (perm)	1676	3516		1676	3539	1583	1676	1663		1593	1689	1583
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)	158	463	21	58	663	463	16	21	53	616	16	211
RTOR Reduction (vph)	0	2	0	0	0	176	0	51	0	0	0	162
Lane Group Flow (vph)	158	482	0	58	663	287	16	23	0	314	318	49
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	14.4	51.3		7.7	44.6	72.1	6.5	6.5		27.5	27.5	27.5
Effective Green, g (s)	12.4	49.3		5.7	42.6	68.1	4.5	4.5		25.5	25.5	25.5
Actuated g/C Ratio	0.11	0.45		0.05	0.39	0.62	0.04	0.04		0.23	0.23	0.23
Clearance Time (s)	4.0	5.0		4.0	5.0	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)	188	1575		86	1370	980	68	68		369	391	366
v/s Ratio Prot	c0.09	0.14		0.03	c0.19	0.07	0.01	c0.01		c0.20	0.19	
v/s Ratio Perm						0.11						0.03
v/c Ratio	0.84	0.31		0.67	0.48	0.29	0.24	0.34		0.85	0.81	0.13
Uniform Delay, d1	47.8	19.4		51.2	25.4	9.7	51.1	51.3		40.4	40.0	33.5
Progression Factor	1.00	1.00		1.28	0.45	0.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	27.2	0.5		18.5	1.2	0.2	1.8	3.0		16.9	12.2	0.2
Delay (s)	75.0	19.9		84.2	12.7	0.2	52.9	54.3		57.3	52.2	33.7
Level of Service	E	B		F	B	A	D	D		E	D	C
Approach Delay (s)		33.5			11.3			54.0			49.5	
Approach LOS		C			B			D			D	
Intersection Summary												
HCM 2000 Control Delay			29.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			110.0			Sum of lost time (s)			25.0			
Intersection Capacity Utilization			65.8%			ICU Level of Service				C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy







2020 PM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↗
Traffic Volume (veh/h)	0	1075	1075	35	0	50
Future Volume (Veh/h)	0	1075	1075	35	0	50
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)	0	1132	1132	37	0	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)		405	325			
pX, platoon unblocked					0.92	
vC, conflicting volume	1169			1716	584	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1169			1605	584	
tC, single (s)	4.1			6.8	6.9	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	100			100	88	
cM capacity (veh/h)	593			88	455	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	566	566	755	414	53	
Volume Left	0	0	0	0	0	
Volume Right	0	0	0	37	53	
cSH	1700	1700	1700	1700	455	
Volume to Capacity	0.33	0.33	0.44	0.24	0.12	
Queue Length 95th (ft)	0	0	0	0	10	
Control Delay (s)	0.0	0.0	0.0	0.0	14.0	
Lane LOS					B	
Approach Delay (s)	0.0	0.0		14.0		
Approach LOS					B	
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			40.8%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 7: McDonalds & University Pkwy

2020 PM DDI Alternative

											
Movement	EBT	EBR	WBL	WBT	NBL	NBR					
Lane Configurations	↑↑↑	↑	↓	↑↑↑		↓					
Traffic Volume (veh/h)	2215	175	15	2160	0	135					
Future Volume (Veh/h)	2215	175	15	2160	0	135					
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)	2332	184	16	2274	0	142					
Pedestrians											
Lane Width (ft)											
Walking Speed (ft/s)											
Percent Blockage											
Right turn flare (veh)											
Median type	None			None							
Median storage (veh)											
Upstream signal (ft)	519			516							
pX, platoon unblocked					0.71						
vC, conflicting volume				2516		3122		777			
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol				2516		2549		777			
tC, single (s)				4.1		6.8		6.9			
tC, 2 stage (s)											
tF (s)				2.2		3.5		3.3			
p0 queue free %				91		100		58			
cM capacity (veh/h)				177		14		339			
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	WB 4	NB 1		
Volume Total	777	777	777	184	16	758	758	758	142		
Volume Left	0	0	0	0	16	0	0	0	0		
Volume Right	0	0	0	184	0	0	0	0	142		
cSH	1700	1700	1700	1700	177	1700	1700	1700	339		
Volume to Capacity	0.46	0.46	0.46	0.11	0.09	0.45	0.45	0.45	0.42		
Queue Length 95th (ft)	0	0	0	0	7	0	0	0	50		
Control Delay (s)	0.0	0.0	0.0	0.0	27.4	0.0	0.0	0.0	23.0		
Lane LOS					D				C		
Approach Delay (s)	0.0			0.2				23.0			
Approach LOS									C		
Intersection Summary											
Average Delay				0.7							
Intersection Capacity Utilization				61.2%		ICU Level of Service				B	
Analysis Period (min)				15							

HCM Signalized Intersection Capacity Analysis
 8: 215 NB Off Ramp & University Pkwy

2020 PM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↑↑					↑↑↑
Traffic Volume (vph)	670	0	0	0	0	1720
Future Volume (vph)	670	0	0	0	0	1720
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					5.0
Lane Util. Factor	0.95					0.76
Frt	1.00					0.85
Flt Protected	1.00					1.00
Satd. Flow (prot)	3539					3610
Flt Permitted	1.00					1.00
Satd. Flow (perm)	3539					3610
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	705	0	0	0	0	1811
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	705	0	0	0	0	1811
Turn Type	NA					Prot
Protected Phases	Free!					2!
Permitted Phases						
Actuated Green, G (s)	110.0					60.0
Effective Green, g (s)	110.0					60.0
Actuated g/C Ratio	1.00					0.55
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	3539					1969
v/s Ratio Prot	0.20					c0.50
v/s Ratio Perm						
v/c Ratio	0.20					0.92
Uniform Delay, d1	0.0					22.8
Progression Factor	1.00					1.00
Incremental Delay, d2	0.1					8.5
Delay (s)	0.1					31.3
Level of Service	A					C
Approach Delay (s)	0.1			0.0	31.3	
Approach LOS	A			A	C	

Intersection Summary

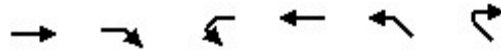
HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: 215 NB Off Ramp & University Pkwy

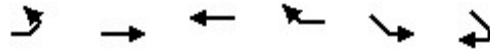
2020 PM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations				↑↑↑	↑	
Traffic Volume (vph)	0	0	0	2050	435	0
Future Volume (vph)	0	0	0	2050	435	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5085	1770	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5085	1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	2158	458	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	2158	458	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				60.0	31.0	
Effective Green, g (s)				60.0	31.0	
Actuated g/C Ratio				0.55	0.28	
Clearance Time (s)				5.0	5.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				2773	498	
v/s Ratio Prot				c0.42	c0.26	
v/s Ratio Perm						
v/c Ratio				0.78	0.92	
Uniform Delay, d1				19.7	38.3	
Progression Factor				0.10	1.00	
Incremental Delay, d2				1.4	22.0	
Delay (s)				3.4	60.3	
Level of Service				A	E	
Approach Delay (s)	0.0			3.4	60.3	
Approach LOS	A			A	E	
Intersection Summary						
HCM 2000 Control Delay			13.4	HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio			0.79			
Actuated Cycle Length (s)			110.0	Sum of lost time (s)	15.0	
Intersection Capacity Utilization			99.9%	ICU Level of Service	F	
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 16: 215 SB Ramp Crossover/University Pkwy & 215 SB Off Ramp

2020 PM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑			↘	
Traffic Volume (vph)	0	665	0	0	115	0
Future Volume (vph)	0	665	0	0	115	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3539			1770	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3539			1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	700	0	0	121	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	700	0	0	121	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		49.0			36.7	
Effective Green, g (s)		49.0			36.7	
Actuated g/C Ratio		0.45			0.33	
Clearance Time (s)		5.0			5.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		1576			590	
v/s Ratio Prot		c0.20			c0.07	
v/s Ratio Perm						
v/c Ratio		0.44			0.21	
Uniform Delay, d1		21.1			26.2	
Progression Factor		0.10			1.00	
Incremental Delay, d2		0.8			0.2	
Delay (s)		2.9			26.4	
Level of Service		A			C	
Approach Delay (s)		2.9	0.0		26.4	
Approach LOS		A	A		C	

Intersection Summary

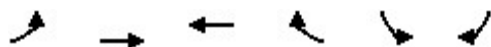
HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

31: 215 SB Ramp Crossover & 215 SB Off Ramp (SB)

2020 PM DDI Alternative






























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑			↑
Traffic Volume (vph)	0	0	1020	0	0	90
Future Volume (vph)	0	0	1020	0	0	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0			5.0
Lane Util. Factor			0.95			1.00
Frt			1.00			0.86
Flt Protected			1.00			1.00
Satd. Flow (prot)			3539			1611
Flt Permitted			1.00			1.00
Satd. Flow (perm)			3539			1611
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	1074	0	0	95
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	1074	0	0	95
Turn Type			NA			Prot
Protected Phases			Free!			2!
Permitted Phases						
Actuated Green, G (s)			110.0			49.0
Effective Green, g (s)			110.0			49.0
Actuated g/C Ratio			1.00			0.45
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)			3539			717
v/s Ratio Prot			0.30			0.06
v/s Ratio Perm						
v/c Ratio			0.30			0.13
Uniform Delay, d1			0.0			18.0
Progression Factor			1.00			1.00
Incremental Delay, d2			0.2			0.4
Delay (s)			0.2			18.4
Level of Service			A			B
Approach Delay (s)		0.0	0.2		18.4	
Approach LOS		A	A		B	
Intersection Summary						
HCM 2000 Control Delay			1.6		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.35			
Actuated Cycle Length (s)			110.0		Sum of lost time (s)	15.0
Intersection Capacity Utilization			54.9%		ICU Level of Service	A
Analysis Period (min)			15			
! Phase conflict between lane groups.						
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

03/05/2018























													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		  			  			 					
Traffic Volume (vph)	150	3075	465	35	1585	35	400	55	40	25	35	335	
Future Volume (vph)	150	3075	465	35	1585	35	400	55	40	25	35	335	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	8.5	8.5		6.5	6.5		
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00		
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.86		
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)	1676	4818	1500	1676	4818	1500	1676	1654		1676	1525		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.36	1.00		0.69	1.00		
Satd. Flow (perm)	1676	4818	1500	1676	4818	1500	639	1654		1222	1525		
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)	158	3237	489	37	1668	37	421	58	42	26	37	353	
RTOR Reduction (vph)	0	0	148	0	0	27	0	28	0	0	227	0	
Lane Group Flow (vph)	158	3237	341	37	1668	10	421	72	0	26	163	0	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA		
Protected Phases	5	2		1	6			8				4	
Permitted Phases			2			6	8			4			
Actuated Green, G (s)	17.5	37.4	37.4	5.1	25.0	25.0	34.5	34.5		34.5	34.5		
Effective Green, g (s)	15.5	34.4	34.4	3.1	24.0	24.0	30.0	30.0		32.0	32.0		
Actuated g/C Ratio	0.17	0.38	0.38	0.03	0.27	0.27	0.33	0.33		0.36	0.36		
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	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)	288	1841	573	57	1284	400	213	551		434	542		
v/s Ratio Prot	0.09	c0.67		0.02	c0.35			0.04				0.11	
v/s Ratio Perm			0.23			0.01	c0.66			0.02			
v/c Ratio	0.55	1.76	0.59	0.65	1.30	0.02	1.98	0.13		0.06	0.30		
Uniform Delay, d1	34.1	27.8	22.2	42.9	33.0	24.4	30.0	20.9		19.1	20.9		
Progression Factor	1.10	1.17	1.30	1.00	1.00	1.00	1.00	1.00		1.00	1.00		
Incremental Delay, d2	0.2	341.4	0.4	22.7	140.4	0.1	455.9	0.1		0.1	0.3		
Delay (s)	37.8	374.0	29.3	65.6	173.4	24.5	485.9	21.0		19.2	21.2		
Level of Service	D	F	C	E	F	C	F	C		B	C		
Approach Delay (s)		316.9			168.0			396.7			21.1		
Approach LOS		F			F			F			C		
Intersection Summary													
HCM 2000 Control Delay			265.0	HCM 2000 Level of Service						F			
HCM 2000 Volume to Capacity ratio			1.90										
Actuated Cycle Length (s)			90.0	Sum of lost time (s)						22.5			
Intersection Capacity Utilization			137.4%	ICU Level of Service						H			
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: 215 NB Off Ramp/215 NB On Ramp & University Pkwy

03/05/2018





















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			  				 				
Traffic Volume (vph)	95	1215	0	0	2160	140	425	10	2510	0	0	0	
Future Volume (vph)	95	1215	0	0	2160	140	425	10	2510	0	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	
Total Lost time (s)	6.5	7.5			7.5	7.5		6.5	6.5				
Lane Util. Factor	1.00	0.95			0.91	1.00		1.00	0.88				
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)	1676	3353			4818	1500		1683	2640				
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00				
Satd. Flow (perm)	1676	3353			4818	1500		1683	2640				
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)	100	1279	0	0	2274	147	447	11	2642	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	41	0	0	43	0	0	0	
Lane Group Flow (vph)	100	1279	0	0	2274	106	0	458	2599	0	0	0	
Turn Type	Prot	NA			NA	Perm	Perm	NA	custom				
Protected Phases	5	2			6			8	18				
Permitted Phases						6	8						
Actuated Green, G (s)	7.5	32.3			48.3	48.3		18.5	46.5				
Effective Green, g (s)	5.5	30.5			46.5	46.5		17.5	45.5				
Actuated g/C Ratio	0.06	0.34			0.52	0.52		0.19	0.51				
Clearance Time (s)	4.5	5.7			5.7	5.7		5.5					
Vehicle Extension (s)	2.0	2.0			2.0	2.0		3.5					
Lane Grp Cap (vph)	102	1136			2489	775		327	1334				
v/s Ratio Prot	0.06	c0.38			0.47				c0.98				
v/s Ratio Perm						0.07		0.27					
v/c Ratio	0.98	1.13			0.91	0.14		1.40	1.95				
Uniform Delay, d1	42.2	29.8			19.9	11.3		36.2	22.2				
Progression Factor	1.21	0.56			0.58	0.12		1.00	1.00				
Incremental Delay, d2	22.4	57.9			0.7	0.0		197.8	429.5				
Delay (s)	73.3	74.6			12.2	1.4		234.1	451.7				
Level of Service	E	E			B	A		F	F				
Approach Delay (s)		74.5			11.6			419.6			0.0		
Approach LOS		E			B			F			A		
Intersection Summary													
HCM 2000 Control Delay			207.5									HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio			1.77										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	20.5
Intersection Capacity Utilization			217.5%									ICU Level of Service	H
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: 215 SB On Ramp/215 SB Off Ramp & University Pkwy

03/05/2018



























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 							 	
Traffic Volume (vph)	0	1015	640	1410	1175	0	0	0	0	295	10	195
Future Volume (vph)	0	1015	640	1410	1175	0	0	0	0	295	10	195
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		7.5		6.5	7.5						6.5	6.5
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)		3158		3252	1765						1683	1500
Flt Permitted		1.00		0.95	1.00						0.95	1.00
Satd. Flow (perm)		3158		3252	1765						1683	1500
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	1068	674	1484	1237	0	0	0	0	311	11	205
RTOR Reduction (vph)	0	111	0	0	0	0	0	0	0	0	0	88
Lane Group Flow (vph)	0	1631	0	1484	1237	0	0	0	0	0	322	117
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases										4		4
Actuated Green, G (s)		37.5		24.5	65.5						14.5	14.5
Effective Green, g (s)		34.5		21.5	62.5						13.5	13.5
Actuated g/C Ratio		0.38		0.24	0.69						0.15	0.15
Clearance Time (s)		4.5		3.5	4.5						5.5	5.5
Vehicle Extension (s)		2.0		2.0	2.0						2.0	2.0
Lane Grp Cap (vph)		1210		776	1225						252	225
v/s Ratio Prot		c0.52		c0.46	0.70							
v/s Ratio Perm											0.19	0.08
v/c Ratio		1.35		1.91	1.01						1.28	0.52
Uniform Delay, d1		27.8		34.2	13.8						38.2	35.3
Progression Factor		0.62		0.69	0.85						1.00	1.00
Incremental Delay, d2		159.2		411.7	15.0						152.0	1.0
Delay (s)		176.4		435.5	26.7						190.3	36.3
Level of Service		F		F	C						F	D
Approach Delay (s)		176.4			249.6			0.0			130.4	
Approach LOS		F			F			A			F	
Intersection Summary												
HCM 2000 Control Delay			211.5			HCM 2000 Level of Service				F		
HCM 2000 Volume to Capacity ratio			1.51									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			20.5			
Intersection Capacity Utilization			217.5%			ICU Level of Service			H			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	130	1165	15	60	730	570	10	10	50	435	20	55
Future Volume (vph)	130	1165	15	60	730	570	10	10	50	435	20	55
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	7.5		6.0	7.5	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Fr _t	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Fl _t Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00
Satd. Flow (prot)	1676	3346		1676	3353	1500	1676	1545		1593	1603	1500
Fl _t Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00
Satd. Flow (perm)	1676	3346		1676	3353	1500	1676	1545		1593	1603	1500
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)	137	1226	16	63	768	600	11	11	53	458	21	58
RTOR Reduction (vph)	0	1	0	0	0	242	0	50	0	0	0	47
Lane Group Flow (vph)	137	1241	0	63	768	358	11	14	0	234	245	11
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	8.0	35.3		10.8	38.1	57.7	8.3	8.3		19.6	19.6	19.6
Effective Green, g (s)	5.0	32.8		7.8	35.6	53.7	6.3	5.8		17.6	17.1	17.1
Actuated g/C Ratio	0.06	0.36		0.09	0.40	0.60	0.07	0.06		0.20	0.19	0.19
Clearance Time (s)	3.0	5.0		3.0	5.0	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)	93	1219		145	1326	895	117	99		311	304	285
v/s Ratio Prot	c0.08	c0.37		0.04	c0.23	0.08	0.01	c0.01		0.15	c0.15	
v/s Ratio Perm						0.16						0.01
v/c Ratio	1.47	1.02		0.43	0.58	0.40	0.09	0.15		0.75	0.81	0.04
Uniform Delay, d ₁	42.5	28.6		39.0	21.3	9.6	39.2	39.8		34.1	34.9	29.7
Progression Factor	1.00	1.00		0.84	1.02	2.40	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d ₂	261.9	30.5		0.8	0.7	0.1	0.4	0.7		9.9	14.4	0.1
Delay (s)	304.4	59.1		33.5	22.5	23.2	39.5	40.4		44.0	49.2	29.8
Level of Service	F	E		C	C	C	D	D		D	D	C
Approach Delay (s)		83.4			23.3			40.3			44.8	
Approach LOS		F			C			D			D	

Intersection Summary












HCM 2000 Control Delay	51.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	26.5
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy











03/05/2018

						
Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	5	1645	1345	5	5	15
Future Volume (Veh/h)	5	1645	1345	5	5	15
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)	5	1732	1416	5	5	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		278	292			
pX, platoon unblocked					0.64	
vC, conflicting volume	1421				2294	710
vC1, stage 1 conf vol					1418	
vC2, stage 2 conf vol					876	
vCu, unblocked vol	1421				1902	710
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				97	96
cM capacity (veh/h)	475				178	376
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SE 1
Volume Total	5	866	866	944	477	21
Volume Left	5	0	0	0	0	5
Volume Right	0	0	0	0	5	16
cSH	475	1700	1700	1700	1700	297
Volume to Capacity	0.01	0.51	0.51	0.56	0.28	0.07
Queue Length 95th (ft)	1	0	0	0	0	6
Control Delay (s)	12.7	0.0	0.0	0.0	0.0	18.0
Lane LOS	B					C
Approach Delay (s)	0.0			0.0		18.0
Approach LOS						C
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			58.0%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: University Pkwy
















03/05/2018

						
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	15	1635	1320	50	20	30
Future Volume (Veh/h)	15	1635	1320	50	20	30
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)	16	1721	1389	53	21	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		378	192			
pX, platoon unblocked					0.64	
vC, conflicting volume	1442				2308	721
vC1, stage 1 conf vol					1416	
vC2, stage 2 conf vol					892	
vCu, unblocked vol	1442				1926	721
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	97				88	91
cM capacity (veh/h)	466				178	370
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SE 1
Volume Total	16	860	860	926	516	53
Volume Left	16	0	0	0	0	21
Volume Right	0	0	0	0	53	32
cSH	466	1700	1700	1700	1700	259
Volume to Capacity	0.03	0.51	0.51	0.54	0.30	0.20
Queue Length 95th (ft)	3	0	0	0	0	19
Control Delay (s)	13.0	0.0	0.0	0.0	0.0	22.4
Lane LOS	B					C
Approach Delay (s)	0.1			0.0		22.4
Approach LOS						C
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			57.7%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

7: University Pkwy & McDonalds




























03/05/2018

										
Movement	WBL	WBR	NBT	NBR	SBL	SBT				
Lane Configurations			  			  				
Traffic Volume (veh/h)	0	110	3580	145	20	2300				
Future Volume (Veh/h)	0	110	3580	145	20	2300				
Sign Control	Stop		Free			Free				
Grade	0%		0%			0%				
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				
Hourly flow rate (vph)	0	116	3768	153	21	2421				
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type	None					None				
Median storage (veh)										
Upstream signal (ft)	344					495				
pX, platoon unblocked	0.83	0.70			0.70					
vC, conflicting volume	4617	1256			3921					
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol	2583	0			3678					
tC, single (s)	6.8	6.9			4.1					
tC, 2 stage (s)										
tF (s)	3.5	3.3			2.2					
p0 queue free %	100	85			50					
cM capacity (veh/h)	9	763			42					
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4	
Volume Total	116	1256	1256	1256	153	21	807	807	807	
Volume Left	0	0	0	0	0	21	0	0	0	
Volume Right	116	0	0	0	153	0	0	0	0	
cSH	763	1700	1700	1700	1700	42	1700	1700	1700	
Volume to Capacity	0.15	0.74	0.74	0.74	0.09	0.50	0.47	0.47	0.47	
Queue Length 95th (ft)	13	0	0	0	0	45	0	0	0	
Control Delay (s)	10.6	0.0	0.0	0.0	0.0	156.6	0.0	0.0	0.0	
Lane LOS	B					F				
Approach Delay (s)	10.6	0.0				1.3				
Approach LOS	B									
Intersection Summary										
Average Delay			0.7							
Intersection Capacity Utilization			90.2%		ICU Level of Service				E	
Analysis Period (min)			15							

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  			 				
Traffic Volume (vph)	320	2710	505	80	2310	50	300	80	40	20	40	250
Future Volume (vph)	320	2710	505	80	2310	50	300	80	40	20	40	250
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	8.5	8.5		6.5	6.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.87	
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)	1676	4818	1500	1676	4818	1500	1676	1676		1676	1536	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.39	1.00		0.68	1.00	
Satd. Flow (perm)	1676	4818	1500	1676	4818	1500	686	1676		1193	1536	
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)	337	2853	532	84	2432	53	316	84	42	21	42	263
RTOR Reduction (vph)	0	0	179	0	0	31	0	20	0	0	190	0
Lane Group Flow (vph)	337	2853	353	84	2432	22	316	106	0	21	115	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8				4
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	15.0	47.0	47.0	9.9	41.9	41.9	30.1	30.1		30.1	30.1	
Effective Green, g (s)	13.0	44.0	44.0	7.9	40.9	40.9	25.6	25.6		27.6	27.6	
Actuated g/C Ratio	0.13	0.44	0.44	0.08	0.41	0.41	0.26	0.26		0.28	0.28	
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	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)	217	2119	660	132	1970	613	175	429		329	423	
v/s Ratio Prot	c0.20	c0.59		0.05	c0.50			0.06				0.07
v/s Ratio Perm			0.24			0.01	c0.46			0.02		
v/c Ratio	1.55	1.35	0.53	0.64	1.23	0.04	1.81	0.25		0.06	0.27	
Uniform Delay, d1	43.5	28.0	20.5	44.7	29.6	17.7	37.2	29.5		26.7	28.3	
Progression Factor	1.04	0.99	1.20	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	250.9	156.2	0.3	9.6	110.1	0.1	384.3	0.3		0.1	0.3	
Delay (s)	296.2	183.9	24.9	54.3	139.7	17.8	421.5	29.8		26.8	28.7	
Level of Service	F	F	C	D	F	B	F	C		C	C	
Approach Delay (s)		171.3			134.4			309.9			28.6	
Approach LOS		F			F			F			C	

Intersection Summary























HCM 2000 Control Delay	160.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.57		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	22.5
Intersection Capacity Utilization	124.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: 215 NB Off Ramp/215 NB On Ramp & University Pkwy





















03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			  				 			
Traffic Volume (vph)	275	1260	0	0	2600	245	445	25	2315	0	0	0
Future Volume (vph)	275	1260	0	0	2600	245	445	25	2315	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.5	7.5			7.5	7.5		6.5	6.5			
Lane Util. Factor	1.00	0.95			0.91	1.00		1.00	0.88			
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)	1676	3353			4818	1500		1685	2640			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1676	3353			4818	1500		1685	2640			
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)	289	1326	0	0	2737	258	468	26	2437	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	48	0	0	14	0	0	0
Lane Group Flow (vph)	289	1326	0	0	2737	210	0	494	2423	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	custom			
Protected Phases	5	2			6			8	18			
Permitted Phases						6	8					
Actuated Green, G (s)	12.5	35.3			49.3	49.3		22.5	53.5			
Effective Green, g (s)	10.5	33.5			47.5	47.5		21.5	52.5			
Actuated g/C Ratio	0.10	0.34			0.48	0.48		0.22	0.52			
Clearance Time (s)	4.5	5.7			5.7	5.7		5.5				
Vehicle Extension (s)	2.0	2.0			2.0	2.0		3.5				
Lane Grp Cap (vph)	175	1123			2288	712		362	1386			
v/s Ratio Prot	0.17	0.40			c0.57				c0.92			
v/s Ratio Perm						0.14		0.29				
v/c Ratio	1.65	1.18			1.20	0.29		1.36	1.75			
Uniform Delay, d1	44.8	33.2			26.2	16.0		39.2	23.8			
Progression Factor	1.20	0.33			0.38	0.10		1.00	1.00			
Incremental Delay, d2	295.5	82.3			88.7	0.1		181.0	339.8			
Delay (s)	349.1	93.3			98.6	1.7		220.2	363.5			
Level of Service	F	F			F	A		F	F			
Approach Delay (s)		139.1			90.3			339.4			0.0	
Approach LOS		F			F			F			A	
Intersection Summary												
HCM 2000 Control Delay			197.5				HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio			1.73									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		20.5			
Intersection Capacity Utilization			223.7%				ICU Level of Service		H			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 3: 215 SB On Ramp/215 SB Off Ramp & University Pkwy

03/05/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 							 	
Traffic Volume (vph)	0	1065	420	1860	1185	0	0	0	0	470	15	190
Future Volume (vph)	0	1065	420	1860	1185	0	0	0	0	470	15	190
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		7.5		6.5	7.5						6.5	6.5
Lane Util. Factor		0.95		0.97	1.00						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)		3211		3252	1765						1683	1500
Flt Permitted		1.00		0.95	1.00						0.95	1.00
Satd. Flow (perm)		3211		3252	1765						1683	1500
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	1121	442	1958	1247	0	0	0	0	495	16	200
RTOR Reduction (vph)	0	42	0	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	0	1521	0	1958	1247	0	0	0	0	0	511	128
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases										4		4
Actuated Green, G (s)		34.3		27.5	66.3						22.5	22.5
Effective Green, g (s)		32.5		25.5	64.5						21.5	21.5
Actuated g/C Ratio		0.32		0.26	0.64						0.22	0.22
Clearance Time (s)		5.7		4.5	5.7						5.5	5.5
Vehicle Extension (s)		2.0		2.0	2.0						2.0	2.0
Lane Grp Cap (vph)		1043		829	1138						361	322
v/s Ratio Prot		c0.47		c0.60	0.71							
v/s Ratio Perm											0.30	0.09
v/c Ratio		1.46		2.36	1.10						1.42	0.40
Uniform Delay, d1		33.8		37.2	17.8						39.2	33.7
Progression Factor		0.58		0.59	0.35						1.00	1.00
Incremental Delay, d2		209.5		613.2	44.7						202.7	0.3
Delay (s)		229.2		635.3	51.0						241.9	34.0
Level of Service		F		F	D						F	C
Approach Delay (s)		229.2			407.9			0.0			183.4	
Approach LOS		F			F			A			F	

Intersection Summary



























HCM 2000 Control Delay	327.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	223.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

03/05/2018











												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	175	645	25	75	790	505	25	25	100	735	20	285
Future Volume (vph)	175	645	25	75	790	505	25	25	100	735	20	285
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.0	7.5		6.0	7.5	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Flt	1.00	0.99		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (prot)	1676	3334		1676	3353	1500	1676	1553		1593	1601	1500
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (perm)	1676	3334		1676	3353	1500	1676	1553		1593	1601	1500
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)	184	679	26	79	832	532	26	26	105	774	21	300
RTOR Reduction (vph)	0	2	0	0	0	241	0	97	0	0	0	231
Lane Group Flow (vph)	184	703	0	79	832	291	26	34	0	395	400	69
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	15.2	40.1		8.4	33.3	58.7	10.1	10.1		25.4	25.4	25.4
Effective Green, g (s)	12.2	37.6		5.4	30.8	54.7	8.1	7.6		23.4	22.9	22.9
Actuated g/C Ratio	0.12	0.38		0.05	0.31	0.55	0.08	0.08		0.23	0.23	0.23
Clearance Time (s)	3.0	5.0		3.0	5.0	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)	204	1253		90	1032	820	135	118		372	366	343
v/s Ratio Prot	c0.11	0.21		0.05	c0.25	0.08	0.02	c0.02		0.25	c0.25	
v/s Ratio Perm						0.11						0.05
v/c Ratio	0.90	0.56		0.88	0.81	0.35	0.19	0.29		1.06	1.09	0.20
Uniform Delay, d1	43.3	24.7		47.0	31.9	12.7	42.9	43.6		38.3	38.5	31.2
Progression Factor	1.00	1.00		0.87	0.75	2.55	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	37.1	1.8		20.1	1.7	0.1	0.7	1.4		64.0	74.3	0.3
Delay (s)	80.4	26.5		60.8	25.5	32.5	43.6	45.0		102.3	112.9	31.4
Level of Service	F	C		E	C	C	D	D		F	F	C
Approach Delay (s)		37.6			30.0			44.8			86.7	
Approach LOS		D			C			D			F	
Intersection Summary												
HCM 2000 Control Delay			49.9	HCM 2000 Level of Service				D				
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			100.0	Sum of lost time (s)				26.5				
Intersection Capacity Utilization			85.3%	ICU Level of Service				E				
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy











03/05/2018

						
Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	5	1475	1360	5	10	10
Future Volume (Veh/h)	5	1475	1360	5	10	10
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)	5	1553	1432	5	11	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage (veh)		2	2			
Upstream signal (ft)		299	272			
pX, platoon unblocked					0.84	
vC, conflicting volume	1437				2221	718
vC1, stage 1 conf vol					1434	
vC2, stage 2 conf vol					786	
vCu, unblocked vol	1437				2070	718
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				94	97
cM capacity (veh/h)	468				173	371
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SE 1
Volume Total	5	776	776	955	482	22
Volume Left	5	0	0	0	0	11
Volume Right	0	0	0	0	5	11
cSH	468	1700	1700	1700	1700	236
Volume to Capacity	0.01	0.46	0.46	0.56	0.28	0.09
Queue Length 95th (ft)	1	0	0	0	0	8
Control Delay (s)	12.8	0.0	0.0	0.0	0.0	21.8
Lane LOS	B					C
Approach Delay (s)	0.0			0.0		21.8
Approach LOS						C
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			53.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: University Pkwy
















03/05/2018

						
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	10	1475	1345	30	10	20
Future Volume (Veh/h)	10	1475	1345	30	10	20
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)	11	1553	1416	32	11	21
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	None			
Median storage (veh)		2				
Upstream signal (ft)		405	166			
pX, platoon unblocked					0.84	
vC, conflicting volume	1448				2230	724
vC1, stage 1 conf vol					1432	
vC2, stage 2 conf vol					798	
vCu, unblocked vol	1448				2084	724
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				94	94
cM capacity (veh/h)	464				173	368
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SE 1
Volume Total	11	776	776	944	504	32
Volume Left	11	0	0	0	0	11
Volume Right	0	0	0	0	32	21
cSH	464	1700	1700	1700	1700	265
Volume to Capacity	0.02	0.46	0.46	0.56	0.30	0.12
Queue Length 95th (ft)	2	0	0	0	0	10
Control Delay (s)	13.0	0.0	0.0	0.0	0.0	20.4
Lane LOS	B					C
Approach Delay (s)	0.1			0.0		20.4
Approach LOS						C
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			53.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

7: University Pkwy & McDonalds

03/05/2018

									
Movement	WBL	WBR	NBT	NBR	SBL	SBT			
Lane Configurations			  			  			
Traffic Volume (veh/h)	0	135	3400	175	15	2845			
Future Volume (Veh/h)	0	135	3400	175	15	2845			
Sign Control	Stop		Free			Free			
Grade	0%		0%			0%			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95			
Hourly flow rate (vph)	0	142	3579	184	16	2995			
Pedestrians									
Lane Width (ft)									
Walking Speed (ft/s)									
Percent Blockage									
Right turn flare (veh)									
Median type	None				None				
Median storage (veh)									
Upstream signal (ft)	344			495					
pX, platoon unblocked	0.75	0.70				0.70			
vC, conflicting volume	4609	1193				3763			
vC1, stage 1 conf vol									
vC2, stage 2 conf vol									
vCu, unblocked vol	1982	0				3452			
tC, single (s)	6.8	6.9				4.1			
tC, 2 stage (s)									
tF (s)	3.5	3.3				2.2			
p0 queue free %	100	81				69			
cM capacity (veh/h)	28	763				52			
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4
Volume Total	142	1193	1193	1193	184	16	998	998	998
Volume Left	0	0	0	0	0	16	0	0	0
Volume Right	142	0	0	0	184	0	0	0	0
cSH	763	1700	1700	1700	1700	52	1700	1700	1700
Volume to Capacity	0.19	0.70	0.70	0.70	0.11	0.31	0.59	0.59	0.59
Queue Length 95th (ft)	17	0	0	0	0	27	0	0	0
Control Delay (s)	10.8	0.0	0.0	0.0	0.0	102.4	0.0	0.0	0.0
Lane LOS	B					F			
Approach Delay (s)	10.8	0.0				0.5			
Approach LOS	B								
Intersection Summary									
Average Delay			0.5						
Intersection Capacity Utilization			88.2%		ICU Level of Service			E	
Analysis Period (min)	15								

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

2040 AM DDI Alternative

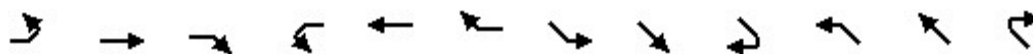
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	150	3075	465	35	1585	35	400	55	40	25	35	335
Future Volume (vph)	150	3075	465	35	1585	35	400	55	40	25	35	335
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	6.5	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.86	
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)	1676	5085	1583	1676	5085	1583	1676	1745		1676	1610	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.38	1.00		0.69	1.00	
Satd. Flow (perm)	1676	5085	1583	1676	5085	1583	664	1745		1222	1610	
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)	158	3237	489	37	1668	37	421	58	42	26	37	353
RTOR Reduction (vph)	0	0	171	0	0	23	0	17	0	0	133	0
Lane Group Flow (vph)	158	3237	318	37	1668	14	421	83	0	26	257	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8				4
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	16.8	65.7	65.7	6.3	57.2	57.2	63.5	63.5		63.5	63.5	
Effective Green, g (s)	14.8	63.7	63.7	4.3	55.2	55.2	61.5	61.5		61.5	61.5	
Actuated g/C Ratio	0.10	0.42	0.42	0.03	0.37	0.37	0.41	0.41		0.41	0.41	
Clearance Time (s)	4.0	6.0	6.0	4.0	4.0	4.0	4.5	4.5		4.5	4.5	
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)	165	2159	672	48	1871	582	272	715		501	660	
v/s Ratio Prot	0.09	c0.64		0.02	c0.33			0.05			0.16	
v/s Ratio Perm			0.20			0.01	c0.63			0.02		
v/c Ratio	0.96	1.50	0.47	0.77	0.89	0.02	1.55	0.12		0.05	0.39	
Uniform Delay, d1	67.3	43.1	31.1	72.4	44.6	30.2	44.2	27.4		26.7	31.1	
Progression Factor	0.95	0.93	0.79	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	35.7	225.8	1.1	53.1	6.9	0.1	264.0	0.1		0.0	0.4	
Delay (s)	99.9	266.0	25.5	125.5	51.5	30.3	308.2	27.5		26.7	31.4	
Level of Service	F	F	C	F	D	C	F	C		C	C	
Approach Delay (s)		229.0			52.6			254.3			31.1	
Approach LOS		F			D			F			C	
Intersection Summary												
HCM 2000 Control Delay			171.6									F
HCM 2000 Volume to Capacity ratio			1.53									
Actuated Cycle Length (s)			150.0							20.5		
Intersection Capacity Utilization			132.8%									H
ICU Level of Service												
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: University Pkwy

2040 AM DDI Alternative



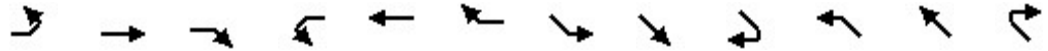
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR	
Lane Configurations					↑↑↑			↑↑					
Traffic Volume (vph)	0	0	0	0	2160	0	0	1215	0	0	0	0	
Future Volume (vph)	0	0	0	0	2160	0	0	1215	0	0	0	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					5.0			5.0					
Lane Util. Factor					0.91			0.95					
Frt					1.00			1.00					
Flt Protected					1.00			1.00					
Satd. Flow (prot)					5085			3539					
Flt Permitted					1.00			1.00					
Satd. Flow (perm)					5085			3539					
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	0	0	0	2274	0	0	1279	0	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	0	2274	0	0	1279	0	0	0	0	
Turn Type					NA			NA					
Protected Phases					2			4 3					
Permitted Phases													
Actuated Green, G (s)					94.0			46.0					
Effective Green, g (s)					94.0			46.0					
Actuated g/C Ratio					0.63			0.31					
Clearance Time (s)					5.0								
Vehicle Extension (s)					3.0								
Lane Grp Cap (vph)					3186			1085					
v/s Ratio Prot					c0.45			c0.36					
v/s Ratio Perm													
v/c Ratio					0.71			1.18					
Uniform Delay, d1					18.9			52.0					
Progression Factor					0.37			0.67					
Incremental Delay, d2					0.5			88.5					
Delay (s)					7.5			123.4					
Level of Service					A			F					
Approach Delay (s)		0.0			7.5			123.4			0.0		
Approach LOS		A			A			F			A		
Intersection Summary													
HCM 2000 Control Delay			49.3		HCM 2000 Level of Service						D		
HCM 2000 Volume to Capacity ratio			0.90										
Actuated Cycle Length (s)			150.0		Sum of lost time (s)						15.0		
Intersection Capacity Utilization			83.7%		ICU Level of Service						E		
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: University Pkwy & 215 SB Ramp Crossover

2040 AM DDI Alternative

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR		
Lane Configurations		↑↑									↑↑			
Traffic Volume (vph)	0	1015	0	0	0	0	0	0	0	0	1175	0		
Future Volume (vph)	0	1015	0	0	0	0	0	0	0	0	1175	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)		5.0									5.0			
Lane Util. Factor		0.95									0.95			
Frt		1.00									1.00			
Flt Protected		1.00									1.00			
Satd. Flow (prot)		3539									3539			
Flt Permitted		1.00									1.00			
Satd. Flow (perm)		3539									3539			
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	1068	0	0	0	0	0	0	0	0	1237	0		
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Lane Group Flow (vph)	0	1068	0	0	0	0	0	0	0	0	1237	0		
Turn Type		NA									NA			
Protected Phases		2									4 3			
Permitted Phases														
Actuated Green, G (s)		70.4									69.6			
Effective Green, g (s)		70.4									69.6			
Actuated g/C Ratio		0.47									0.46			
Clearance Time (s)		5.0												
Vehicle Extension (s)		3.0												
Lane Grp Cap (vph)		1660									1642			
v/s Ratio Prot		c0.30									c0.35			
v/s Ratio Perm														
v/c Ratio		0.64									0.75			
Uniform Delay, d1		30.3									33.1			
Progression Factor		0.83									0.68			
Incremental Delay, d2		1.5									1.1			
Delay (s)		26.5									23.6			
Level of Service		C									C			
Approach Delay (s)		26.5			0.0			0.0			23.6			
Approach LOS		C			A			A			C			
Intersection Summary														
HCM 2000 Control Delay			25.0									HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio			0.72											
Actuated Cycle Length (s)			150.0								15.0		Sum of lost time (s)	
Intersection Capacity Utilization			68.9%										ICU Level of Service	C
Analysis Period (min)			15											

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

2040 AM DDI Alternative

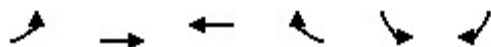
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	1170	15	60	755	570	10	10	50	435	20	55
Future Volume (vph)	130	1170	15	60	755	570	10	10	50	435	20	55
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	6.0	7.0		6.0	7.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00
Satd. Flow (prot)	1676	3532		1676	3539	1583	1676	1631		1593	1692	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00
Satd. Flow (perm)	1676	3532		1676	3539	1583	1676	1631		1593	1692	1583
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)	137	1232	16	63	795	600	11	11	53	458	21	58
RTOR Reduction (vph)	0	0	0	0	0	201	0	51	0	0	0	47
Lane Group Flow (vph)	137	1248	0	63	795	399	11	13	0	238	241	11
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	22.8	88.4		8.9	74.5	103.8	6.4	6.4		29.3	29.3	29.3
Effective Green, g (s)	20.8	86.4		6.9	72.5	99.8	4.4	4.4		27.3	27.3	27.3
Actuated g/C Ratio	0.14	0.58		0.05	0.48	0.67	0.03	0.03		0.18	0.18	0.18
Clearance Time (s)	4.0	5.0		4.0	5.0	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)	232	2034		77	1710	1116	49	47		289	307	288
v/s Ratio Prot	0.08	c0.35		c0.04	0.22	0.07	0.01	c0.01		c0.15	0.14	
v/s Ratio Perm						0.19						0.01
v/c Ratio	0.59	0.61		0.82	0.46	0.36	0.22	0.27		0.82	0.79	0.04
Uniform Delay, d1	60.6	20.8		70.9	25.8	11.0	71.1	71.2		59.0	58.5	50.5
Progression Factor	1.00	1.00		1.09	0.38	0.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.0	1.4		45.4	0.9	0.2	2.3	3.0		17.0	12.4	0.1
Delay (s)	64.6	22.2		122.4	10.7	0.2	73.5	74.3		76.1	70.9	50.6
Level of Service	E	C		F	B	A	E	E		E	E	D
Approach Delay (s)		26.4			11.2			74.1			71.0	
Approach LOS		C			B			E			E	
Intersection Summary												
HCM 2000 Control Delay			28.0				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)				25.0	
Intersection Capacity Utilization			73.9%				ICU Level of Service				D	
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy







2040 AM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↗
Traffic Volume (veh/h)	0	1655	1315	55	0	70
Future Volume (Veh/h)	0	1655	1315	55	0	70
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)	0	1742	1384	58	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)		405	325			
pX, platoon unblocked				0.76		
vC, conflicting volume	1442			2284	721	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1442			2063	721	
tC, single (s)	4.1			6.8	6.9	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	100			100	80	
cM capacity (veh/h)	466			36	370	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	871	871	923	519	74	
Volume Left	0	0	0	0	0	
Volume Right	0	0	0	58	74	
cSH	1700	1700	1700	1700	370	
Volume to Capacity	0.51	0.51	0.54	0.31	0.20	
Queue Length 95th (ft)	0	0	0	0	18	
Control Delay (s)	0.0	0.0	0.0	0.0	17.2	
Lane LOS						C
Approach Delay (s)	0.0		0.0		17.2	
Approach LOS						C
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			49.1%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 7: McDonalds & University Pkwy

2040 AM DDI Alternative

										
Movement	EBT	EBR	WBL	WBT	NBL	NBR				
Lane Configurations	↑↑↑	↑	↓	↑↑↑		↓				
Traffic Volume (veh/h)	3580	145	20	2300	0	110				
Future Volume (Veh/h)	3580	145	20	2300	0	110				
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)	3768	153	21	2421	0	116				
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type	None			None						
Median storage (veh)										
Upstream signal (ft)	519			516						
pX, platoon unblocked					0.69					
vC, conflicting volume				3921		4617		1256		
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol				3921		4669		1256		
tC, single (s)				4.1		6.8		6.9		
tC, 2 stage (s)										
tF (s)				2.2		3.5		3.3		
p0 queue free %				56		100		29		
cM capacity (veh/h)				47		0		163		
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	WB 4	NB 1	
Volume Total	1256	1256	1256	153	21	807	807	807	116	
Volume Left	0	0	0	0	21	0	0	0	0	
Volume Right	0	0	0	153	0	0	0	0	116	
cSH	1700	1700	1700	1700	47	1700	1700	1700	163	
Volume to Capacity	0.74	0.74	0.74	0.09	0.44	0.47	0.47	0.47	0.71	
Queue Length 95th (ft)	0	0	0	0	40	0	0	0	107	
Control Delay (s)	0.0	0.0	0.0	0.0	131.3	0.0	0.0	0.0	68.8	
Lane LOS					F				F	
Approach Delay (s)	0.0			1.1				68.8		
Approach LOS									F	
Intersection Summary										
Average Delay				1.7						
Intersection Capacity Utilization				86.0%		ICU Level of Service				E
Analysis Period (min)				15						

HCM Signalized Intersection Capacity Analysis

8: 215 NB Off Ramp & University Pkwy

2040 AM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↑↑					↑↑↑↑
Traffic Volume (vph)	1215	0	0	0	0	2510
Future Volume (vph)	1215	0	0	0	0	2510
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					5.0
Lane Util. Factor	0.95					0.76
Frt	1.00					0.85
Flt Protected	1.00					1.00
Satd. Flow (prot)	3539					3610
Flt Permitted	1.00					1.00
Satd. Flow (perm)	3539					3610
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1279	0	0	0	0	2642
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1279	0	0	0	0	2642
Turn Type	NA					Prot
Protected Phases	Free!					2!
Permitted Phases						
Actuated Green, G (s)	150.0					94.0
Effective Green, g (s)	150.0					94.0
Actuated g/C Ratio	1.00					0.63
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	3539					2262
v/s Ratio Prot	0.36					c0.73
v/s Ratio Perm						
v/c Ratio	0.36					1.17
Uniform Delay, d1	0.0					28.0
Progression Factor	1.00					1.00
Incremental Delay, d2	0.0					80.8
Delay (s)	0.0					108.8
Level of Service	A					F
Approach Delay (s)	0.0			0.0	108.8	
Approach LOS	A			A	F	

Intersection Summary

HCM 2000 Control Delay	73.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: 215 NB Off Ramp & University Pkwy

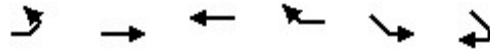
2040 AM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations				↑↑↑	↑	
Traffic Volume (vph)	0	0	0	2160	425	0
Future Volume (vph)	0	0	0	2160	425	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5085	1770	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5085	1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	2274	447	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	2274	447	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				94.0	37.0	
Effective Green, g (s)				94.0	37.0	
Actuated g/C Ratio				0.63	0.25	
Clearance Time (s)				5.0	5.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				3186	436	
v/s Ratio Prot				c0.45	c0.25	
v/s Ratio Perm						
v/c Ratio				0.71	1.03	
Uniform Delay, d1				18.9	56.5	
Progression Factor				0.01	1.00	
Incremental Delay, d2				1.0	49.7	
Delay (s)				1.1	106.2	
Level of Service				A	F	
Approach Delay (s)	0.0			1.1	106.2	
Approach LOS	A			A	F	
Intersection Summary						
HCM 2000 Control Delay			18.4	HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio			0.78			
Actuated Cycle Length (s)			150.0	Sum of lost time (s)		15.0
Intersection Capacity Utilization			116.8%	ICU Level of Service		H
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 16: 215 SB Ramp Crossover/University Pkwy & 215 SB Off Ramp

2040 AM DDI Alternative



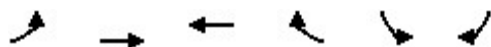
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑			↘	
Traffic Volume (vph)	0	1015	0	0	295	0
Future Volume (vph)	0	1015	0	0	295	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3539			1770	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3539			1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1068	0	0	311	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1068	0	0	311	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		70.4			55.7	
Effective Green, g (s)		70.4			55.7	
Actuated g/C Ratio		0.47			0.37	
Clearance Time (s)		5.0			5.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		1660			657	
v/s Ratio Prot		c0.30			c0.18	
v/s Ratio Perm						
v/c Ratio		0.64			0.47	
Uniform Delay, d1		30.3			36.0	
Progression Factor		0.05			1.00	
Incremental Delay, d2		1.5			0.5	
Delay (s)		2.9			36.5	
Level of Service		A			D	
Approach Delay (s)		2.9	0.0		36.5	
Approach LOS		A	A		D	
Intersection Summary						
HCM 2000 Control Delay			10.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.53			
Actuated Cycle Length (s)			150.0		Sum of lost time (s)	15.0
Intersection Capacity Utilization			51.9%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

31: 215 SB Ramp Crossover & 215 SB Off Ramp (SB)

2040 AM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑			↗
Traffic Volume (vph)	0	0	1175	0	0	195
Future Volume (vph)	0	0	1175	0	0	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0			5.0
Lane Util. Factor			0.95			1.00
Frt			1.00			0.86
Flt Protected			1.00			1.00
Satd. Flow (prot)			3539			1611
Flt Permitted			1.00			1.00
Satd. Flow (perm)			3539			1611
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	1237	0	0	205
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	1237	0	0	205
Turn Type			NA			Prot
Protected Phases			Free!			2!
Permitted Phases						
Actuated Green, G (s)			150.0			70.4
Effective Green, g (s)			150.0			70.4
Actuated g/C Ratio			1.00			0.47
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)			3539			756
v/s Ratio Prot			0.35			0.13
v/s Ratio Perm						
v/c Ratio			0.35			0.27
Uniform Delay, d1			0.0			24.2
Progression Factor			1.00			1.00
Incremental Delay, d2			0.2			0.9
Delay (s)			0.2			25.1
Level of Service			A			C
Approach Delay (s)		0.0	0.2		25.1	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			3.7		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.39			
Actuated Cycle Length (s)			150.0		Sum of lost time (s)	15.0
Intersection Capacity Utilization			68.9%		ICU Level of Service	C
Analysis Period (min)			15			
! Phase conflict between lane groups.						
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

1: State St/Varsity Ave & University Pkwy

2040 PM DDI Alternative

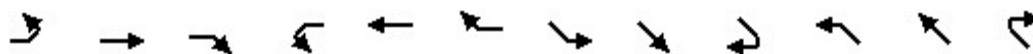
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	320	2710	505	80	2310	50	300	80	40	20	40	250
Future Volume (vph)	320	2710	505	80	2310	50	300	80	40	20	40	250
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	6.0	8.0	8.0	6.0	6.0	6.0	6.5	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.87	
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)	1676	5085	1583	1676	5085	1583	1676	1770		1676	1622	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.42	1.00		0.66	1.00	
Satd. Flow (perm)	1676	5085	1583	1676	5085	1583	746	1770		1172	1622	
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)	337	2853	532	84	2432	53	316	84	42	21	42	263
RTOR Reduction (vph)	0	0	215	0	0	33	0	12	0	0	150	0
Lane Group Flow (vph)	337	2853	317	84	2432	20	316	114	0	21	155	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			8				4
Permitted Phases			2			6	8			4		
Actuated Green, G (s)	25.0	74.0	74.0	8.0	59.0	59.0	53.5	53.5		53.5	53.5	
Effective Green, g (s)	23.0	72.0	72.0	6.0	57.0	57.0	51.5	51.5		51.5	51.5	
Actuated g/C Ratio	0.15	0.48	0.48	0.04	0.38	0.38	0.34	0.34		0.34	0.34	
Clearance Time (s)	4.0	6.0	6.0	4.0	4.0	4.0	4.5	4.5		4.5	4.5	
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)	256	2440	759	67	1932	601	256	607		402	556	
v/s Ratio Prot	c0.20	0.56		0.05	c0.48			0.06			0.10	
v/s Ratio Perm			0.20			0.01	c0.42			0.02		
v/c Ratio	1.32	1.17	0.42	1.25	1.26	0.03	1.23	0.19		0.05	0.28	
Uniform Delay, d1	63.5	39.0	25.4	72.0	46.5	29.2	49.2	34.6		32.9	35.8	
Progression Factor	1.06	0.97	1.09	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	157.1	78.9	0.9	192.8	120.8	0.1	134.5	0.2		0.1	0.3	
Delay (s)	224.3	116.8	28.5	264.8	167.3	29.3	183.8	34.7		33.0	36.0	
Level of Service	F	F	C	F	F	C	F	C		C	D	
Approach Delay (s)		114.0			167.7			141.3			35.8	
Approach LOS		F			F			F			D	
Intersection Summary												
HCM 2000 Control Delay			131.6	HCM 2000 Level of Service				F				
HCM 2000 Volume to Capacity ratio			1.28									
Actuated Cycle Length (s)			150.0	Sum of lost time (s)				20.5				
Intersection Capacity Utilization			119.3%	ICU Level of Service				H				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

2: University Pkwy

2040 PM DDI Alternative



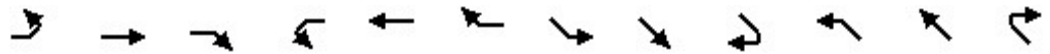
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR	
Lane Configurations					↑↑↑			↑↑					
Traffic Volume (vph)	0	0	0	0	2600	0	0	1260	0	0	0	0	
Future Volume (vph)	0	0	0	0	2600	0	0	1260	0	0	0	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					5.0			5.0					
Lane Util. Factor					0.91			0.95					
Frt					1.00			1.00					
Flt Protected					1.00			1.00					
Satd. Flow (prot)					5085			3539					
Flt Permitted					1.00			1.00					
Satd. Flow (perm)					5085			3539					
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	0	0	0	2737	0	0	1326	0	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	0	0	0	0	2737	0	0	1326	0	0	0	0	
Turn Type					NA			NA					
Protected Phases					2			4 3					
Permitted Phases													
Actuated Green, G (s)					92.0			48.0					
Effective Green, g (s)					92.0			48.0					
Actuated g/C Ratio					0.61			0.32					
Clearance Time (s)					5.0								
Vehicle Extension (s)					3.0								
Lane Grp Cap (vph)					3118			1132					
v/s Ratio Prot					c0.54			c0.37					
v/s Ratio Perm													
v/c Ratio					0.88			1.17					
Uniform Delay, d1					24.3			51.0					
Progression Factor					0.35			0.94					
Incremental Delay, d2					0.4			84.6					
Delay (s)					8.8			132.3					
Level of Service					A			F					
Approach Delay (s)		0.0			8.8			132.3			0.0		
Approach LOS		A			A			F			A		
Intersection Summary													
HCM 2000 Control Delay			49.1		HCM 2000 Level of Service						D		
HCM 2000 Volume to Capacity ratio			1.01										
Actuated Cycle Length (s)			150.0		Sum of lost time (s)						15.0		
Intersection Capacity Utilization			93.4%		ICU Level of Service						F		
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

3: University Pkwy & 215 SB Ramp Crossover

2040 PM DDI Alternative

























Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR		
Lane Configurations		↑↑									↑↑			
Traffic Volume (vph)	0	1065	0	0	0	0	0	0	0	0	1185	0		
Future Volume (vph)	0	1065	0	0	0	0	0	0	0	0	1185	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)		5.0									5.0			
Lane Util. Factor		0.95									0.95			
Frt		1.00									1.00			
Flt Protected		1.00									1.00			
Satd. Flow (prot)		3539									3539			
Flt Permitted		1.00									1.00			
Satd. Flow (perm)		3539									3539			
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	1121	0	0	0	0	0	0	0	0	1247	0		
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0		
Lane Group Flow (vph)	0	1121	0	0	0	0	0	0	0	0	1247	0		
Turn Type		NA									NA			
Protected Phases		2									4 3			
Permitted Phases														
Actuated Green, G (s)		73.0									67.0			
Effective Green, g (s)		73.0									67.0			
Actuated g/C Ratio		0.49									0.45			
Clearance Time (s)		5.0												
Vehicle Extension (s)		3.0												
Lane Grp Cap (vph)		1722									1580			
v/s Ratio Prot		c0.32									c0.35			
v/s Ratio Perm														
v/c Ratio		0.65									0.79			
Uniform Delay, d1		28.9									35.5			
Progression Factor		0.59									1.02			
Incremental Delay, d2		1.5									1.0			
Delay (s)		18.6									37.1			
Level of Service		B									D			
Approach Delay (s)		18.6			0.0			0.0			37.1			
Approach LOS		B			A			A			D			
Intersection Summary														
HCM 2000 Control Delay			28.3									HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio			0.74											
Actuated Cycle Length (s)			150.0								15.0		Sum of lost time (s)	
Intersection Capacity Utilization			70.5%										ICU Level of Service	C
Analysis Period (min)			15											

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: Hallmark Pkwy & University Pkwy

2040 PM DDI Alternative

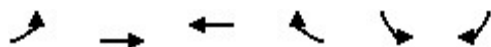
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	175	650	25	75	810	505	25	25	100	735	20	285
Future Volume (vph)	175	650	25	75	810	505	25	25	100	735	20	285
Ideal Flow (vphpl)	1800	1900	1900	1800	1900	1900	1800	1900	1900	1800	1900	1900
Total Lost time (s)	6.0	7.0		6.0	7.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (prot)	1676	3520		1676	3539	1583	1676	1639		1593	1690	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00
Satd. Flow (perm)	1676	3520		1676	3539	1583	1676	1639		1593	1690	1583
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)	184	684	26	79	853	532	26	26	105	774	21	300
RTOR Reduction (vph)	0	2	0	0	0	171	0	100	0	0	0	201
Lane Group Flow (vph)	184	708	0	79	853	361	26	31	0	395	400	99
Turn Type	Prot	NA		Prot	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	4	3	3		4	4	
Permitted Phases						6						4
Actuated Green, G (s)	20.5	68.4		11.9	59.8	103.3	9.2	9.2		43.5	43.5	43.5
Effective Green, g (s)	18.5	66.4		9.9	57.8	99.3	7.2	7.2		41.5	41.5	41.5
Actuated g/C Ratio	0.12	0.44		0.07	0.39	0.66	0.05	0.05		0.28	0.28	0.28
Clearance Time (s)	4.0	5.0		4.0	5.0	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	1558		110	1363	1047	80	78		440	467	437
v/s Ratio Prot	c0.11	0.20		0.05	c0.24	0.10	0.02	c0.02		c0.25	0.24	
v/s Ratio Perm						0.13						0.06
v/c Ratio	0.89	0.45		0.72	0.63	0.34	0.33	0.40		0.90	0.86	0.23
Uniform Delay, d1	64.8	29.2		68.7	37.3	11.1	69.0	69.3		52.2	51.4	41.9
Progression Factor	1.00	1.00		1.39	0.35	0.52	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	34.9	1.0		19.3	2.1	0.2	2.4	3.3		20.5	14.3	0.3
Delay (s)	99.7	30.1		114.4	15.2	6.0	71.4	72.6		72.7	65.7	42.1
Level of Service	F	C		F	B	A	E	E		E	E	D
Approach Delay (s)		44.4			17.2			72.4			61.8	
Approach LOS		D			B			E			E	
Intersection Summary												
HCM 2000 Control Delay			39.9	HCM 2000 Level of Service				D				
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			150.0	Sum of lost time (s)				25.0				
Intersection Capacity Utilization			82.4%	ICU Level of Service				E				
Analysis Period (min)			15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

5: University Pkwy

2040 PM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↑
Traffic Volume (veh/h)	0	1485	1340	35	0	50
Future Volume (Veh/h)	0	1485	1340	35	0	50
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)	0	1563	1411	37	0	53
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)		405	325			
pX, platoon unblocked					0.86	
vC, conflicting volume	1448				2211	724
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1448				2085	724
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	86
cM capacity (veh/h)	464				39	368
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	782	782	941	507	53	
Volume Left	0	0	0	0	0	
Volume Right	0	0	0	37	53	
cSH	1700	1700	1700	1700	368	
Volume to Capacity	0.46	0.46	0.55	0.30	0.14	
Queue Length 95th (ft)	0	0	0	0	12	
Control Delay (s)	0.0	0.0	0.0	0.0	16.4	
Lane LOS					C	
Approach Delay (s)	0.0		0.0		16.4	
Approach LOS					C	
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			48.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

7: McDonalds & University Pkwy

2040 PM DDI Alternative

	→	↘	↙	←	↖	↗					
Movement	EBT	EBR	WBL	WBT	NBL	NBR					
Lane Configurations	↑↑↑	↑	↓	↑↑↑		↓					
Traffic Volume (veh/h)	3400	175	15	2845	0	135					
Future Volume (Veh/h)	3400	175	15	2845	0	135					
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)	3579	184	16	2995	0	142					
Pedestrians											
Lane Width (ft)											
Walking Speed (ft/s)											
Percent Blockage											
Right turn flare (veh)											
Median type	None			None							
Median storage (veh)											
Upstream signal (ft)	519			516							
pX, platoon unblocked					0.63						
vC, conflicting volume			3763		4609		1193				
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol			3763		4674		1193				
tC, single (s)			4.1		6.8		6.9				
tC, 2 stage (s)											
tF (s)			2.2		3.5		3.3				
p0 queue free %			71		100		21				
cM capacity (veh/h)			55		0		179				
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	WB 4	NB 1		
Volume Total	1193	1193	1193	184	16	998	998	998	142		
Volume Left	0	0	0	0	16	0	0	0	0		
Volume Right	0	0	0	184	0	0	0	0	142		
cSH	1700	1700	1700	1700	55	1700	1700	1700	179		
Volume to Capacity	0.70	0.70	0.70	0.11	0.29	0.59	0.59	0.59	0.79		
Queue Length 95th (ft)	0	0	0	0	25	0	0	0	133		
Control Delay (s)	0.0	0.0	0.0	0.0	95.2	0.0	0.0	0.0	74.9		
Lane LOS					F			F			
Approach Delay (s)	0.0				0.5		74.9				
Approach LOS								F			
Intersection Summary											
Average Delay			1.8								
Intersection Capacity Utilization			84.1%		ICU Level of Service				E		
Analysis Period (min)			15								

HCM Signalized Intersection Capacity Analysis

8: 215 NB Off Ramp & University Pkwy

2040 PM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↑↑					↑↑↑↑
Traffic Volume (vph)	1260	0	0	0	0	2315
Future Volume (vph)	1260	0	0	0	0	2315
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0					5.0
Lane Util. Factor	0.95					0.76
Frt	1.00					0.85
Flt Protected	1.00					1.00
Satd. Flow (prot)	3539					3610
Flt Permitted	1.00					1.00
Satd. Flow (perm)	3539					3610
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1326	0	0	0	0	2437
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1326	0	0	0	0	2437
Turn Type	NA					Prot
Protected Phases	Free!					2!
Permitted Phases						
Actuated Green, G (s)	150.0					92.0
Effective Green, g (s)	150.0					92.0
Actuated g/C Ratio	1.00					0.61
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	3539					2214
v/s Ratio Prot	0.37					c0.68
v/s Ratio Perm						
v/c Ratio	0.37					1.10
Uniform Delay, d1	0.0					29.0
Progression Factor	1.00					1.00
Incremental Delay, d2	0.0					52.9
Delay (s)	0.0					81.9
Level of Service	A					F
Approach Delay (s)	0.0			0.0	81.9	
Approach LOS	A			A	F	

Intersection Summary

HCM 2000 Control Delay	53.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 11: 215 NB Off Ramp & University Pkwy

2040 PM DDI Alternative



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations				↑↑↑	↑	
Traffic Volume (vph)	0	0	0	2600	445	0
Future Volume (vph)	0	0	0	2600	445	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5085	1770	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5085	1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	2737	468	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	2737	468	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				92.0	39.0	
Effective Green, g (s)				92.0	39.0	
Actuated g/C Ratio				0.61	0.26	
Clearance Time (s)				5.0	5.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				3118	460	
v/s Ratio Prot				c0.54	c0.26	
v/s Ratio Perm						
v/c Ratio				0.88	1.02	
Uniform Delay, d1				24.3	55.5	
Progression Factor				0.05	1.00	
Incremental Delay, d2				1.8	46.4	
Delay (s)				3.0	101.9	
Level of Service				A	F	
Approach Delay (s)	0.0			3.0	101.9	
Approach LOS	A			A	F	

Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	122.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 16: 215 SB Ramp Crossover/University Pkwy & 215 SB Off Ramp

2040 PM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑			↓	
Traffic Volume (vph)	0	1065	0	0	470	0
Future Volume (vph)	0	1065	0	0	470	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3539			1770	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3539			1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1121	0	0	495	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1121	0	0	495	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		73.0			58.0	
Effective Green, g (s)		73.0			58.0	
Actuated g/C Ratio		0.49			0.39	
Clearance Time (s)		5.0			5.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		1722			684	
v/s Ratio Prot		c0.32			c0.28	
v/s Ratio Perm						
v/c Ratio		0.65			0.72	
Uniform Delay, d1		28.9			39.2	
Progression Factor		0.05			1.00	
Incremental Delay, d2		1.5			3.8	
Delay (s)		2.9			43.0	
Level of Service		A			D	
Approach Delay (s)		2.9	0.0		43.0	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
 31: 215 SB Ramp Crossover & 215 SB Off Ramp (SB)

2040 PM DDI Alternative



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑			↗
Traffic Volume (vph)	0	0	1185	0	0	190
Future Volume (vph)	0	0	1185	0	0	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0			5.0
Lane Util. Factor			0.95			1.00
Frt			1.00			0.86
Flt Protected			1.00			1.00
Satd. Flow (prot)			3539			1611
Flt Permitted			1.00			1.00
Satd. Flow (perm)			3539			1611
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	1247	0	0	200
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	1247	0	0	200
Turn Type			NA			Prot
Protected Phases			Free!			2!
Permitted Phases						
Actuated Green, G (s)			150.0			73.0
Effective Green, g (s)			150.0			73.0
Actuated g/C Ratio			1.00			0.49
Clearance Time (s)						5.0
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)			3539			784
v/s Ratio Prot			0.35			0.12
v/s Ratio Perm						
v/c Ratio			0.35			0.26
Uniform Delay, d1			0.0			22.6
Progression Factor			1.00			1.00
Incremental Delay, d2			0.2			0.8
Delay (s)			0.2			23.3
Level of Service			A			C
Approach Delay (s)		0.0	0.2		23.3	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			3.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.39			
Actuated Cycle Length (s)			150.0		Sum of lost time (s)	15.0
Intersection Capacity Utilization			70.5%		ICU Level of Service	C
Analysis Period (min)			15			
! Phase conflict between lane groups.						
c Critical Lane Group						



Appendix E. HCS Worksheets

Phone: Fax:
E-mail:

-----Merge Analysis-----

Analyst: KV
Agency/Co.: HDR
Date performed: 8/11/2017
Analysis time period: AM
Freeway/Dir of Travel: NB 215
Junction: University Pkwy On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	67.0	mph	
Volume on freeway	1310	vph	

-----On Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	125	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?	No		
Volume on adjacent Ramp	0	vph	
Position of adjacent Ramp			
Type of adjacent Ramp			
Distance to adjacent Ramp	1000	ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1310	125	0	vph
Peak-hour factor, PHF	0.95	0.95	0.94	
Peak 15-min volume, v15	345	33	0	v
Trucks and buses	9	3	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.0*	2.0*	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.971	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	1503	136	0	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)

EQ

P = 1.000 Using Equation 0

FM

v = v (P) = 1503 pc/h

12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	1639	4740	No
FO			
v or v	0 pc/h	(Equation 13-14 or 13-17)	
3 av34			
Is v or v	> 2700 pc/h?	No	
3 av34			
Is v or v	> 1.5 v /2	No	
3 av34	12		
If yes, v	= 1503	(Equation 13-15, 13-16, 13-18, or 13-19)	
12A			

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v	1639	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 14.4 pc/mi/ln

R R 12 A B

Level of service for ramp-freeway junction areas of influence B

----- Speed Estimation -----

Intermediate speed variable,	M = 0.287	
	S	
Space mean speed in ramp influence area,	S = 59.8	mph
	R	
Space mean speed in outer lanes,	S = N/A	mph
	0	
Space mean speed for all vehicles,	S = 59.8	mph

Phone: Fax:
E-mail:

-----Diverge Analysis-----

Analyst: KV
Agency/Co.: HDR
Date performed: 8/11/2017
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-215 SB
Junction: University Pkwy Off Ramp
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	65.0	mph	
Volume on freeway	3180	vph	

-----Off Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	45.0	mph	
Volume on ramp	165	vph	
Length of first accel/decel lane	140	ft	
Length of second accel/decel lane		ft	

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	No		
Volume on adjacent ramp	0	vph	
Position of adjacent ramp			
Type of adjacent ramp			
Distance to adjacent ramp	1000	ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3180	165	0	vph
Peak-hour factor, PHF	0.95	0.95	0.94	
Peak 15-min volume, v15	837	43	0	v
Trucks and buses	9	3	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	2.0*	2.0*	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	0.971	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3649	179	0	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)

EQ

P = 1.000 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P = 3649$ pc/h
 12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	3649	4700	No
$v_{FO} = v_F - v_R$	3470	4700	No
v_R	179	2100	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700$ pc/h?		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3649$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
v_{12}	3649	4400	No

----- Level of Service Determination (if not F) -----

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 34.4$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable,	D = 0.314	
Space mean speed in ramp influence area,	S _R = 57.8	mph
Space mean speed in outer lanes,	S ₀ = N/A	mph
Space mean speed for all vehicles,	S = 57.8	mph

Phone: Fax:
E-mail:

-----Merge Analysis-----

Analyst: KV
Agency/Co.: HDR
Date performed: 8/11/2017
Analysis time period: PM
Freeway/Dir of Travel: NB 215
Junction: University Pkwy On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	61.0	mph	
Volume on freeway	2765	vph	

-----On Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	180	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?	No		
Volume on adjacent Ramp		vph	
Position of adjacent Ramp			
Type of adjacent Ramp			
Distance to adjacent Ramp		ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2765	180		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	728	47		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3172	195	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)
 EQ
 P = 1.000 Using Equation 0
 FM
 $v_{12} = v_{F, FM} = 3172 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v _{FO}	3367	4620	No
v ₃ or v _{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v ₃ or v _{av34} > 2700 pc/h?		No	
Is v ₃ or v _{av34} > 1.5 v ₁₂ / 2		No	
If yes, v _{12A} = 3172		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v _{R12}	3367	4600	No

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.9 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable,	M = 0.380	
Space mean speed in ramp influence area,	S _R = 53.8	mph
Space mean speed in outer lanes,	S ₀ = N/A	mph
Space mean speed for all vehicles,	S = 53.8	mph

Phone: Fax:
 E-mail:

-----Diverge Analysis-----

Analyst: KV
 Agency/Co.: HDR
 Date performed: 8/11/2017
 Analysis time period: PM
 Freeway/Dir of Travel: I-215 SB
 Junction: University Pkwy Off Ramp
 Jurisdiction: Caltrans
 Analysis Year: Existing (2017)
 Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	69.0	mph	
Volume on freeway	1955	vph	

-----Off Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	45.0	mph	
Volume on ramp	145	vph	
Length of first accel/decel lane	140	ft	
Length of second accel/decel lane		ft	

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	No		
Volume on adjacent ramp		vph	
Position of adjacent ramp			
Type of adjacent ramp			
Distance to adjacent ramp		ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1955	145		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	514	38		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2243	157	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)

EQ

P = 1.000 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P = 2243$ pc/h

12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	2243	4780	No
$v_{FO} = v_F - v_R$	2086	4780	No
v_R	157	2100	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700$ pc/h?		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2243$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
v_{12}	2243	4400	No

----- Level of Service Determination (if not F) -----

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 22.3$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable,	D = 0.312	
Space mean speed in ramp influence area,	S = 60.6	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 60.6	mph

Phone: Fax:
 E-mail:

-----Merge Analysis-----

Analyst: KV
 Agency/Co.: HDR
 Date performed: 8/11/2017
 Analysis time period: PM
 Freeway/Dir of Travel: NB 215
 Junction: University Pkwy On Ramp
 Jurisdiction: Caltrans
 Analysis Year: 2020
 Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	2960	vph	

-----On Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	235	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?	No		
Volume on adjacent Ramp		vph	
Position of adjacent Ramp			
Type of adjacent Ramp			
Distance to adjacent Ramp		ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2960	235		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	779	62		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3396	255	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)

EQ

P = 1.000 Using Equation 0

FM

v = v (P) = 3396 pc/h

12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	3651	4500	No
FO			
v or v	0 pc/h	(Equation 13-14 or 13-17)	
3 av34			
Is v or v	> 2700 pc/h?	No	
3 av34			
Is v or v	> 1.5 v /2	No	
3 av34	12		
If yes, v	= 3396	(Equation 13-15, 13-16, 13-18, or 13-19)	
12A			

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v	3651	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 30.1$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable,	M = 0.417	
	S	
Space mean speed in ramp influence area,	S = 49.6	mph
	R	
Space mean speed in outer lanes,	S = N/A	mph
	0	
Space mean speed for all vehicles,	S = 49.6	mph

Phone: Fax:
E-mail:

-----Merge Analysis-----

Analyst: KV
Agency/Co.: HDR
Date performed: 8/11/2017
Analysis time period: AM
Freeway/Dir of Travel: NB 215
Junction: University Pkwy On Ramp
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	1400	vph	

-----On Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	150	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?	No		
Volume on adjacent Ramp		vph	
Position of adjacent Ramp			
Type of adjacent Ramp			
Distance to adjacent Ramp		ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1400	150		vph
Peak-hour factor, PHF	0.95	0.93		
Peak 15-min volume, v15	368	40		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1606	166	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)

EQ

P = 1.000 Using Equation 0

FM

v = v (P) = 1606 pc/h

12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	1772	4500	No
FO			
v or v	0 pc/h	(Equation 13-14 or 13-17)	
3 av34			
Is v or v	> 2700 pc/h?	No	
3 av34			
Is v or v	> 1.5 v /2	No	
3 av34	12		
If yes, v	= 1606	(Equation 13-15, 13-16, 13-18, or 13-19)	
12A			

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v	1772	4600	No
R12			

----- Level of Service Determination (if not F) -----

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 15.5 pc/mi/ln

R R 12 A

Level of service for ramp-freeway junction areas of influence B

----- Speed Estimation -----

Intermediate speed variable,	M = 0.290	
	S	
Space mean speed in ramp influence area,	S = 51.2	mph
	R	
Space mean speed in outer lanes,	S = N/A	mph
	0	
Space mean speed for all vehicles,	S = 51.2	mph

Phone: Fax:
 E-mail:

-----Diverge Analysis-----

Analyst: KV
 Agency/Co.: HDR
 Date performed: 8/11/2017
 Analysis time period: AM
 Freeway/Dir of Travel: I-215 SB
 Junction: University Pkwy Off Ramp
 Jurisdiction: Caltrans
 Analysis Year: 2020
 Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	3290	vph	

-----Off Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	45.0	mph	
Volume on ramp	215	vph	
Length of first accel/decel lane	140	ft	
Length of second accel/decel lane		ft	

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	No		
Volume on adjacent ramp		vph	
Position of adjacent ramp			
Type of adjacent ramp			
Distance to adjacent ramp		ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3290	215		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	866	57		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00	%	0.00	%
Length	0.00	mi	0.00	mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3775	233	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)

EQ

P = 1.000 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P = 3775$ pc/h
 12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	3775	4500	No
$v_{FO} = v_F - v_R$	3542	4500	No
v_R	233	2100	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700$ pc/h?		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3775$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
v_{12}	3775	4400	No

----- Level of Service Determination (if not F) -----

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 35.5$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence E

----- Speed Estimation -----

Intermediate speed variable,	D = 0.319	
Space mean speed in ramp influence area,	S _R = 50.9	mph
Space mean speed in outer lanes,	S ₀ = N/A	mph
Space mean speed for all vehicles,	S = 50.9	mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: KV
Agency/Co.: HDR
Date performed: 8/11/2017
Analysis time period: PM
Freeway/Dir of Travel: I-215 SB
Junction: University Pkwy Off Ramp
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Parkway

----- Freeway Data -----

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	3550	vph	

----- Off Ramp Data -----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	45.0	mph	
Volume on ramp	675	vph	
Length of first accel/decel lane	140	ft	
Length of second accel/decel lane		ft	

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	No		
Volume on adjacent ramp		vph	
Position of adjacent ramp			
Type of adjacent ramp			
Distance to adjacent ramp		ft	

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3550	675		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	934	178		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4073	732	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)
 EQ
 P = 1.000 Using Equation 0
 FD
 $v_{12} = v_R + (v_F - v_R) P = 4073$ pc/h
 FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	4073	4500	No
$v_{FO} = v_F - v_R$	3341	4500	No
v_R	732	2100	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700$ pc/h?		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4073$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
v_{12}	4073	4400	No

----- Level of Service Determination (if not F) -----

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 38.0$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence E

----- Speed Estimation -----

Intermediate speed variable,	D = 0.364	
Space mean speed in ramp influence area,	S = 50.3	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 50.3	mph

Phone: Fax:
E-mail:

----- Diverge Analysis -----

Analyst: KV
Agency/Co.: HDR
Date performed: 8/11/2017
Analysis time period: AM
Freeway/Dir of Travel: I-215 SB
Junction: University Pkwy Off Ramp
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Parkway

----- Freeway Data -----

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	4640	vph	

----- Off Ramp Data -----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	45.0	mph	
Volume on ramp	500	vph	
Length of first accel/decel lane	140	ft	
Length of second accel/decel lane		ft	

----- Adjacent Ramp Data (if one exists) -----

Does adjacent ramp exist?	No		
Volume on adjacent ramp		vph	
Position of adjacent ramp			
Type of adjacent ramp			
Distance to adjacent ramp		ft	

----- Conversion to pc/h Under Base Conditions -----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4640	500		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	1221	132		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5324	542	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)
 EQ
 P = 1.000 Using Equation 0
 FD
 $v_{12} = v_R + (v_F - v_R) P = 5324$ pc/h
 FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	5324	4500	Yes
$v_{FO} = v_F - v_R$	4782	4500	Yes
v_R	542	2100	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or $v_{av34} > 2700$ pc/h?		No	
Is v_3 or $v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5324$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
v_{12}	5324	4400	Yes

----- Level of Service Determination (if not F) -----

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D = 48.8$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.347	
Space mean speed in ramp influence area,	S = 50.5	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 50.5	mph

Phone: Fax:
E-mail:

-----Merge Analysis-----

Analyst: KV
Agency/Co.: HDR
Date performed: 8/11/2017
Analysis time period: PM
Freeway/Dir of Travel: NB 215
Junction: University Pkwy On Ramp
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Merge		
Number of lanes in freeway	3		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	4175	vph	

-----On Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	545	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?	No		
Volume on adjacent Ramp		vph	
Position of adjacent Ramp			
Type of adjacent Ramp			
Distance to adjacent Ramp		ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4175	545		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	1099	143		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4790	591	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)

EQ

P = 0.594 Using Equation 3

FM

v = v (P) = 2847 pc/h

12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	5381	6750	No
FO			
v or v	1943 pc/h	(Equation 13-14 or 13-17)	
3 av34			
Is v or v	> 2700 pc/h?	No	
3 av34			
Is v or v	> 1.5 v /2	Yes	
3 av34	12		
If yes, v	= 2847	(Equation 13-15, 13-16, 13-18, or 13-19)	
12A			

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v	3438	4600	No
12A			

----- Level of Service Determination (if not F) -----

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 28.3 pc/mi/ln

R R 12 A

Level of service for ramp-freeway junction areas of influence D

----- Speed Estimation -----

Intermediate speed variable,	M = 0.388	
	S	
Space mean speed in ramp influence area,	S = 50.0	mph
	R	
Space mean speed in outer lanes,	S = 49.8	mph
	0	
Space mean speed for all vehicles,	S = 49.9	mph

Phone: Fax:
 E-mail:

-----Merge Analysis-----

Analyst: KV
 Agency/Co.: HDR
 Date performed: 8/11/2017
 Analysis time period: AM
 Freeway/Dir of Travel: NB 215
 Junction: University Pkwy On Ramp
 Jurisdiction: Caltrans
 Analysis Year: 2040
 Description: I-215 University Parkway

-----Freeway Data-----

Type of analysis	Merge		
Number of lanes in freeway	4		
Free-flow speed on freeway	55.0	mph	
Volume on freeway	1895	vph	

-----On Ramp Data-----

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	45.0	mph	
Volume on ramp	245	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?	No		
Volume on adjacent Ramp		vph	
Position of adjacent Ramp			
Type of adjacent Ramp			
Distance to adjacent Ramp		ft	

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1895	245		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	499	64		v
Trucks and buses	9	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	2.0*	2.0*		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.917	0.971	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2174	266	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)

EQ

P = 0.333 Using Equation 0

FM

v = v (P) = 724 pc/h

12 F FM

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v	2440	9000	No
FO			
v or v	725 pc/h	(Equation 13-14 or 13-17)	
3 av34			
Is v or v	> 2700 pc/h?	No	
3 av34			
Is v or v	> 1.5 v /2	Yes	
3 av34	12		
If yes, v	= 869	(Equation 13-15, 13-16, 13-18, or 13-19)	
12A			

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v	1135	4600	No
12A			

----- Level of Service Determination (if not F) -----

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 10.4 pc/mi/ln

R R 12 A B

Level of service for ramp-freeway junction areas of influence B

----- Speed Estimation -----

Intermediate speed variable,	M = 0.279	
	S	
Space mean speed in ramp influence area,	S = 51.4	mph
	R	
Space mean speed in outer lanes,	S = 54.5	mph
	0	
Space mean speed for all vehicles,	S = 53.0	mph

Project Name
Freeway Ramp Major Diverge Worksheet

I-215 NB - Peak Hour LOS Analysis		FFS: 55		3 PHF: 0.95		PCE: 1.5		Major Diverge						
Location Description	Type	ML	Rmp	Flow	Truck %	Length	LOS	Den^T	Speed^T	v_{FD}/C_{FD}	v_R/C_R	v/C	D	LOS
NB University Parkway Off-Ramp (2017 AM)	Major Off3	4	2	2,015	9%	--	B	16.0	N/A	0.16	0.49	0.41	16.0	B
--	Basic	4	--	3,325	9%	--				--	--	--	--	--
NB University Parkway Off-Ramp (2017 PM)	Major Off3	4	2	2,100	9%	--	C	23.4	N/A	0.34	0.51	0.59	23.4	C
--	Basic	4	--	4,865	9%	--				--	--	--	--	--
NB University Parkway Off-Ramp (2020 AM)	Major Off3	4	2	2,120	9%	--	B	16.9	N/A	0.17	0.52	0.43	16.9	B
--	Basic	4	--	3,520	9%	--				--	--	--	--	--
NB University Parkway Off-Ramp (2020 PM)	Major Off3	4	2	2,170	9%	--	C	24.7	N/A	0.36	0.53	0.63	24.7	C
--	Basic	4	--	5,130	9%	--				--	--	--	--	--
NB University Parkway Off-Ramp (2040 AM)	Major Off3	4	2	2,945	9%	--	C	23.3	N/A	0.23	0.72	0.59	23.3	C
--	Basic	4	--	4,840	9%	--				--	--	--	--	--
NB University Parkway Off-Ramp (2040 PM)	Major Off3	4	2	2,785	2%	--	D	32.4	N/A	0.49	0.66	0.82	32.4	D
--	Basic	4	--	6,960	2%	--				--	--	--	--	--

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: I-215 NB
From/To: Btw University On & Off Ramps
Jurisdiction: SBCTA
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	1310	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	345	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	752	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	67.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	67.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	752	pc/h/ln
Free-flow speed, FFS	67.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	11.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: _____ Fax: _____
 E-mail: _____

----- Operational Analysis -----

Analyst: KV
 Agency or Company: HDR Inc.
 Date Performed: 8/11/2017
 Analysis Time Period: AM
 Freeway/Direction: NB I-215
 From/To: n/o of University Pkwy
 Jurisdiction: Caltrans
 Analysis Year: Existing (2017)
 Description: I-215 University Pkwy

----- Flow Inputs and Adjustments -----

Volume, V	1435	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	378	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	823	pc/h/ln

----- Speed Inputs and Adjustments -----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	67.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	67.0	mi/h

----- LOS and Performance Measures -----

Flow rate, vp	823	pc/h/ln
Free-flow speed, FFS	67.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	2	
Density, D	12.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

----- Operational Analysis -----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: NB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

----- Flow Inputs and Adjustments -----

Volume, V	3325	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	875	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	954	pc/h/ln

----- Speed Inputs and Adjustments -----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	62.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	62.0	mi/h

----- LOS and Performance Measures -----

Flow rate, vp	954	pc/h/ln
Free-flow speed, FFS	62.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	15.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
 E-mail:

-----Operational Analysis-----

Analyst: KV
 Agency or Company: HDR Inc.
 Date Performed: 8/11/2017
 Analysis Time Period: AM
 Freeway/Direction: SB I-215
 From/To: s/o University Pkwy
 Jurisdiction: Caltrans
 Analysis Year: Existing (2017)
 Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4770	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1255	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1824	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1824	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	62.5	mi/h
Number of lanes, N	3	
Density, D	29.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3180	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	837	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1824	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	67.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	67.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1824	pc/h/ln
Free-flow speed, FFS	67.0	mi/h
Average passenger-car speed, S	62.5	mi/h
Number of lanes, N	2	
Density, D	29.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: Btwn University On & Off
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3015	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	793	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1730	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1730	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	63.5	mi/h
Number of lanes, N	2	
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.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: NB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4865	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1280	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1395	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	61.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	61.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1395	pc/h/ln
Free-flow speed, FFS	61.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	4	
Density, D	23.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

----- Operational Analysis -----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: NB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

----- Flow Inputs and Adjustments -----

Volume, V	2945	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	775	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1690	pc/h/ln

----- Speed Inputs and Adjustments -----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	58.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	58.0	mi/h

----- LOS and Performance Measures -----

Flow rate, vp	1690	pc/h/ln
Free-flow speed, FFS	58.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	2	
Density, D	28.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: I-215 NB
From/To: Btw University On & Off Ramps
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	2765	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	728	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1586	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	61.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	61.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1586	pc/h/ln
Free-flow speed, FFS	61.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	26.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3605	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	949	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1379	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	65.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	65.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1379	pc/h/ln
Free-flow speed, FFS	65.0	mi/h
Average passenger-car speed, S	65.0	mi/h
Number of lanes, N	3	
Density, D	21.2	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	1955	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	514	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1122	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	69.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	69.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1122	pc/h/ln
Free-flow speed, FFS	69.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	16.0	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: Btwn University On & Off
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	1810	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	476	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1038	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	69.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	69.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1038	pc/h/ln
Free-flow speed, FFS	69.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	2	
Density, D	14.8	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: NB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	5130	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1350	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1472	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1472	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	4	
Density, D	26.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: NB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3520	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	926	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1010	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1010	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	4	
Density, D	18.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: NB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3195	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	841	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1833	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1833	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	2	
Density, D	33.3	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: NB I-215
From/To: n/o of University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	1550	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	408	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	889	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	889	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	2	
Density, D	16.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: I-215 NB
From/To: Btw University On & Off Ramps
Jurisdiction: Caltrans
Analysis Year: Existing (2017)
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	2960	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	779	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1698	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1698	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	2	
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.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: I-215 NB
From/To: Btw University On & Off Ramps
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	1400	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	368	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	803	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	803	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	2	
Density, D	14.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: Btw University On & Off
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3075	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	809	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1764	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1764	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	2	
Density, D	32.1	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3810	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1003	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1457	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1457	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	26.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4950	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1303	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1893	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1893	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.8	mi/h
Number of lanes, N	3	
Density, D	34.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	2140	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	563	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1228	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1228	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	2	
Density, D	22.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3290	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	866	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1887	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1887	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.8	mi/h
Number of lanes, N	2	
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.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: Btw University On & Off
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	1925	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	507	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1104	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1104	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	2	
Density, D	20.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2020
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4950	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1303	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.952	
Driver population factor, fp	1.00	
Flow rate, vp	1824	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1824	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	33.2	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

----- Operational Analysis -----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

----- Flow Inputs and Adjustments -----

Volume, V	5170	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1361	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1977	pc/h/ln

----- Speed Inputs and Adjustments -----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

----- LOS and Performance Measures -----

Flow rate, vp	1977	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.2	mi/h
Number of lanes, N	3	
Density, D	36.5	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	6200	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1632	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	2371	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	2371	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	47.0	mi/h
Number of lanes, N	3	
Density, D	50.5	pc/mi/ln
Level of service, LOS	F	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	3550	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	934	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1358	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1358	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	24.7	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4640	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1221	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1775	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1775	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	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.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: SB I-215
From/To: Btw University On & Off
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	2875	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	757	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1100	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1100	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	20.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: SB I-215
From/To: Btw University On & Off
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4140	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1089	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1583	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1583	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	28.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

----- Operational Analysis -----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: NB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

----- Flow Inputs and Adjustments -----

Volume, V	6960	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1832	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1996	pc/h/ln

----- Speed Inputs and Adjustments -----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

----- LOS and Performance Measures -----

Flow rate, vp	1996	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.1	mi/h
Number of lanes, N	4	
Density, D	36.9	pc/mi/ln
Level of service, LOS	E	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: NB I-215
From/To: s/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4840	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1274	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1388	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1388	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	4	
Density, D	25.2	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

----- Operational Analysis -----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: NB I-215
From/To: n/o University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

----- Flow Inputs and Adjustments -----

Volume, V	4720	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1242	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1805	pc/h/ln

----- Speed Inputs and Adjustments -----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

----- LOS and Performance Measures -----

Flow rate, vp	1805	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	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.

Phone: Fax:
E-mail:

----- Operational Analysis -----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: NB I-215
From/To: N of University Pkwy
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

----- Flow Inputs and Adjustments -----

Volume, V	2140	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	563	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	818	pc/h/ln

----- Speed Inputs and Adjustments -----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

----- LOS and Performance Measures -----

Flow rate, vp	818	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	14.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: PM
Freeway/Direction: I-215 NB
From/To: Btw University On & Off Ramps
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	4175	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1099	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1597	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	1597	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	29.0	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

-----Operational Analysis-----

Analyst: KV
Agency or Company: HDR Inc.
Date Performed: 8/11/2017
Analysis Time Period: AM
Freeway/Direction: I-215 NB
From/To: Btw University On & Off Ramps
Jurisdiction: Caltrans
Analysis Year: 2040
Description: I-215 University Pkwy

-----Flow Inputs and Adjustments-----

Volume, V	1895	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	499	v
Trucks and buses	9	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.0*	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	725	pc/h/ln

-----Speed Inputs and Adjustments-----

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h

-----LOS and Performance Measures-----

Flow rate, vp	725	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	3	
Density, D	13.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Appendix F. Draft Geometric Approval Drawings

PREPARED BY: MARK HAGER, P.E. PROJECT MANAGER, HDR ENGINEERING, INC. DATE:
SUBMITTED BY: PAULA BEAUCHAMP SBCA DIRECTOR OF PROJECT DELIVERY DATE:
CONCURRED BY: NAISSAM YAHYA TRAFFIC OPERATIONS, REGION B DATE:
APPROVED BY: JASON COLLADO BRANCH CHIEF (ACTING) CALTRANS DESIGN OVERSIGHT DATE:
REVIEWED BY: SERGIO E. AVILA CALTRANS DISTRICT DESIGN LIAISON DATE:

Table with 4 columns: NO., R, Δ, T, L. Contains center/station line curve data for various stationing points.

Table with 4 columns: NO., R, Δ, T, L. Contains DDI lane line curve data for various stationing points.

MARK S. HAGER REGISTERED CIVIL ENGINEER. Includes professional seal and project information: EA 08-0E420.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to boldface standard for intersection spacing.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to boldface standard for roadway shoulder width.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to underlined standard for 50+ access control.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to underlined standard for single lane ramps.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to boldface standard for intersection spacing.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to underlined standard for pedestrian facilities.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to underlined standard for side slopes.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to boldface standard for intersection spacing.

Table with 3 columns: STANDARD, EXISTING, PROPOSED. Exception to underlined standard for side slopes.

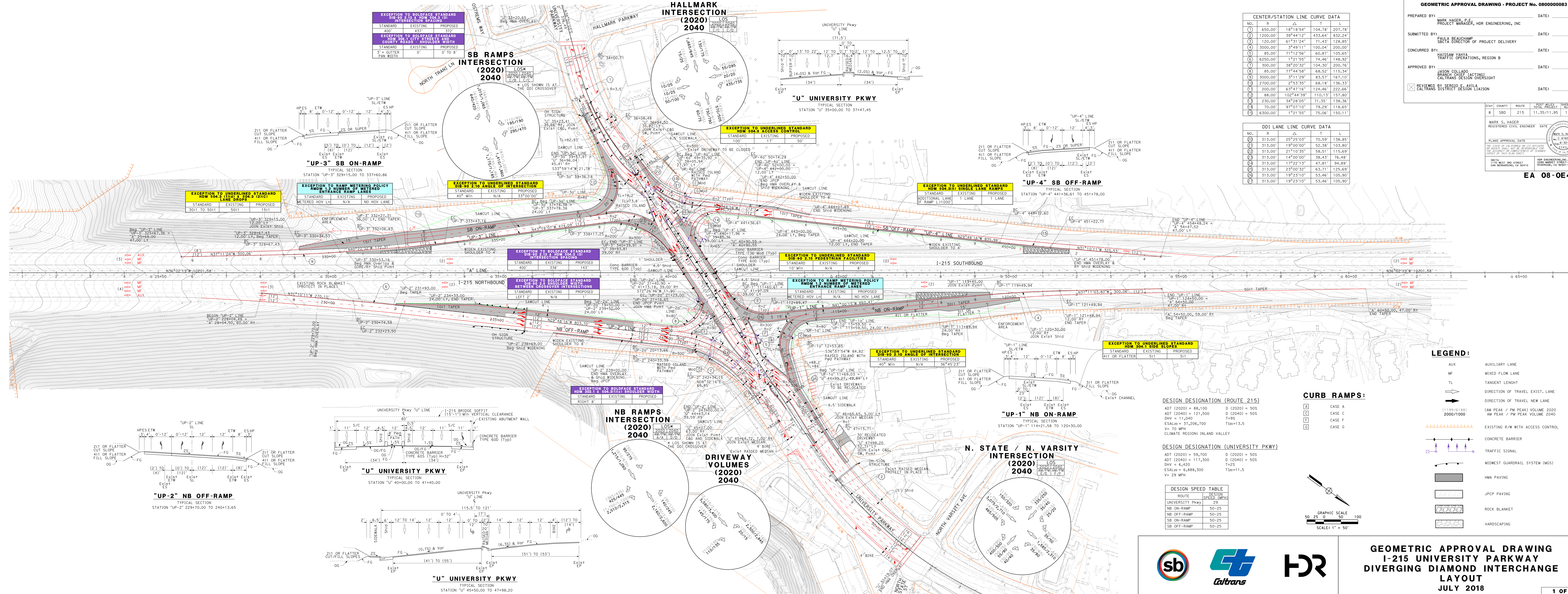
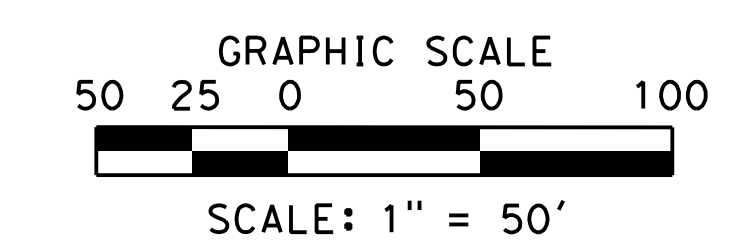
DESIGN DESIGNATION (ROUTE 215)
ADT (2020) = 88,100 D (2020) = 50%
ADT (2040) = 121,500 D (2040) = 50%
DIVV = 11,040 T=9%
ESAL20 = 37,206,700 T100=13.5
V = 70 MPH
CLIMATE REGION: INLAND VALLEY

DESIGN DESIGNATION (UNIVERSITY PKWY)
ADT (2020) = 59,700 D (2020) = 50%
ADT (2040) = 117,300 D (2040) = 50%
DIVV = 6,420 T=9%
ESAL20 = 6,988,300 T100=11.5
V = 29 MPH

DESIGN SPEED TABLE
ROUTE DESIGN SPEED (MPH)
UNIVERSITY PKWY 29
NB ON-RAMP 50-25
NB OFF-RAMP 50-25
SB ON-RAMP 50-25
SB OFF-RAMP 50-25

CURB RAMPS:
A CASE A
C CASE C
F CASE F
G CASE G

LEGEND:
AUXILIARY LANE
MIXED FLOW LANE
TANGENT LENGTH
DIRECTION OF TRAVEL EXIST. LANE
DIRECTION OF TRAVEL NEW LANE
EXISTING R/W WITH ACCESS CONTROL
CONCRETE BARRIER
TRAFFIC SIGNAL
MIDWEST GUARDRAIL SYSTEM (MGS)
HMA PAVING
JPCP PAVING
ROCK BLANKET
HARDSCAPING

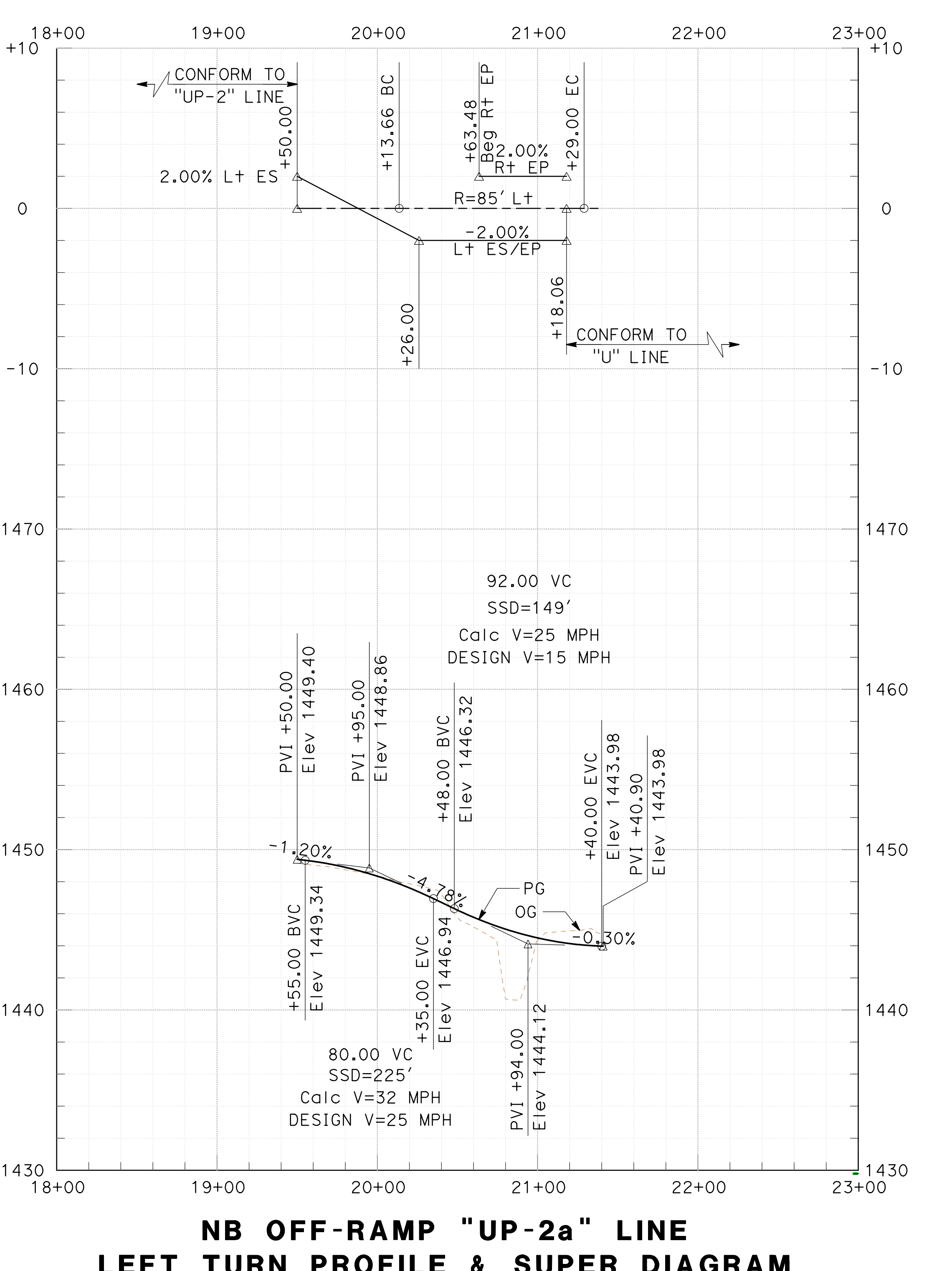
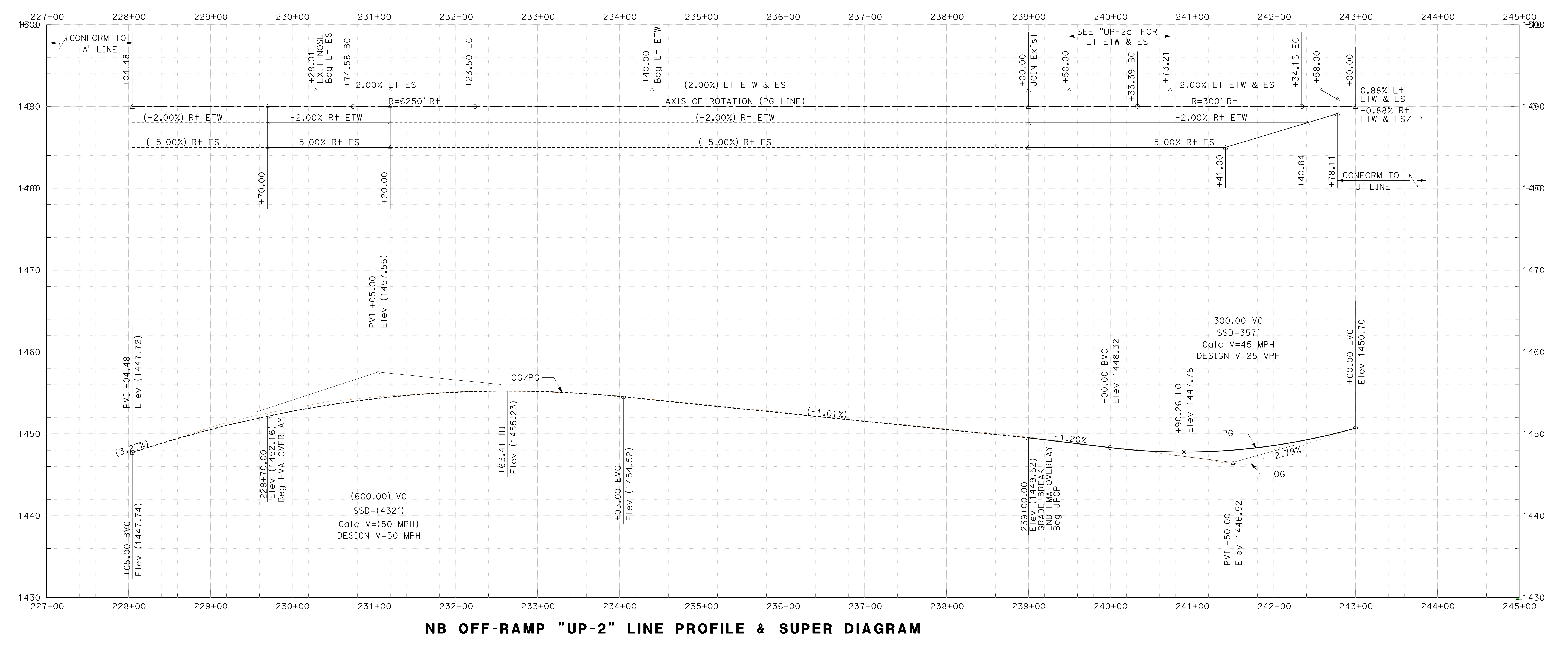
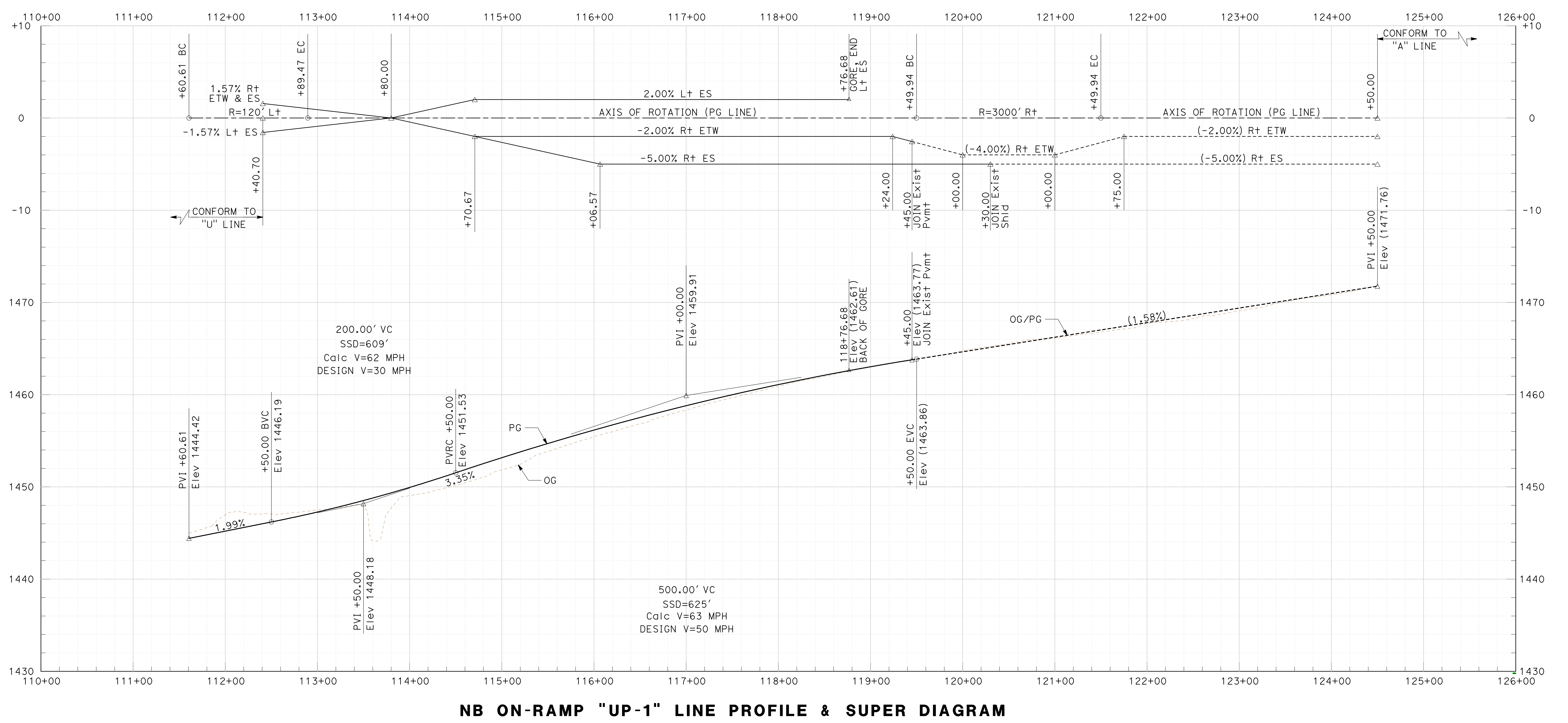
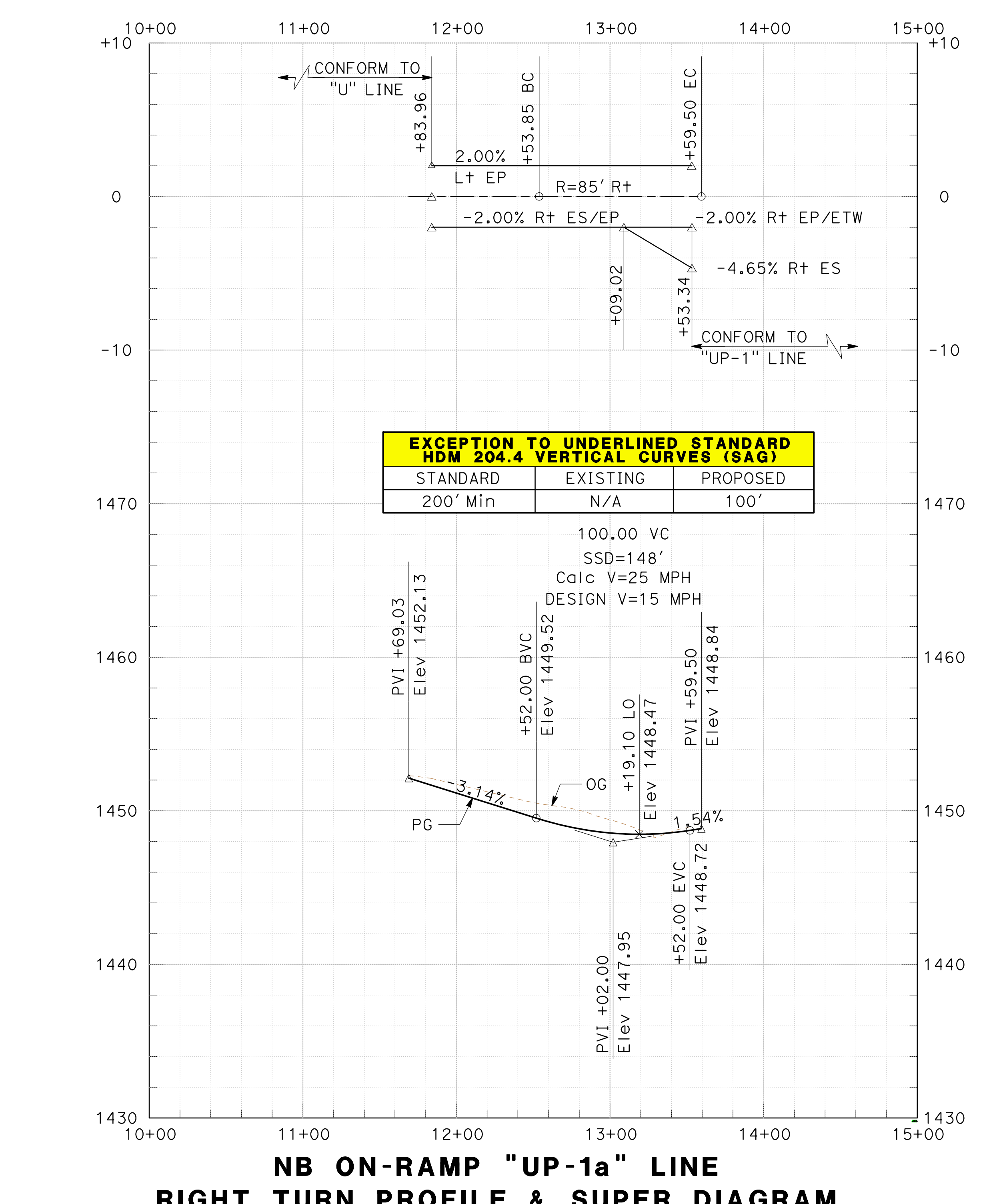
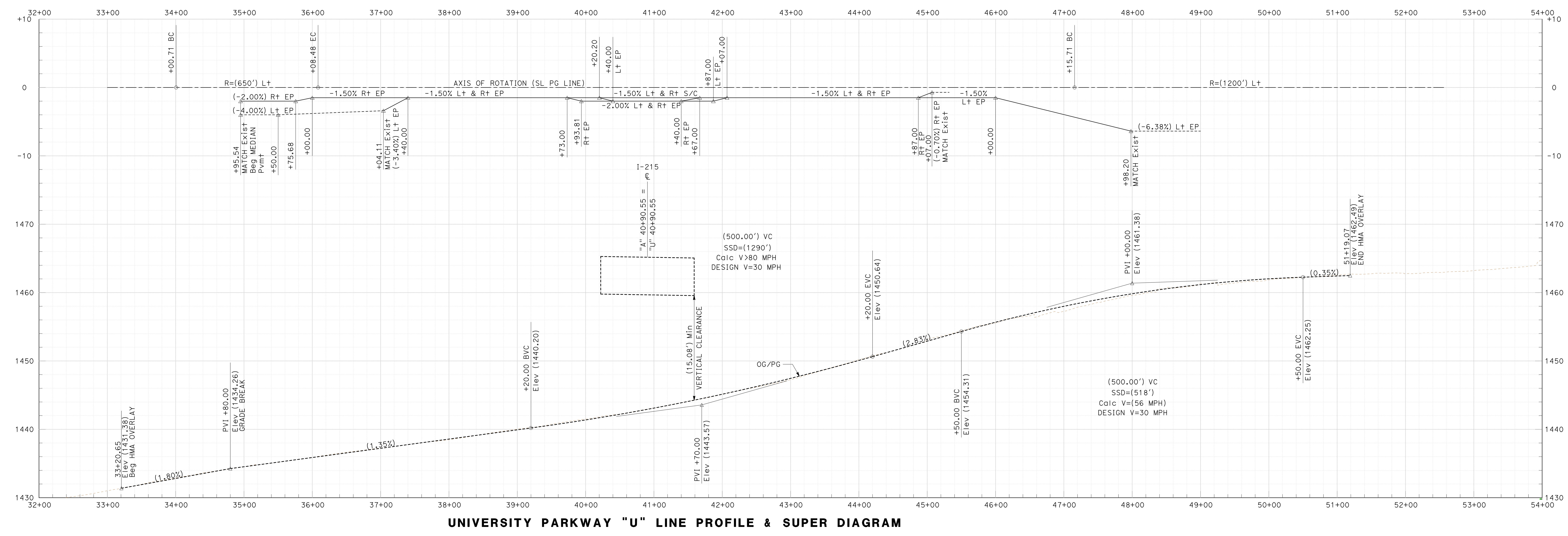


PREPARED BY: MARK HAGER, P.E. DATE: _____
 PROJECT MANAGER, HDR ENGINEERING, INC
 SUBMITTED BY: PAULA BEAUCHAMP DATE: _____
 SBCTA DIRECTOR OF PROJECT DELIVERY
 CONCURRED BY: HAISSAM YAHYA DATE: _____
 TRAFFIC OPERATIONS, REGION B
 APPROVED BY: JASON COLLADO DATE: _____
 BRANCH CHIEF (ACTING)
 CALTRANS DESIGN OVERSIGHT
 REVIEWED BY: SERGIO E. AVILA DATE: _____
 CALTRANS DISTRICT DESIGN LIAISON

DIST	COUNTY	ROUTE	POST MILES	SHEET TOTAL
8	SBD	215	11.35/11.95	2 3

MARK S. HAGER
 REGISTERED CIVIL ENGINEER DATE: _____
 STATE OF CALIFORNIA REG. NO. 67659
 CIVIL
 PLANS APPROVAL DATE: _____
 THE STATE OF CALIFORNIA AND ITS OFFICERS
 DO NOT WARRANT, GUARANTEE, OR
 ACCEPT ANY LIABILITY FOR THE DESIGN OR
 CONSTRUCTION OF THIS PROJECT.
 DISTRICT OFFICE: 1700 WEST 3RD STREET
 SAN BERNARDINO, CA 92410
 HDR ENGINEERING, INC
 2800 MARKET STREET, SUITE 100
 RIVERSIDE, CA 92501-2110

EA 08-OE420



EXCEPTION TO UNDERLINED STANDARD
NM 204 VERTICAL CURVES (334)

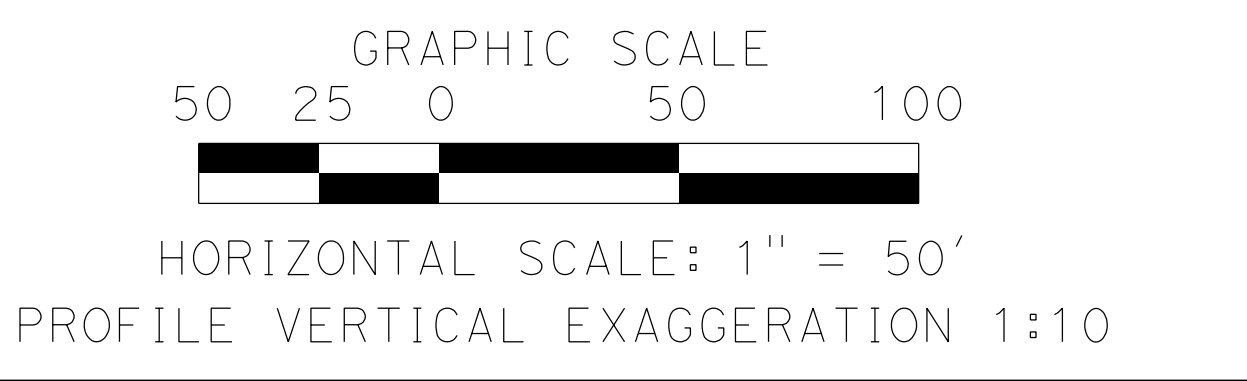
STANDARD	EXISTING	PROPOSED
200' Min	N/A	100'

EXCEPTION TO UNDERLINED STANDARD
NM 104.2 (1) DESCENDING OFF-RAMP VERTICAL BAG CURVES

STANDARD	EXISTING	PROPOSED
100'	N/A	92'

LEGEND:

- SE SUPERELEVATION
- Coic CALCULATED

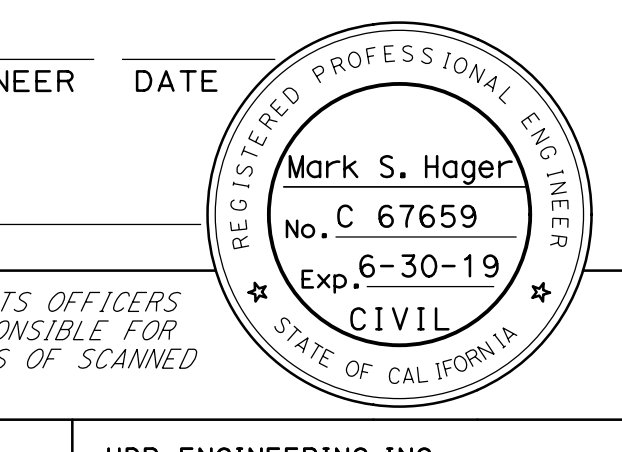


GEOMETRIC APPROVAL DRAWING
I-215 UNIVERSITY PARKWAY
DIVERGING DIAMOND INTERCHANGE
PROFILES & SUPER ELEVATION DIAGRAMS
 JULY 2018

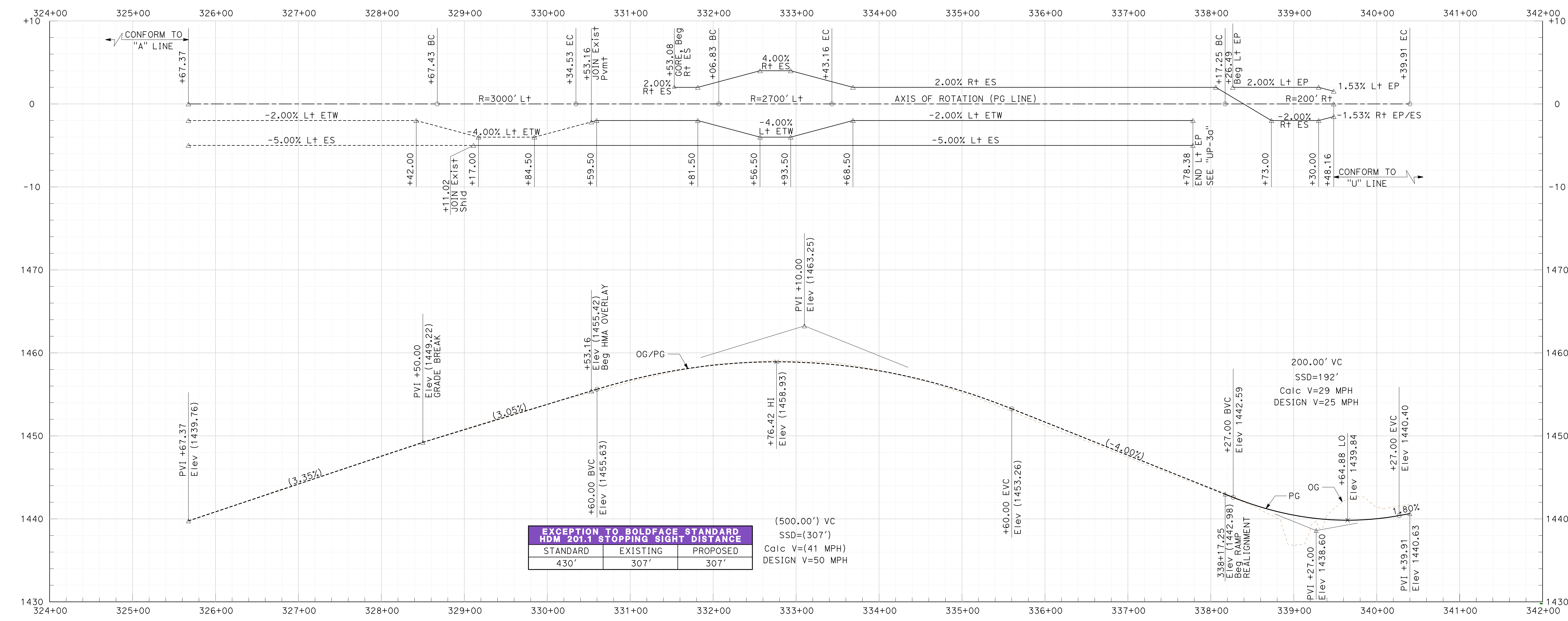
DIST	COUNTY	ROUTE	POST MILES	SHEET TOTAL
8	SBD	215	11.35/11.95	3 3

STANDARD	EXISTING	PROPOSED
200' Min	N/A	80'

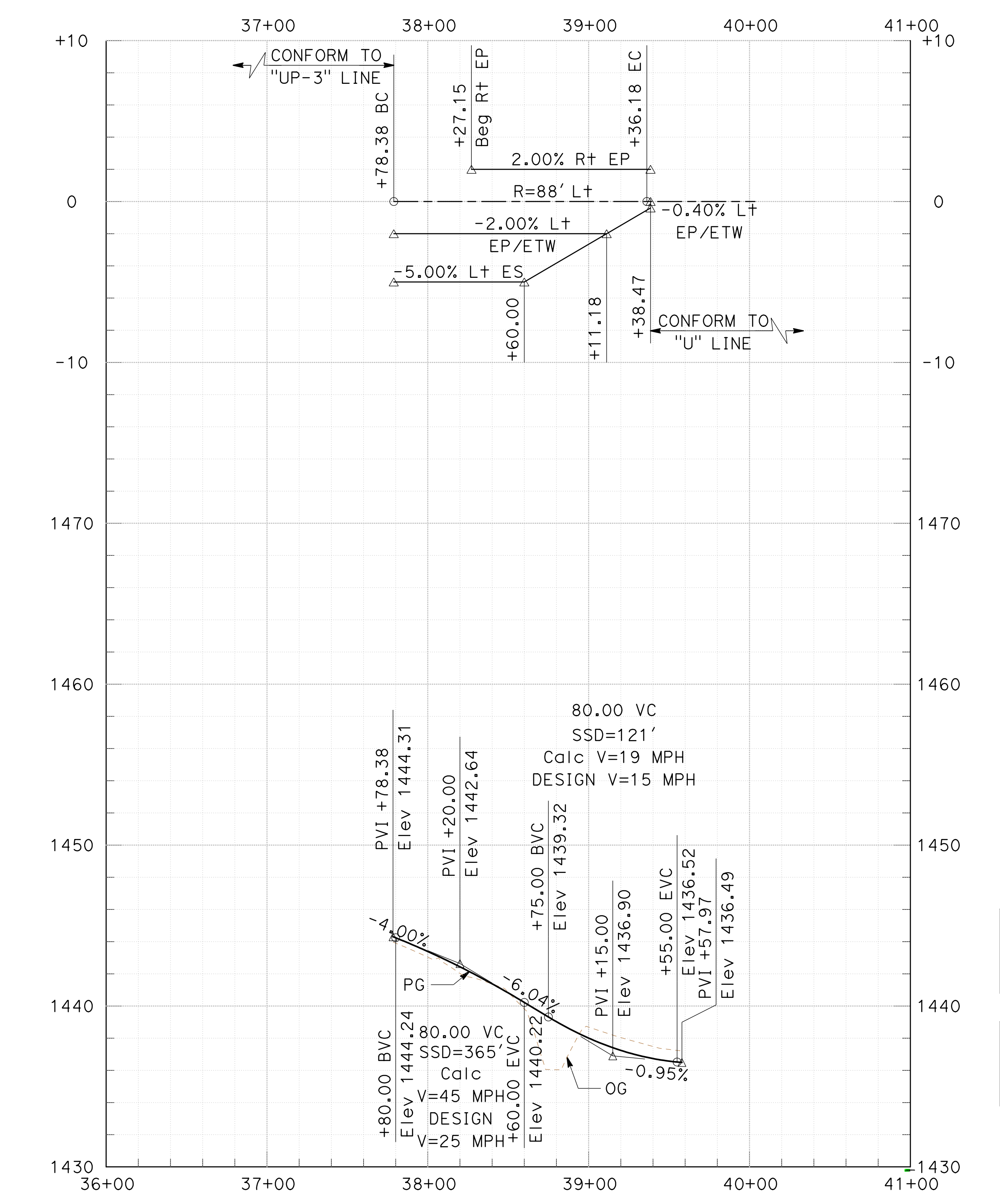
STANDARD	EXISTING	PROPOSED
200' Min	N/A	80'



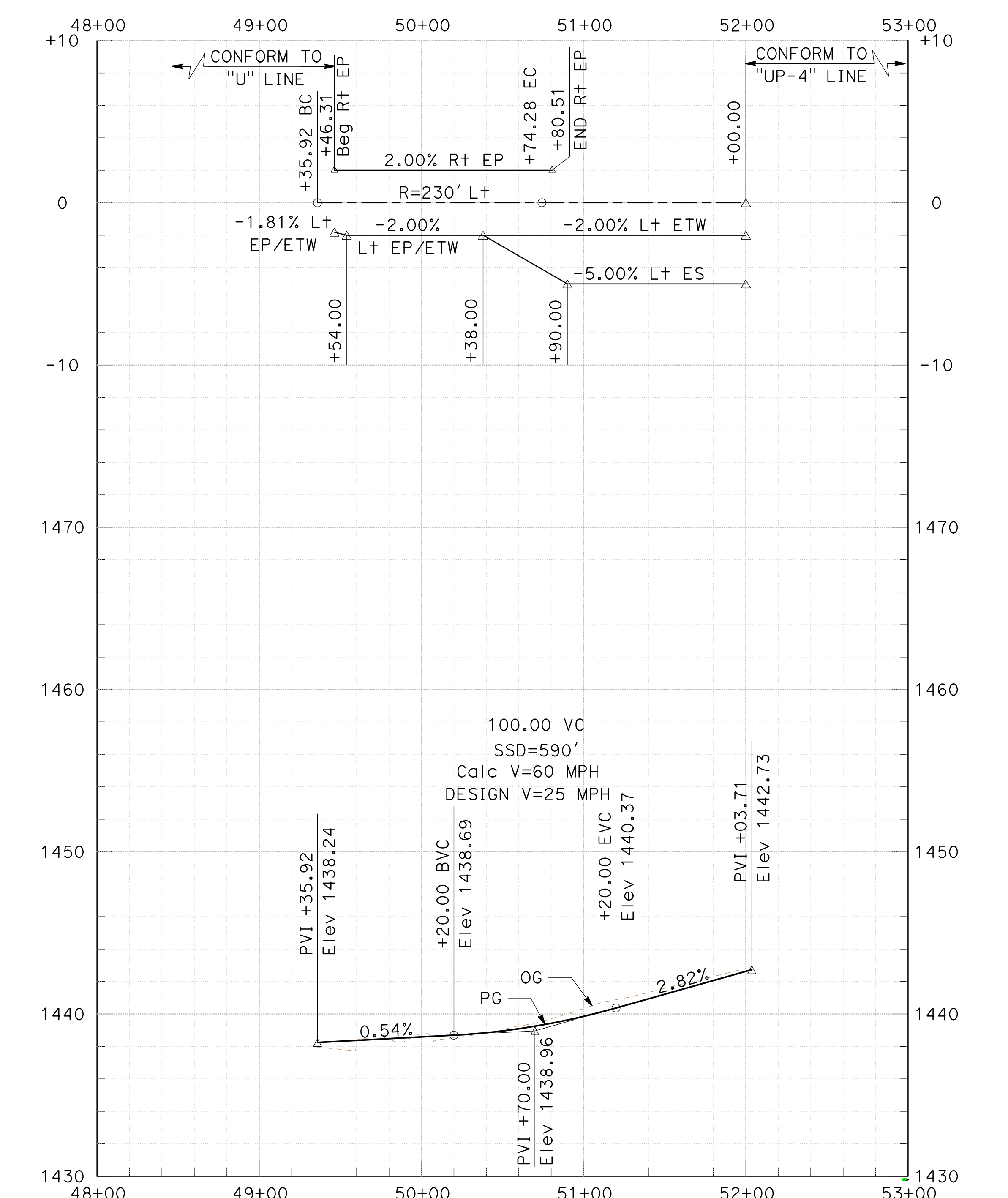
EA 08-OE420



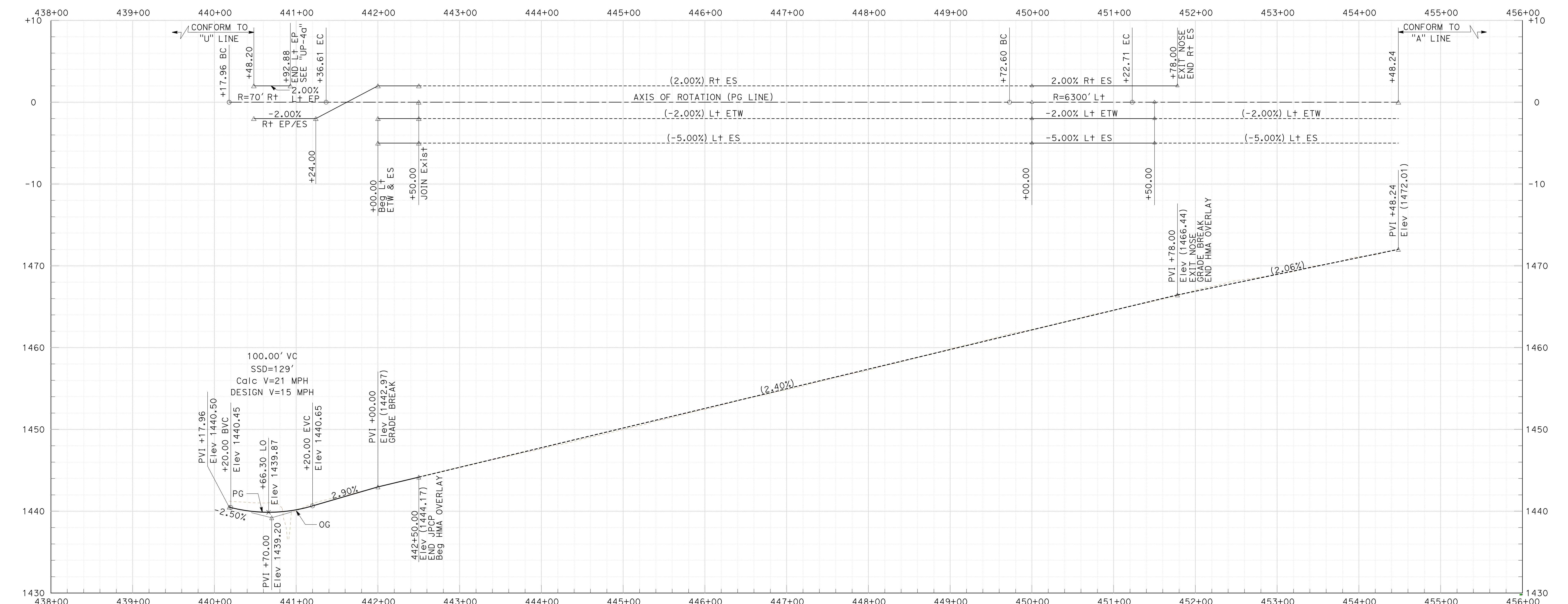
SB ON-RAMP "UP-3" LINE PROFILE & SUPER DIAGRAM



SB ON-RAMP "UP-3a" LINE RIGHT TURN PROFILE & SUPER DIAGRAM



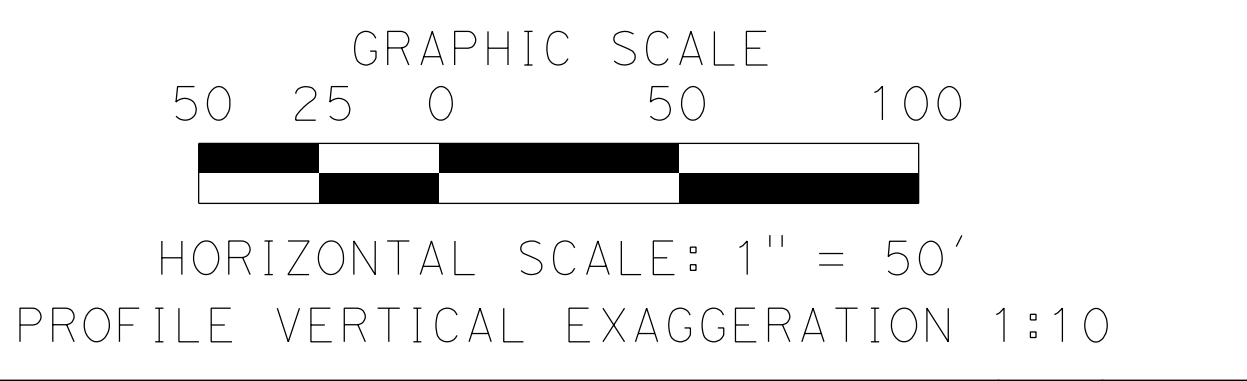
SB OFF-RAMP "UP-4a" LINE RIGHT TURN PROFILE & SUPER DIAGRAM



SB OFF-RAMP "UP-4" LINE PROFILE & SUPER DIAGRAM

LEGEND:

- SE SUPERELEVATION
- Calc CALCULATED





Appendix G. Response to Comments

District 8 Quality Review Comments - Summary

Dist-Co-Rte-PM: 08-SBd-215-PM 11.35/11.95
 Project ID# (EA): 0800000083 (0E420) I-215/University Parkway Interchange Improvement
 Document: Traffic Operations Analysis Report (TOAR)
 Date: July 20, 2018

No.	Plan/SSP/ Page No.	Comments	Status/Changes
1	General	Please submit 4 (four) copies of the revised Traffic Operations Analysis Report (TOAR) for review. The resubmittal shall include resolutions and responses to all of the following comments.	Four (4) copies of the revised TOAR will be submitted for review.
2	General	Include comment responses in an Excel format.	Please refer to Appendix G for the response to comments.
3	General	Additional comments may follow as supplemental. Operations may provide comments on the late submittal of synchro analysis.	Will address additional comments if needed.
4	General	Please spell out the acronyms when first time it appears.	All acronyms were spelled out in the report.
5	General	Accident Data: Total number of accident column in Tables 2-4, 2-5, and 2-8 should not be listed	Total number of accident column were removed from Tables 2-4, 2-5, and 2-8.
6	General	Methodology: The HCM 2000, HCM 6th output files for signal intersections are not consistent with the methodology under Section 4.1.4 Intersection Level of Service Standards and Thresholds.	Signalized interchange analysis methodology in Section 4.1.4 were revised to use the HCM 2000 output/Synchro calculation, instead of HCM 2010 output files, due to software limitation.
7	General	Please discuss the DDI for the year of failure with intersection #2 and 3 including I-215 northbound off ramp.	We have complied with comment. A memo indicates the year of failure for the DDI option.
8	General	Please include I-215 Southbound Off Ramp and University Parkway (node #31 in Synchro) in your build intersection LOS results.	Intersection #31 LOS results were added in all build scenario intersection result summary tables E-1, 4-14, 4-22, and 5-1. Figure 1-2, Figure 3-2, and Figure 3-4 were also revised to include intersection #31.
9	Executive Summary	The information at the bottom two paragraphs do not match.	The fifth paragraph in Executive Summary section were revised to reflect the correct LOS information.
10	Table E-1	Page 3 there are 8 intersections study per Table E-1, please including the intersection number 8 and also label intersection number 8 on Figure 1-2	Intersection #8 LOS results were added in all build scenario intersection result summary tables E-1, 4-14, 4-22, and 5-1. Figure 1-2, Figure 3-2, and Figure 3-4 were also revised to include intersection #8.
11	Table E-1	Previous comment No. 38 still did not address some of the locations still have LOS F, please revisit.	At our meeting on April 19, 2018 it was determined that this comment did not apply.
12	Page 61	Page 61: I-215 Southbound Ramps and University Parkway AM build level of service is LOS 'C' and not LOS 'B' as shown. This is a global comment.	Tables E-1, 4-22, and 5-1 were revised with correct LOS at intersection #3.
13	Page 61	Page 61: Volume over capacity (i.e. $V/C \geq 1$) governs when calculating level of service. I-215 Northbound Ramp and University Parkway PM intersection build scenario has a V/C ratio of 1.01, therefore its corresponding LOS is 'F'. This is a global comment. Please add I-215 Northbound Ramp and University Parkway (PM Peak Hour) to the horizon failure list found on page 71. Please calculate the design failure year of this intersection, as it will be different from the calculated "thirteen year after opening year 2020" design failure year found on page 71.	At our meeting on April 19, 2018 it was determined that we should disregard the first comment. We have also added I-215 NB at University to the list of intersections that failed and provided failure year analysis.
14	Page 71	Page 71: Please document the design failure year of all build scenarios found on page 71, 73, and 75 separately as there corresponding failures will be in different years.	The design year failure analysis were conducted and documented.
15	Page 74	Ramp Metering Analysis: Please identify for the Opening and Horizon year AM and PM per Table 5-5	In Section 5 subsection of Ramp Metering Analysis, the ramps forecasted not to provided adequate storages under Opening and Horizon years were identified per specific time periods of AM/PM peak hours.

District 8 Quality Review Comments - Summary

Dist-Co-Rte-PM: 08-SBd-215-PM 11.35/11.95
 Project ID# (EA): 0800000083 (0E420) I-215/University Parkway Interchange Improvement
 Document: Traffic Operations Analysis Report (TOAR)
 Date: July 20, 2018

No.	Plan/SSP/ Page No.	Comments	Status/Changes
16	Page 74 and	Page 74-Second paragraph from bottom and Page 75-first paragraph under bullets: Please check the appropriateness of the sentence "...there are no feasible improvements recommended".	The texts in the paragraph were revised.
17	Pages 09 and 16	Page 9 and page 16, Delete the "30 percent" Accident analysis should only indicate higher and lower than the statewide average. Also please delete the "30 percent" on Table 2-5 as well.	Specific 30 percents higher rates for accident analysis were deleted in Section 2.3, Section 2.4, Table 2-4, and Table 2-5.
18	Table 3-1, 3-2	Show as N/A (Not Applicable) instead of "0".	Table 3-1 and Table 3-2 were revised.
19	Table 4-15	Previous comment No. 31 still did not address some of the locations still have inadequate storage. Also the intersection number 8 missing from this table. Please include it.	In a follow up to our meeting of April 19th, Caltrans indicated that we should disregard this comment.
20	Table 4-16	Table 4-16 there are some locations showing inadequate storage please revisit.	In a follow up to our meeting of April 19th, Caltrans indicated that we should disregard this comment.
21	Table 4-21	Table 4-21 there is one location with LOS F, please revisit.	In a follow up to our meeting of April 19th, Caltrans indicated that we should disregard this comment.
22	Table 4-22	Previous comment No. 34 still did not address some of the locations still have LOS F, please revisit	In a follow up to our meeting of April 19th, Caltrans indicated that we should disregard this comment.
23	Table 4-22 and 5-1	At the beginning of the report only 7 study areas are identified. These two tables showing study area# 8. Please clarify.	See response to comments #10.
24	Table 4-23	Previous comment No. 35 still did not address some of the locations still have inadequate storage. Also the intersection number 8 missing from this table. Please include it.	In a follow up to our meeting of April 19th, Caltrans indicated that we should disregard this comment.
25	Table 4-24	Previous comment No. 36 still did not address some of the locations still have inadequate storage	In a follow up to our meeting of April 19th, Caltrans indicated that we should disregard this comment.
26	Table 4-25	Previous comment No. 37 still did not address one of the location still has LOS F, please revisit	In a follow up to our meeting of April 19th, Caltrans indicated that we should disregard this comment.
27	Table 4-7, 4-11, 4-19 & Table 5-2	In Table 4-7, 4-11 and 4-19, I-215 NB Ramps & University Pkwy "NBL" and I-215 SB Ramps & University Pkwy "SBL" rows are missing while these rows are shown in Table 5-2. Please make consistent.	Under the existing and future No Build conditions, no exclusive NBL and SBL turn lanes exist at the I-215 NB and SB Ramp intersections, respectively. Therefore, no queuing results available. Table 5-2 was revised to labeled as "N/A" for those movements.
28	Table 5	Please also make sure the Table 5 in Summary and Conclusion update as well per the comments provided	We have verified and revised the table and report text accordingly.
29	Table E-3, 4-12, 4-20 and 5-3	Southbound University Pkwy Off-Ramp: For the future Year 2040 AM LOS D which is better than opening Year 2020 AM LOS E. Please confirm.	Table E-3, Table 4-10, Table 5-3, and Appendix E were revised.
30	Appendix A & C	Caltrans Truck Traffic Census (2016) data are for the I-215 mainline which has been verified in 2004. In addition, truck traffic data has not been provided for University Parkway as well as the I-215 ramps. The previous TOAR report dated December 4, 2017 provided 2007 counts that include truck by axle classification, but not ADT for University Parkway and the ramps. Please coordinate with Caltrans Environmental Engineering (Oversight) team, if they will allow this as typically and per the approved Methodology Memorandum, this data is needed and shall not be more than 3 years old.	Truck percentages have been provided by axle for appropriate locations. Truck percentages range from 2 to 3%.

District 8 Quality Review Comments - Summary

Dist-Co-Rte-PM: 08-SBd-215-PM 11.35/11.95
 Project ID# (EA): 0800000083 (0E420) I-215/University Parkway Interchange Improvement
 Document: Traffic Operations Analysis Report (TOAR)
 Date: July 20, 2018

No.	Plan/SSP/ Page No.	Comments	Status/Changes
COMMENTS FROM HAISSAM YAHYA - TRAFFIC OPERATIONS, OFFICE CHIEF			
1	Table 2-4, 2-5, and 2-8	Delete total number of accident column from Tables 2-4, 2-5, and 2-8.	Please refer to response to comment #5. All tables have been revised.
2	Table 4-22	I-215 NB off ramp AM and PM peak hour (Horizon Year 2040 Build): Based on output files, this ramp is still fail. Therefore, the LOS in Table 4-22 should provide accordingly.	The Synchro output files have been updated per revised geometrics. Table 4-22 has been revised.
3	Synchro	Crossover through movements, vehicles stop at pedestrian crossing, and the queue is spill back onto intersections.	The Synchro model has been modified based on revised geometrics and we have revised phasing and coding accordingly.

District 8 Quality Review Comments - Summary

Dist-Co-Rte-PM: 08-SBd-215-PM 11.35/11.95
 Project ID# (EA): 0800000083 (0E420) I-215/University Parkway Interchange Improvement
 Document: Traffic Operations Analysis Report (TOAR)
 Date: August 22, 2018

No.	Plan/SSP/ Page No.	Comments	Status/Changes
1	General	Include a description at the beginning of the document stating why certain intersections and segments are listed as not applicable (N/A) for the build scenario for 2020 and 2040.	In Section 1.2, the study intersections were revised to include the four future intersections and describe the elimination of the intersection at Driveway 2 and University Parkway.
2	Page ii	In the fourth paragraph under Executive Summary, it should state that there were nine study intersections instead of seven per the addition of intersections #8 and #31. Please revise.	The fourth paragraph was revised to have eleven study intersections. Intersections #8, #11, #16, and #31 were added.
3	Page 4	In Figure 1-2: <ul style="list-style-type: none"> • For the legend of the intersection, replace "1" with "#" in the circle and square. • Clarify "Future Intersections". This is for the DDI Ramp Termini but it is not clearly defined. • Label State Street. 	Figure 1-2 was updated in the TOAR.
4	Page 9	Revise all "Error! Reference source not found" on this page. Check for other pages, too.	The report was revised to remove all the Error information.
5	Page 9-16	In Section 2.3 Accident Analysis, Tables 2-4, 2-5, 2-6, 2-7, 2-8, 2-9 and in Section 2.4 Existing Deficiencies: Do not show the actual number of accidents but refer to the rate of accidents.	Table 2-4 through Table 2-9 was updated with removing all the actual number of accidents. Previous Table 2-8 was eliminated. Section 2.3 and Section 2.4 were revised.
6	Page 17	In the first paragraph, please verify the location of the existing Class II bike lane. Does it begin/end just north (instead of east) of the intersection of N Varsity Ave/N State St and University Pkwy?	The statement in the TOAR is accurate. The existing Class II bike lane begins/ends just north of the intersection in question. It currently does not continue through the interchange.
7	Page 19	In the 3rd paragraph: Clarify "No Project", Is it trying to be said the No Build project or the Project? Rewrite	The sentence was revised in Section 3.2.
8	Pages 21-24	Table 3-1 thru 3-5: Is this for No Build? If so, State in heading.	In last paragraph in Section 3.3, the report defines the volumes under Build and No Build conditions as being the same because the project is a operational improvement and does not add actual capacity. Therefore, the volumes in Table 3-1 through Table 3-5 are the same for with and without project conditions.
9	Page 24	The title of Table 3-5 has the word "mainline" while the table contains 4 ramps. Please revise the title.	Table 3-5 was updated in the report.
10	Pages 25-31	Figures 3-1 thru 3-4: Delineate which intersections are signalized.	Figure 3-1 through Figure 3-4, and Figure 2-1 were updated to show intersection controls.
11	Page 33	Under Section 4.1.1 Highway and Intersection Capacity Standards, please revise the last sentence to "...LOS D or better...".	The report was revised.

District 8 Quality Review Comments - Summary

Dist-Co-Rte-PM: 08-SBd-215-PM 11.35/11.95
 Project ID# (EA): 0800000083 (0E420) I-215/University Parkway Interchange Improvement
 Document: Traffic Operations Analysis Report (TOAR)
 Date: August 22, 2018

No.	Plan/SSP/ Page No.	Comments	Status/Changes
12	Pages 33-69	Please check the intersection LOS tables in Section 4 (Traffic Operations Analysis) for negative signs in front of average delay values. For example, see Table 4-14.	Delta is the difference between Build condition delay and No Build condition delay. Delta definition formula was added in the footnote in Table 4-14 and Table 4-22.
13	Pages 37, 52, 64, and 82	For Tables 4-5, 4-17, 4-25, and 5-6, change the word "interchange" to "intersection" in the title of each table.	Interchange should be the appropriate term for the tables.
14	Pages 38 and 76	The LOS for Intersections #3 through #31 in Table 4-6 do not match the Intersection LOS Summary Table 5-1 for the Existing (2017) condition. These intersections in Table 5-1 also seem to have the same average delay for all of these intersections and these delay values are different than in the previous submittal of the TOAR. Please verify and revise as needed.	Table 5-1 was updated in the report.
15	Pages 39-40, 43-44, and 54-55	For Tables 4-7, 4-11, and 4-19, recommend including a row for the NBL movement at the I-215 NB Ramps & University Parkway intersection and a row for the SBL movement at the I-215 SB Ramps & University Parkway intersection for the existing (2017), opening year (2020), and horizon year (2040) no build conditions, and to state "N/A" across the row for these conditions to be consistent with Table 5-2 (pages 77-78) .	In Table 4-7, 4-11, and 4-19, NBL movements was added at the I-215 NB Ramps and University Parkway intersection and SBT was added at the I-215 SB Ramps & University Parkway intersection.
16	Page 49, 61	Add intersections #11 (NB left to University Pkwy) and #16 (SB left to University Pkwy) to Tables 4-14 and 4-22.	#11 and #16 results were added in Table 4-14 and 4-22.
17	Page 49, 61	Based on Synchro outputs for I-215 NB off ramp AM and PM peak hour (Horizon Year 2040 Build) showed LOS F. Therefore, the LOS on Tables 4-14 and 4-22 should be matched with the Synchro output files. Verify LOS for each lane group Note: Intersection 8, NB off ramp to University Pkwy is a signal control with one phase and EB through on University Pkwy is a free flow movement, these two movements should not have average control delay, then transfer it to the Tables 4-14 and 4-22. Also check I-215 SB left to University Pkwy	Synchro is not a perfect tool to simulate the actual operation of a DDI design. In the case of this DDI, the operation is best replicated by the way we have it modeled in the simulation. This is a worst case scenario and the actual operation results will be better than simulated most of the time. Intersection #8 is a partial signalization of the northbound off ramp intersection due to the specific crosswalk and signalization features of the design. The free flow movements are taken into account in the delay calculation of the intersection. The intersection delay including the free flow movements were illustrated in Table 4-14 and Table 4-22. The signalized interchange analysis looks into each route passing through the interchange. Each movement contributes to delay in the interchange analysis results. Please refer to revised Table 4-17 and Table 4-25 for the movement/route results. The northbound off ramp approach results in the interchange failure under year 2040 build conditions. However, we need to point out that overall, the build conditions of this interchange perform far better than if No Build Conditions were maintained.

District 8 Quality Review Comments - Summary

Dist-Co-Rte-PM: 08-SBd-215-PM 11.35/11.95
 Project ID# (EA): 0800000083 (0E420) I-215/University Parkway Interchange Improvement
 Document: Traffic Operations Analysis Report (TOAR)
 Date: August 22, 2018

No.	Plan/SSP/ Page No.	Comments	Status/Changes
18	Page 59	Section 4.4.2 Horizon Year 2040 Build Analysis: Discuss what year that the intersections will fail, when applicable.	The design year failure analysis and the expected failure year of 2033 was introduced in Section 4.4.2 under "Signalized Interchange Analysis". A design exception memorandum has been prepared for District approval to cover this design year failure.
19	Page 70	Under "Existing (2017) Conditions", all the intersections are operating at LOS E or F according to Table 5-1. Please revise to make consistent.	Table 5-1 was updated in the report.
20	Page 71	Under "Horizon Year (2040) No Build Conditions", the intersection of "Hallmark Pkwy & University Pkwy (PM Peak Hour)" will operate at LOS D at both AM and PM peak hours based on Table 5-1. Please revise to make consistent.	Section 5 under "Horizon Year (2040) No Build Conditions" was revised to be consistent with Table 5-1.
21	Page 72	Under "Intersection Queuing Analysis", for "Horizon Year (2040) No Build Conditions", "westbound through turn lanes" should be "westbound through lanes" for the North Varsity Avenue/North State Street & University Parkway intersection.	"Intersection Queuing Analysis" section was revised by removing "turn" for the through movement.
22	Page 74, 80	Table 5-4 states for that for the northbound mainline segment South of University Parkway Off-Ramp for Horizon Year (2040) for the PM peak hour the LOS is E, but under "Freeway Mainline Analysis" on Page 74, it states that it is the On-Ramp instead. Please verify and ensure these match.	"Freeway Mainline Analysis" section was revised to match Table 5-4.
23	Page 82	For Table 5-6, "Opening Year" should be "Horizon Year" next to 2040 Build AM Peak Hour and PM Peak Hour	Table 5-6 was revised.
24	Synchro	Cycle length for Year 2040 AM and PM peak hour should not exceed 120 seconds. Verify with Electrical Operations Unit	Cycle length at congested intersections are allowed to exceed 120 seconds.
25	Synchro	Lane groups for WB through (intersection #11, NB left and University Pkwy) and EB through (Intersection #16, SB left and University Pkwy) should be not code as a signal phases. These movements should not be stopped at through movements. Verify	The NBL turn movement at #11 and SBL turn movement at #16 need to have signals for make safe left turns. The through movement signal phases are coordinated and clustered with the main crossover ramp intersections #2 and #3. Therefore, the stops are not expected to significantly impact traffic operations at the interchange.

District 8 Quality Review Comments - Summary

Dist-Co-Rte-PM: 08-SBd-215-PM 11.35/11.95
 Project ID# (EA): 0800000083 (0E420) I-215/University Parkway Interchange Improvement
 Document: Traffic Operations Analysis Report (TOAR)
 Date: October 10, 2018

No.	Plan/SSP/ Page No.	Comments	Status/Changes
1	General	See additional comments in the shared PDF.	All the bold/non-bold comments were addressed in the final TOAR. Please refer to comment #4 for additional comment in the shared PDF.
2	Pages 47 and 59	Based on the proposed build (DDI) alternative in Figures 3-2 and 3-4, add intersections of #8 (I-215 NB right to University Parkway), #11 (I-215 NB left to University Parkway), #16 (I-215 SB left to University Parkway), and #31 (I-215 SB right to University Parkway) to the queuing results tables (Tables 4-15 and 4-23).	Intersection queuing results at #8 (NBR) and #11 (NBL) were included in intersection queuing results at #2. Similarly, Intersection queuing results at #16 (SBL) and #31 (SBR) were included in intersection queuing results at #3. Footnotes were added in the tables for clarification.
3	Synchro Output Reports	<p>Previous Synchro comments that submitted by us by memorandum on August 21, 2018 has not been addressed. These comments are listed below:</p> <ul style="list-style-type: none"> • Cycle length for Year 2040 AM and PM peak hour should not exceed 120 seconds. Verify with Electrical Operations Unit. • Lane groups for WB through (intersection #11, NB left and University Pkwy) and EB through (Intersection #16, SB left and University Pkwy) should not be coded as a signal phase. These movements should not be stopped at through movements. Please verify. <p>Note: The second bullet, the EB through (Intersection #16) and WB through (Intersection #11) that you code as a signal phases, the vehicles queues for these WB and EB through movements are blocking intersections. It should not be signal phases for these WB and EB through movements.</p>	<ul style="list-style-type: none"> - The cycle length proposed is for future conditions. Real cycle length might be different when built. - The NBL turn movement at #11 and SBL turn movement at #16 need to have signals to make safe left turns. The through movement signal phases are coordinated and clustered with the main crossover ramp intersections #2 and #3. Therefore, the stops are not expected to significantly impact traffic operations at the interchange.
4	Table 4-22 on Page 58 and Table 5-1 on Page 73	<p>Synchro output on Page 203 showed LOS F at intersection #8 NBR approach during the AM and PM peak hours. The average delay and LOS at #8 in both tables should reflect the NBR approach results. Also see Table 5-1 for similar comment.</p> <p>Note: It should not have average control delay with free movement (0 delay).</p>	To be consistent, the average delay and LOS as shown in Table 4-22 and Table 5-1 are based on intersection results, not approach results for all the intersections. The approach average delay and LOS were shown in Table 4-25 on Page 61 and Table 5-6 on Page 79 (NBR of intersection #2), respectively.