

# US 6 Bridges Design Build Project

BR 0061-083

Sub Account Number 18838 (CN)

## Transportation Analysis Technical Report

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Federal Highway Administration

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## List of Abbreviated Terms

AM	morning
CCD	City and County of Denver
CDOT	Colorado Department of Transportation
CFR	Code of Federal Regulations
DRCOG	Denver Regional Council of Governments
EB	eastbound
EIS	Environmental Impact Statement
FHU	Felsburg, Holt & Ullevig
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
I-25	Interstate 25
ITS	intelligent transportation system
LOS	level-of-service
MPH	miles per hour
NB	northbound
PM	afternoon/evening
ROD	Record of Decision
ROD2	Record of Decision 2
RTP	Regional Transportation Plan
SB	southbound
US 6	6 <sup>th</sup> Avenue
VPD	vehicles per day
WB	westbound

## **Introduction**

This Transportation Analysis Technical Report documents a transportation analysis and study conducted in support of a Re-evaluation under 23 CFR 771.129 for the US 6 Bridges Design Build Project (the Project). It takes into consideration the following factors relative to the I-25 Valley Highway Final Environmental Impact Statement (FEIS) and the resultant 2007 Record of Decision (ROD):

- Have there been changes in the project or its surroundings?
- Have any new issues been identified?
- Are there new circumstances to be considered?
- Is there new information that was not considered in the original document?
- Are there changes in laws or regulations that apply to the project?

## **Project Background**

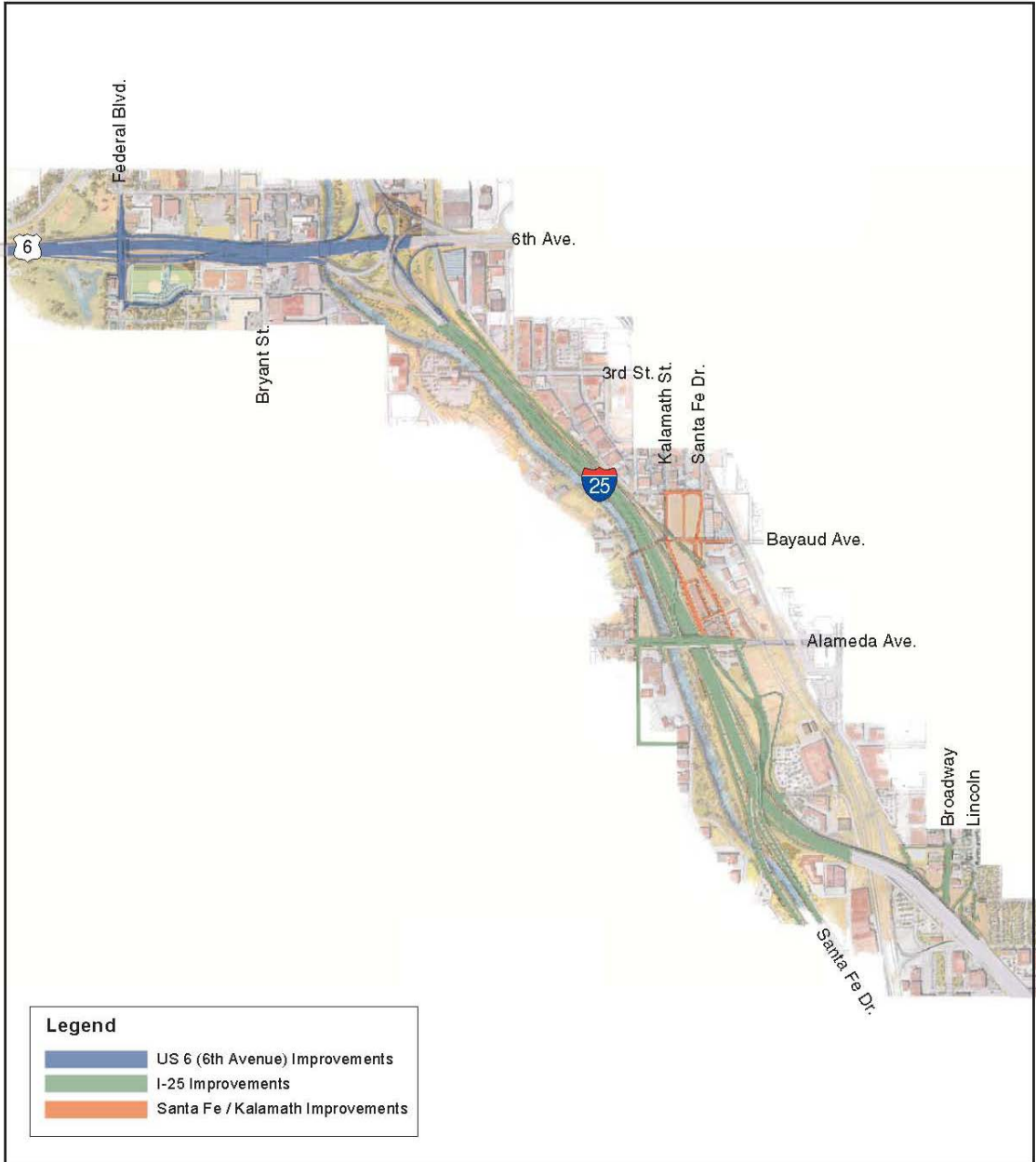
The Project includes modifications to the roadway, interchanges, and bridges along 6<sup>th</sup> Avenue (US 6) between Sheridan Boulevard and the BNSF Railway in Denver, Colorado. The Colorado Department of Transportation (CDOT) is preparing a Reevaluation and Record of Decision (ROD2) to document the impacts of and mitigation for the Project.

### **The Valley Highway Project**

The Federal Highway Administration (FHWA) and CDOT prepared a Final Environmental Impact Statement (FEIS) in 2006 and a ROD in 2007 for the Interstate 25 (I-25) Valley Highway Project, located in Denver, Colorado. The Valley Highway Project includes the reconstruction of I-25 and reconfiguration of interchanges from Logan Street to United States Highway (US) 6, US 6 from I-25 to Federal Boulevard, and the crossing of Santa Fe Drive and Kalamath Street at the Consolidated Main Line railroad. The Preferred Alternative, as described in the FEIS, includes the following elements:

- I-25 Mainline: Widening of I-25 to provide a consistent section with four through lanes plus auxiliary lanes in each direction throughout the project area
- I-25/Broadway: Tight diamond interchange
- I-25/Santa Fe Drive: Single point urban interchange with a flyover ramp for northbound Santa Fe Drive to northbound I-25
- I-25/Alameda/Santa Fe/Kalamath: Offset partial urban interchange at I-25 and Alameda Avenue; Santa Fe Drive and Kalamath Street grade separated under the railroad close to their current alignments
- US 6: Ramp improvements at the I-25/US 6 interchange; closure of the Bryant Street interchange; diamond interchange at US 6/Federal Boulevard with slip ramps to Bryant Street and a braided ramp from Federal Boulevard to eastbound US 6; reconstruction of US 6 with collector-distributor roads/auxiliary lanes throughout the project area

The Preferred Alternative of the Valley Highway Project is shown in Figure 1.



**Figure 1: I-25 Valley Highway Project Preferred Alternative**

## US 6 Bridges Design Build Project

The Project includes the reconstruction of US 6, reconfiguration of interchanges from Federal Boulevard to I-25, and replacement of the US 6 bridges from Federal Boulevard to the bridge over the BNSF Railway. More specifically, the Project includes the following elements:

- The replacement of five bridges along US 6: Federal Boulevard, Bryant Street, South Platte River, I-25, and BNSF Railway. Three of these bridges are in poor condition and the other two are functionally obsolete. The project would also add a tunnel immediately east of I-25 under US 6 to separate traffic on northbound I-25 from traffic exiting the interstate to travel east and west on US 6.
- Ramp improvements at the I-25/US 6 interchange, closure of the westbound (WB) US 6 to Bryant Street ramp, a diamond interchange at US 6/Federal Boulevard with slip ramps to Bryant Street, and a braided ramp from Federal Boulevard to eastbound (EB) US 6.
- Reconstruction of US 6 with collector-distributor roads/auxiliary lanes from Federal Boulevard to the BNSF Railway bridge structure
- Conversion of 5<sup>th</sup> Avenue to two-way traffic from Federal Boulevard to Decatur Street
- Widening of Federal Boulevard, from five to six lanes, from 5<sup>th</sup> to 7<sup>th</sup> Avenues to accommodate current and future improvements
- Pavement resurfacing of US 6 from Knox Boulevard to Sheridan Boulevard
- In-kind replacement of impacted facilities for Barnum East Park
- A bicycle/pedestrian bridge structure over US 6, connecting Barnum North Park and Barnum Park (also known as Barnum Park South, and herein referred to as Barnum Park South)
- Upgrading portions of the South Platte River Trail to current standards

Figure 2 shows the Project.



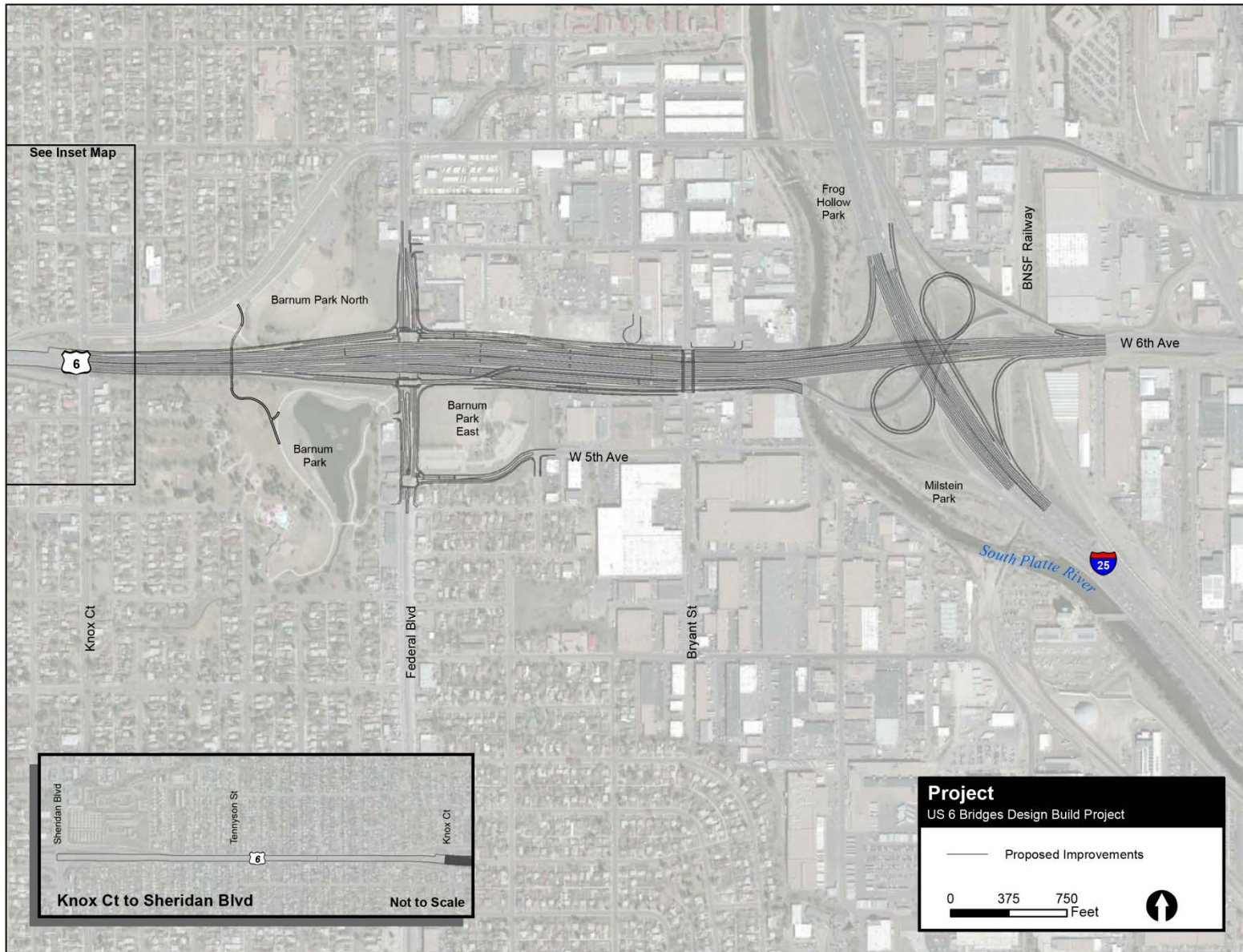


Figure 2: Project

## **Relationship of the Valley Highway Project and the US 6 Bridges Design Build Project**

At the time of the FEIS, funding had not been identified for the entire Preferred Alternative. Although budget placeholders were included in the 2030 Regional Transportation Plan (RTP), these budgets fell short of the estimated cost of the Preferred Alternative. Therefore, FHWA and CDOT planned for a phased implementation of the Preferred Alternative. These six phases are outlined in Chapter 7 of the FEIS. The ROD2 for the Project will reevaluate part of Phase 1 (the part including the US 6/Federal Boulevard interchange) as presented in the 2007 ROD, and provide a decision for Phase 5 of the Valley Highway Project. The ROD2 for the Project will also address six new, minor project elements, which were not part of the FEIS. Due to the minor environmental significance and nature of these additional components, they are included in the ROD2 and will not affect the independent utility, logical termini, or Preferred Alternative of the Valley Highway Project.

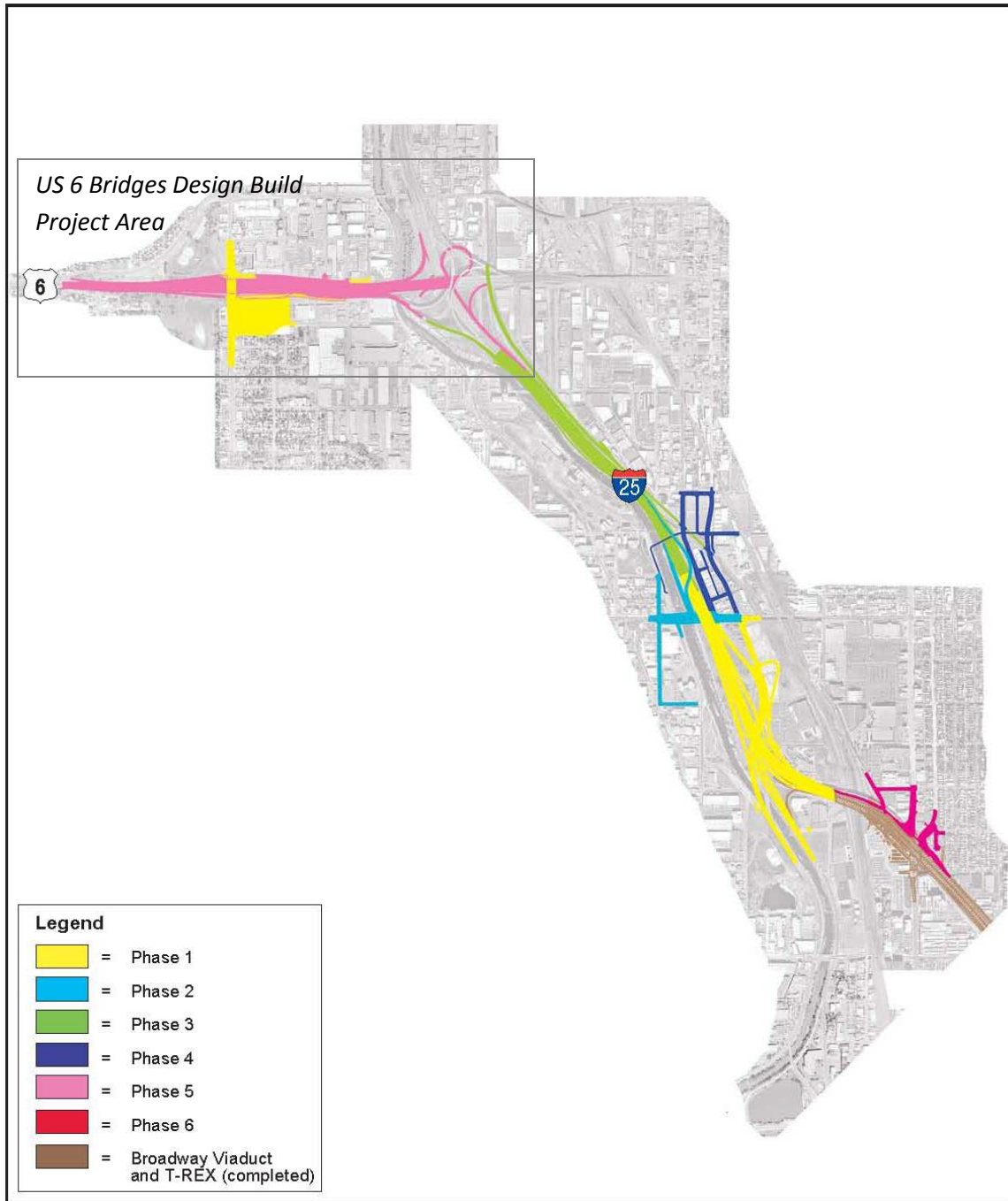
### ***Phasing of the FEIS Preferred Alternative***

The Project includes elements of two of the six construction phases—Phase 1 and Phase 5—from the Valley Highway Project. A decision on construction Phase 1 of the Valley Highway Project, which included the US 6/Federal Boulevard bridge and ramps, excluding the braided ramp, was made in the 2007 ROD. Figure 3 shows the phases of the Valley Highway Project’s Preferred Alternative and Figure 4 shows the Project Elements and how they relate to the FEIS phasing.

### ***Additional Project Elements in the Project***

At this time, the Project includes six additional elements that were not included in the FEIS or 2007 ROD:

- Reconstruction of the southbound (SB) I-25 to EB US 6 ramp;
- A bicycle/pedestrian bridge structure over US 6, connecting Barnum North and Barnum South parks;
- Replacement of the US 6 bridge over Bryant Street;
- Replacement of the US 6 bridge over I-25;
- Replacement of the US 6 bridge over the BNSF Railway; and
- Pavement resurfacing of US 6 between Sheridan Boulevard and Knox Court



**Figure 3: FEIS Phased Implementation of the Preferred Alternative**

*(source: I-25 Valley Highway FEIS)*



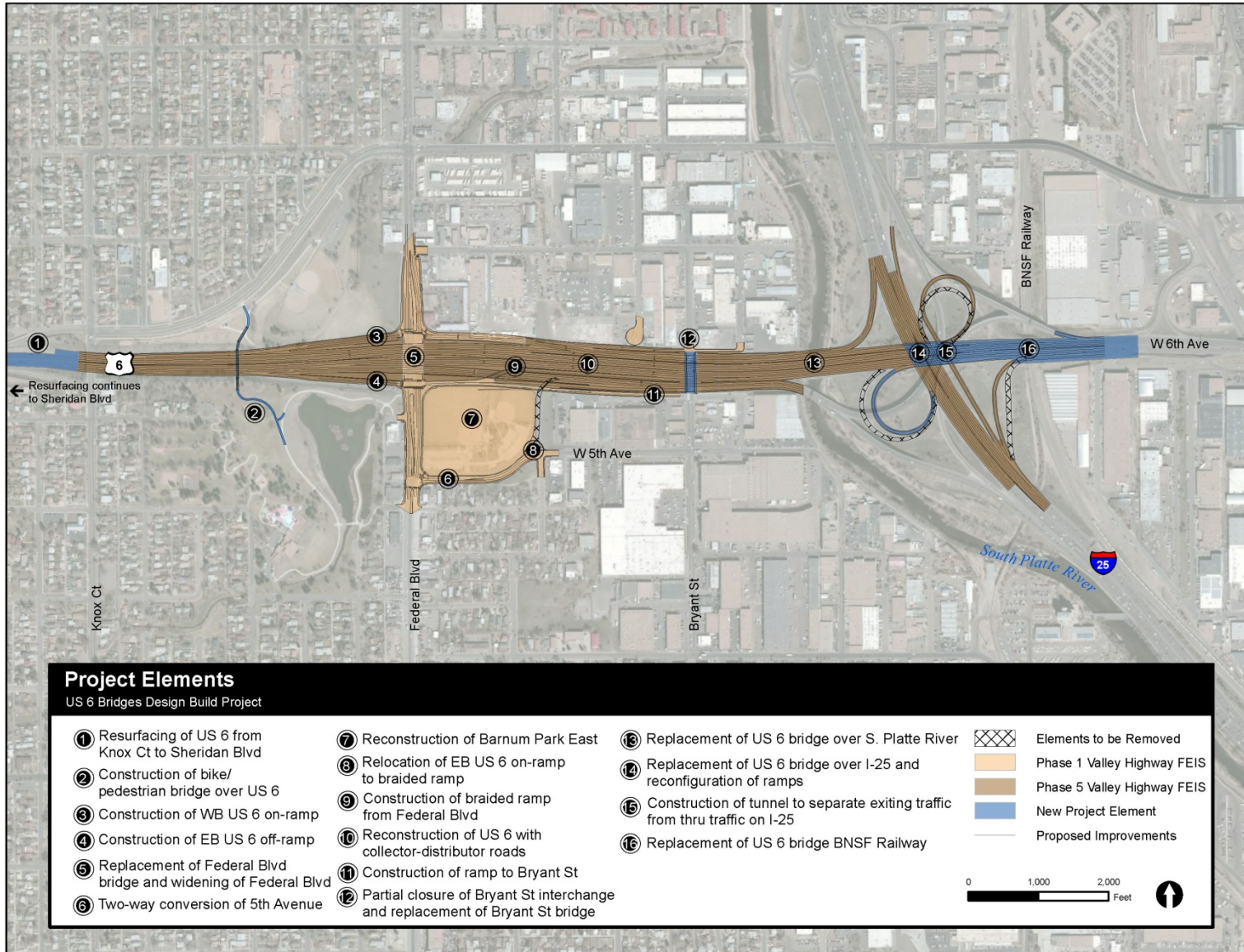


Figure 4: Project Elements

## Transportation Analysis Introduction

This transportation analysis report includes the following elements:

- Updated existing, 2035 No Build, and 2035 Project traffic operations for intersections and freeways Level of Service (LOS) (see details on the *Appendices A, B, and C*)
- June 11, 2012 FHWA concurrence letter regarding the Traffic Data for the FEIS and 2007 ROD Re-evaluation (see details on the *Appendix D*)
- August 3, 2012 memorandum for CDOT of Traffic Circulation Evaluation for US 6 Bridges for Air Quality analysis of PM 10 and MSAT (see details on the *Appendix D*)

## Purpose of the Report

The purpose of this transportation analysis and report is to:

- Document the existing, 2035 No Build, and 2035 Project traffic projections.
- Analyze the traffic performance of the 2035 No Build to the 2035 Project and compare them.
- Provide traffic projections and level of service findings as a basis for the analyses of air quality and noise impacts of the Project.

## Existing Roadway Network

**Figure 5** shows the traffic analysis study area for this updated transportation analysis. Major roadways within the study area include:

- **Freeways:** Freeways provide for interregional travel and carry the greatest proportion of regional trips. Freeways within the study area include I-25, which serves north-south traffic through the Denver metropolitan area, and US 6, which serves east-west traffic.
- **Principal Arterials:** Principal arterials carry regional trips while serving local access. Principal arterials within the study area include Federal Boulevard and Bryant Street.
- **Minor Arterials:** Minor arterials serve both through traffic and facilitate local access. Minor arterials within the study area include 5<sup>th</sup> Avenue, 7<sup>th</sup> Avenue, and Decatur Street.

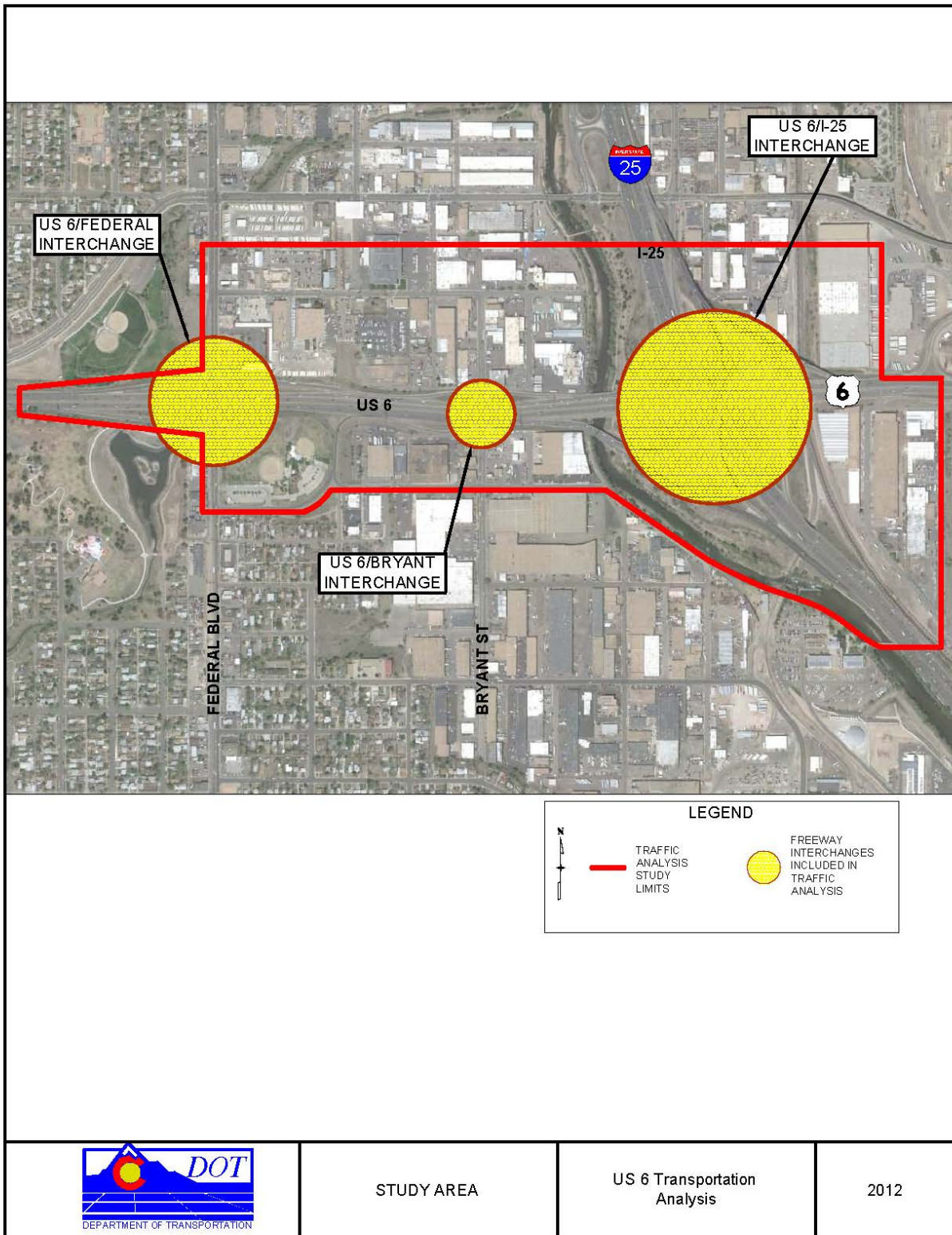


Figure 5: Study Area

## Capacity Analysis Methodology

The traffic operations within the study area were analyzed based on the methodologies described in the Transportation Research Boards' *Highway Capacity Manual (HCM), 2010 Edition*. Capacity analysis is used to determine level of service (LOS), which is an established measure of effectiveness for the operation of a transportation facility and is a qualitative assessment of the traffic flow for a given roadway facility. LOS is described using a letter designation ranging from "A" to "F". LOS A represents essentially uninterrupted flow and LOS F represents the breakdown of traffic flow with excessive congestion and delay.

For signalized intersections the LOS rating is determined by assessing the intersection as a whole and is defined as a function of the average vehicle control delay of the entire intersection. For unsignalized intersections, the LOS rating is defined as a function of control delay for each critical vehicle movement. For freeway segments and junctions, LOS is defined in terms of vehicular density within the analysis area.

Synchro (Version 7) was used to calculate LOS ratings for signalized and unsignalized intersections within the study area. Freeway and ramp LOS was calculated using Highway Capacity Software (HCS) 2010.

**Table 1** summarizes the LOS Criteria thresholds for the each facility types where analysis was performed.



**Table 1: LOS Threshold**

	Type of Roadway Configuration and LOS Criteria Threshold					
	Signalized Intersections	Unsignalized Intersections	Mainline Freeway	Freeway Weaving		Freeway Ramp
LOS	Control Delay	Control Delay	Density	Mainline - Density	Multilane & Collector-Distributor - Density	Merge & Diverge
	(seconds/ vehicle)	(seconds/ vehicle)	(pc/mi/ln)	(pc/mi/ln)	(pc/mi/ln)	(pc/mi/ln)
A	≤ 10	0 - 10	≤ 11	0 - 10	0 -12	≤ 10
B	> 10 - 20	> 10 -15	> 11 - 18	> 10 -20	> 12 -24	> 10 - 20
C	> 20 - 35	> 15 - 25	> 18 -26	> 20 -28	> 24 -32	> 20 -28
D	> 35 - 55	> 25 - 35	> 26 -35	> 28 -35	> 32 -36	> 28 - 35
E	> 55 - 80	> 35 -50	> 35 - 45	> 35	> 36	> 35
F	> 80	> 50	> 45 *	Demand exceeds capacity		

\* Demand exceeds capacity

Source: Highway Capacity Manual, 2010

The traffic analysis parameters shown in **Table 2** were taken from the “Traffic Report for the Valley Highway EIS, Denver, Colorado”, prepared for FHWA by Felsburg, Holt & Ullevig (FHU) and CDOT in February 28, 2005.

These traffic analysis parameters were established during the FEIS process and were used as the basis for the operational analysis of freeway sections and surface street intersections.



**Table 2: Traffic Analysis Parameters**

Traffic Parameter	Freeway Sections		Surface Street Intersections		
	I-25 Freeway	US 6 Freeway	Bryant/5th/8th intersection	Federal Boulevard	Others
% trucks and buses	7%	3%	30%	6%	7%
% Recreation Vehicles	1%	1%	1%	1%	1%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90
Free-flow Speed	65	65	n/a	n/a	n/a
Terrain/Area Type	Level	Level	Non-CBD	Non-CBD	Non-CBD
Cycle Length	n/a	n/a	100 Seconds	100 Seconds	75, 100 Seconds

Source: "Traffic Report for the Valley Highway EIS, Denver, Colorado"; Prepared for Federal Highway Administration by Felsburg, Holt & Ullevig and the Colorado Department of Transportation, February 28, 2005

Additionally, the updated traffic analysis assumed a posted speed limit of 55 mph for mainline freeway segments and 35 mph for freeway ramps and the adjacent arterial roadway system. Existing signal timing provided by City and County of Denver (CCD) was utilized to complete the signalized intersection analysis with cycle lengths ranging from 60 to 100 seconds. For future conditions, traffic signal cycle lengths and splits were optimized to complete the analysis assuming that cycle lengths will be modified to better accommodate future traffic demand.

## Assessment of Existing Conditions

### Existing Traffic Volumes

Existing traffic counts were collected by All Traffic Data in November 2011. **Figure 6** summarizes these counts and illustrates existing daily traffic movements in the study area. Average daily traffic volumes on I-25 are approximately 237,500 vehicles per day north of US 6 interchange and 226,600 vehicles per day (vpd) south of US 6 interchange. Daily traffic volumes show that mainline I-25 traffic is relatively balanced by direction within the study area. Average daily traffic volumes on US 6 are approximately 132,100 vehicles per day west of I-25 interchange and 69,600 vehicles per day east of I-25 interchange. Daily traffic volumes show that mainline US 6 traffic is relatively balanced by direction within the study area.

**Figure 7** and **Figure 8** illustrate the existing AM and PM Peak Hour turning movements, respectively.

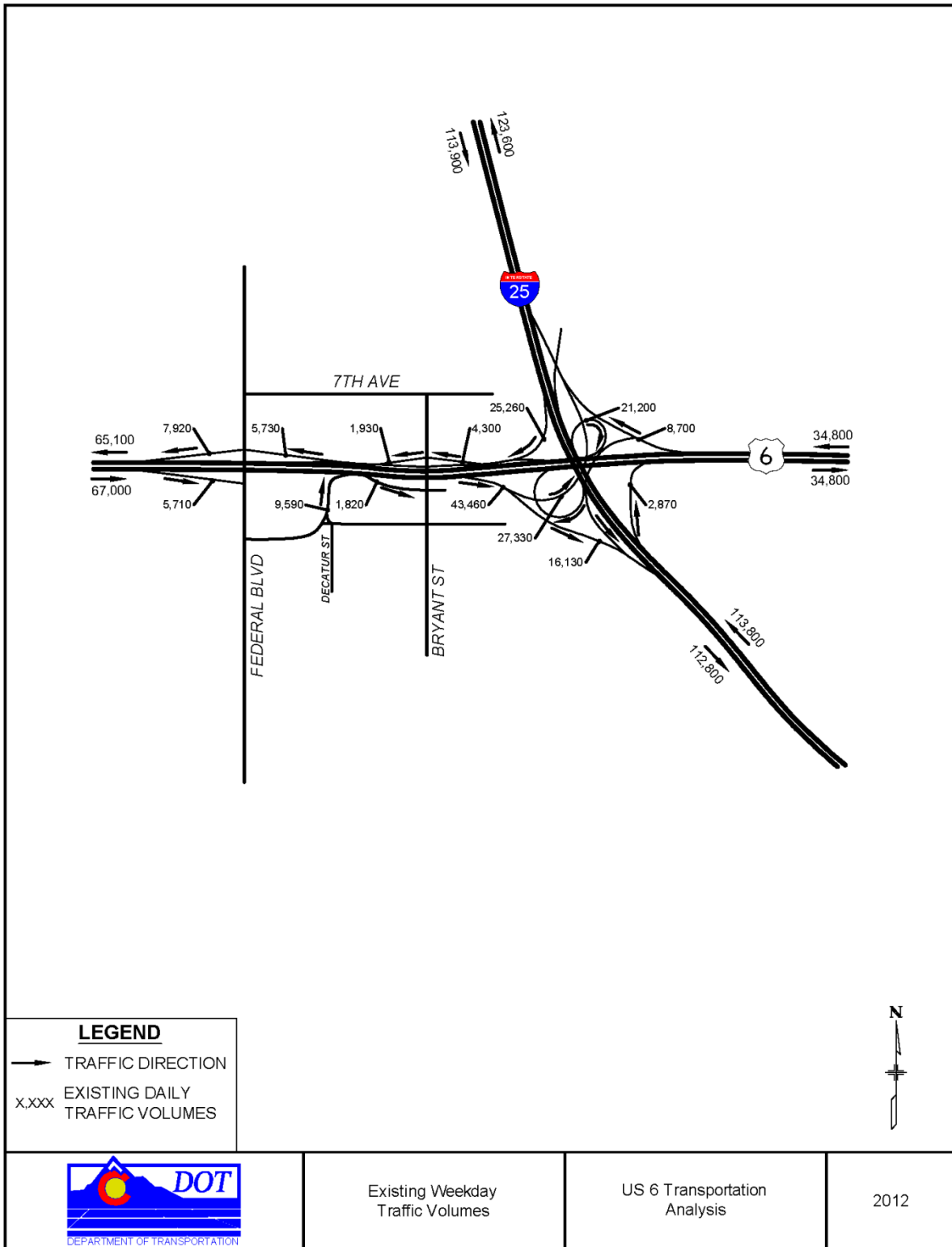


Figure 6: Existing Weekday Traffic Volumes

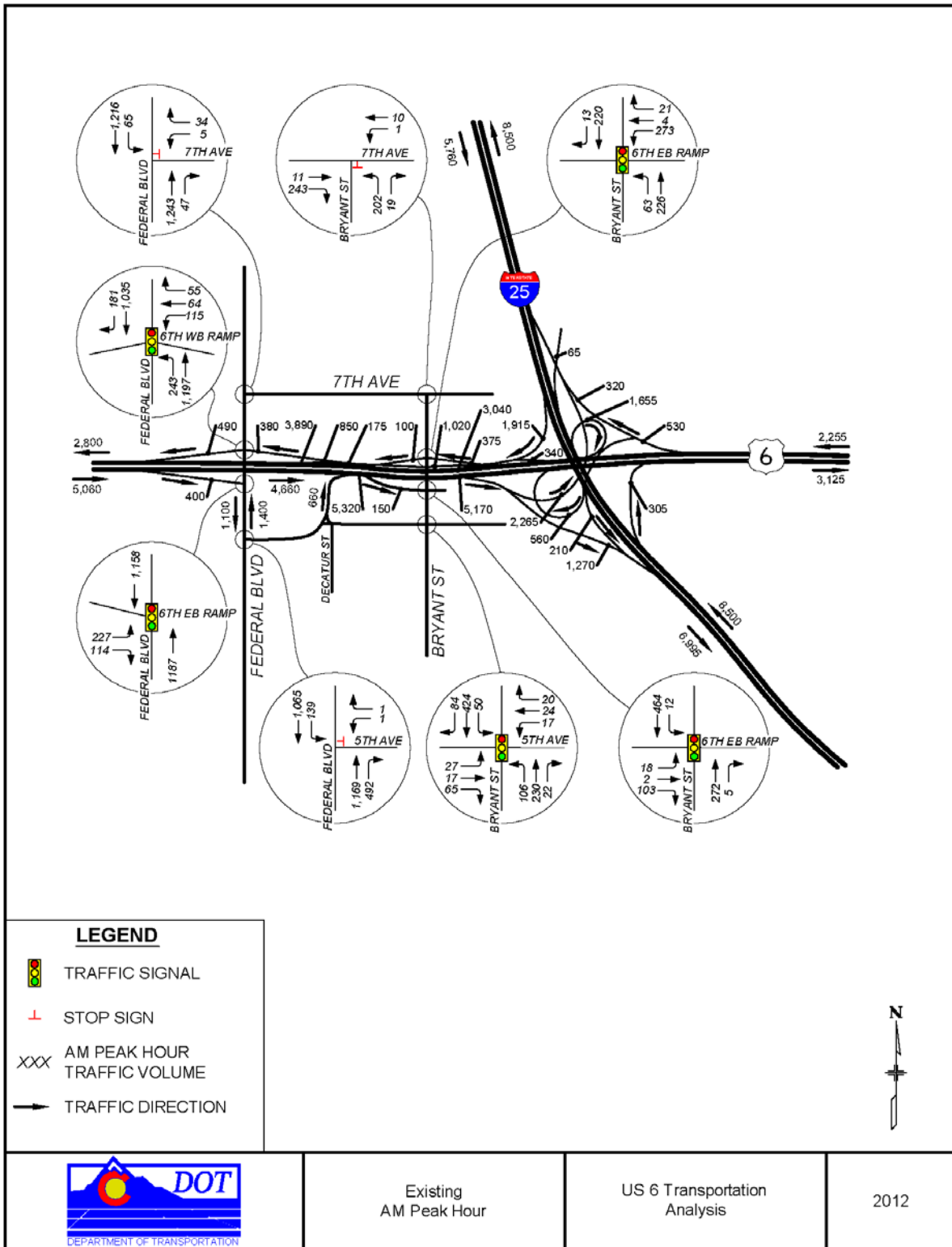


Figure 7: Existing AM Peak Hour

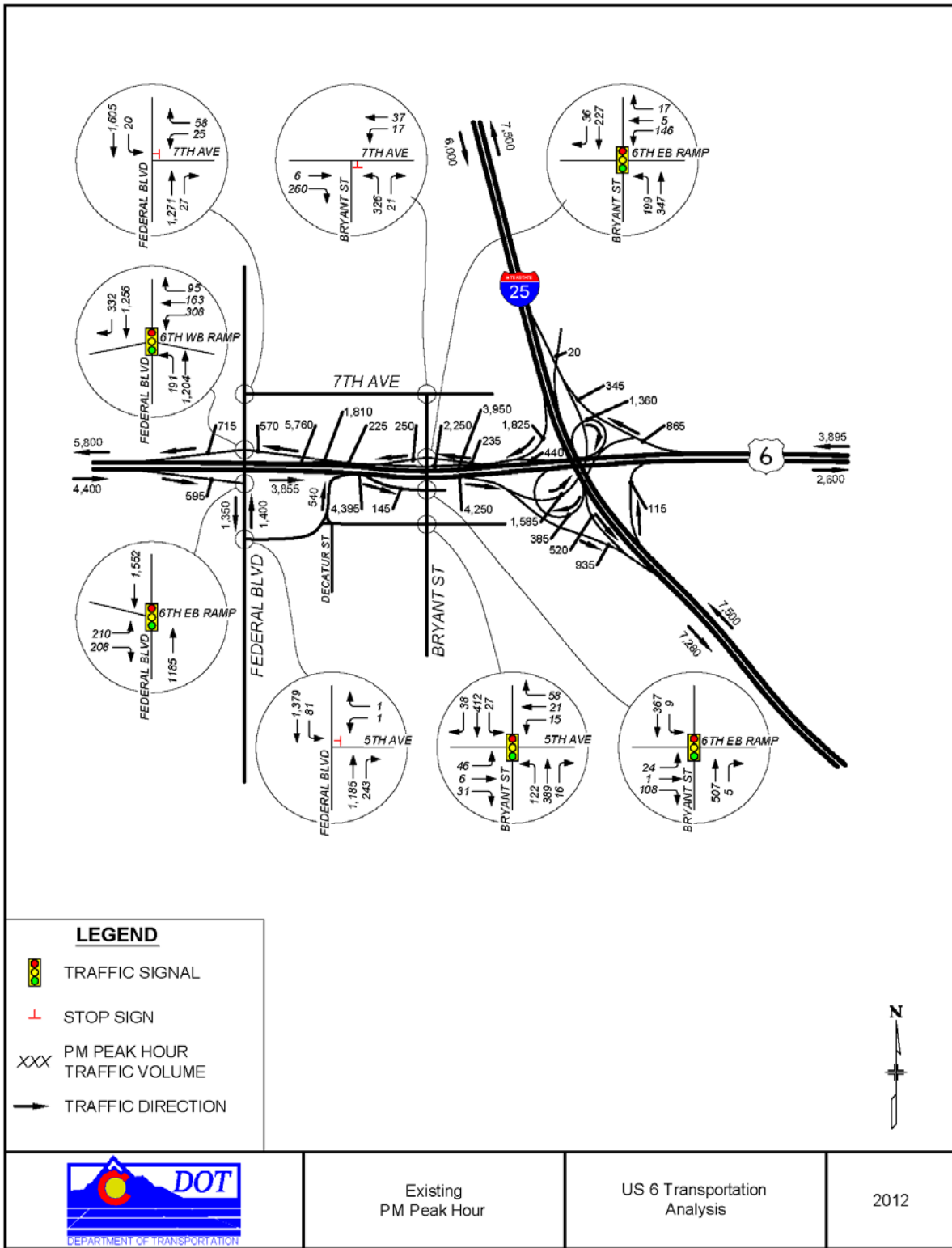


Figure 8: Existing PM Peak Hour

## **Existing Capacity Analysis**

Traffic operations analyses of the existing traffic volumes were completed for the study area intersections and freeway facilities as described in Section 1.3. The results of the analyses are summarized in **Figure 9** (Freeways Sections) and **Figure 10** (Surface Street Intersections) which illustrate graphically the AM and PM Peak hour LOS.

### ***Freeway Sections***

The analysis of I-25 and US 6 within the study area includes an assessment of mainline, ramp merge, diverge, and weaving sections. Figure 9 summarizes the resulting LOS. Multiple capacity deficiencies were identified along I-25 and US 6 as indicated by LOS E or F.

### **Mainline Freeway Sections**

The northbound direction of I-25 illustrates deficient operational condition. Congested operating conditions along mainline I-25 negatively impacts ramp merge and diverge movements. US 6 currently operates at LOS D or better during the peak hours.

### **Weaving Sections**

There are no weaving sections on I-25 within the study area. Westbound weaving movement associated with Bryant Street and Federal Boulevard along US 6 currently operates at LOS F during the AM and PM peak hour. Westbound movement between Bryant Street and I-25 SB off ramp operates at LOS E during PM peak hour.

### **Merge/Diverge Sections**

A few sections operate at LOS C or better during AM and PM peak hour conditions. Each of the merge/diverge sections along US 6 currently operates at LOS D or better during the peak hours, except the westbound Federal Boulevard on-ramp merge. It operates at LOS F. Westbound US 6 off ramp diverge operates at LOS E during the PM peak hour.

### ***Surface Street Intersections***

As shown in **Figure 10**, for the Federal Boulevard and 7<sup>th</sup> Avenue unsignalized intersection the westbound movement is operating at a deficient level of service (LOS F) during the PM Peak. For all other intersections, overall operations were acceptable.

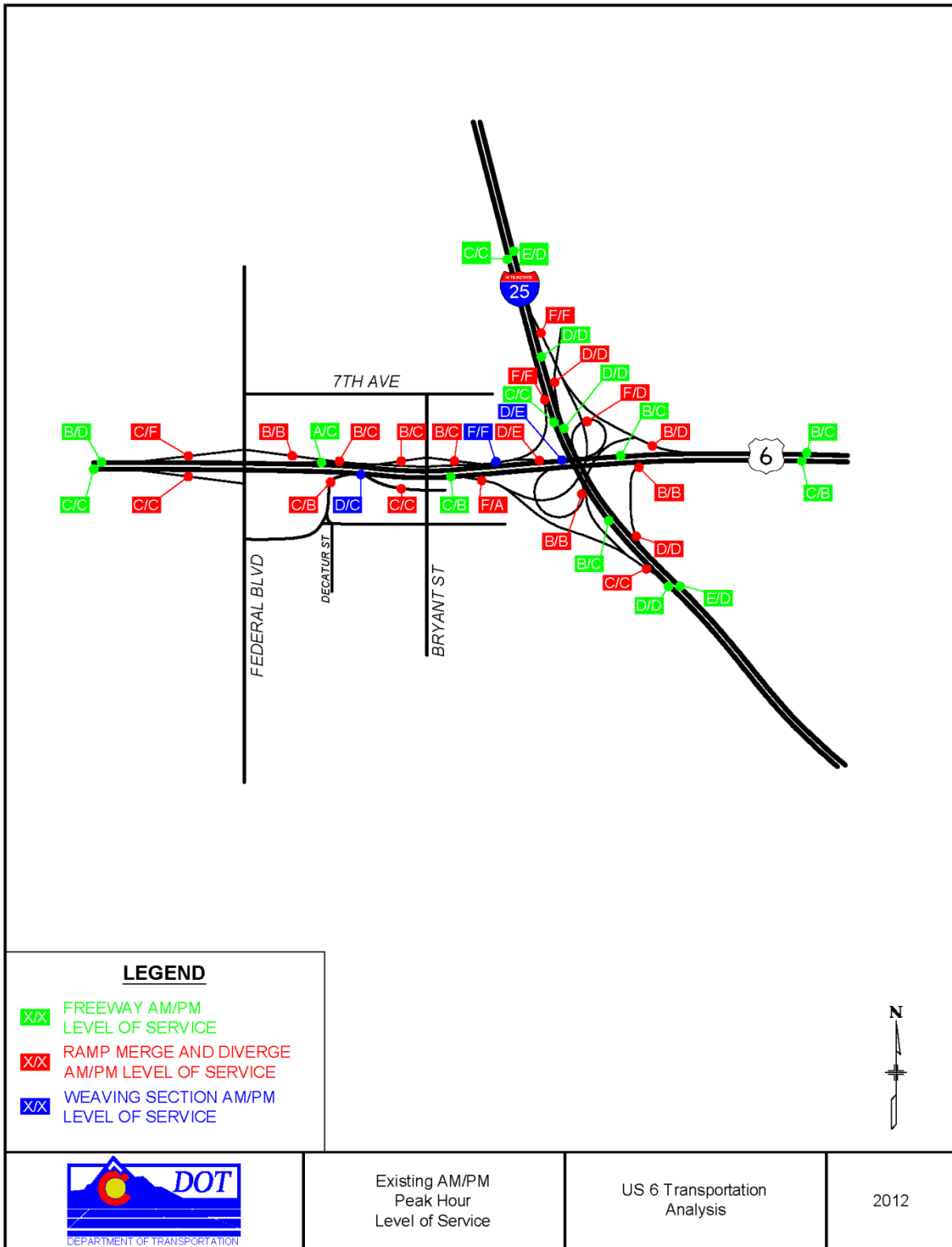


Figure 9: Existing AM/PM Peak Hour Level of Service

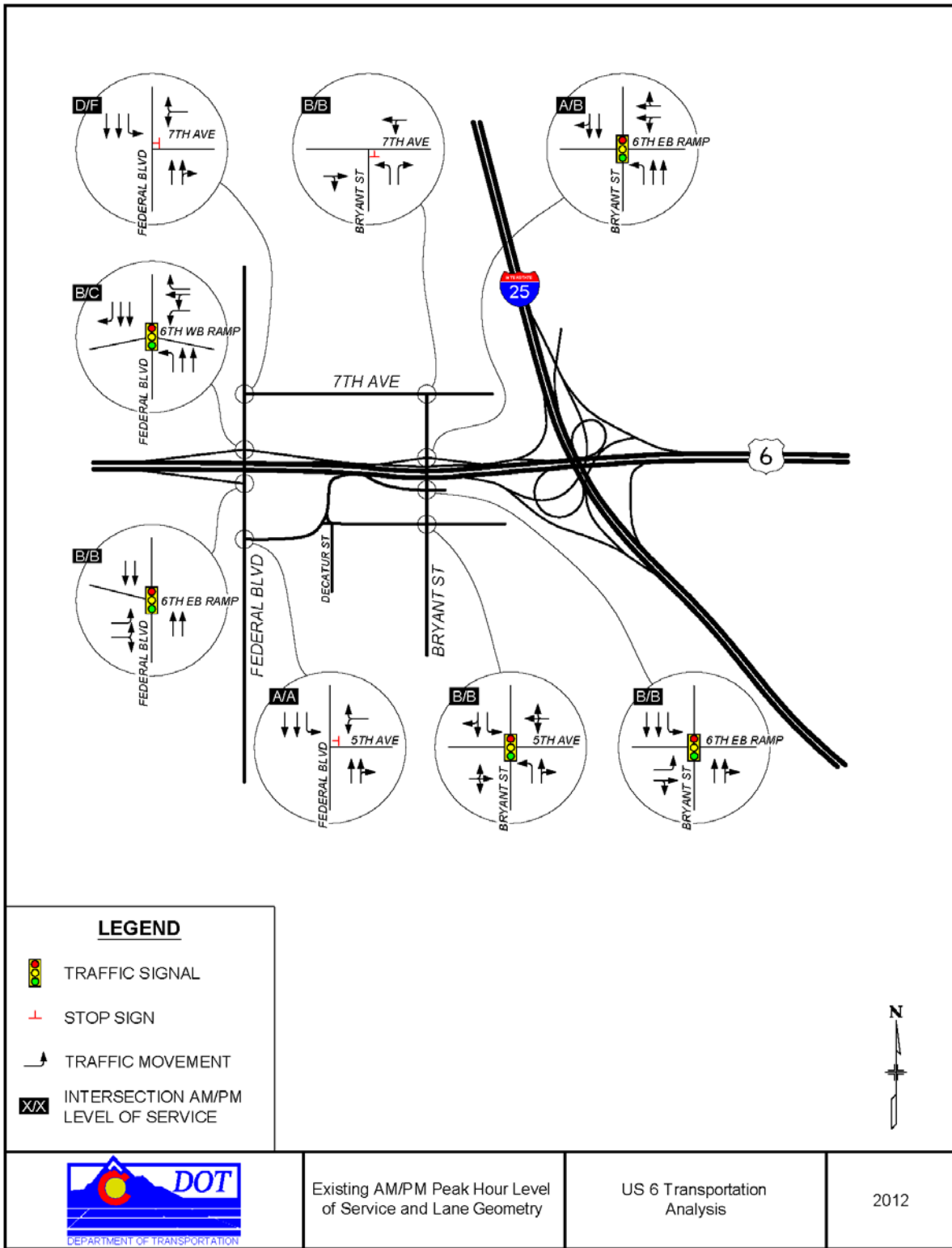


Figure 10: Existing AM/PM Peak Hour Level of Service and Lane Geometry

## Assessment of Future 2035 Conditions – No Build

### Traffic Projections

Using the 2025 FEIS traffic projections documented in various traffic reports<sup>1</sup> as the basis, Year 2035 traffic volumes on the study area roadways were forecasted. The FEIS 2025 AM and PM peak hour traffic counts were projected forward by one percent per year to establish the 2035 peak hour traffic volumes for the future analysis. This is consistent with the projected growth rate identified in the I-25 FEIS. This methodology and approach were established through collaboration and concurrence with CDOT and FHWA, as noted in the FHWA letter of concurrence on June 11, 2012. As part of this overall process, the 2011 traffic counts were also compared to the traffic volumes documented in the FEIS. When the 2011 traffic counts were higher than the EIS traffic counts, the traffic forecasts were adjusted to take into account the change in condition and provide for a more conservative analyses.

During the process, the 2035 traffic projections within the limits of this study area were also compared to the current Denver Regional Council of Governments (DRCOG) 2035 Metro Vision Regional Transportation Plan. From a system wide perspective, the methodology and approach for this traffic analyses update is consistent with the plan in establishing future traffic demand.

**Figure 11** illustrates 2035 No Action two-way daily traffic movements. Average daily traffic volumes on I-25 are approximately 370,200 vehicles per day north of US 6 interchange and 353,600 vehicles per day south of US 6 interchange. Daily traffic volumes show that mainline I-25 traffic is relatively balanced by direction within the study area. Average daily traffic volumes on US 6 are approximately 185,600 vehicles per day west of I-25 interchange and 87,400 vehicles per day east of I-25 interchange. Daily traffic volumes show that mainline US 6 traffic is relatively balanced by direction within the study area.

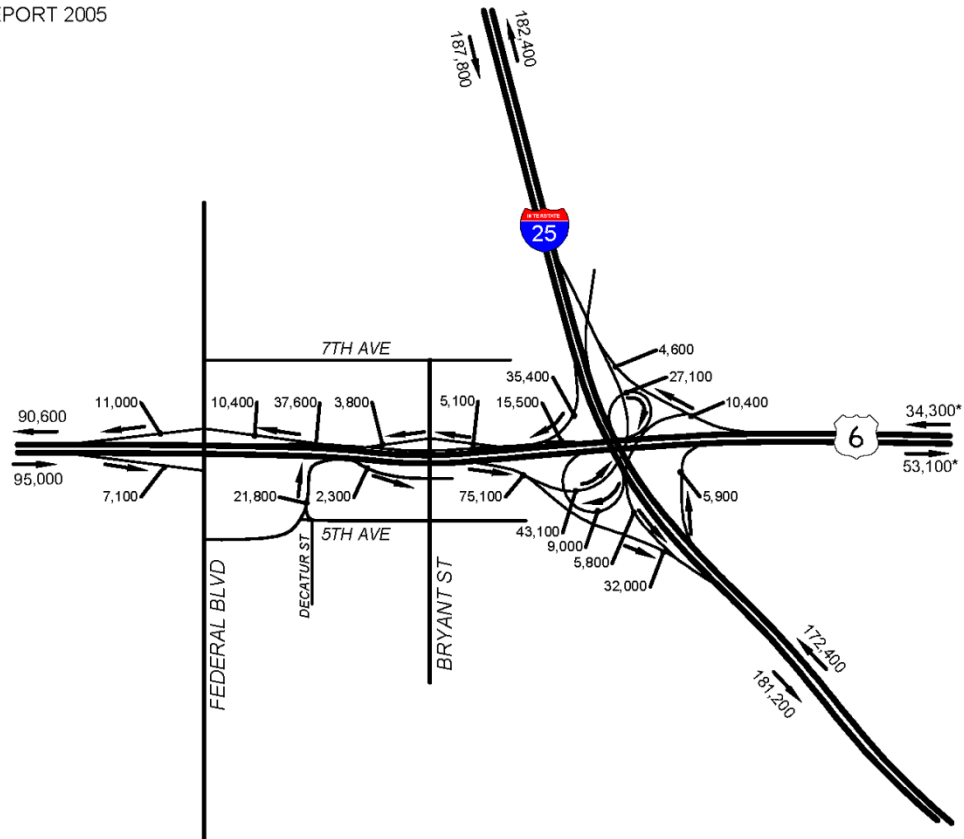
**Figure 12** and **Figure 13** illustrate the 2035 No Action AM and PM Peak Hour turning movements respectively.

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<sup>1</sup> Traffic Report for the Valley Highway EIS Denver, Colorado, prepared for FHWA by Felsburg, Holt & Ullevig and CDOT, February 28, 2005; Traffic Report addendum for the Valley Highway EIS Denver, Colorado, prepared for FHWA by Felsburg, Holt & Ullevig and CDOT, October, 2006; Valley Highway System Level Study, Colorado, prepared for CDOT by Felsburg, Holt & Ullevig, May 2007; and Record of Decision for the I-25 Valley Highway Logan to US 6 Denver CDOT Project IM 0252-315 FHWA-CO-EIS-05-01-F, Colorado, prepared for FHWA by Felsburg, Holt & Ullevig, June, 2007.



\*NOTE: ESTIMATED FROM  
AM PEAK HOUR  
INFORMATION - TRAFFIC  
REPORT 2005



**LEGEND**  
 → TRAFFIC DIRECTION  
 X,XXX EXISTING DAILY TRAFFIC VOLUMES




	2035 No-Build Weekday Traffic Volumes	US 6 Transportation Analysis	2012
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Figure 11: 2035 No-Build Weekday Traffic Volumes

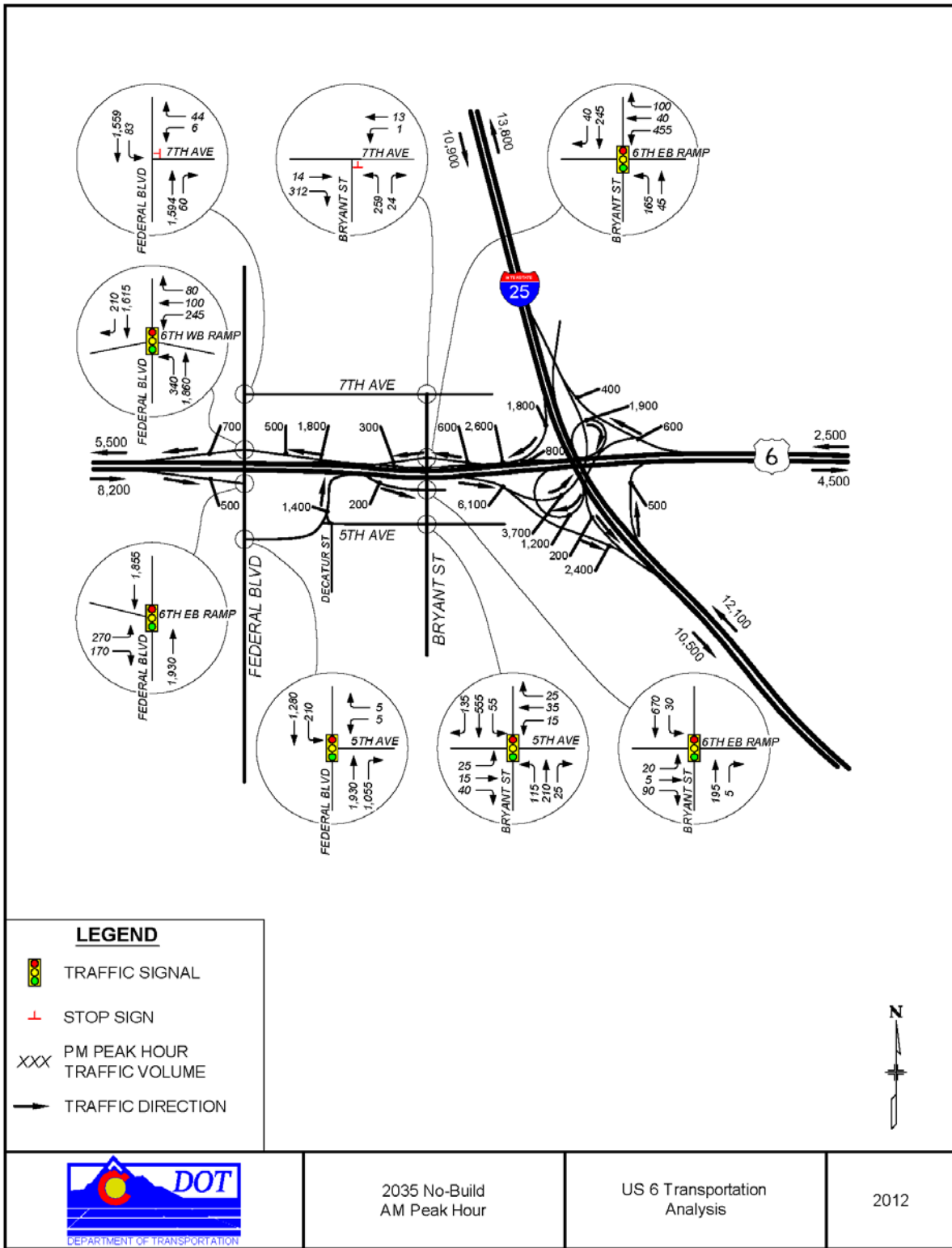


Figure 12: 2035 No-Build AM Peak Hour

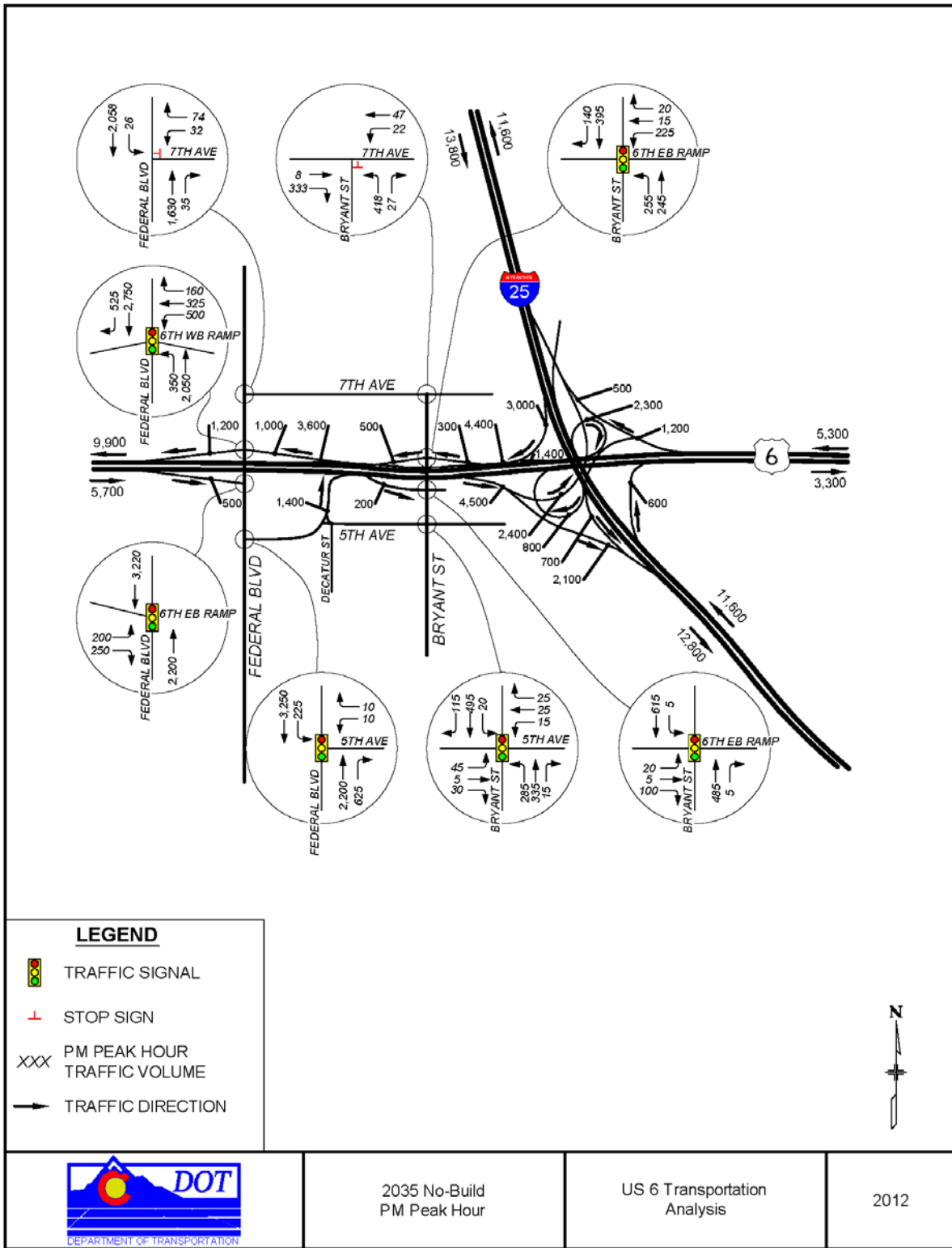


Figure 13: 2035 No-Build PM Peak Hour

## **Year 2035 No Build Capacity Analysis**

Traffic operations analyses were completed for the study area freeway facilities and surface street intersections for the 2035 No Build scenario as described in Section 1.3. The results of that analysis are summarized in **Figure 14** (Freeway Facilities) and **Figure 15** (Surface Street Intersections) which illustrate graphically the AM and PM Peak hour LOS for 2035 No-Action traffic volumes, which does not include major I-25 and US 6 interchange reconfiguration.

### ***Freeway Sections***

The section of I-25 and US 6 within the study area includes an assortment of mainline, ramp merge, diverge, and weaving sections. Multiple capacity or operational deficiencies were identified along I-25 and US 6, as evidenced by LOS E and F on many sections of the freeway.

### **Mainline Freeway Sections**

Both the northbound and southbound direction of I-25 would operate deficiently at LOS F. As with existing, congested operating conditions along mainline I-25 create difficulty for ramp weaving, merge and diverge movements. Both westbound and eastbound along the US 6 mainline there several areas that would operate at LOS E or worse during the AM and PM peak hour.

### **Weaving Sections**

Both the westbound and eastbound weaving movement along US 6 associated with Bryant Street and Federal Boulevard would operate at LOS F during the AM and PM peak hour

### **Merge/Diverge Sections**

Each of the I-25 merge/diverge sections analyzed would operate at LOS F on both AM and PM peak hour conditions. Each of the westbound US 6 merge/diverge sections would operate at LOS D or worse during the PM peak hour. The eastbound merge/diverge sections would operate at LOS C or worse.

### ***Surface Street Intersections***

Analysis of projected Year 2035 traffic condition indicates that multiple surface street intersections would operate deficiently. As shown in **Figure 15**, the following intersections illustrate deficient operations during the AM and PM peak periods: Federal Boulevard/7th Avenue, Federal Boulevard/6th Avenue WB Ramp, Federal Boulevard/6th Avenue EB Ramp, Federal Boulevard/5th Avenue, and Bryant St/6th Avenue eastbound Ramp.

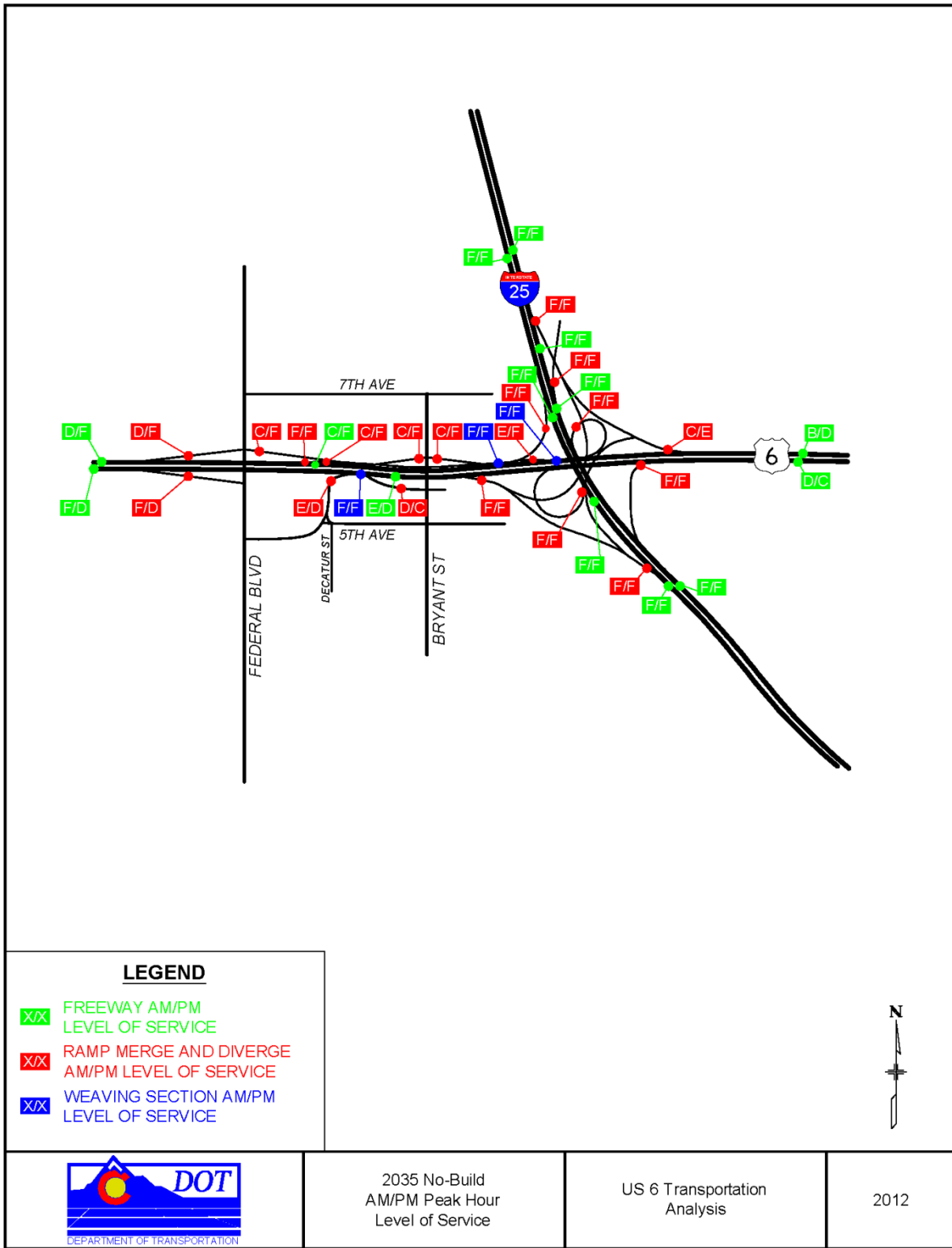


Figure 14: 2035 No-Build AM/PM Peak Hour Level of Service

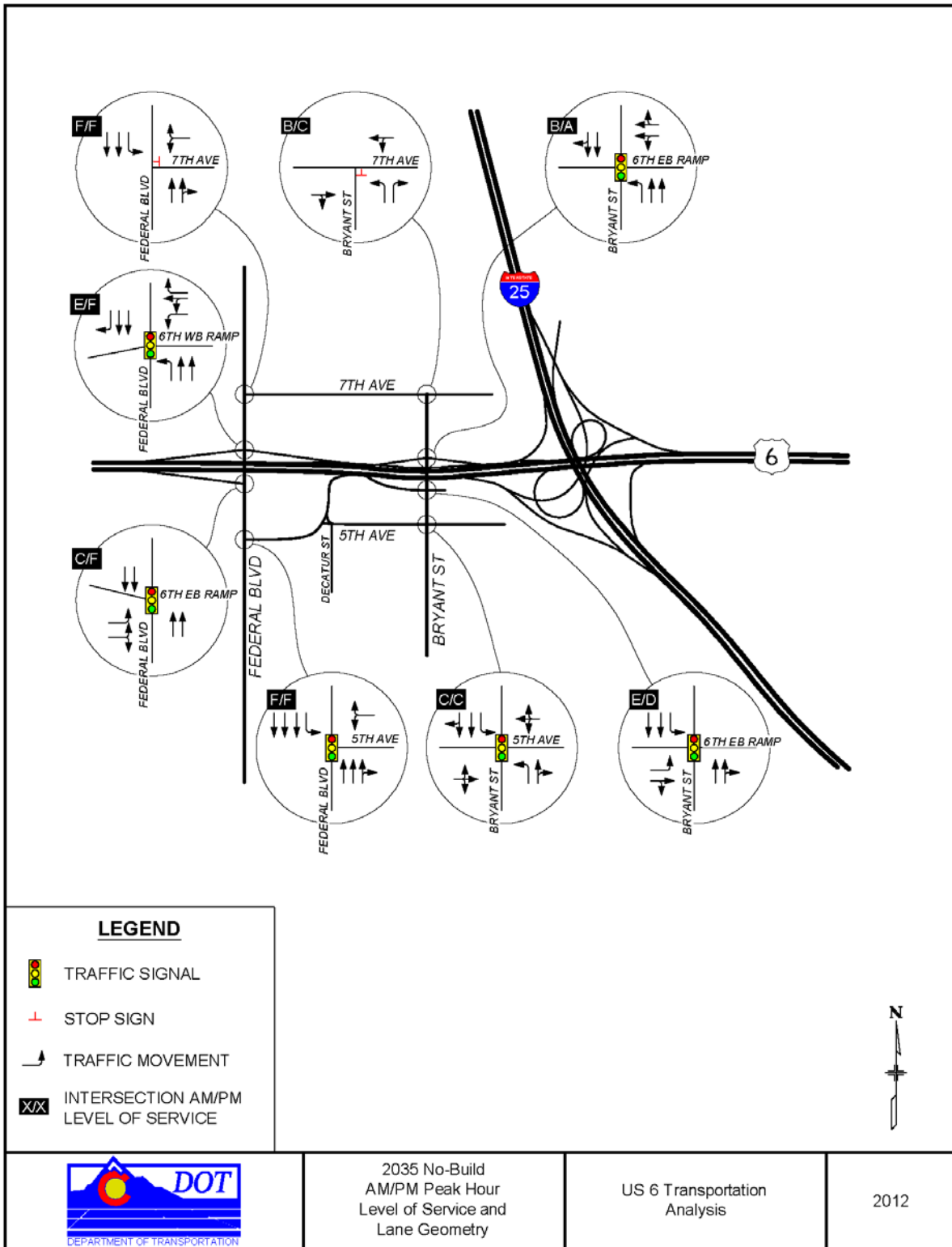


Figure 15: 2035 No-Build AM/PM Peak Hour Level of Service and Lane Geometry

## Assessment of Project

### Future Travel Demand – Future 2035 Project

**Figure 16** illustrates year 2035 Project two-way daily traffic movements with the project. Average daily traffic volumes on I-25 would be approximately 370,300 vehicles per day north of US 6 interchange and 353,600 vehicles per day south of US 6 interchange. Average daily traffic volumes on US 6 would be approximately 185,600 vehicles per day west of the I-25 interchange and 87,400 vehicles per day east of the I-25 interchange. These volumes show that mainline traffic would continue to be relatively balanced by direction within the study area.

**Figure 17** and **Figure 18** illustrate the future 2035 Project AM and PM Peak Hour turning movements respectively.

NOTE: ESTIMATED FROM AM  
PEAK HOUR TRAFFIC VOLUMES  
- TRAFFIC REPORT 2005

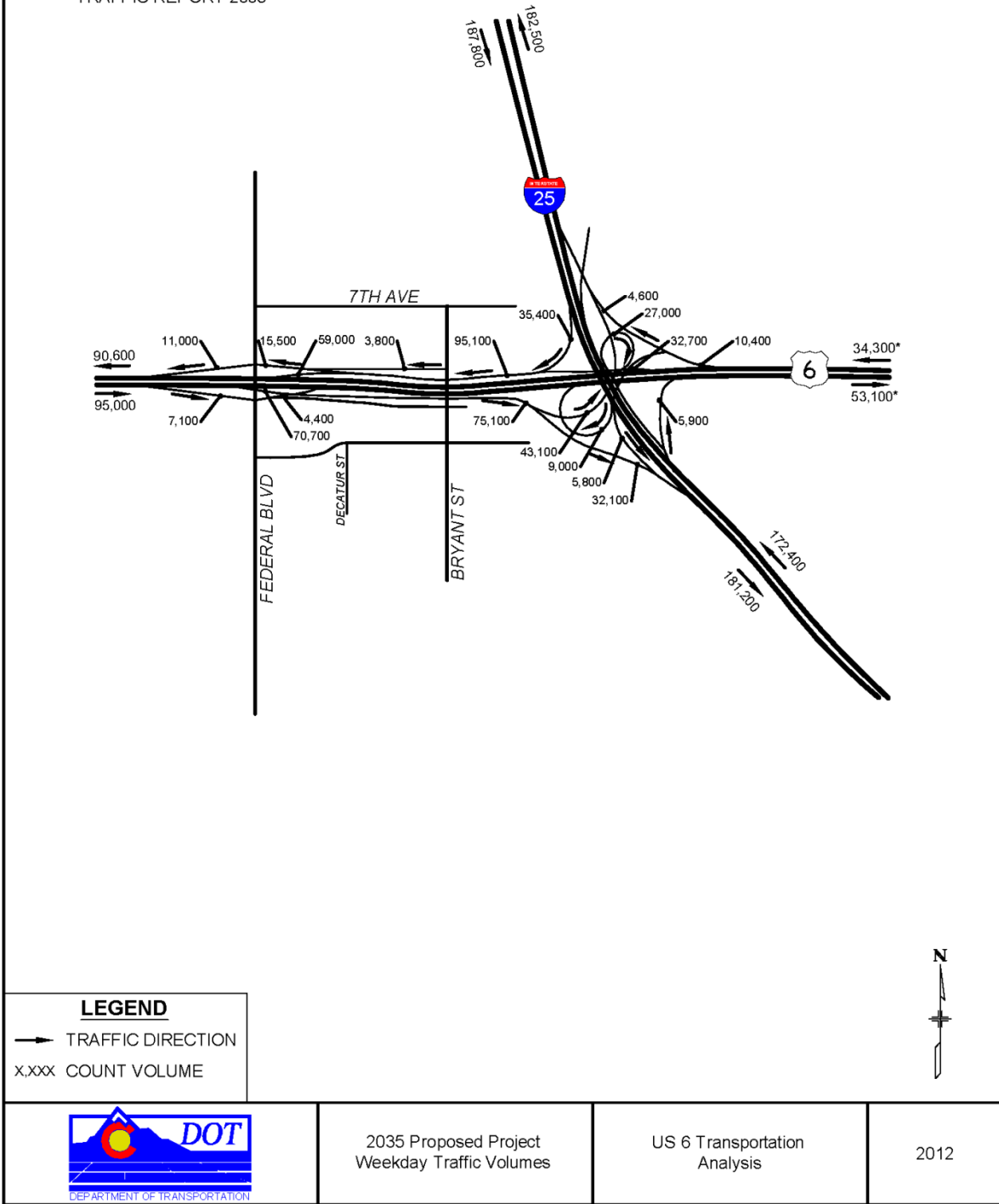


Figure 16: 2035 Project Weekday Traffic Volumes



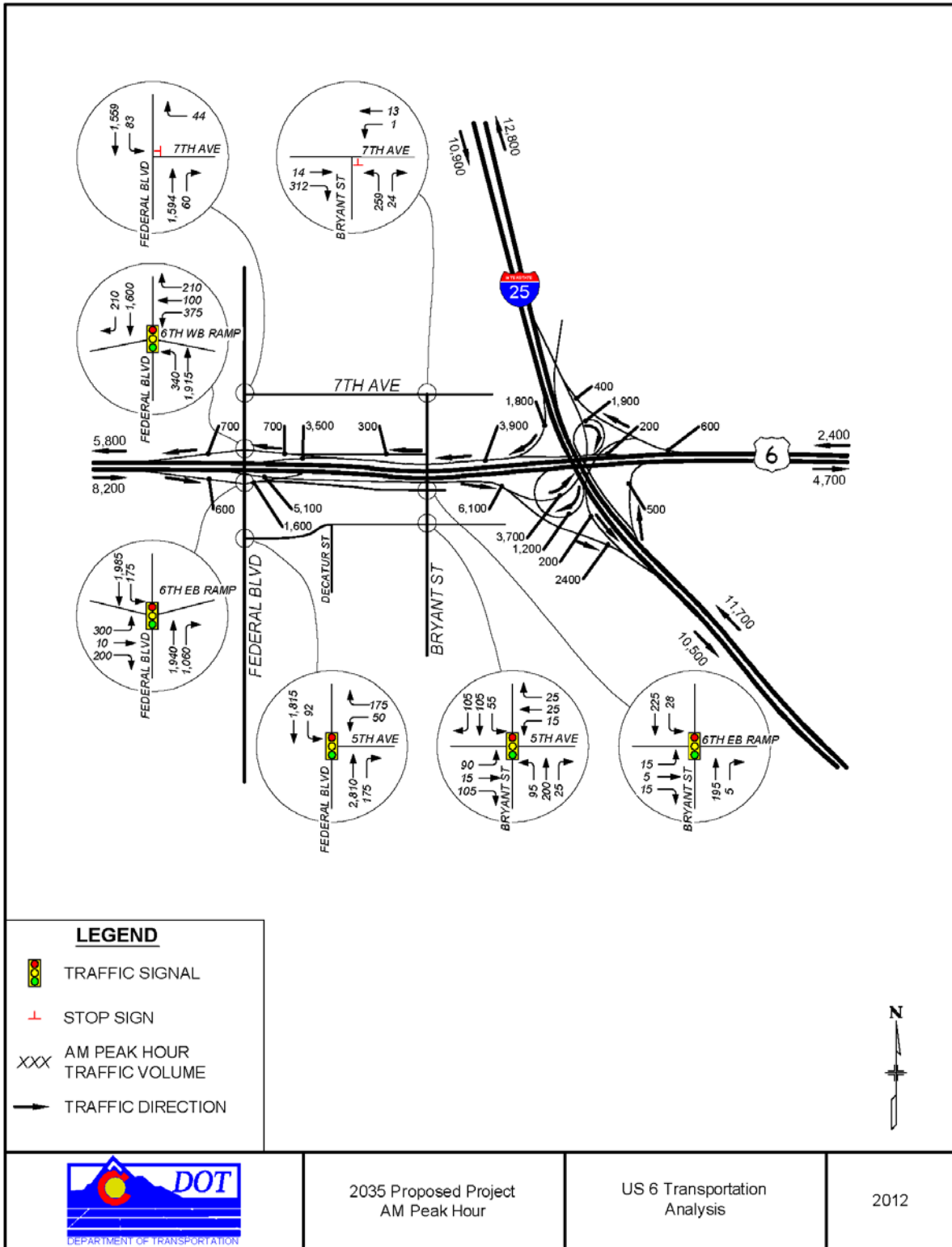


Figure 17: 2035 Project AM Peak Hour

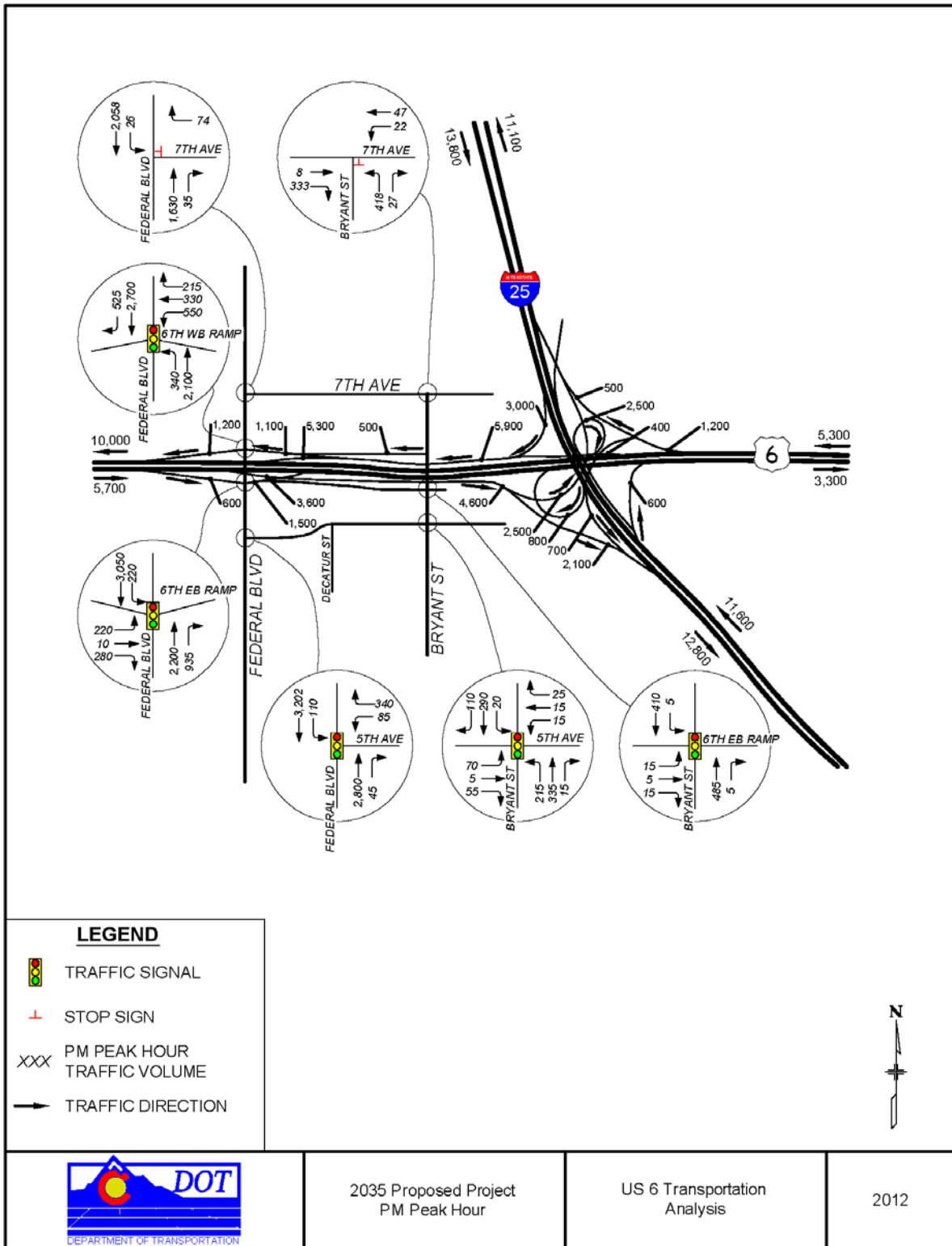


Figure 18: 2035 Project PM Peak Hour

## **Capacity Analysis Year 2035 Project**

Traffic operations analyses were completed for the study area freeway facilities and surface street intersections using the methodology described in Section 1.3. For the signalized intersections, signal timing was optimized based upon the 2035 Project traffic volumes. The resulting AM and PM Peak hour LOS for 2035 Project traffic volumes are shown in **Figure 19** (Freeway Facilities) and **Figure 20** (Surface Street Intersections).

### ***Freeway Sections***

As in the FEIS report the Project is not projected to eliminate congestion, but is shown to decrease the time duration of congested conditions in comparison with the No Build alternative.

### **Mainline Freeway Sections**

Both the northbound and southbound direction of I-25 would operate at LOS F. This is expected because there are no improvements to the I-25 mainline in the Project. As with existing and no build, congested operating conditions along mainline I-25 would create difficulty for ramp weaving, merge and diverge movements. Along US 6 mainline both westbound and eastbound within the study area would operate at LOS E or worse during the AM and PM peak hour.

### **Weaving Sections**

There would be no weaving sections on US 6 after the improvements.

### **Merge/Diverge Sections**

Each of the I-25 merge/diverge sections analyzed would operate at LOS F for both AM and PM peak hour conditions. Most of the westbound and eastbound US 6 merge/diverge sections would operate at LOS E or worse during the PM peak hour. Several locations would operate better during both peak hours with the implementation of the Project.

### ***Surface Street Intersections***

As shown in **Figure 20** most of the intersections would operate at an acceptable level of service. The signalization of the intersection of Federal Boulevard and 5<sup>th</sup> Avenue would improve operations at the intersection.

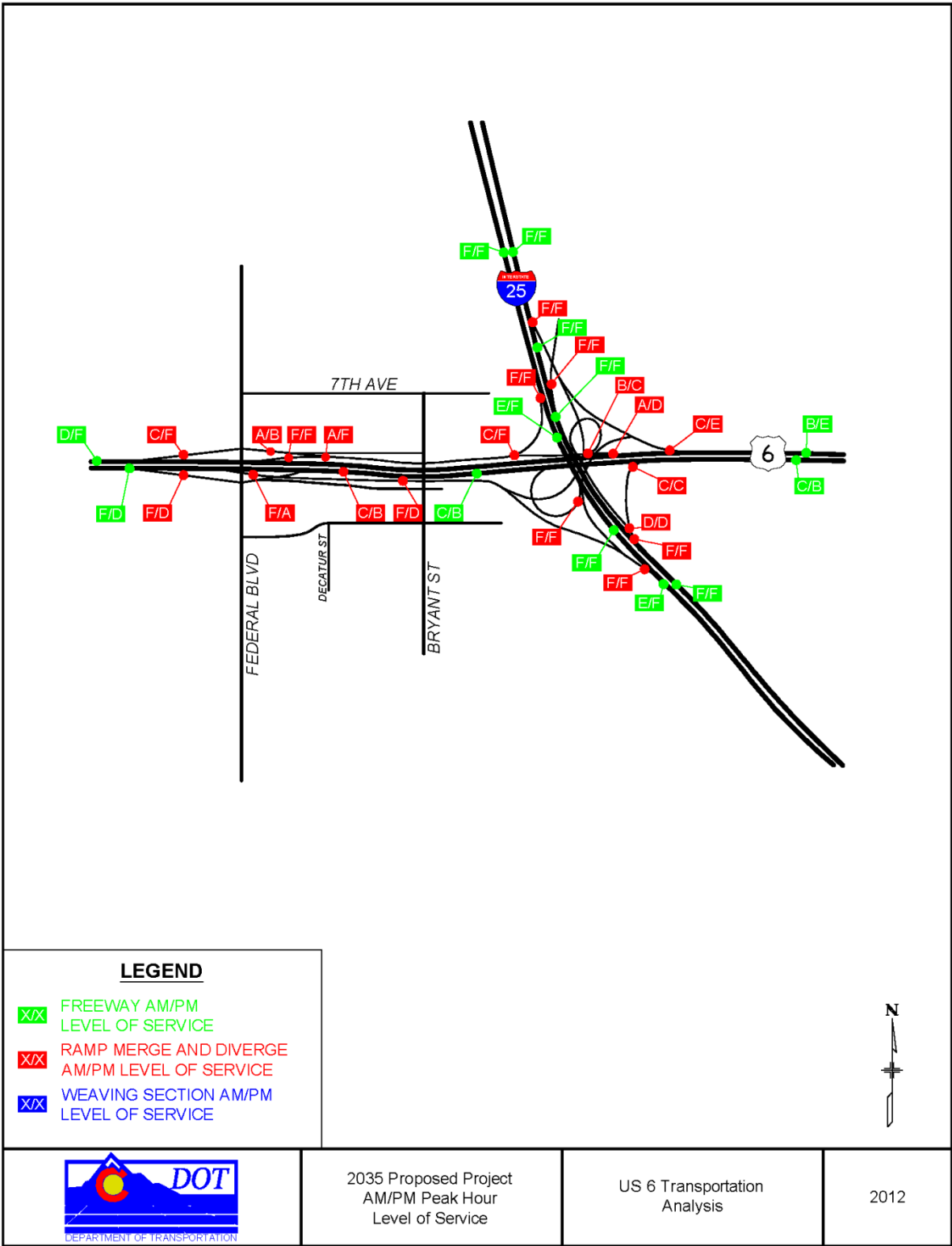


Figure 19: 2035 Project AM/PM Peak Hour Level of Service

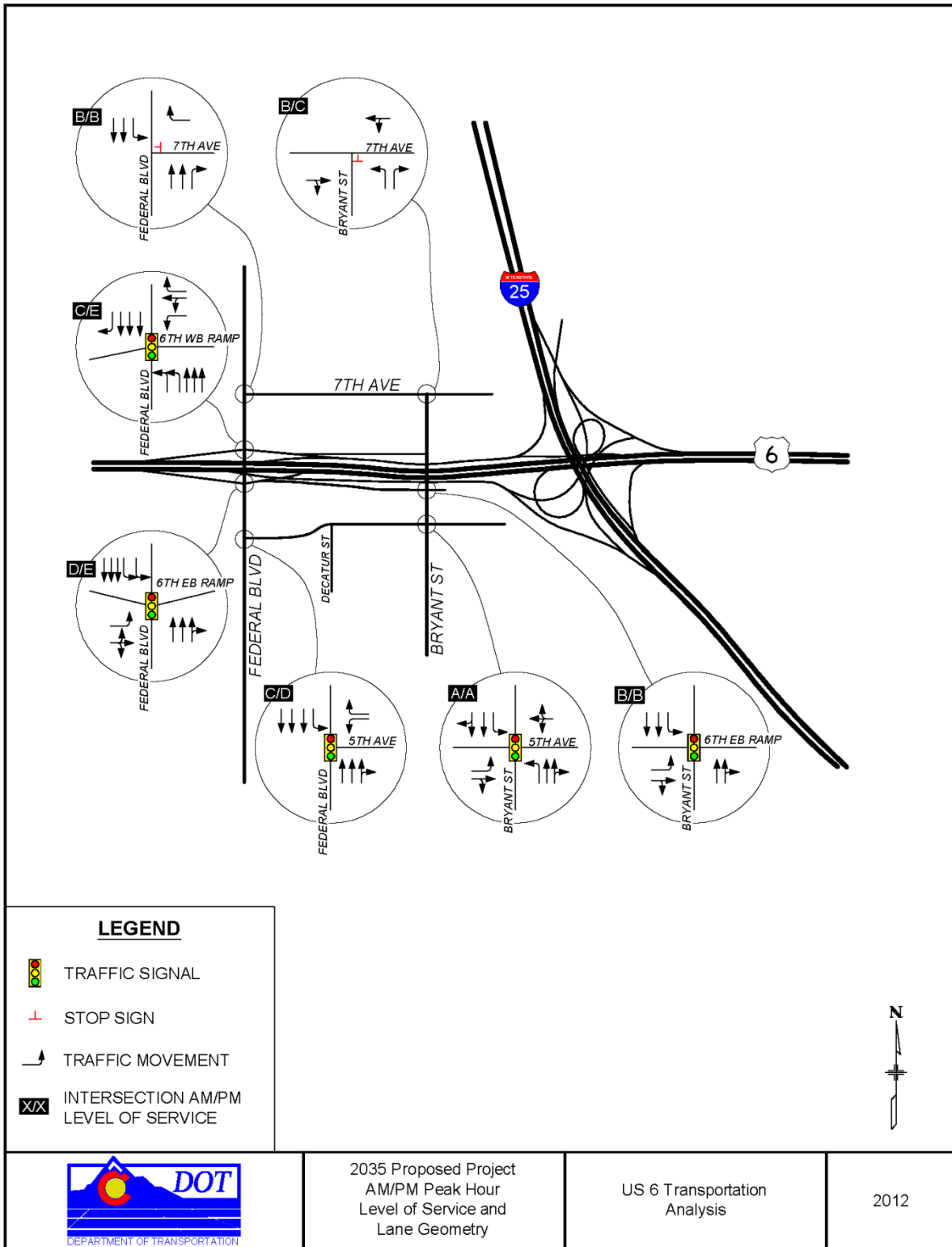


Figure 20: 2035 Project AM/PM Level of Service and Lane Geometry

# Operational Analysis Comparison Summary

## Freeway Sections

### Mainline Freeway Sections

In both the 2035 No Build and 2035 Project condition, mainline I-25 traffic would operate deficiently at LOS F during the AM and PM peak hours. Eastbound US 6, West of Federal Boulevard, would operate at LOS F during the AM Peak Hour with both the 2035 No Build and the 2035 Project. Similarly, Westbound US 6, at both the Federal on- and off-ramps, would operate at LOS F during the PM peak hour. The other locations along US 6, in both directions, would operate at LOS D or better during the AM and PM peak hour. **Table 3** summarizes the operational results of mainline freeway sections.

**Table 3: Mainline Freeway Sections Level of Service**

Direction	Location Description	Existing		2035 No Build		2035 Project	
		AM	PM	AM	PM	AM	PM
<b>US 6 Freeway Section Operations</b>							
Eastbound (listed east-to-west)	West of Federal Blvd Off-Ramp	C	C	F	D	F	D
	East of Bryant St Off-Ramp	C	B	E	D	C	B
	East of NB I-25 On-Ramp	C	B	D	C	C	B
Westbound (listed west-to-east)	East of I-25 Off-Ramp	B	C	B	D	B	E
	West of Federal Blvd On-Ramp	B	D	D	F	D	F
	West of Federal Blvd Off-Ramp - US 6	A	C	C	F	-	-
<b>I-25 Freeway Section Operations</b>							
Northbound (listed south-to-north)	South of EB US 6 Off-Ramp	E	D	F	F	F	F
	South of 8th Avenue Off-Ramp	D	D	F	F	F	F
	South of US 6 On-Ramp	D	D	F	F	F	F
	North of US 6 On-Ramp	E	D	F	F	F	F
Southbound (listed north-to-south)	North of WB US 6 Off-Ramp	C	C	F	F	F	F
	South of WB US 6 Off-Ramp	C	C	F	F	E	F
	South of EB US 6 Off-Ramp	B	C	F	F	F	F
	South of US 6 On-Ramp	D	D	F	F	F	F

**Weaving Sections**

In the 2035 No Build alternative, the short eastbound US 6 weaving section between Federal Boulevard and Bryant Street off ramp would operate at LOS F during the AM and PM peak hour. Similarly, the westbound US 6 weaving section between the northbound I-25 on-ramp and WB US 6 Frontage Road off-ramp and between the southbound I-25 on-ramp and the Bryant Street off ramp would operate LOS F during AM and PM peak hour. The 2035 Project would improve freeway operations by removing these weaving sections from the freeway system. **Table 4** summarizes the operational results of the weaving sections.

**Table 4: Weaving Sections Level of Service**

Direction	Location Description	Existing		2035 No Build		2035 Project	
		AM	PM	AM	PM	AM	PM
<b>US 6 Freeway Section Operations</b>							
Eastbound (listed east-to-west)	Decatur St On-Ramp to Bryant St Off-Ramp (Weave)	D	C	F	F	-	-
Westbound (listed west-to-east)	NB I-25 On-Ramp to WB US 6 Frontage Rd Off-Ramp (Weave)	D	E	F	F	-	-
	SB I-25 On-Ramp to Bryant St Off-Ramp US 6 Frontage Rd (Weave)	F	F	F	F	-	-

**Merge/Diverge Sections**

For the 2035 No Build and 2035 Project each of the I-25 merge/diverge sections analyzed would operate at LOS F for both peak hour conditions. In the No Build each of the I-25 merge/diverge sections analyzed would operate at LOS F for both AM and PM peak hour conditions. Most of the westbound and eastbound US 6 merge/diverge sections would operate at LOS E or worse during the PM peak hour. With the implementation of the 2035 Project each of the westbound and eastbound US 6 merge/diverge sections would operate the same or better for both AM and PM peak hours compared to the 2035 No Build alternative. **Table 5** summarizes the operational results of merge/diverge sections.

**Table 5: Merge/Diverge Sections Level of Service**

(a) US 6 Freeway Section Operations

Direction	Location Description	Existing		2035 No Build		2035 Project	
		AM	PM	AM	PM	AM	PM
Eastbound (listed east-to-west)	Federal Blvd Off-Ramp (Diverge)	C	C	F	D	F	D
	Decatur St On-Ramp (Merge)	C	B	E	D	-	-
	Bryant St Off-Ramp (Diverge)	C	C	D	C	-	-
	I-25 Off-Ramp (Diverge)	F	A	F	F	F	A
	Federal Blvd On-Ramp (Merge)	-	-	-	-	C	B
	Federal Blvd On-Ramp after improvement (Merge)	-	-	-	-	F	D
Westbound (listed west-to-east)	I-25 Off-Ramp (Diverge)	B	D	C	E	C	E
	US 6 Frontage Rd Off-Ramp (Diverge)	D	E	E	F	A	D
	Federal Blvd On-Ramp (Merge)	C	F	D	F	C	F
	NB I-25 On-Ramp - US 6 (Merge)	-	-	-	-	B	C
	Bryant Rd Off-Ramp - US 6 (Diverge)	B	C	C	F	-	-
	Federal Blvd Off-Ramp - US 6 (Diverge)	B	C	C	F	A	F
	Bryant Rd On-Ramp (Merge)	B	C	C	F	A	B



(b) I-25 Freeway Section Operations

Direction	Location Description	Existing		2035 No Build		2035 Project	
		AM	PM	AM	PM	AM	PM
Northbound (listed south-to-north)	US 6 Off-Ramp (Diverge)	-	-	-	-	F	F
	EB US 6 Off-Ramp (Diverge)	D	D	F	F	-	-
	WB US 6 Off-Ramp (Diverge)	F	D	F	F	-	-
	8th Avenue Off-Ramp (Diverge)	D	D	F	F	F	F
	US 6 On-Ramp (Merge)	-	-	-	-	F	F
	EB US 6 / WB US 6 (Diverge)	-	-	-	-	D	D
	US 6 On-Ramp (Merge)	F	F	F	F	-	-
Southbound (listed north-to-south)	WB US 6 Off-Ramp (Diverge)	F	F	F	F	F	F
	EB US 6 Off-Ramp (Diverge)	B	B	F	F	F	F
	US 6 On-Ramp (Merge)	C	C	F	F	F	F

### Surface Street Intersections

Surface street intersection operations generally would be worse for the No Build alternative than with the Project. There are several intersections that operate with deficient levels of service for the No Build scenario. With the Project, most of the intersections would be within acceptable LOS after signal timing is optimized for the future traffic volumes. **Table 6** summarizes the findings of the Existing, 2035 No Build, and 2035 Project operations analysis for surface street intersections within the project corridor.

**Table 6: Surface Street Intersections Level of Service**

Intersection	Control	Existing Condition		2035 No Build		2035 Project	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Federal Blvd/7th Avenue	TWSC	D	F	F	F	B	B
Federal Blvd/6th Avenue WB Ramp	Signal	B	C	E	F	C	E
Federal Blvd/6th Avenue EB Ramp	Signal	B	B	C	F	D	E
Federal Blvd/5th Avenue	TWSC *	A	A	F	F	C	D
Bryant St/5th Avenue	Signal	B	B	C	C	A	A
Bryant St/6th Avenue EB Ramp	Signal	B	B	E	D	B	B
Bryant St/6th Avenue WB Ramp	Signal	A	B	B	A	No longer exists	
Bryant St/7th Avenue	TWSC	B	B	B	C	B	B

\* For 2035 Build Condition the Federal Blvd/5th Avenue intersection will operate under signal control

## Bicycle and Pedestrian Facilities

The FEIS identified pedestrian and bicycle mobility within the corridor as a project need. The City and County of Denver had previously identified key corridors for pedestrian and bicycle mobility and adopted standards for these facilities. These are formalized in the *Draft City and County of Denver Pedestrian Master Plan* (CCD, 2002b) and the *Denver Bicycle Master Plan Update 2001* (CCD, 2002a). The only existing pedestrian and bike facility identified in the plan that is within the study area is the South Platte River Trail.

The FEIS includes bicycle and pedestrian safety improvements within the study area. These improvements include:

- Replacement of the existing bridge over the South Platte River Trail that would result in increased vertical clearance for the trail under the bridges, mitigating the current deficiency and improved visibility for users of the facility.
- Improvement of pedestrian facilities in the vicinity of the US 6/Federal Boulevard interchange with wider sidewalks across the Federal bridge over US 6 and crosswalk and signal phasing improvements at the intersections.

Additional bicycle and pedestrian improvements that are consistent with the FEIS and would be implemented with the Project include the following:

- Construction of a bicycle/pedestrian bridge over US 6, which would offer a separate crossing over the freeway with connections to existing paths and routes.
- The widening of sidewalks on the Federal Boulevard bridge from 5-feet to 8-feet on both sides of the roadway.
- Lighting modifications across the Federal Boulevard Bridge that would conform to City and County of Denver corridor lighting standards.

## **Safety Impact Analysis**

The 2005 *Traffic Safety Assessment Report* addressed collisions as being an issue within the corridor and it was established that it is related to congestion, recurrent and frequent queuing, close interchange spacing, and the geometric characteristics of the existing alignment. The history of collisions throughout the corridor indicates a high potential for accident reduction if improvements are constructed. The implementation of the Project is expected to reduce the number of accidents by 1,550 – 1,750 relative to the 2025 FEIS No Build Alternative in the US 6 area by separating eastbound weaving movements using a collector – distributor road.

## **Summary of Traffic Operations of Project versus FEIS**

This transportation analysis of the Project includes traffic projections to 2035 and traffic operations updates to the FEIS. Overall, since the FEIS and 2007 ROD, there have been no changes to the Project with regards to lane configurations and geometry, no new issues identified, and no new circumstances to be considered. Since the preparation of the FEIS, and typical of the industry as a whole, standard traffic operations methodologies have continued to be updated and refined.

The FEIS and 2007 ROD improvements maximize safety and operations by developing roadway improvements that separate traffic movements to mitigate friction between traffic streams. The Project would not have any adverse impacts on traffic operations and would result in overall traffic operations improvements. These impacts are similar to those disclosed in the FEIS for the Preferred Alternative.

## References

Colorado Department of Transportation. November 2006. Final Environmental Impact Statement/Final Section 4(f) Evaluation: I-25 Valley Highway Project, Logan to US 6.

Federal Highway Administration. July 2007. Record of Decision: I-25 Valley Highway Project, Logan to US 6.

Felsburg,Holt & Ullevig and CDOT. February 28, 2005. Traffic Report for the Valley Highway EIS Denver, Colorado.

Felsburg,Holt & Ullevig and CDOT. October, 2006. Traffic Report addendum for the Valley Highway EIS Denver, Colorado.

Felsburg,Holt & Ullevig and CDOT. October, 2006. Traffic Safety Report Addendum for the Valley Highway EIS Denver, Colorado.

Felsburg,Holt & Ullevig. May 2007. Valley Highway System Level Study, Colorado.

Transportation Research Board. Highway Capacity Manual (HCM) 2010. Washington D.C.

# **Appendix A Existing Conditions of LOS**

# Freeway Facilities

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Direction: US 6/Eastbound  
From/To: West of Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5060	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1406	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1429	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	1429	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	26.0-	pc/mi/ln
Level of service, LOS	C	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Period  
 Freeway/Direction: US 6/Eastbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	4400	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1222	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1243	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	1243	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	22.6	pc/mi/ln
Level of service, LOS	C	



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of Bryant St Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5170	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1436	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1168	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	5	
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	1168	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	5	
Density, D	21.2	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:  
 E-mail:

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of Bryant St Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	4250	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1181	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	961	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	5	
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	961	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	5	
Density, D	17.5	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Direction: US 6/Eastbound  
From/To: East of NB I-25 On-Ramp (3)  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	3125	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	868	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1177	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	1177	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	21.4	pc/mi/ln
Level of service, LOS	C	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Period  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of NB I-25 On-Ramp (3)  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2600	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	722	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	979	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	979	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	17.8	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5060	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	400	vph
Length of first accel/decel lane	130	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)	5060	400	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	1406	111	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5718	452	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 2748 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5718	9000	No
$v_{FO} = v_F - v_R$	5266	9000	No
$v_R$	452	2000	No
$v_3 \text{ or } v_{av34}$	1485 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2748$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2748	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 26.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.469	
Space mean speed in ramp influence area,	S = 48.9	mph
Space mean speed in outer lanes,	S = 58.4	mph
Space mean speed for all vehicles,	S = 53.4	mph

-----

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4400	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	545	vph
Length of first accel/decel lane	130	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)	4400	545	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	1222	151	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	0.00	%	0.00
Length	0.00	mi	0.00
Trucks and buses PCE, ET	1.5	1.5	mi
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4972	616	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 2515 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4972	9000	No
$v_{FO} = v_F - v_R$	4356	9000	No
$v_R$	616	2000	No
$v_3 \text{ or } v_{av34}$	1228 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2515$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2515	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 24.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.483	
Space mean speed in ramp influence area,	S = 48.7	mph
Space mean speed in outer lanes,	S = 59.4	mph
Space mean speed for all vehicles,	S = 53.5	mph

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Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6/Eastbound  
 Junction: Decatur St On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4660	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	660	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	150	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4660	660	150	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1294	183	42	v
Trucks and buses	3	3	0	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.998	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5266	746	167	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.125 Using Equation 4  
FM  
 $v_{12} = v_F (P_{FM}) = 512 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	4854	9000	No
v <sub>3</sub> or v <sub>av34</sub>	1798 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 1643		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	4854	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.352	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.4	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 52.4	mph
Space mean speed for all vehicles,	S = 51.4	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Decatur St On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3855	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	540	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	200	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3855	540	200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1071	150	56	v
Trucks and buses	3	3	0	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.998	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4356	610	223	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.142 Using Equation 4  
FM  
 $v_{12} = v_F (P_{FM}) = 481 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	4008	9000	No
v <sub>3</sub> or v <sub>av34</sub>	1458 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 1359		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	4008	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 19.5 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	M = 0.337	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.6	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 53.1	mph
Space mean speed for all vehicles,	S = 51.9	mph

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Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6/Eastbound  
 Junction: Bryant St Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5320	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	150	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	660	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5320	150	660	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1478	42	183	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6012	170	746	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2324 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5111	9000	No
$v_{FO} = v_F - v_R$	4941	9000	No
$v_R$	170	2000	No
$v_3 \text{ or } v_{av34}$	1393 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2324$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2324	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 22.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.443	
Space mean speed in ramp influence area,	S = 49.2	mph
Space mean speed in outer lanes,	S = 58.8	mph
Space mean speed for all vehicles,	S = 54.0	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Bryant St Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4395	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	145	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	540	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4395	145	540	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1221	40	150	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4966	164	610	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2041 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4470	9000	No
$v_{FO} = v_F - v_R$	4306	9000	No
$v_R$	164	2000	No
$v_3 \text{ or } v_{av34}$	1214 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2041$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2041	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 20.3 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.443	
Space mean speed in ramp influence area,	S = 49.2	mph
Space mean speed in outer lanes,	S = 59.5	mph
Space mean speed for all vehicles,	S = 54.3	mph



Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5170	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	3535	vph
Length of first accel/decel lane	1250	ft
Length of second accel/decel lane	1500	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	150	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5170	3535	150	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1436	982	42	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5842	4073	170	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.260 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4533 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5842	9000	No
$v_{FO} = v_F - v_R$	1769	9000	No
$v_R$	4073	4000	Yes
$v_3 \text{ or } v_{av34}$	654 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4533$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4533	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 7.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.795	
Space mean speed in ramp influence area,	S = 44.7	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 47.4	mph

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Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6/Eastbound  
 Junction: I-25 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4250	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2520	vph
Length of first accel/decel lane	1250	ft
Length of second accel/decel lane	1500	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	145	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4250	2520	145	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1181	700	40	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4803	2904	164	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.260 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3398 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4803	9000	No
$v_{FO} = v_F - v_R$	1899	9000	No
$v_R$	2904	4000	No
$v_3 \text{ or } v_{av34}$	702 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3398$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3398	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = -2.5 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence A

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

Intermediate speed variable,	D = 0.689	
Space mean speed in ramp influence area,	S = 46.0	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 49.5	mph

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Phone:  
E-mail:

Fax:

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Operational Analysis  
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Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Weaving Location: Decatur St On to Bryant St Off  
Analysis Year: Existing  
Description: US 6 Bridges

-----  
Inputs  
-----

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	5	ln
Weaving segment length, LS	170	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

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

	Volume Components				veh/h
	VFF	VRF	VFR	VRR	
Volume, V	5320	660	150	5	
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1478	183	42	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6012	746	170	6	pc/h
Volume ratio, VR		0.132			

-----  
Configuration Characteristics  
-----

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.34	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	0	lc/h
Non-weaving vehicle index, INW	35	
Non-weaving lane change, LCNW	369	lc/h
Total lane changes, LCALL	369	lc/h

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Weaving and Non-Weaving Speeds  
-----

Weaving intensity factor, W	0.417
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Average weaving speed, SW	43.2	mi/h
Average non-weaving speed, SNW	48.3	mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S	47.6	mi/h
Weaving segment density, D	29.1	pc/mi/ln
Level of service, LOS	D	
Weaving segment v/c ratio	0.705	
Weaving segment flow rate, v	6934	pc/h
Weaving segment capacity, cW	9676	veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	3854	170	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1968	c
v/c ratio		Maximum 1.00	Analyzed 0.705	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

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Phone:  
E-mail:

Fax:

Operational Analysis

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Dir of Travel: US 6/Eastbound  
 Weaving Location: Decatur St On to Bryant St Off  
 Analysis Year: Existing  
 Description: US 6 Bridges

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	5	ln
Weaving segment length, LS	170	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				veh/h
	VFF	VRF	VFR	VRR	
Volume, V	4395	540	145	5	
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1221	150	40	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4966	610	164	6	pc/h
Volume ratio, VR		0.135			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.34	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	0	lc/h
Non-weaving vehicle index, INW	29	
Non-weaving lane change, LCNW	153	lc/h
Total lane changes, LCALL	153	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.208
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Average weaving speed, SW	48.1	mi/h
Average non-weaving speed, SNW	49.5	mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S	49.3	mi/h
Weaving segment density, D	23.3	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.585	
Weaving segment flow rate, v	5746	pc/h
Weaving segment capacity, cW	9666	veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	3880	170	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1966	c
v/c ratio		Maximum 1.00	Analyzed 0.585	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: East of I-25 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2255	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	626	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	637	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	637	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	11.6	pc/mi/ln
Level of service, LOS	B	

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 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: East of I-25 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	3895	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1082	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
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	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	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	4	
Density, D	20.0	pc/mi/ln
Level of service, LOS	C	

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 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: West of Federal Blvd On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	778	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	791	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	791	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	14.4	pc/mi/ln
Level of service, LOS	B	

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 Freeway/Direction: US 6/Westbound  
 From/To: West of Federal Blvd On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1611	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1639	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	1639	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	29.8	pc/mi/ln
Level of service, LOS	D	

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-----Operational Analysis-----

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 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6 Frontage Rd/Westbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	1020	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	283	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	576	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	576	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	10.5	pc/mi/ln
Level of service, LOS	A	

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-----Operational Analysis-----

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 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6 Frontage Rd/Westbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2250	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	625	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1271	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	1271	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	23.1	pc/mi/ln
Level of service, LOS	C	

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2255	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	530	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?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	470	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2255	530	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	626	147	0	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2548	611	0	pcph

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

L = 0.00 (Equation 13-12 or 13-13)  
EQ  
P = 0.668 Using Equation 5  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 1905 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2548	6750	No
$v_{FO} = v_F - v_R$	1937	6750	No
$v_R$	611	2000	No
$v_3 \text{ or } v_{av34}$	643 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 1905$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	1905	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 19.4 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	D = 0.483	
Space mean speed in ramp influence area,	S = 48.7	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 51.2	mph

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3895	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	865	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?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	470	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3895	865	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1082	240	0	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4401	997	0	pcph

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

L = 0.00 (Equation 13-12 or 13-13)  
EQ  
P = 0.604 Using Equation 5  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3053 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4401	6750	No
$v_{FO} = v_F - v_R$	3404	6750	No
$v_R$	997	2000	No
$v_3 \text{ or } v_{av34}$	1348 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3053$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3053	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 29.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.518	
Space mean speed in ramp influence area,	S = 48.3	mph
Space mean speed in outer lanes,	S = 59.0	mph
Space mean speed for all vehicles,	S = 51.1	mph

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6/Westbound  
 Junction: US 6 Frontage Rd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3380	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	340	vph
Length of first accel/decel lane	475	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1655	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	475	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3380	340	1655	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	939	94	460	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3819	384	1870	pcph

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

L = 14423.11 Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 6  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3819 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3819	6750	No
$v_{FO} = v_F - v_R$	3435	6750	No
$v_R$	384	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3819$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3819	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 32.8 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.463	
Space mean speed in ramp influence area,	S = 49.0	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 49.0	mph

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

Analyst: SM  
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Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: US 6 Frontage Rd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4390	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	440	vph
Length of first accel/decel lane	475	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1360	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	475	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4390	440	1360	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1219	122	378	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4961	497	1537	pcph

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

L = 10432.29 Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 6  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4961 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4961	6750	No
$v_{FO} = v_F - v_R$	4464	6750	No
$v_R$	497	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4961$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4961	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 42.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence E

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

Intermediate speed variable,	D = 0.473	
Space mean speed in ramp influence area,	S = 48.9	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 48.9	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3890	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	490	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	850	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1225	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3890	490	850	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1081	136	236	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4396	554	961	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.619 Using Equation 1  
FM  
 $v_{12} = v_F (P_{FM}) = 2723 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	4950	6750	No
v <sub>3</sub> or v <sub>av34</sub>	1673 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 2723		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	4950	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 21.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.319	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.8	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 50.8	mph
Space mean speed for all vehicles,	S = 50.8	mph

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Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6/Westbound  
 Junction: Federal Blvd On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5760	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	715	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1810	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1225	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5760	715	1810	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1600	199	503	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6509	808	2045	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.619 Using Equation 1  
FM  
 $v_{12} = v_{F} (P) = 4032 \text{ pc/h}$   
12 F FM

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	7317	6750	Yes
v <sub>3</sub> or v <sub>av34</sub>	2477 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 4032		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	7317	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 33.5 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 0.709	
Space mean speed in ramp influence area,	S <sub>R</sub> = 45.8	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 47.4	mph
Space mean speed for all vehicles,	S = 46.3	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
 Junction: Bryant St Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	1415	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	375	vph
Length of first accel/decel lane	265	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1915	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1415	375	1915	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	393	104	532	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	1599	424	2164	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 1599 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1599	4500	No
$v_{FO} = v_F - v_R$	1175	4500	No
$v_R$	424	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 1599$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	1599	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 15.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	D = 0.466	
Space mean speed in ramp influence area,	S = 48.9	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 48.9	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
Junction: Bryant St Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2315	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	235	vph
Length of first accel/decel lane	265	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1825	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2315	235	1825	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	643	65	507	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2616	266	2062	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2616 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2616	4500	No
$v_{FO} = v_F - v_R$	2350	4500	No
$v_R$	266	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2616$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2616	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 24.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.452	
Space mean speed in ramp influence area,	S = 49.1	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 49.1	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
 Junction: Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	1020	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	135	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	850	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	600	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1020	135	850	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	283	38	236	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	1153	153	961	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 1153 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1153	4500	No
$v_{FO} = v_F - v_R$	1000	4500	No
$v_R$	153	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 1153$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	1153	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 13.3 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	D = 0.442	
Space mean speed in ramp influence area,	S = 49.3	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 49.3	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
 Junction: Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2250	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	225	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1810	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	600	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2250	225	1810	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	625	63	503	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2543	254	2045	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2543 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2543	4500	No
$v_{FO} = v_F - v_R$	2289	4500	No
$v_R$	254	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2543$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2543	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 25.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.451	
Space mean speed in ramp influence area,	S = 49.1	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 49.1	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6 Frnt Rd Federal Off/WB  
 Junction: US 6 Frnt Rd Fed Off/Bryant On  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	1020	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	0	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)	1020	100	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	283	28	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1153	113	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 1.000 Using Equation 0  
 FM  
 $v_{12} = v_F (P_{FM}) = 1153 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	1266	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 1153		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	1266	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 15.3 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	M = 0.335	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.6	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S = 50.6	mph

Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6 Frnt Rd Federal Off/WB  
 Junction: US 6 Frnt Rd Fed Off/Bryant On  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2250	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	225	vph
Length of first accel/decel lane	0	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)	2250	225	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	625	63	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2543	254	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 1.000 Using Equation 0  
 FM  
 $v_{12} = v_F (P_{FM}) = 2543 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	2797	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 2543		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	2797	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.2 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.385	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.0	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S <sub>0</sub> = 50.0	mph

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Operational Analysis  
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Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Weaving Location: NB I-25 On to US 6 Front Off  
Analysis Year: Existing  
Description: US 6 Bridges

-----  
Inputs  
-----

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	475	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

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

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	3380	1655	340	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	939	460	94	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	3819	1870	384	6	pc/h
Volume ratio, VR		0.371			

-----  
Configuration Characteristics  
-----

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	101	lc/h
Non-weaving vehicle index, INW	53	
Non-weaving lane change, LCNW	275	lc/h
Total lane changes, LCALL	376	lc/h

-----  
Weaving and Non-Weaving Speeds  
-----

Weaving intensity factor, W	0.188
-----------------------------	-------

Average weaving speed, SW	48.7	mi/h
Average non-weaving speed, SNW	47.7	mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S	48.1	mi/h
Weaving segment density, D	31.6	pc/mi/ln
Level of service, LOS	D	
Weaving segment v/c ratio	0.939	
Weaving segment flow rate, v	6079	pc/h
Weaving segment capacity, cW	6365	veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6356	475	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1800	c
v/c ratio		Maximum 1.00	Analyzed 0.939	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

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Operational Analysis  
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Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Weaving Location: NB I-25 On to US 6 Front Off  
Analysis Year: Existing  
Description: US 6 Bridges

-----  
Inputs  
-----

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	475	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

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

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	4390	1360	440	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1219	378	122	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4961	1537	497	6	pc/h
Volume ratio, VR		0.291			

-----  
Configuration Characteristics  
-----

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	101	lc/h
Non-weaving vehicle index, INW	68	
Non-weaving lane change, LCNW	510	lc/h
Total lane changes, LCALL	611	lc/h

-----  
Weaving and Non-Weaving Speeds  
-----

Weaving intensity factor, W	0.276
-----------------------------	-------

Average weaving speed, SW	46.4	mi/h
Average non-weaving speed, SNW	46.6	mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S	46.5	mi/h
Weaving segment density, D	37.6	pc/mi/ln
Level of service, LOS	E	
Weaving segment v/c ratio	0.937	
Weaving segment flow rate, v	7001	pc/h
Weaving segment capacity, cW	7343	veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5483	475	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1867	c
v/c ratio		Maximum 1.00	Analyzed 0.937	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

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Phone:  
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-----Operational Analysis-----

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
 Weaving Location: SB I-25 On to Bryant St Off  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Inputs-----

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	2	ln
Weaving segment length, LS	275	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

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

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1415	1915	375	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	393	532	104	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1599	2164	424	6	pc/h
Volume ratio, VR		0.617			

-----Configuration Characteristics-----

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW		
Non-weaving lane change, LCNW		lc/h
Total lane changes, LCALL		lc/h

-----Weaving and Non-Weaving Speeds-----

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS F  
 Weaving segment v/c ratio 1.339  
 Weaving segment flow rate, v 4193 pc/h  
 Weaving segment capacity, cW 3078 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	9228	275	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1565	c
v/c ratio		Maximum 1.00	Analyzed 1.339	d

- Notes:
- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
  - b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
  - c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
  - d. Volumes exceed the weaving segment capacity. The level of service is F.

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Operational Analysis

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
 Weaving Location: SB I-25 On to Bryant St Off  
 Analysis Year: Existing  
 Description: US 6 Bridges

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	2	ln
Weaving segment length, LS	275	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	2315	1825	235	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	643	507	65	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2616	2062	266	6	pc/h
Volume ratio, VR		0.470			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW		
Non-weaving lane change, LCNW		lc/h
Total lane changes, LCALL		lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS F  
 Weaving segment v/c ratio 1.457  
 Weaving segment flow rate, v 4950 pc/h  
 Weaving segment capacity, cW 3341 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7481	275	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1699	c
v/c ratio		Maximum 1.00	Analyzed 1.457	d

- Notes:
- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
  - b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
  - c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
  - d. Volumes exceed the weaving segment capacity. The level of service is F.

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	8500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2361	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1959	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	5	
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	1959	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.4	mi/h
Number of lanes, N	5	
Density, D	36.0	pc/mi/ln
Level of service, LOS	E	

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	7500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2083	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1728	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	5	
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	1728	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	5	
Density, D	31.4	pc/mi/ln
Level of service, LOS	D	



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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of 8th Ave Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	6540	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1817	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1884	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	1884	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.8	mi/h
Number of lanes, N	4	
Density, D	34.4	pc/mi/ln
Level of service, LOS	D	

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of 8th Ave Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	6005	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1668	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
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	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	1730	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	31.5	pc/mi/ln
Level of service, LOS	D	

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	6475	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1799	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1865	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	1865	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.9	mi/h
Number of lanes, N	4	
Density, D	34.0	pc/mi/ln
Level of service, LOS	D	

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	6025	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1674	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1736	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	1736	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	31.6	pc/mi/ln
Level of service, LOS	D	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: North of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	8500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2361	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1959	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	5	
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	1959	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	54.4	mi/h
Number of lanes, N	5	
Density, D	36.0	pc/mi/ln
Level of service, LOS	E	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: North of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	7500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2083	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1728	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	5	
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	1728	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	5	
Density, D	31.4	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8500	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	305	vph
Length of first accel/decel lane	100	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)	8500	305	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2361	85	v
Trucks and buses	7	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	9794	345	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3611 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7836	9000	No
$v_{FO} = v_F - v_R$	7491	9000	No
$v_R$	345	2000	No
$v_3 \text{ or } v_{av34}$	2112 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3611$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3611	4400	No

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

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

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

Intermediate speed variable,	D = 0.459	
Space mean speed in ramp influence area,	S = 49.0	mph
Space mean speed in outer lanes,	S = 56.0	mph
Space mean speed for all vehicles,	S = 52.6	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	7500	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	115	vph
Length of first accel/decel lane	100	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)	7500	115		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2083	32		v
Trucks and buses	7	3		%
Recreational vehicles	1	1		%
Terrain type:	Level	Level		
Grade	0.00	%	0.00	%
Length	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.964	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	8642	130	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 3088 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6914	9000	No
$v_{FO} = v_F - v_R$	6784	9000	No
$v_R$	130	2000	No
$v_3 \text{ or } v_{av34}$	1913 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3088$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3088	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 29.9 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.440	
Space mean speed in ramp influence area,	S = 49.3	mph
Space mean speed in outer lanes,	S = 56.8	mph
Space mean speed for all vehicles,	S = 53.2	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8195	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1655	vph
Length of first accel/decel lane	1000	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	500	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1000	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8195	1655	500	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2276	460	139	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9442	1870	576	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5171 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9442	9000	Yes
$v_{FO} = v_F - v_R$	7572	9000	No
$v_R$	1870	2000	No
$v_3 \text{ or } v_{av34}$	2135 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5171$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	5171	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 39.7 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.596	
Space mean speed in ramp influence area,	S = 47.2	mph
Space mean speed in outer lanes,	S = 55.9	mph
Space mean speed for all vehicles,	S = 50.8	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	7385	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1360	vph
Length of first accel/decel lane	1000	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	115	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1000	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7385	1360	115	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2051	378	32	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8509	1537	133	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4577 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8509	9000	No
$v_{FO} = v_F - v_R$	6972	9000	No
$v_R$	1537	2000	No
$v_3 \text{ or } v_{av34}$	1966 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4577$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4577	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 34.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.566	
Space mean speed in ramp influence area,	S = 47.6	mph
Space mean speed in outer lanes,	S = 56.6	mph
Space mean speed for all vehicles,	S = 51.4	mph

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Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: I-25/Northbound  
 Junction: 8th Avenue Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6540	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	65	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1900	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	450	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6540	65	1900	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1817	18	528	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7536	75	2189	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3328 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7536	9000	No
$v_{FO} = v_F - v_R$	7461	9000	No
$v_R$	75	2000	No
$v_3 \text{ or } v_{av34}$	2104 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3328$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3328	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 31.5 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.435	
Space mean speed in ramp influence area,	S = 49.3	mph
Space mean speed in outer lanes,	S = 56.0	mph
Space mean speed for all vehicles,	S = 52.9	mph



Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: 8th Avenue Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6025	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	20	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1360	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	450	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6025	20	1360	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1674	6	378	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6942	23	1567	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3040 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6942	9000	No
$v_{FO} = v_F - v_R$	6919	9000	No
$v_R$	23	2000	No
$v_3 \text{ or } v_{av34}$	1951 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3040$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3040	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 29.0 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.430	
Space mean speed in ramp influence area,	S = 49.4	mph
Space mean speed in outer lanes,	S = 56.6	mph
Space mean speed for all vehicles,	S = 53.2	mph

Phone: Fax:  
E-mail:

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

Analyst:  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6475	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2585	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane	400	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	85	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6475	2585	85	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1799	718	24	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7461	2978	98	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.209 Using Equation 0  
FM  
 $v_{12} = v_F (P_{FM}) = 1559 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	10439	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	2951 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 2984		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	10439	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.3 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 1.598	
Space mean speed in ramp influence area,	S = 34.2	mph
Space mean speed in outer lanes,	S = 48.7	mph
Space mean speed for all vehicles,	S = 39.2	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6005	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1840	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane	400	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	75	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6005	1840	75	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1668	511	21	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6919	2120	86	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.209 Using Equation 0  
FM  
 $v_{12} = v_F (P) = 1446 \text{ pc/h}$   
12 F FM

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	9039	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	2736 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 2767		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	9039	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 21.3 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 0.600	
Space mean speed in ramp influence area,	S <sub>R</sub> = 47.2	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 49.3	mph
Space mean speed for all vehicles,	S <sub>0</sub> = 48.2	mph

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Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (6)  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5760	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1600	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1106	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	6	
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	1106	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	6	
Density, D	20.1	pc/mi/ln
Level of service, LOS	C	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (6)  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	6000	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1667	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1152	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	6	
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	1152	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	6	
Density, D	20.9	pc/mi/ln
Level of service, LOS	C	



Phone: Fax:  
 E-mail:

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of WB US 6 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	3845	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1068	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1108	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	1108	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	20.1	pc/mi/ln
Level of service, LOS	C	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of WB US 6 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	4175	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1160	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1203	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	1203	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	21.9	pc/mi/ln
Level of service, LOS	C	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	3285	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	913	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	946	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	946	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	17.2	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:  
 E-mail:

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	3790	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1053	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1092	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	1092	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	19.9	pc/mi/ln
Level of service, LOS	C	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	6995	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1943	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1612	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	5	
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	1612	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	5	
Density, D	29.3	pc/mi/ln
Level of service, LOS	D	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	7280	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2022	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	1678	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	5	
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	1678	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	5	
Density, D	30.5	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: I-25/Southbound  
 Junction: Westbound US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5700	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1915	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	60	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5700	1915	60	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1583	532	17	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6568	2164	69	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3655 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5583	9000	No
$v_{FO} = v_F - v_R$	3419	9000	No
$v_R$	2164	2000	Yes
$v_3 \text{ or } v_{av34}$	964 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3655$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3655	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 25.3 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.623	
Space mean speed in ramp influence area,	S = 46.9	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 50.8	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6000	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1825	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	60	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6000	1825	60	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1667	507	17	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6913	2062	69	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3725 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5877	9000	No
$v_{FO} = v_F - v_R$	3815	9000	No
$v_R$	2062	2000	Yes
$v_3 \text{ or } v_{av34}$	1076 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3725$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3725	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 25.9 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.614	
Space mean speed in ramp influence area,	S = 47.0	mph
Space mean speed in outer lanes,	S = 60.0	mph
Space mean speed for all vehicles,	S = 51.1	mph

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Heavy vehicle adjustment, fHV	0.964	0.983	0.985	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4430	633	2160	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2288 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4430	9000	No
$v_{FO} = v_F - v_R$	3797	9000	No
$v_R$	633	2000	No
$v_3 \text{ or } v_{av34}$	1071 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2288$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2288	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 10.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	D = 0.485	
Space mean speed in ramp influence area,	S = 48.7	mph
Space mean speed in outer lanes,	S = 60.1	mph
Space mean speed for all vehicles,	S = 53.6	mph

-----

Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: I-25/Southbound  
 Junction: Eastbound US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3845	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	560	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1915	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3845	560	1915	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1068	156	532	v
Trucks and buses	7	3	3	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.985	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4430	633	2160	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2288 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4430	9000	No
$v_{FO} = v_F - v_R$	3797	9000	No
$v_R$	633	2000	No
$v_3 \text{ or } v_{av34}$	1071 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2288$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2288	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 10.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	D = 0.485	
Space mean speed in ramp influence area,	S = 48.7	mph
Space mean speed in outer lanes,	S = 60.1	mph
Space mean speed for all vehicles,	S = 53.6	mph

-----

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4175	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	385	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1825	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4175	385	1825	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1160	107	507	v
Trucks and buses	7	3	3	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.985	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4811	435	2058	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2343 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4811	9000	No
$v_{FO} = v_F - v_R$	4376	9000	No
$v_R$	435	2000	No
$v_3 \text{ or } v_{av34}$	1234 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2343$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2343	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 10.9 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	D = 0.467	
Space mean speed in ramp influence area,	S = 48.9	mph
Space mean speed in outer lanes,	S = 59.4	mph
Space mean speed for all vehicles,	S = 53.8	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: Existing  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3285	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1480	vph
Length of first accel/decel lane	1500	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)	3285	1480	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	913	411	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	



Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3785	1705	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 0.005 Using Equation 4  
 FM  
 $v_{12} = v_F (P_{FM}) = 18 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	5490	9000	No
v <sub>3</sub> or v <sub>av34</sub>	1883 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 1514		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	5490	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.4 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.314	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.9	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 52.7	mph
Space mean speed for all vehicles,	S = 51.6	mph

-----

Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: I-25/Southbound  
 Junction: US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: Existing  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3790	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1455	vph
Length of first accel/decel lane	1500	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)	3790	1455	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	1053	404	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4367	1676	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 0.008 Using Equation 4  
 FM  
 $v_{12} = v_F (P_{FM}) = 36 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	6043	9000	No
v <sub>3</sub> or v <sub>av34</sub>	2165 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 1746		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	6043	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.0 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.335	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.6	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 52.1	mph
Space mean speed for all vehicles,	S = 51.3	mph

## **Surface Street Intersections**

# HCM Unsignalized Intersection Capacity Analysis

## 1: W. 7th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	34	1243	47	65	1216
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	38	1381	52	72	1351
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			701			796
pX, platoon unblocked	0.80	0.80			0.80	
vC, conflicting volume	2227	717			1433	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2029	130			1031	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	84	95			86	
cM capacity (veh/h)	34	710			528	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	43	921	513	72	676	676
Volume Left	6	0	0	72	0	0
Volume Right	38	0	52	0	0	0
cSH	199	1700	1700	528	1700	1700
Volume to Capacity	0.22	0.54	0.30	0.14	0.40	0.40
Queue Length 95th (ft)	20	0	0	12	0	0
Control Delay (s)	28.0	0.0	0.0	12.9	0.0	0.0
Lane LOS	D			B		
Approach Delay (s)	28.0	0.0		0.7		
Approach LOS	D					
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			52.8%		ICU Level of Service	A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 1: W. 7th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	25	58	1271	27	20	1605
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	28	64	1412	30	22	1783
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			701			796
pX, platoon unblocked	0.79	0.79			0.79	
vC, conflicting volume	2363	721			1442	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2191	105			1021	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	3	91			96	
cM capacity (veh/h)	29	729			527	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	92	941	501	22	892	892
Volume Left	28	0	0	22	0	0
Volume Right	64	0	30	0	0	0
cSH	87	1700	1700	527	1700	1700
Volume to Capacity	1.05	0.55	0.29	0.04	0.52	0.52
Queue Length 95th (ft)	155	0	0	3	0	0
Control Delay (s)	198.9	0.0	0.0	12.1	0.0	0.0
Lane LOS	F			B		
Approach Delay (s)	198.9	0.0		0.1		
Approach LOS	F					

Intersection Summary						
Average Delay			5.6			
Intersection Capacity Utilization			56.0%		ICU Level of Service	B
Analysis Period (min)			15			

# HCM Signalized Intersection Capacity Analysis

## 2: 6th WB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖	↖	↕			↕	↖
Volume (vph)	0	0	0	115	64	55	243	1197	0	0	1035	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.99	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1665	1727	1568	1752	3505			3505	1568
Flt Permitted				0.95	0.99	1.00	0.17	1.00			1.00	1.00
Satd. Flow (perm)				1665	1727	1568	317	3505			3505	1568
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)	0	0	0	125	70	60	264	1301	0	0	1125	197
RTOR Reduction (vph)	0	0	0	0	0	49	0	0	0	0	0	83
Lane Group Flow (vph)	0	0	0	96	99	11	264	1301	0	0	1125	114
Turn Type				Perm		Perm	pm+pt					Perm
Protected Phases					4		1	6			2	
Permitted Phases				4		4	6					2
Actuated Green, G (s)				19.0	19.0	19.0	69.0	69.0			58.0	58.0
Effective Green, g (s)				19.0	19.0	19.0	69.0	69.0			58.0	58.0
Actuated g/C Ratio				0.19	0.19	0.19	0.69	0.69			0.58	0.58
Clearance Time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Grp Cap (vph)				316	328	298	290	2418			2033	909
v/s Ratio Prot							c0.05	0.37			0.32	
v/s Ratio Perm				c0.06	0.06	0.01	c0.58					0.07
v/c Ratio				0.30	0.30	0.04	0.91	0.54			0.55	0.13
Uniform Delay, d1				34.8	34.8	33.0	11.9	7.6			13.0	9.5
Progression Factor				1.00	1.00	1.00	1.89	1.56			1.00	1.00
Incremental Delay, d2				2.5	2.4	0.2	30.8	0.7			1.1	0.3
Delay (s)				37.3	37.2	33.3	53.4	12.7			14.1	9.8
Level of Service				D	D	C	D	B			B	A
Approach Delay (s)		0.0			36.3			19.5			13.4	
Approach LOS		A			D			B			B	

### Intersection Summary

HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: 6th WB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖	↖	↑↑			↑↑	↖
Volume (vph)	0	0	0	308	163	95	191	1204	0	0	1256	332
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.98	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1665	1725	1568	1752	3505			3505	1568
Flt Permitted				0.95	0.98	1.00	0.11	1.00			1.00	1.00
Satd. Flow (perm)				1665	1725	1568	200	3505			3505	1568
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)	0	0	0	335	177	103	208	1309	0	0	1365	361
RTOR Reduction (vph)	0	0	0	0	0	67	0	0	0	0	0	129
Lane Group Flow (vph)	0	0	0	251	261	36	208	1309	0	0	1365	232
Turn Type				Perm		Perm	pm+pt					Perm
Protected Phases					4		1	6			2	
Permitted Phases				4		4	6					2
Actuated Green, G (s)				20.0	20.0	20.0	68.0	68.0			57.0	57.0
Effective Green, g (s)				20.0	20.0	20.0	68.0	68.0			57.0	57.0
Actuated g/C Ratio				0.20	0.20	0.20	0.68	0.68			0.57	0.57
Clearance Time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Grp Cap (vph)				333	345	314	214	2383			1998	894
v/s Ratio Prot							c0.05	0.37			0.39	
v/s Ratio Perm				0.15	0.15	0.02	c0.61					0.15
v/c Ratio				0.75	0.76	0.11	0.97	0.55			0.68	0.26
Uniform Delay, d1				37.7	37.7	32.7	16.0	8.2			15.1	10.8
Progression Factor				1.00	1.00	1.00	1.44	1.55			1.00	1.00
Incremental Delay, d2				14.6	14.3	0.7	49.2	0.8			1.9	0.7
Delay (s)				52.3	52.0	33.5	72.2	13.4			17.1	11.5
Level of Service				D	D	C	E	B			B	B
Approach Delay (s)		0.0			49.0			21.5			15.9	
Approach LOS		A			D			C			B	

### Intersection Summary

HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 3: 6th EB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	227	114	0	1187	1158	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	6.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.95			1.00	1.00	
Flt Protected	0.97			1.00	1.00	
Satd. Flow (prot)	3290			3505	3505	
Flt Permitted	0.97			1.00	1.00	
Satd. Flow (perm)	3290			3505	3505	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	247	124	0	1290	1259	0
RTOR Reduction (vph)	66	0	0	0	0	0
Lane Group Flow (vph)	305	0	0	1290	1259	0
Turn Type						
Protected Phases	4			6	2	
Permitted Phases						
Actuated Green, G (s)	19.0			69.0	69.0	
Effective Green, g (s)	19.0			69.0	69.0	
Actuated g/C Ratio	0.19			0.69	0.69	
Clearance Time (s)	6.0			6.0	6.0	
Lane Grp Cap (vph)	625			2418	2418	
v/s Ratio Prot	c0.09			c0.37	0.36	
v/s Ratio Perm						
v/c Ratio	0.49			0.53	0.52	
Uniform Delay, d1	36.2			7.6	7.5	
Progression Factor	1.00			1.00	1.10	
Incremental Delay, d2	2.7			0.8	0.7	
Delay (s)	38.9			8.5	9.0	
Level of Service	D			A	A	
Approach Delay (s)	38.9			8.5	9.0	
Approach LOS	D			A	A	

### Intersection Summary

HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 3: 6th EB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	TT			TT	TT	
Volume (vph)	210	208	0	1185	1552	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	6.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.93			1.00	1.00	
Flt Protected	0.98			1.00	1.00	
Satd. Flow (prot)	3230			3505	3505	
Flt Permitted	0.98			1.00	1.00	
Satd. Flow (perm)	3230			3505	3505	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	226	0	1288	1687	0
RTOR Reduction (vph)	33	0	0	0	0	0
Lane Group Flow (vph)	421	0	0	1288	1687	0
Turn Type						
Protected Phases	4			6	2	
Permitted Phases						
Actuated Green, G (s)	19.0			69.0	69.0	
Effective Green, g (s)	19.0			69.0	69.0	
Actuated g/C Ratio	0.19			0.69	0.69	
Clearance Time (s)	6.0			6.0	6.0	
Lane Grp Cap (vph)	614			2418	2418	
v/s Ratio Prot	c0.13			0.37	c0.48	
v/s Ratio Perm						
v/c Ratio	0.69			0.53	0.70	
Uniform Delay, d1	37.7			7.6	9.3	
Progression Factor	1.00			1.00	1.28	
Incremental Delay, d2	6.1			0.8	1.2	
Delay (s)	43.8			8.4	13.1	
Level of Service	D			A	B	
Approach Delay (s)	43.8			8.4	13.1	
Approach LOS	D			A	B	

### Intersection Summary

HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 4: W. 5th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↕	↘	↙	↕
Volume (veh/h)	0	0	1169	492	139	1065
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	0	1271	535	151	1158
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						710
pX, platoon unblocked	0.85					
vC, conflicting volume	2419	903			1805	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2318	903			1805	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			55	
cM capacity (veh/h)	15	278			333	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	847	958	151	579	579
Volume Left	0	0	0	151	0	0
Volume Right	0	0	535	0	0	0
cSH	1700	1700	1700	333	1700	1700
Volume to Capacity	0.00	0.50	0.56	0.45	0.34	0.34
Queue Length 95th (ft)	0	0	0	57	0	0
Control Delay (s)	0.0	0.0	0.0	24.5	0.0	0.0
Lane LOS	A			C		
Approach Delay (s)	0.0	0.0		2.8		
Approach LOS	A					

Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			62.4%	ICU Level of Service		B
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: W. 5th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	0	1185	243	81	1379
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	1317	270	90	1532
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						710
pX, platoon unblocked	0.73					
vC, conflicting volume	2398	793	1587			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2181	793	1587			
tC, single (s)	6.9	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	78			
cM capacity (veh/h)	22	329	405			

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	878	709	90	766	766
Volume Left	0	0	0	90	0	0
Volume Right	0	0	270	0	0	0
cSH	1700	1700	1700	405	1700	1700
Volume to Capacity	0.00	0.52	0.42	0.22	0.45	0.45
Queue Length 95th (ft)	0	0	0	21	0	0
Control Delay (s)	0.0	0.0	0.0	16.4	0.0	0.0
Lane LOS	A			C		
Approach Delay (s)	0.0	0.0	0.9			
Approach LOS	A					

Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			51.7%	ICU Level of Service	A	
Analysis Period (min)	15					

# HCM Signalized Intersection Capacity Analysis

## 5: W 5th Ave & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↕		↗	↕	
Volume (vph)	27	17	65	17	24	20	106	230	22	50	424	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.92			0.96		1.00	0.99		1.00	0.98	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1676			1740		1752	3460		1752	3418	
Flt Permitted		0.93			0.92		0.30	1.00		0.58	1.00	
Satd. Flow (perm)		1570			1615		556	3460		1070	3418	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	30	19	72	19	27	22	118	256	24	56	471	93
RTOR Reduction (vph)	0	50	0	0	15	0	0	11	0	0	27	0
Lane Group Flow (vph)	0	71	0	0	53	0	118	269	0	56	537	0
Turn Type	Perm		Perm		pm+pt		Perm					
Protected Phases		8			4		1	6				2
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Effective Green, g (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Actuated g/C Ratio		0.30			0.30		0.53	0.53		0.33	0.33	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		471			485		436	1845		357	1139	
v/s Ratio Prot							c0.03	0.08				c0.16
v/s Ratio Perm		c0.04			0.03		0.11			0.05		
v/c Ratio		0.15			0.11		0.27	0.15		0.16	0.47	
Uniform Delay, d1		15.4			15.2		7.6	7.1		14.1	15.8	
Progression Factor		1.00			1.00		1.00	1.00		1.06	1.14	
Incremental Delay, d2		0.7			0.5		1.5	0.2		0.6	0.9	
Delay (s)		16.1			15.6		9.1	7.3		15.5	19.0	
Level of Service		B			B		A	A		B	B	
Approach Delay (s)		16.1			15.6			7.8			18.7	
Approach LOS		B			B			A			B	

### Intersection Summary

HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 5: W 5th Ave & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↕		↗	↕	
Volume (vph)	46	6	31	15	21	58	122	389	16	27	412	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.95			0.92		1.00	0.99		1.00	0.99	
Flt Protected		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1705			1678		1752	3484		1752	3461	
Flt Permitted		0.81			0.95		0.34	1.00		0.49	1.00	
Satd. Flow (perm)		1424			1612		628	3484		908	3461	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	51	7	34	17	23	64	136	432	18	30	458	42
RTOR Reduction (vph)	0	24	0	0	45	0	0	5	0	0	11	0
Lane Group Flow (vph)	0	68	0	0	59	0	136	445	0	30	489	0
Turn Type	Perm			Perm			pm+pt			Perm		
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Effective Green, g (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Actuated g/C Ratio		0.30			0.30		0.53	0.53		0.33	0.33	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		427			484		466	1858		303	1154	
v/s Ratio Prot							c0.03	0.13			c0.14	
v/s Ratio Perm		c0.05			0.04		0.12			0.03		
v/c Ratio		0.16			0.12		0.29	0.24		0.10	0.42	
Uniform Delay, d1		15.4			15.3		7.5	7.5		13.8	15.5	
Progression Factor		1.00			1.00		1.00	1.00		1.05	1.15	
Incremental Delay, d2		0.8			0.5		1.6	0.3		0.5	0.9	
Delay (s)		16.2			15.8		9.1	7.8		15.0	18.8	
Level of Service		B			B		A	A		B	B	
Approach Delay (s)		16.2			15.8			8.1			18.6	
Approach LOS		B			B			A			B	

### Intersection Summary

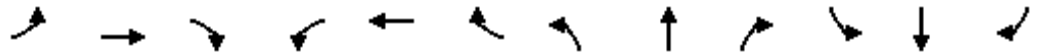
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: 6th EB Ramp & Bryant St

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗						↕		↖	↗	
Volume (vph)	18	2	103	0	0	0	0	272	5	12	464	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00						0.95		1.00	0.95	
Frt	1.00	0.85						1.00		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1752	1573						3495		1752	3505	
Flt Permitted	0.95	1.00						1.00		0.56	1.00	
Satd. Flow (perm)	1752	1573						3495		1041	3505	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	20	2	114	0	0	0	0	302	6	13	516	0
RTOR Reduction (vph)	0	72	0	0	0	0	0	2	0	0	0	0
Lane Group Flow (vph)	20	44	0	0	0	0	0	306	0	13	516	0
Turn Type	Perm						Perm					
Protected Phases	4						6					
Permitted Phases	4						2					
Actuated Green, G (s)	22.0	22.0						28.0		11.0	11.0	
Effective Green, g (s)	22.0	22.0						28.0		11.0	11.0	
Actuated g/C Ratio	0.37	0.37						0.47		0.18	0.18	
Clearance Time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Grp Cap (vph)	642	577						1631		191	643	
v/s Ratio Prot		c0.03						c0.09			c0.15	
v/s Ratio Perm	0.01									0.01		
v/c Ratio	0.03	0.08						0.19		0.07	0.80	
Uniform Delay, d1	12.2	12.4						9.4		20.3	23.5	
Progression Factor	1.00	1.00						0.63		0.75	0.80	
Incremental Delay, d2	0.1	0.3						0.3		0.7	10.0	
Delay (s)	12.3	12.6						6.1		15.9	28.7	
Level of Service	B	B						A		B	C	
Approach Delay (s)		12.6			0.0			6.1			28.4	
Approach LOS		B			A			A			C	

### Intersection Summary

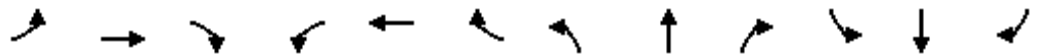
HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: 6th EB Ramp & Bryant St

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↖	↗						↕		↖	↗		
Volume (vph)	24	1	108	0	0	0	0	507	5	9	367	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0		
Lane Util. Factor	1.00	1.00						0.95		1.00	0.95		
Frt	1.00	0.85						1.00		1.00	1.00		
Flt Protected	0.95	1.00						1.00		0.95	1.00		
Satd. Flow (prot)	1752	1570						3499		1752	3505		
Flt Permitted	0.95	1.00						1.00		0.44	1.00		
Satd. Flow (perm)	1752	1570						3499		808	3505		
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Adj. Flow (vph)	27	1	120	0	0	0	0	563	6	10	408	0	
RTOR Reduction (vph)	0	76	0	0	0	0	0	1	0	0	0	0	
Lane Group Flow (vph)	27	45	0	0	0	0	0	568	0	10	408	0	
Turn Type	Perm						Perm						
Protected Phases	4						6						
Permitted Phases	4						2						
Actuated Green, G (s)	22.0	22.0						28.0		11.0	11.0		
Effective Green, g (s)	22.0	22.0						28.0		11.0	11.0		
Actuated g/C Ratio	0.37	0.37						0.47		0.18	0.18		
Clearance Time (s)	5.0	5.0						5.0		5.0	5.0		
Lane Grp Cap (vph)	642	576						1633		148	643		
v/s Ratio Prot	c0.03						c0.16						
v/s Ratio Perm	0.02						0.01						
v/c Ratio	0.04	0.08						0.35		0.07	0.63		
Uniform Delay, d1	12.2	12.4						10.2		20.3	22.6		
Progression Factor	1.00	1.00						0.61		1.09	1.10		
Incremental Delay, d2	0.1	0.3						0.6		0.9	4.7		
Delay (s)	12.3	12.7						6.8		23.0	29.5		
Level of Service	B							A		C		C	
Approach Delay (s)	12.6		0.0					6.8		29.4			
Approach LOS	B		A					A		C			

### Intersection Summary

HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 7: 6th WB Ramp & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕↕		↗	↕↕			↕↕	
Volume (vph)	0	0	0	273	4	21	63	226	0	0	220	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0	5.0			5.0	
Lane Util. Factor					0.95		1.00	0.95			0.95	
Frt					0.99		1.00	1.00			0.99	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					3316		1752	3505			3476	
Flt Permitted					0.96		0.59	1.00			1.00	
Satd. Flow (perm)					3316		1092	3505			3476	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	303	4	23	70	251	0	0	244	14
RTOR Reduction (vph)	0	0	0	0	9	0	0	0	0	0	6	0
Lane Group Flow (vph)	0	0	0	0	321	0	70	251	0	0	252	0
Turn Type				Perm			Perm					
Protected Phases					8		2				6	
Permitted Phases				8			2					
Actuated Green, G (s)					15.0		35.0	35.0			35.0	
Effective Green, g (s)					15.0		35.0	35.0			35.0	
Actuated g/C Ratio					0.25		0.58	0.58			0.58	
Clearance Time (s)					5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)					829		637	2045			2028	
v/s Ratio Prot								0.07			c0.07	
v/s Ratio Perm					0.10		0.06					
v/c Ratio					0.39		0.11	0.12			0.12	
Uniform Delay, d1					18.7		5.6	5.6			5.6	
Progression Factor					1.00		0.15	0.15			1.00	
Incremental Delay, d2					1.4		0.3	0.1			0.1	
Delay (s)					20.0		1.2	0.9			5.7	
Level of Service					C		A	A			A	
Approach Delay (s)		0.0			20.0			1.0			5.7	
Approach LOS		A			C			A			A	

### Intersection Summary

HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 7: 6th WB Ramp & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↔↔		↗	↕↕			↕↔	
Volume (vph)	0	0	0	146	5	17	199	347	0	0	227	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0	5.0			5.0	
Lane Util. Factor					0.95		1.00	0.95			0.95	
Frt					0.98		1.00	1.00			0.98	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					3308		1752	3505			3433	
Flt Permitted					0.96		0.57	1.00			1.00	
Satd. Flow (perm)					3308		1057	3505			3433	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	162	6	19	221	386	0	0	252	40
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	0	0	17	0
Lane Group Flow (vph)	0	0	0	0	173	0	221	386	0	0	275	0
Turn Type					Perm		Perm					
Protected Phases						8		2			6	
Permitted Phases				8			2					
Actuated Green, G (s)					15.0		35.0	35.0			35.0	
Effective Green, g (s)					15.0		35.0	35.0			35.0	
Actuated g/C Ratio					0.25		0.58	0.58			0.58	
Clearance Time (s)					5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)					827		617	2045			2003	
v/s Ratio Prot								0.11			0.08	
v/s Ratio Perm					0.05		c0.21					
v/c Ratio					0.21		0.36	0.19			0.14	
Uniform Delay, d1					17.8		6.6	5.9			5.7	
Progression Factor					1.00		2.60	2.50			1.00	
Incremental Delay, d2					0.6		1.5	0.2			0.1	
Delay (s)					18.4		18.6	14.8			5.8	
Level of Service					B		B	B			A	
Approach Delay (s)		0.0			18.4			16.2			5.8	
Approach LOS		A			B			B			A	

### Intersection Summary

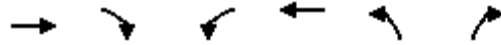
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 8: W. 7th Ave & Bryant St

8/7/2012



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Volume (veh/h)	11	243	1	10	202	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	12	270	1	11	224	21
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			282		161	147
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			282		161	147
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		73	98
cM capacity (veh/h)			1274		827	897

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	282	12	224	21
Volume Left	0	1	224	0
Volume Right	270	0	0	21
cSH	1700	1274	827	897
Volume to Capacity	0.17	0.00	0.27	0.02
Queue Length 95th (ft)	0	0	28	2
Control Delay (s)	0.0	0.7	11.0	9.1
Lane LOS		A	B	A
Approach Delay (s)	0.0	0.7	10.8	
Approach LOS			B	

Intersection Summary			
Average Delay		4.9	
Intersection Capacity Utilization		33.5%	ICU Level of Service A
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 8: W. 7th Ave & Bryant St

8/7/2012



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Volume (veh/h)	6	260	17	37	326	21
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	289	19	41	362	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			296		230	151
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			296		230	151
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		51	97
cM capacity (veh/h)			1260		745	893

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	296	60	362	23
Volume Left	0	19	362	0
Volume Right	289	0	0	23
cSH	1700	1260	745	893
Volume to Capacity	0.17	0.01	0.49	0.03
Queue Length 95th (ft)	0	1	67	2
Control Delay (s)	0.0	2.6	14.3	9.1
Lane LOS		A	B	A
Approach Delay (s)	0.0	2.6	14.0	
Approach LOS			B	

Intersection Summary			
Average Delay		7.5	
Intersection Capacity Utilization	41.7%		ICU Level of Service A
Analysis Period (min)		15	

## **Appendix B Future 2035 No Build of LOS**

# Freeway Facilities

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst:  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	8200	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2278	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	2317	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	2317	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	48.4	mi/h
Number of lanes, N	4	
Density, D	47.9	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Period  
 Freeway/Direction: US 6/Eastbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5700	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1583	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1610	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	1610	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	29.3	pc/mi/ln
Level of service, LOS	D	



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of Bryant St Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	8900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2472	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	2011	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	5	
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	2011	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	53.9	mi/h
Number of lanes, N	5	
Density, D	37.3	pc/mi/ln
Level of service, LOS	E	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of Bryant St Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	6400	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1778	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1446	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	5	
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	1446	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	55.0	mi/h
Number of lanes, N	5	
Density, D	26.3	pc/mi/ln
Level of service, LOS	D	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of NB I-25 On-Ramp (3)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	4500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1250	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1695	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	1695	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	30.8	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Period  
Freeway/Direction: US 6/Eastbound  
From/To: East of NB I-25 On-Ramp (3)  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	3300	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	917	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1243	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	1243	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	22.6	pc/mi/ln
Level of service, LOS	C	

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8200	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	130	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)	8200	500	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2278	139	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	9266	565	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4359 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9266	9000	Yes
$v_{FO} = v_F - v_R$	8701	9000	No
$v_R$	565	2000	No
$v_3 \text{ or } v_{av34}$	2453 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4359$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4359	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 40.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.479	
Space mean speed in ramp influence area,	S = 48.8	mph
Space mean speed in outer lanes,	S = 54.7	mph
Space mean speed for all vehicles,	S = 51.7	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5700	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	130	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)	5700	500		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1583	139		v
Trucks and buses	3	3		%
Recreational vehicles	1	1		%
Terrain type:	Level	Level		
Grade	0.00	%	0.00	%
Length	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6441	565	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 3127 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6441	9000	No
$v_{FO} = v_F - v_R$	5876	9000	No
$v_R$	565	2000	No
$v_3 \text{ or } v_{av34}$	1657 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3127$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3127	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 30.0 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.479	
Space mean speed in ramp influence area,	S = 48.8	mph
Space mean speed in outer lanes,	S = 57.8	mph
Space mean speed for all vehicles,	S = 53.0	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Decatur St On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	7700	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1400	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	200	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7700	1400	200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2139	389	56	v
Trucks and buses	3	3	0	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.998	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8701	1582	223	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.020 Using Equation 4  
FM  
 $v_{12} = v_{F} (P) = 124 \text{ pc/h}$   
FM

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	7783	9000	No
v <sub>3</sub> or v <sub>av34</sub>	3038 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 2480		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	7783	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 35.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence E

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

Intermediate speed variable,	M = 0.536	
Space mean speed in ramp influence area,	S <sub>R</sub> = 48.0	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 50.1	mph
Space mean speed for all vehicles,	S = 49.0	mph

Phone: Fax:  
 E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6/Eastbound  
 Junction: Decatur St On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5200	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1400	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	200	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5200	1400	200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1444	389	56	v
Trucks and buses	3	3	0	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.998	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5876	1582	223	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.020 Using Equation 4  
FM  
 $v_{12} = v_F (P_{FM}) = 90 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	6048	9000	No
v <sub>3</sub> or v <sub>av34</sub>	2188 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 1786		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	6048	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 30.0 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable, M = 0.422  
S  
Space mean speed in ramp influence area, S = 49.5 mph  
R  
Space mean speed in outer lanes, S = 52.0 mph  
O  
Space mean speed for all vehicles, S = 50.6 mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Bryant St Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	9100	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	200	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1400	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	9100	200	1400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2528	56	389	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10283	226	1582	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3714$  pc/h  
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8227	9000	No
$v_{FO} = v_F - v_R$	8001	9000	No
$v_R$	226	2000	No
$v_3$ or $v_{av34}$	2256 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, $v_{12A} = 3714$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3714	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 34.7$  pc/mi/ln  
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.448	
Space mean speed in ramp influence area,	S = 49.2	mph
Space mean speed in outer lanes,	S = 55.4	mph
Space mean speed for all vehicles,	S = 52.4	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Bryant St Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6600	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	200	vph
Length of first accel/decel lane	170	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1400	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	170	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6600	200	1400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1833	56	389	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7458	226	1582	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2729 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5967	9000	No
$v_{FO} = v_F - v_R$	5741	9000	No
$v_R$	226	2000	No
$v_3 \text{ or } v_{av34}$	1619 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2729$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2729	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 26.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.448	
Space mean speed in ramp influence area,	S = 49.2	mph
Space mean speed in outer lanes,	S = 57.9	mph
Space mean speed for all vehicles,	S = 53.6	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8900	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	6100	vph
Length of first accel/decel lane	1250	ft
Length of second accel/decel lane	1500	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	200	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8900	6100	200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2472	1694	56	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10057	7029	226	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.260 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 7816 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10057	9000	Yes
$v_{FO} = v_F - v_R$	3028	9000	No
$v_R$	7029	4000	Yes
$v_3 \text{ or } v_{av34}$	1120 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7816$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	7816	4400	Yes

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

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

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

Intermediate speed variable,	D = 1.061	
Space mean speed in ramp influence area,	S = 41.2	mph
Space mean speed in outer lanes,	S = 59.9	mph
Space mean speed for all vehicles,	S = 44.3	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6400	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	4500	vph
Length of first accel/decel lane	1250	ft
Length of second accel/decel lane	1500	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	200	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6400	4500	200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1778	1250	56	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7232	5185	226	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.260 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5717 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7232	9000	No
$v_{FO} = v_F - v_R$	2047	9000	No
$v_R$	5185	4000	Yes
$v_3 \text{ or } v_{av34}$	757 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5717$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	5717	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 17.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.895	
Space mean speed in ramp influence area,	S = 43.4	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 46.1	mph

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Phone:  
E-mail:

Fax:

Operational Analysis

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Dir of Travel: US 6/Eastbound  
 Weaving Location: Decatur St On to Bryant St Off  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	5	ln
Weaving segment length, LS	170	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	9100	1400	200	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	2528	389	56	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	10283	1582	226	6	pc/h
Volume ratio, VR		0.149			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.34	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW		
Non-weaving lane change, LCNW		lc/h
Total lane changes, LCALL		lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS F  
 Weaving segment v/c ratio 1.237  
 Weaving segment flow rate, v 12097 pc/h  
 Weaving segment capacity, cW 9612 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4026	170	a,b
Density-based capacity, cIWL (pc/h/ln)		2250	1955	c
v/c ratio		1.00	1.237	d

- Notes:
- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
  - b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
  - c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
  - d. Volumes exceed the weaving segment capacity. The level of service is F.

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Phone:  
E-mail:

Fax:

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Operational Analysis  
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Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Weaving Location: Decatur St On to Bryant St Off  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----  
Inputs  
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Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	5	ln
Weaving segment length, LS	170	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

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

	Volume Components				veh/h
	VFF	VRF	VFR	VRR	
Volume, V	6600	1400	200	5	
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1833	389	56	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7458	1582	226	6	pc/h
Volume ratio, VR		0.195			

-----  
Configuration Characteristics  
-----

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.34	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW	43	
Non-weaving lane change, LCNW	667	lc/h
Total lane changes, LCALL		lc/h

-----  
Weaving and Non-Weaving Speeds  
-----

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS  
 Weaving segment v/c ratio 0.966  
 Weaving segment flow rate, v 9272 pc/h  
 Weaving segment capacity, cW 9440 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4485	170	a,b
Density-based capacity, cIWL (pc/h/ln)		2250	1920	c
v/c ratio		1.00	0.966	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

\_\_\_\_\_



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: East of I-25 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	694	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	706	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	706	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	12.8	pc/mi/ln
Level of service, LOS	B	

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 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: East of I-25 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5460	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1517	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1542	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	1542	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	28.0	pc/mi/ln
Level of service, LOS	D	

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 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: West of Federal Blvd On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1528	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1554	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	1554	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	28.3	pc/mi/ln
Level of service, LOS	D	

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: West of Federal Blvd On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	9900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2750	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	2797	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	2797	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	30.5	mi/h
Number of lanes, N	4	
Density, D	91.8	pc/mi/ln
Level of service, LOS	F	

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 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6 Frontage Rd/Westbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2000	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	556	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1130	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	1130	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	20.5	pc/mi/ln
Level of service, LOS	C	

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 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6 Frontage Rd/Westbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	4100	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1139	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	2317	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	2317	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	48.4	mi/h
Number of lanes, N	2	
Density, D	47.9	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2500	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	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?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	470	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2500	600	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	694	167	0	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2825	691	0	pcph

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

L = 0.00 (Equation 13-12 or 13-13)  
EQ  
P = 0.658 Using Equation 5  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2094 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2825	6750	No
$v_{FO} = v_F - v_R$	2134	6750	No
$v_R$	691	2000	No
$v_3 \text{ or } v_{av34}$	731 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2094$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2094	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 21.0 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.490	
Space mean speed in ramp influence area,	S = 48.6	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 51.2	mph

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Phone: Fax:  
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-----Diverge Analysis-----

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5460	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1200	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?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	470	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5460	1200	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1517	333	0	v
Trucks and buses	3	7	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6170	1383	0	pcph

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

L = 0.00 (Equation 13-12 or 13-13)  
EQ  
P = 0.542 Using Equation 5  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3978 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6170	6750	No
$v_{FO} = v_F - v_R$	4787	6750	No
$v_R$	1383	2000	No
$v_3 \text{ or } v_{av34}$	2192 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3978$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3978	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 37.2 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence E

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

Intermediate speed variable,	D = 0.552	
Space mean speed in ramp influence area,	S = 47.8	mph
Space mean speed in outer lanes,	S = 55.7	mph
Space mean speed for all vehicles,	S = 50.3	mph

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Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6/Westbound  
 Junction: US 6 Frontage Rd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3800	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	800	vph
Length of first accel/decel lane	475	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1900	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	475	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3800	800	1900	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1056	222	528	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4294	904	2147	pcph

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

L = 21245.22 Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 6  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4294 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4294	6750	No
$v_{FO} = v_F - v_R$	3390	6750	No
$v_R$	904	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4294$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4294	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 36.9 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence E

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

Intermediate speed variable,	D = 0.509	
Space mean speed in ramp influence area,	S = 48.4	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 48.4	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: US 6 Frontage Rd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	6500	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1400	vph
Length of first accel/decel lane	475	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	2300	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	475	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6500	1400	2300	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1806	389	639	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	7345	1582	2599	pcph

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

L = 21712.07 Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 6  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 7345 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	7345	6750	Yes
$v_{FO} = v_F - v_R$	5763	6750	No
$v_R$	1582	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7345$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	7345	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 63.1 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.570	
Space mean speed in ramp influence area,	S = 47.6	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 47.6	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4800	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	700	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1800	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1225	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4800	700	1800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1333	194	500	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5424	791	2034	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.619 Using Equation 1  
FM  
 $v_{12} = v_F (P_{FM}) = 3360 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	6215	6750	No
v <sub>3</sub> or v <sub>av34</sub>	2064 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 3360		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	6215	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 28.1 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	M = 0.464	
Space mean speed in ramp influence area,	S <sub>R</sub> = 49.0	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 49.4	mph
Space mean speed for all vehicles,	S = 49.1	mph

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Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6/Westbound  
 Junction: Federal Blvd On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8700	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3600	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1225	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8700	1200	3600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2417	333	1000	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9831	1356	4068	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.619 Using Equation 1  
FM  
 $v_{12} = v_F (P_{FM}) = 6090 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	11187	6750	Yes
v <sub>3</sub> or v <sub>av34</sub>	3741 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 7131		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	11187	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 61.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 19.136
Space mean speed in ramp influence area,	S <sub>R</sub> = -193.8 mph
Space mean speed in outer lanes,	S <sub>0</sub> = 46.1 mph
Space mean speed for all vehicles,	S = 755.5 mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
Junction: Bryant St Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2600	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	265	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1800	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2600	600	1800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	722	167	500	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2938	678	2034	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2938 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2938	4500	No
$v_{FO} = v_F - v_R$	2260	4500	No
$v_R$	678	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2938$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2938	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 27.1 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.489	
Space mean speed in ramp influence area,	S = 48.6	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 48.6	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
Junction: Bryant St Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4400	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	300	vph
Length of first accel/decel lane	265	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	3000	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4400	300	3000	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1222	83	833	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4972	339	3390	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4972 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4972	4500	Yes
$v_{FO} = v_F - v_R$	4633	4500	Yes
$v_R$	339	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4972$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4972	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 44.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.459	
Space mean speed in ramp influence area,	S = 49.0	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 49.0	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2000	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	200	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1800	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	600	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2000	200	1800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	556	56	500	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2260	226	2034	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2260 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2260	4500	No
$v_{FO} = v_F - v_R$	2034	4500	No
$v_R$	226	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2260$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2260	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 22.8 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.448	
Space mean speed in ramp influence area,	S = 49.2	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 49.2	mph



Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4100	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	3600	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	600	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4100	500	3600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1139	139	1000	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4633	565	4068	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4633 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4633	4500	Yes
$v_{FO} = v_F - v_R$	4068	4500	No
$v_R$	565	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4633$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4633	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 43.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.479	
Space mean speed in ramp influence area,	S = 48.8	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 48.8	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6 Frnt Rd Federal Off/WB  
 Junction: US 6 Frnt Rd Fed Off/Bryant On  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2000	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	300	vph
Length of first accel/decel lane	0	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)	2000	300	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	556	83	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2260	339	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 1.000 Using Equation 0  
FM  
 $v_{12} = v_F (P_{FM}) = 2260 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	2599	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 2260		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	2599	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 25.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.373	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.1	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S <sub>0</sub> = 50.1	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6 Frnt Rd Federal Off/WB  
 Junction: US 6 Frnt Rd Fed Off/Bryant On  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	4100	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	0	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)	4100	500	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	1139	139	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4633	565	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 1.000 Using Equation 0  
 FM  
 $v_{12} = v_{F} (P_{FM}) = 4633 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	5198	4500	Yes
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 4633		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	5198	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 45.8 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 1.027	
Space mean speed in ramp influence area,	S = 41.7	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 41.7	mph

Phone:  
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Operational Analysis

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Dir of Travel: US 6/Westbound  
 Weaving Location: NB I-25 On to US 6 Front Off  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	475	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	3800	1900	800	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1056	528	222	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4294	2147	904	6	pc/h
Volume ratio, VR		0.415			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW	59	
Non-weaving lane change, LCNW		lc/h
Total lane changes, LCALL		lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS F  
 Weaving segment v/c ratio 1.271  
 Weaving segment flow rate, v 7351 pc/h  
 Weaving segment capacity, cW 5686 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6850	475	a,b
Density-based capacity, cIWL (pc/h/ln)		2250	1762	c
v/c ratio		1.00	1.271	d

- Notes:
- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
  - b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
  - c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
  - d. Volumes exceed the weaving segment capacity. The level of service is F.

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Phone:  
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Operational Analysis

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Dir of Travel: US 6/Westbound  
 Weaving Location: NB I-25 On to US 6 Front Off  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	475	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	6500	2300	1400	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1806	639	389	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7345	2599	1582	6	pc/h
Volume ratio, VR		0.363			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW	59	
Non-weaving lane change, LCNW		lc/h
Total lane changes, LCALL		lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS F  
 Weaving segment v/c ratio 1.742  
 Weaving segment flow rate, v 11532 pc/h  
 Weaving segment capacity, cW 6509 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6265	475	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1807	c
v/c ratio		Maximum 1.00	Analyzed 1.742	d

- Notes:
- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
  - b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
  - c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
  - d. Volumes exceed the weaving segment capacity. The level of service is F.

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-----Operational Analysis-----

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
 Weaving Location: SB I-25 On to Bryant St Off  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Inputs-----

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	2	ln
Weaving segment length, LS	275	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

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

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	2600	1800	600	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	722	500	167	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2938	2034	678	6	pc/h
Volume ratio, VR		0.479			

-----Configuration Characteristics-----

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW		
Non-weaving lane change, LCNW		lc/h
Total lane changes, LCALL		lc/h

-----Weaving and Non-Weaving Speeds-----

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS F  
 Weaving segment v/c ratio 1.673  
 Weaving segment flow rate, v 5656 pc/h  
 Weaving segment capacity, cW 3325 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7588	275	a,b
Density-based capacity, cIWL (pc/h/ln)		2250	1691	c
v/c ratio		1.00	1.673	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

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Phone:  
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Operational Analysis  
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Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
Weaving Location: SB I-25 On to Bryant St Off  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----  
Inputs  
-----

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	2	ln
Weaving segment length, LS	275	ft
Freeway free-flow speed, FFS	55	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2250	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

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

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	4400	3000	300	5	veh/h
Peak hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1222	833	83	1	
Trucks and buses	3	3	3	0	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.983	0.983	0.983	0.998	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4972	3390	339	6	pc/h
Volume ratio, VR		0.428			

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Configuration Characteristics  
-----

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.29	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN		lc/h
Weaving lane changes, LCW		lc/h
Non-weaving vehicle index, INW		
Non-weaving lane change, LCNW		lc/h
Total lane changes, LCALL		lc/h

-----  
Weaving and Non-Weaving Speeds  
-----

Weaving intensity factor, W

Average weaving speed, SW mi/h  
 Average non-weaving speed, SNW mi/h

\_\_\_\_\_Weaving Segment Speed, Density, Level of Service and Capacity\_\_\_\_\_

Weaving segment speed, S mi/h  
 Weaving segment density, D pc/mi/ln  
 Level of service, LOS F  
 Weaving segment v/c ratio 2.508  
 Weaving segment flow rate, v 8707 pc/h  
 Weaving segment capacity, cW 3414 veh/h

\_\_\_\_\_Limitations on Weaving Segments\_\_\_\_\_

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7000	275	a,b
Density-based capacity, cIWL (pc/h/ln)		Maximum 2250	Analyzed 1736	c
v/c ratio		Maximum 1.00	Analyzed 2.508	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

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-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Direction: I-25/Northbound  
From/To: South of EB US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	12100	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3361	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2788	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	5	
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	2788	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	30.9	mi/h
Number of lanes, N	5	
Density, D	90.2	pc/mi/ln
Level of service, LOS	F	

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-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	11600	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3222	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2673	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	5	
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	2673	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	36.2	mi/h
Number of lanes, N	5	
Density, D	73.9	pc/mi/ln
Level of service, LOS	F	



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 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of 8th Ave Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	9700	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2694	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2794	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	2794	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	30.6	mi/h
Number of lanes, N	4	
Density, D	91.3	pc/mi/ln
Level of service, LOS	F	

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-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Direction: I-25/Northbound  
From/To: South of 8th Ave Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	8670	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2408	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2497	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	2497	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	43.0	mi/h
Number of lanes, N	4	
Density, D	58.1	pc/mi/ln
Level of service, LOS	F	

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E-mail:

-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Direction: I-25/Northbound  
From/To: South of US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	9650	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2681	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2780	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	2780	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	31.3	mi/h
Number of lanes, N	4	
Density, D	88.9	pc/mi/ln
Level of service, LOS	F	

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 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	8700	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2417	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2506	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	2506	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	42.7	mi/h
Number of lanes, N	4	
Density, D	58.7	pc/mi/ln
Level of service, LOS	F	

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-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Direction: I-25/Northbound  
From/To: North of US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	13750	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3819	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	3169	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	5	
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	3169	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	8.7	mi/h
Number of lanes, N	5	
Density, D	363.1	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Northbound  
 From/To: North of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	11570	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3214	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2666	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	5	
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	2666	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	36.5	mi/h
Number of lanes, N	5	
Density, D	73.1	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	12000	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	100	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)	12000	500	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	3333	139	v
Trucks and buses	7	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	13827	565	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5142 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11062	9000	Yes
$v_{FO} = v_F - v_R$	10497	9000	Yes
$v_R$	565	2000	No
$v_3 \text{ or } v_{av34}$	2960 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5662$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12A}$	5662	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 52.0 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.479	
Space mean speed in ramp influence area,	S = 48.8	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 51.1	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: I-25/Northbound  
 Junction: Eastbound US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	11600	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	100	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)	11600	600		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	3222	167		v
Trucks and buses	7	3		%
Recreational vehicles	1	1		%
Terrain type:	Level	Level		
Grade	0.00	%	0.00	%
Length	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.964	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	13366	678	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P_{FD} = 5045 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10693	9000	Yes
$v_{FO} = v_F - v_R$	10015	9000	Yes
$v_R$	678	2000	No
$v_3 \text{ or } v_{av34}$	2824 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5293$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12A}$	5293	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 48.9 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.489	
Space mean speed in ramp influence area,	S = 48.6	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 51.1	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	11600	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1900	vph
Length of first accel/decel lane	1000	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	500	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1000	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	11600	1900	500	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3222	528	139	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	13366	2147	576	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 7038 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	13366	9000	Yes
$v_{FO} = v_F - v_R$	11219	9000	Yes
$v_R$	2147	2000	Yes
$v_3 \text{ or } v_{av34}$	3164 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7966$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12A}$	7966	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 63.8 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.621	
Space mean speed in ramp influence area,	S = 46.9	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 49.4	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	11000	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2300	vph
Length of first accel/decel lane	1000	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	600	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	1000	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	11000	2300	600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3056	639	167	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	12674	2599	691	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 6992 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12674	9000	Yes
$v_{FO} = v_F - v_R$	10075	9000	Yes
$v_R$	2599	2000	Yes
$v_3 \text{ or } v_{av34}$	2841 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7274$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12A}$	7274	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 57.8 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.662	
Space mean speed in ramp influence area,	S = 46.4	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 49.3	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: 8th Avenue Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	9700	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	50	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1900	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	450	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	9700	50	1900	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2694	14	528	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11177	58	2189	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4906 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	11177	9000	Yes
$v_{FO} = v_F - v_R$	11119	9000	Yes
$v_R$	58	2000	No
$v_3 \text{ or } v_{av34}$	3135 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5777$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12A}$	5777	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 52.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.433	
Space mean speed in ramp influence area,	S = 49.4	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 51.4	mph

-----



Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: 8th Avenue Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8700	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	30	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	2300	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	450	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8700	30	2300	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2417	8	639	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10024	35	2650	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4390 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10024	9000	Yes
$v_{FO} = v_F - v_R$	9989	9000	Yes
$v_R$	35	2000	No
$v_3 \text{ or } v_{av34}$	2817 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4624$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12A}$	4624	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 42.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.431	
Space mean speed in ramp influence area,	S = 49.4	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 51.6	mph

-----

Phone: Fax:  
E-mail:

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

Analyst:  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	9650	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	4100	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane	400	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	140	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	9650	4100	140	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2681	1139	39	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	11119	4724	161	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.209 Using Equation 0  
FM  
 $v_{12} = v_F (P_{FM}) = 2324 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	15843	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	4397 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 4447		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	15843	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 53.5 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 37.579
Space mean speed in ramp influence area,	S <sub>R</sub> = -433.5 mph
Space mean speed in outer lanes,	S <sub>0</sub> = 42.3 mph
Space mean speed for all vehicles,	S = 115.9 mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Northbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8670	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2900	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane	400	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	115	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	500	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8670	2900	115	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2408	806	32	v
Trucks and buses	7	7	7	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	0.964	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9990	3341	133	pcph

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

L = (Equation 25-2 or 25-3)  
EQ  
P = 0.209 Using Equation 0  
FM  
 $v_{12} = v_F (P_{FM}) = 2088 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	13331	9000	Yes
v <sub>3 or av34</sub>	3951 pc/h	(Equation 25-4 or 25-5)	
Is v <sub>3 or av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3 or av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 3996		(Equation 25-8)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	3996	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 39.8 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 6.074	
Space mean speed in ramp influence area,	S <sub>R</sub> = -24.0	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 44.3	mph
Space mean speed for all vehicles,	S =	mph

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (5)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3028	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2512	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	5	
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	2512	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	42.5	mi/h
Number of lanes, N	5	
Density, D	59.1	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (5)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	13800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3833	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	3180	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	5	
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	3180	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	8.0	mi/h
Number of lanes, N	5	
Density, D	398.5	pc/mi/ln
Level of service, LOS	F	



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of WB US 6 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	9100	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2528	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2621	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	2621	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	38.4	mi/h
Number of lanes, N	4	
Density, D	68.3	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of WB US 6 Off-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3000	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	3111	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	3111	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	12.6	mi/h
Number of lanes, N	4	
Density, D	247.6	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	7900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2194	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2276	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	2276	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	49.4	mi/h
Number of lanes, N	4	
Density, D	46.1	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10000	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2778	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2881	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	2881	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	26.1	mi/h
Number of lanes, N	4	
Density, D	110.2	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: SM  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2917	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2420	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	5	
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	2420	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	45.5	mi/h
Number of lanes, N	5	
Density, D	53.2	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: SM  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Direction: I-25/Southbound  
From/To: South of US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	12800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3556	v
Trucks and buses	7	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.964	
Driver population factor, fp	1.00	
Flow rate, vp	2950	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	5	
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	2950	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	22.3	mi/h
Number of lanes, N	5	
Density, D	132.0	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10900	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1800	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	110	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	10900	1800	110	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3028	500	31	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	12559	2034	126	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5528 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10048	9000	Yes
$v_{FO} = v_F - v_R$	8014	9000	No
$v_R$	2034	2000	Yes
$v_3 \text{ or } v_{av34}$	2260 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5528$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	5528	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 41.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.611	
Space mean speed in ramp influence area,	S = 47.1	mph
Space mean speed in outer lanes,	S = 55.4	mph
Space mean speed for all vehicles,	S = 50.5	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	13800	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	3000	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	140	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	13800	3000	140	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3833	833	39	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	15901	3390	161	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 7458 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12721	9000	Yes
$v_{FO} = v_F - v_R$	9331	9000	Yes
$v_R$	3390	2000	Yes
$v_3 \text{ or } v_{av34}$	2631 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7458$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	7458	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 58.0 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.733	
Space mean speed in ramp influence area,	S = 45.5	mph
Space mean speed in outer lanes,	S = 54.0	mph
Space mean speed for all vehicles,	S = 48.6	mph

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Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	9100	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1800	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	9100	1200	1800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2528	333	500	v
Trucks and buses	7	3	3	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.985	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10485	1356	2030	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5336 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10485	9000	Yes
$v_{FO} = v_F - v_R$	9129	9000	Yes
$v_R$	1356	2000	No
$v_3 \text{ or } v_{av34}$	2574 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5336$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	5336	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 36.6 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.550	
Space mean speed in ramp influence area,	S = 47.8	mph
Space mean speed in outer lanes,	S = 54.2	mph
Space mean speed for all vehicles,	S = 50.8	mph

-----

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10800	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	800	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	3000	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	10800	800	3000	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3000	222	833	v
Trucks and buses	7	3	3	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.985	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	12444	904	3383	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5935 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12444	9000	Yes
$v_{FO} = v_F - v_R$	11540	9000	Yes
$v_R$	904	2000	No
$v_3 \text{ or } v_{av34}$	3254 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7044$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12A}$	7044	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 51.3 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.509	
Space mean speed in ramp influence area,	S = 48.4	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 50.6	mph

Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	7900	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2600	vph
Length of first accel/decel lane	1500	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)	7900	2600	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2194	722	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	9103	2996	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = -0.157 Using Equation 4  
 FM  
 $v_{12} = v_F (P_{FM}) = -1425 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	12099	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	5264 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 3641		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	12099	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 46.5 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 3.191	
Space mean speed in ramp influence area,	S = 13.5	mph
Space mean speed in outer lanes,	S = 45.9	mph
Space mean speed for all vehicles,	S = 19.8	mph

-----



Phone: Fax:  
E-mail:

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

Analyst: SM  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10000	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2800	vph
Length of first accel/decel lane	1500	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)	10000	2800	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2778	778	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	11522	3226	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = -0.185 Using Equation 4  
FM  
 $v_{12} = v_F (P_{FM}) = -2136 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	14748	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	6829 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 4608		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	14748	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 55.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 10.064	
Space mean speed in ramp influence area,	S <sub>R</sub> = -75.8	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 41.5	mph
Space mean speed for all vehicles,	S = 233.4	mph

-----

## **Surface Street Intersections**

# HCM Unsignalized Intersection Capacity Analysis

## 1: W. 7th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	44	1594	60	83	1559
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	49	1771	67	92	1732
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			701			796
pX, platoon unblocked	0.53	0.53			0.53	
vC, conflicting volume	2855	919			1838	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2725	0			797	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	1	91			79	
cM capacity (veh/h)	7	570			430	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	56	1181	657	92	866	866
Volume Left	7	0	0	92	0	0
Volume Right	49	0	67	0	0	0
cSH	52	1700	1700	430	1700	1700
Volume to Capacity	1.08	0.69	0.39	0.21	0.51	0.51
Queue Length 95th (ft)	120	0	0	20	0	0
Control Delay (s)	275.9	0.0	0.0	15.7	0.0	0.0
Lane LOS	F			C		
Approach Delay (s)	275.9	0.0		0.8		
Approach LOS	F					

Intersection Summary						
Average Delay			4.5			
Intersection Capacity Utilization			63.9%		ICU Level of Service	B
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 1: W. 7th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	32	74	1630	35	26	2058
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	36	82	1811	39	29	2287
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			701			796
pX, platoon unblocked	0.42	0.42			0.42	
vC, conflicting volume	3032	925			1850	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3076	0			248	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	82			95	
cM capacity (veh/h)	4	452			546	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	118	1207	643	29	1143	1143
Volume Left	36	0	0	29	0	0
Volume Right	82	0	39	0	0	0
cSH	12	1700	1700	546	1700	1700
Volume to Capacity	9.93	0.71	0.38	0.05	0.67	0.67
Queue Length 95th (ft)	Err	0	0	4	0	0
Control Delay (s)	Err	0.0	0.0	12.0	0.0	0.0
Lane LOS	F			B		
Approach Delay (s)	Err	0.0		0.1		
Approach LOS	F					

Intersection Summary						
Average Delay			275.0			
Intersection Capacity Utilization			69.9%	ICU Level of Service		C
Analysis Period (min)			15			

# HCM Signalized Intersection Capacity Analysis

## 2: 6th WB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖	↖	↑↑			↑↑	↖
Volume (vph)	0	0	0	245	100	80	340	1860	0	0	1615	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.98	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1665	1716	1568	1752	3505			3505	1568
Flt Permitted				0.95	0.98	1.00	0.06	1.00			1.00	1.00
Satd. Flow (perm)				1665	1716	1568	115	3505			3505	1568
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)	0	0	0	266	109	87	370	2022	0	0	1755	228
RTOR Reduction (vph)	0	0	0	0	0	16	0	0	0	0	0	96
Lane Group Flow (vph)	0	0	0	186	189	71	370	2022	0	0	1755	132
Turn Type				Perm		Perm	pm+pt					Perm
Protected Phases					4		1	6			2	
Permitted Phases				4		4	6					2
Actuated Green, G (s)				19.0	19.0	19.0	69.0	69.0			58.0	58.0
Effective Green, g (s)				19.0	19.0	19.0	69.0	69.0			58.0	58.0
Actuated g/C Ratio				0.19	0.19	0.19	0.69	0.69			0.58	0.58
Clearance Time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Grp Cap (vph)				316	326	298	161	2418			2033	909
v/s Ratio Prot							c0.11	0.58			0.50	
v/s Ratio Perm				c0.11	0.11	0.05	c1.47					0.08
v/c Ratio				0.59	0.58	0.24	2.30	0.84			0.86	0.15
Uniform Delay, d1				36.9	36.9	34.4	27.6	11.4			17.7	9.6
Progression Factor				1.00	1.00	1.00	0.93	1.33			1.00	1.00
Incremental Delay, d2				7.8	7.3	1.9	593.8	1.8			5.2	0.3
Delay (s)				44.8	44.2	36.2	619.5	16.9			22.8	10.0
Level of Service				D	D	D	F	B			C	A
Approach Delay (s)		0.0			42.9			110.1			21.3	
Approach LOS		A			D			F			C	

### Intersection Summary

HCM Average Control Delay	67.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.84		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: 6th WB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖	↖	↕			↕	↖
Volume (vph)	0	0	0	500	325	160	350	2050	0	0	2750	525
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Util. Factor				0.95	0.95	1.00	1.00	0.95			0.95	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.99	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1665	1733	1568	1752	3505			3505	1568
Flt Permitted				0.95	0.99	1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)				1665	1733	1568	1752	3505			3505	1568
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)	0	0	0	543	353	174	380	2228	0	0	2989	571
RTOR Reduction (vph)	0	0	0	0	0	10	0	0	0	0	0	37
Lane Group Flow (vph)	0	0	0	440	456	164	380	2228	0	0	2989	534
Turn Type				Perm		Perm	custom					Perm
Protected Phases					4		1	6			2	
Permitted Phases				4		4	1					2
Actuated Green, G (s)				20.0	20.0	20.0	5.0	68.0			57.0	57.0
Effective Green, g (s)				20.0	20.0	20.0	5.0	68.0			57.0	57.0
Actuated g/C Ratio				0.20	0.20	0.20	0.05	0.68			0.57	0.57
Clearance Time (s)				6.0	6.0	6.0	6.0	6.0			6.0	6.0
Lane Grp Cap (vph)				333	347	314	88	2383			1998	894
v/s Ratio Prot							c0.22	0.64			c0.85	
v/s Ratio Perm				c0.26	0.26	0.10						0.34
v/c Ratio				1.32	1.31	0.52	4.32	0.93			1.50	0.60
Uniform Delay, d1				40.0	40.0	35.7	47.5	14.1			21.5	14.0
Progression Factor				1.00	1.00	1.00	1.02	1.31			1.00	1.00
Incremental Delay, d2				164.2	160.5	6.1	1500.5	2.8			225.9	2.9
Delay (s)				204.2	200.5	41.9	1548.9	21.2			247.4	17.0
Level of Service				F	F	D	F	C			F	B
Approach Delay (s)		0.0			176.2			243.8			210.4	
Approach LOS		A			F			F			F	

### Intersection Summary

HCM Average Control Delay	217.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.63		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	132.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 3: 6th EB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	←←			↑↑	↑↑	
Volume (vph)	270	170	0	1930	1855	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	6.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.94			1.00	1.00	
Flt Protected	0.97			1.00	1.00	
Satd. Flow (prot)	3271			3505	3505	
Flt Permitted	0.97			1.00	1.00	
Satd. Flow (perm)	3271			3505	3505	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	293	185	0	2098	2016	0
RTOR Reduction (vph)	16	0	0	0	0	0
Lane Group Flow (vph)	462	0	0	2098	2016	0
Turn Type						
Protected Phases	4			6	2	
Permitted Phases						
Actuated Green, G (s)	19.0			69.0	69.0	
Effective Green, g (s)	19.0			69.0	69.0	
Actuated g/C Ratio	0.19			0.69	0.69	
Clearance Time (s)	6.0			6.0	6.0	
Lane Grp Cap (vph)	621			2418	2418	
v/s Ratio Prot	c0.14			c0.60	0.58	
v/s Ratio Perm						
v/c Ratio	0.74			0.87	0.83	
Uniform Delay, d1	38.2			12.0	11.3	
Progression Factor	1.00			1.00	1.53	
Incremental Delay, d2	7.9			4.5	1.9	
Delay (s)	46.1			16.5	19.2	
Level of Service	D			B	B	
Approach Delay (s)	46.1			16.5	19.2	
Approach LOS	D			B	B	

### Intersection Summary

HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 3: 6th EB Ramp & Federal Blvd

8/7/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔↔			↑↑	↑↑	
Volume (vph)	200	250	0	2200	3220	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	6.0	
Lane Util. Factor	0.97			0.95	0.95	
Frt	0.92			1.00	1.00	
Flt Protected	0.98			1.00	1.00	
Satd. Flow (prot)	3209			3505	3505	
Flt Permitted	0.98			1.00	1.00	
Satd. Flow (perm)	3209			3505	3505	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	272	0	2391	3500	0
RTOR Reduction (vph)	1	0	0	0	0	0
Lane Group Flow (vph)	488	0	0	2391	3500	0
Turn Type						
Protected Phases	4			6	2	
Permitted Phases						
Actuated Green, G (s)	19.0			69.0	69.0	
Effective Green, g (s)	19.0			69.0	69.0	
Actuated g/C Ratio	0.19			0.69	0.69	
Clearance Time (s)	6.0			6.0	6.0	
Lane Grp Cap (vph)	610			2418	2418	
v/s Ratio Prot	c0.15			0.68	c1.00	
v/s Ratio Perm						
v/c Ratio	0.89dr			0.99	1.45	
Uniform Delay, d1	38.7			15.1	15.5	
Progression Factor	1.00			1.00	1.43	
Incremental Delay, d2	10.6			15.9	201.6	
Delay (s)	49.3			31.0	223.7	
Level of Service	D			C	F	
Approach Delay (s)	49.3			31.0	223.7	
Approach LOS	D			C	F	

### Intersection Summary

HCM Average Control Delay	138.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	132.8%	ICU Level of Service	H
Analysis Period (min)	15		
dr Defacto Right Lane. Recode with 1 though lane as a right lane.			
c Critical Lane Group			

# HCM Unsignalized Intersection Capacity Analysis

## 4: W. 5th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	5	1930	1055	210	1280
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	6	2144	1172	233	1422
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						710
pX, platoon unblocked	0.67					
vC, conflicting volume	3908	1658			3317	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	4349	1658			3317	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	94			0	
cM capacity (veh/h)	0	86			82	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	11	1430	1887	233	711	711
Volume Left	6	0	0	233	0	0
Volume Right	6	0	1172	0	0	0
cSH	0	1700	1700	82	1700	1700
Volume to Capacity	Err	0.84	1.11	2.83	0.42	0.42
Queue Length 95th (ft)	Err	0	0	568	0	0
Control Delay (s)	Err	0.0	0.0	936.1	0.0	0.0
Lane LOS	F			F		
Approach Delay (s)	Err	0.0		131.9		
Approach LOS	F					

Intersection Summary						
Average Delay			Err			
Intersection Capacity Utilization			112.1%		ICU Level of Service	H
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 4: W. 5th Ave & Federal Blvd

8/7/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	10	2200	625	225	3250
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	11	2444	694	250	3611
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						710
pX, platoon unblocked	0.32					
vC, conflicting volume	5097	1569			3139	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	9464	1569			3139	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	89			0	
cM capacity (veh/h)	0	99			97	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	22	1630	1509	250	1806	1806
Volume Left	11	0	0	250	0	0
Volume Right	11	0	694	0	0	0
cSH	0	1700	1700	97	1700	1700
Volume to Capacity	Err	0.96	0.89	2.57	1.06	1.06
Queue Length 95th (ft)	Err	0	0	578	0	0
Control Delay (s)	Err	0.0	0.0	803.0	0.0	0.0
Lane LOS	F			F		
Approach Delay (s)	Err	0.0		52.0		
Approach LOS	F					

Intersection Summary						
Average Delay			Err			
Intersection Capacity Utilization			106.6%		ICU Level of Service	G
Analysis Period (min)			15			

# HCM Signalized Intersection Capacity Analysis

## 5: W 5th Ave & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Volume (vph)	25	15	40	15	35	25	115	210	25	55	555	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.93			0.95		1.00	0.98		1.00	0.97	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1695			1744		1752	3448		1752	3402	
Flt Permitted		0.91			0.94		0.19	1.00		0.59	1.00	
Satd. Flow (perm)		1559			1662		358	3448		1089	3402	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	28	17	44	17	39	28	128	233	28	61	617	150
RTOR Reduction (vph)	0	31	0	0	20	0	0	13	0	0	35	0
Lane Group Flow (vph)	0	58	0	0	64	0	128	248	0	61	732	0
Turn Type	Perm			Perm			pm+pt			Perm		
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Effective Green, g (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Actuated g/C Ratio		0.30			0.30		0.53	0.53		0.33	0.33	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		468			499		354	1839		363	1134	
v/s Ratio Prot							c0.04	0.07			c0.22	
v/s Ratio Perm		0.04			c0.04		0.15			0.06		
v/c Ratio		0.12			0.13		0.36	0.13		0.17	0.65	
Uniform Delay, d1		15.3			15.3		8.4	7.0		14.1	17.0	
Progression Factor		1.00			1.00		1.00	1.00		1.99	1.97	
Incremental Delay, d2		0.5			0.5		2.9	0.2		0.1	0.3	
Delay (s)		15.8			15.8		11.3	7.2		28.2	33.7	
Level of Service		B			B		B	A		C	C	
Approach Delay (s)		15.8			15.8			8.5			33.3	
Approach LOS		B			B			A			C	

### Intersection Summary

HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 5: W 5th Ave & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↕		↗	↕	
Volume (vph)	45	5	30	15	25	25	285	335	15	20	495	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.95			0.95		1.00	0.99		1.00	0.97	
Flt Protected		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1704			1729		1752	3482		1752	3406	
Flt Permitted		0.83			0.94		0.24	1.00		0.52	1.00	
Satd. Flow (perm)		1446			1637		439	3482		963	3406	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	50	6	33	17	28	28	317	372	17	22	550	128
RTOR Reduction (vph)	0	23	0	0	20	0	0	6	0	0	33	0
Lane Group Flow (vph)	0	66	0	0	53	0	317	383	0	22	645	0
Turn Type	Perm			Perm			pm+pt			Perm		
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Effective Green, g (s)		18.0			18.0		32.0	32.0		20.0	20.0	
Actuated g/C Ratio		0.30			0.30		0.53	0.53		0.33	0.33	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		434			491		387	1857		321	1135	
v/s Ratio Prot							c0.10	0.11			0.19	
v/s Ratio Perm		c0.05			0.03		c0.34			0.02		
v/c Ratio		0.15			0.11		0.82	0.21		0.07	0.57	
Uniform Delay, d1		15.4			15.2		9.4	7.3		13.6	16.4	
Progression Factor		1.00			1.00		1.00	1.00		1.99	1.94	
Incremental Delay, d2		0.7			0.4		17.4	0.3		0.1	0.7	
Delay (s)		16.1			15.6		26.8	7.6		27.3	32.7	
Level of Service		B			B		C	A		C	C	
Approach Delay (s)		16.1			15.6			16.2			32.5	
Approach LOS		B			B			B			C	

### Intersection Summary

HCM Average Control Delay	23.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: 6th EB Ramp & Bryant St

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗						↕	↗	↖	↕	
Volume (vph)	20	5	90	0	0	0	0	195	5	30	670	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00						0.95		1.00	0.95	
Frt	1.00	0.86						1.00		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1752	1584						3491		1752	3505	
Flt Permitted	0.95	1.00						1.00		0.61	1.00	
Satd. Flow (perm)	1752	1584						3491		1130	3505	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	6	100	0	0	0	0	217	6	33	744	0
RTOR Reduction (vph)	0	63	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	22	43	0	0	0	0	0	220	0	33	744	0
Turn Type	Perm						Perm					
Protected Phases	4						6					
Permitted Phases	4						2					
Actuated Green, G (s)	22.0	22.0						28.0		11.0	11.0	
Effective Green, g (s)	22.0	22.0						28.0		11.0	11.0	
Actuated g/C Ratio	0.37	0.37						0.47		0.18	0.18	
Clearance Time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Grp Cap (vph)	642	581						1629		207	643	
v/s Ratio Prot		c0.03						c0.06			c0.21	
v/s Ratio Perm	0.01									0.03		
v/c Ratio	0.03	0.07						0.13		0.16	1.16	
Uniform Delay, d1	12.2	12.4						9.1		20.6	24.5	
Progression Factor	1.00	1.00						0.67		0.65	0.65	
Incremental Delay, d2	0.1	0.2						0.2		1.4	85.0	
Delay (s)	12.3	12.6						6.3		14.9	101.0	
Level of Service	B	B						A		B	F	
Approach Delay (s)		12.6			0.0			6.3			97.3	
Approach LOS		B			A			A			F	

### Intersection Summary

HCM Average Control Delay	69.7	HCM Level of Service	E
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: 6th EB Ramp & Bryant St

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗						↕		↖	↗	
Volume (vph)	20	5	100	0	0	0	0	485	5	5	615	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00						0.95		1.00	0.95	
Frt	1.00	0.86						1.00		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1752	1582						3499		1752	3505	
Flt Permitted	0.95	1.00						1.00		0.45	1.00	
Satd. Flow (perm)	1752	1582						3499		827	3505	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	6	111	0	0	0	0	539	6	6	683	0
RTOR Reduction (vph)	0	70	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	22	47	0	0	0	0	0	544	0	6	683	0
Turn Type	Perm						Perm					
Protected Phases	4						6					
Permitted Phases	4						2					
Actuated Green, G (s)	22.0	22.0						28.0		11.0	11.0	
Effective Green, g (s)	22.0	22.0						28.0		11.0	11.0	
Actuated g/C Ratio	0.37	0.37						0.47		0.18	0.18	
Clearance Time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Grp Cap (vph)	642	580						1633		152	643	
v/s Ratio Prot		c0.03						c0.16			c0.19	
v/s Ratio Perm	0.01									0.01		
v/c Ratio	0.03	0.08						0.33		0.04	1.06	
Uniform Delay, d1	12.2	12.4						10.1		20.2	24.5	
Progression Factor	1.00	1.00						0.65		1.05	1.09	
Incremental Delay, d2	0.1	0.3						0.5		0.5	52.6	
Delay (s)	12.3	12.7						7.1		21.7	79.2	
Level of Service	B	B						A		C	E	
Approach Delay (s)		12.6			0.0			7.1			78.7	
Approach LOS		B			A			A			E	

### Intersection Summary

HCM Average Control Delay	43.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 7: 6th WB Ramp & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↔↔		↗	↕↕			↕↕	
Volume (vph)	0	0	0	455	40	100	165	45	0	0	245	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0	5.0			5.0	
Lane Util. Factor					0.95		1.00	0.95			0.95	
Frt					0.97		1.00	1.00			0.98	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					3291		1752	3505			3432	
Flt Permitted					0.96		0.56	1.00			1.00	
Satd. Flow (perm)					3291		1033	3505			3432	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	506	44	111	183	50	0	0	272	44
RTOR Reduction (vph)	0	0	0	0	28	0	0	0	0	0	18	0
Lane Group Flow (vph)	0	0	0	0	633	0	183	50	0	0	298	0
Turn Type				Perm			Perm					
Protected Phases					8			2			6	
Permitted Phases				8			2					
Actuated Green, G (s)					15.0		35.0	35.0			35.0	
Effective Green, g (s)					15.0		35.0	35.0			35.0	
Actuated g/C Ratio					0.25		0.58	0.58			0.58	
Clearance Time (s)					5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)					823		603	2045			2002	
v/s Ratio Prot								0.01			0.09	
v/s Ratio Perm					0.19		c0.18					
v/c Ratio					1.09dl		0.30	0.02			0.15	
Uniform Delay, d1					20.9		6.3	5.3			5.7	
Progression Factor					1.00		2.33	2.19			1.00	
Incremental Delay, d2					6.8		1.3	0.0			0.2	
Delay (s)					27.7		16.0	11.6			5.9	
Level of Service					C		B	B			A	
Approach Delay (s)		0.0			27.7			15.1			5.9	
Approach LOS		A			C			B			A	

### Intersection Summary

HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 7: 6th WB Ramp & Bryant St

8/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↔↔		↗	↕↕			↕↕	
Volume (vph)	0	0	0	225	15	20	255	245	0	0	395	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0	5.0			5.0	
Lane Util. Factor					0.95		1.00	0.95			0.95	
Frt					0.99		1.00	1.00			0.96	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					3321		1752	3505			3367	
Flt Permitted					0.96		0.42	1.00			1.00	
Satd. Flow (perm)					3321		782	3505			3367	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	250	17	22	283	272	0	0	439	156
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	0	0	60	0
Lane Group Flow (vph)	0	0	0	0	279	0	283	272	0	0	535	0
Turn Type					Perm		Perm					
Protected Phases						8		2				6
Permitted Phases					8		2					
Actuated Green, G (s)						15.0		35.0	35.0			35.0
Effective Green, g (s)						15.0		35.0	35.0			35.0
Actuated g/C Ratio						0.25		0.58	0.58			0.58
Clearance Time (s)						5.0		5.0	5.0			5.0
Lane Grp Cap (vph)						830		456	2045			1964
v/s Ratio Prot								0.08				0.16
v/s Ratio Perm						0.08		0.36				
v/c Ratio						0.34		0.62	0.13			0.27
Uniform Delay, d1						18.4		8.2	5.6			6.2
Progression Factor						1.00		0.96	0.45			1.00
Incremental Delay, d2						1.1		6.0	0.1			0.3
Delay (s)						19.5		13.8	2.7			6.5
Level of Service						B		B	A			A
Approach Delay (s)		0.0				19.5		8.4				6.5
Approach LOS		A				B		A				A

### Intersection Summary

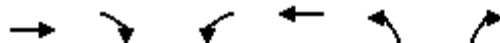
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 8: W. 7th Ave & Bryant St

8/7/2012



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Volume (veh/h)	14	312	1	13	259	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	16	347	1	14	288	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			362		206	189
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			362		206	189
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		63	97
cM capacity (veh/h)			1191		780	850

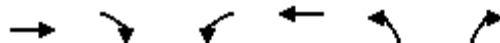
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	362	16	288	27
Volume Left	0	1	288	0
Volume Right	347	0	0	27
cSH	1700	1191	780	850
Volume to Capacity	0.21	0.00	0.37	0.03
Queue Length 95th (ft)	0	0	43	2
Control Delay (s)	0.0	0.6	12.3	9.4
Lane LOS		A	B	A
Approach Delay (s)	0.0	0.6	12.0	
Approach LOS			B	

Intersection Summary			
Average Delay		5.5	
Intersection Capacity Utilization	41.0%		ICU Level of Service A
Analysis Period (min)	15		

# HCM Unsignalized Intersection Capacity Analysis

## 8: W. 7th Ave & Bryant St

8/7/2012



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Volume (veh/h)	8	333	22	47	418	27
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	9	370	24	52	464	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			379		295	194
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			379		295	194
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		32	96
cM capacity (veh/h)			1174		679	845

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	379	77	464	30
Volume Left	0	24	464	0
Volume Right	370	0	0	30
cSH	1700	1174	679	845
Volume to Capacity	0.22	0.02	0.68	0.04
Queue Length 95th (ft)	0	2	135	3
Control Delay (s)	0.0	2.7	20.9	9.4
Lane LOS		A	C	A
Approach Delay (s)	0.0	2.7	20.2	
Approach LOS			C	

Intersection Summary			
Average Delay		10.8	
Intersection Capacity Utilization		51.7%	ICU Level of Service A
Analysis Period (min)		15	

## **Appendix C Future 2035 Build of LOS**

# Freeway Facilities

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: West of Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	8200	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2278	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2339	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	2339	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	47.8	mi/h
Number of lanes, N	4	
Density, D	48.9	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: PS  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Direction: US 6/Eastbound  
From/To: West of Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5700	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1583	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	1626	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	1626	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	29.6	pc/mi/ln
Level of service, LOS	D	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of I-25 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	694	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	1426	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	1426	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	25.9	pc/mi/ln
Level of service, LOS	C	



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of I-25 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	1500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	417	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	856	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	856	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	15.6	pc/mi/ln
Level of service, LOS	B	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst:  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of NB I-25 On-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	4700	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1306	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	1341	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	1341	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	24.4	pc/mi/ln
Level of service, LOS	C	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Eastbound  
 From/To: East of NB I-25 On-Ramp (4)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	3300	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	917	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	941	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	941	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	17.1	pc/mi/ln
Level of service, LOS	B	

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8200	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	165	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)	8200	600		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2278	167		v
Trucks and buses	3	3		%
Recreational vehicles	1	1		%
Terrain type:	Level	Level		
Grade	0.00	%	0.00	%
Length	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	9266	678	pcph

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

L = (Equation 25-8 or 25-9)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4422 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	9266	9000	Yes
$v_{FO} = v_F - v_R$	8588	9000	No
$v_R$	678	2000	No
$v_{3 \text{ or } av34}$	2422 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4422$		(Equation 25-18)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4422	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 40.8 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.489	
Space mean speed in ramp influence area,	S = 48.6	mph
Space mean speed in outer lanes,	S = 54.8	mph
Space mean speed for all vehicles,	S = 51.7	mph

Phone: Fax:  
 E-mail:

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

Analyst: PS  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: PM Peak Hour  
 Freeway/Dir of Travel: US 6/Eastbound  
 Junction: Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5700	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	165	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)	5700	600	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	1583	167	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6441	678	pcph

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

L = (Equation 25-8 or 25-9)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3191 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{12} = v_{Fi}$	6441	9000	No
$v_{FO} = v_F - v_R$	5763	9000	No
$v_R$	678	2000	No
$v_{3 \text{ or } av34}$	1625 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3191$		(Equation 25-18)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3191	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 30.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.489	
Space mean speed in ramp influence area,	S = 48.6	mph
Space mean speed in outer lanes,	S = 57.9	mph
Space mean speed for all vehicles,	S = 52.9	mph

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	7600	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	55.0	mph
Volume on ramp	5100	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane	1500	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	600	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	660	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7600	5100	600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2111	1417	167	v
Trucks and buses	3	7	0	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	



Heavy vehicle adjustment, fHV	0.983	0.964	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	8588	5876	667	pcph

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

L = (Equation 25-8 or 25-9)  
EQ  
P = 0.450 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 7096 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	8588	6750	Yes
$v_{FO} = v_F - v_R$	2712	6750	No
$v_R$	5876	4400	Yes
$v_{3 \text{ or } av34}$	1492 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7096$		(Equation 25-18)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	7096	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 24.8 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	D = 0.697	
Space mean speed in ramp influence area,	S = 45.9	mph
Space mean speed in outer lanes,	S = 58.4	mph
Space mean speed for all vehicles,	S = 47.7	mph

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5100	vph

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

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	55.0	mph
Volume on ramp	3600	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane	1500	ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	600	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	660	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5100	3600	600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1417	1000	167	v
Trucks and buses	3	7	0	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5763	4148	667	pcph

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

L = (Equation 25-8 or 25-9)  
EQ  
P = 0.450 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4875 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{12} = v_{Fi}$	5763	6750	No
$v_{FO} = v_F - v_R$	1615	6750	No
$v_R$	4148	4400	No
$v_{3 \text{ or } av34}$	888 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4875$		(Equation 25-18)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4875	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 5.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence A

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

Intermediate speed variable,	D = 0.541	
Space mean speed in ramp influence area,	S = 48.0	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 49.5	mph

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2500	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	500	vph
Length of first accel/decel lane	1500	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)	2500	500	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	694	139	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2825	565	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 1.000 Using Equation 0  
 FM  
 $v_{12} = v_F (P_{FM}) = 2825 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	3390	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 2825		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	3390	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.3 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.332	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.7	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S <sub>0</sub> = 50.7	mph

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Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Eastbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	1500	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	400	vph
Length of first accel/decel lane	1500	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)	1500	400	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	417	111	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1695	452	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 1.000 Using Equation 0  
 FM  
 $v_{12} = v_F (P_{FM}) = 1695 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	2147	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 1695		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	2147	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 12.6 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	M = 0.249	
Space mean speed in ramp influence area,	S <sub>R</sub> = 51.8	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S = 51.8	mph

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6 (I-25 Off-Ramp)/Eastbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5100	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1000	vph
Length of first accel/decel lane	165	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)	5100	1000	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	1417	278	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	



Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5876	1152	pcph

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

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 0.582 Using Equation 1  
 FM  
 $v_{12} = v_F (P_{FM}) = 3421 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	7028	6750	Yes
v <sub>3</sub> or v <sub>av34</sub>	2455 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 3421		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	7028	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 39.6 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 0.687	
Space mean speed in ramp influence area,	S <sub>R</sub> = 46.1	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 47.5	mph
Space mean speed for all vehicles,	S = 46.6	mph

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Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6 (I-25 Off-Ramp)/Eastbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3600	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1000	vph
Length of first accel/decel lane	165	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)	3600	1000	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	1000	278	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4148	1152	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.582 Using Equation 1  
FM  
 $v_{12} = v_{F, FM} = 2415 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	5300	6750	No
v <sub>3</sub> or v <sub>av34</sub>	1733 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 2415		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	5300	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 31.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	M = 0.448	
Space mean speed in ramp influence area,	S <sub>R</sub> = 49.2	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 50.6	mph
Space mean speed for all vehicles,	S = 49.6	mph

Phone: Fax:  
 E-mail:

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: East of I-25 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	2400	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	667	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	913	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	913	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	16.6	pc/mi/ln
Level of service, LOS	B	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: East of I-25 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5300	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1472	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2016	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	2016	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	53.8	mi/h
Number of lanes, N	3	
Density, D	37.4	pc/mi/ln
Level of service, LOS	E	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: US 6/Westbound  
 From/To: West of Federal Blvd On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	5800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1611	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	1639	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	1639	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	29.8	pc/mi/ln
Level of service, LOS	D	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: PS  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Direction: US 6/Westbound  
From/To: West of Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10000	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2778	v
Trucks and buses	3	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.983	
Driver population factor, fp	1.00	
Flow rate, vp	2825	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	2825	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	29.1	mi/h
Number of lanes, N	4	
Density, D	97.2	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	2400	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	200	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2400	600	200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	667	167	56	v
Trucks and buses	3	7	0	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	



Heavy vehicle adjustment, fHV	0.983	0.964	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2712	691	222	pcph

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

L = 274.77 (Equation 13-12 or 13-13)  
EQ  
P = 0.663 Using Equation 7  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2031 \text{ pc/h}$   
12 R F R FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2712	6750	No
$v_{FO} = v_F - v_R$	2021	6750	No
$v_R$	691	2000	No
$v_3 \text{ or } v_{av34}$	681 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2031$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2031	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 20.8 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	D = 0.490	
Space mean speed in ramp influence area,	S = 48.6	mph
Space mean speed in outer lanes,	S = 60.3	mph
Space mean speed for all vehicles,	S = 51.1	mph

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: I-25 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5300	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	400	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5300	1200	400	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1472	333	111	v
Trucks and buses	3	7	0	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5989	1383	444	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.547 Using Equation 5  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 3901 \text{ pc/h}$   
FD

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5989	6750	No
$v_{FO} = v_F - v_R$	4606	6750	No
$v_R$	1383	2000	No
$v_3 \text{ or } v_{av34}$	2088 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 3901$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	3901	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 36.9 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence E

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

Intermediate speed variable,	D = 0.552	
Space mean speed in ramp influence area,	S = 47.8	mph
Space mean speed in outer lanes,	S = 56.1	mph
Space mean speed for all vehicles,	S = 50.4	mph

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Phone: Fax:  
E-mail:

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

Analyst:  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: WB US 6 Frontage Rd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	1800	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	200	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	600	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1800	200	600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	500	56	167	v
Trucks and buses	3	7	0	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2034	230	667	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 2034 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2034	4500	No
$v_{FO} = v_F - v_R$	1804	4500	No
$v_R$	230	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2034$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	2034	4400	No

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 8.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence A

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

Intermediate speed variable,	D = 0.449	
Space mean speed in ramp influence area,	S = 49.2	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 49.2	mph

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Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: WB US 6 Frontage Rd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3900	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	400	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1200	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	265	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3900	400	1200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1083	111	333	v
Trucks and buses	3	7	0	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.964	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4407	461	1333	pcph

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

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4407 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4407	4500	No
$v_{FO} = v_F - v_R$	3946	4500	No
$v_R$	461	2000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4407$		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
$v_{12}$	4407	4400	Yes

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

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 28.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence D

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

Intermediate speed variable,	D = 0.469	
Space mean speed in ramp influence area,	S = 48.9	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 48.9	mph

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Phone: Fax:  
E-mail:

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

Analyst:  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5100	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	700	vph
Length of first accel/decel lane	730	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3500	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5100	700	3500	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1417	194	972	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	



Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5763	791	3955	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.119 Using Equation 4  
FM  
 $v_{12} = v_F (P_{FM}) = 685 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	6554	9000	No
v <sub>3</sub> or v <sub>av34</sub>	2539 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 2305		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	6554	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 24.7 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

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

Intermediate speed variable,	M = 0.356	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.4	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 50.6	mph
Space mean speed for all vehicles,	S = 50.5	mph

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Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6/Westbound  
Junction: Federal Blvd On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	8800	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	730	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	5300	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	925	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8800	1200	5300	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2444	333	1472	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	9944	1356	5989	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 0.048 Using Equation 4  
FM  
 $v_{12} = v_F (P_{FM}) = 480 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	11300	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	4732 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 3977		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	11300	4600	Yes

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 41.9 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

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

Intermediate speed variable,	M = 1.077	
Space mean speed in ramp influence area,	S <sub>R</sub> = 41.0	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 44.4	mph
Space mean speed for all vehicles,	S = 42.7	mph

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Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Road/Westbound  
Junction: Northbound I-25 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	200	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1900	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1800	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	600	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	200	1900	1800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	56	528	500	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	226	2147	2034	pcph

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

L = (Equation 13-6 or 13-7)  
EQ  
P = 1.000 Using Equation 0  
FM  
 $v_{12} = v_F (P_{FM}) = 226 \text{ pc/h}$

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

	Actual	Maximum	LOS F?
v <sub>FO</sub>	2373	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 226		(Equation 13-15, 13-16, 13-18, or 13-19)	

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

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	2373	4600	No

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

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 13.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence B

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

Intermediate speed variable,	M = 0.258	
Space mean speed in ramp influence area,	S <sub>R</sub> = 51.6	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S = 51.6	mph

Phone: Fax:  
E-mail:

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

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Road/Westbound  
Junction: Northbound I-25 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

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

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	400	vph

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

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2500	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

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

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3000	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	600	ft

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

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	400	2500	3000	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	111	694	833	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade		%	%	%
Length		mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	452	2825	3390	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)  
EQ  
P = 1.000 Using Equation 0  
FM  
 $v_{12} = v_F (P_{FM}) = 452 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v <sub>FO</sub>	3277	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 452		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	3277	4600	No

----- Level of Service Determination (if not F) -----

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.3 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence C

----- Speed Estimation -----

Intermediate speed variable,	M = 0.319	
Space mean speed in ramp influence area,	S <sub>R</sub> = 50.8	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S = 50.8	mph

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Diverge Analysis-----

Analyst:  
 Agency/Co.: Parsons Brinckerhoff  
 Date performed: 7/20/2012  
 Analysis time period: AM Peak Hour  
 Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
 Junction: Federal Blvd Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 No Action  
 Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	3900	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	400	vph
Length of first accel/decel lane	1235	ft
Length of second accel/decel lane	1235	ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1600	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1175	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3900	400	1600	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1083	111	444	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	



Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4407	452	1808	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 4407 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4407	4500	No
$v_{FO} = v_F - v_R$	3955	4500	No
$v_R$	452	4000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4407$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	4407	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 8.8 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence A

----- Speed Estimation -----

Intermediate speed variable,	D = 0.469	
Space mean speed in ramp influence area,	S = 48.9	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 48.9	mph

Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: US 6 Frontage Rd/Westbound  
Junction: Federal Blvd Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 No Action  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	5900	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	600	vph
Length of first accel/decel lane	1235	ft
Length of second accel/decel lane	1235	ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	3500	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1175	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5900	600	3500	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1639	167	972	v
Trucks and buses	3	3	3	%
Recreational vehicles	1	1	1	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	0.983	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	6667	678	3955	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 1.000 Using Equation 0  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 6667 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6667	4500	Yes
$v_{FO} = v_F - v_R$	5989	4500	Yes
$v_R$	678	4000	No
$v_3 \text{ or } v_{av34}$	0 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 6667$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	6667	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 28.2 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.489	
Space mean speed in ramp influence area,	S = 48.6	mph
Space mean speed in outer lanes,	S = N/A	mph
Space mean speed for all vehicles,	S = 48.6	mph

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Phone: Fax:  
E-mail:

-----Merge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: Federal Off-Ramp/WB  
Junction: Bryant On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	400	vph

-----On Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	0	vph
Length of first accel/decel lane	300	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)	400	0	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	111	0	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	452	0	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 1.000 Using Equation 0  
 FM  
 $v_{12} = v_F (P_{FM}) = 452 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v <sub>FO</sub>	452	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 452		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	452	4600	No

----- Level of Service Determination (if not F) -----

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 7.1 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence A

----- Speed Estimation -----

Intermediate speed variable,	M = 0.306	
Space mean speed in ramp influence area,	S <sub>R</sub> = 51.0	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S = 51.0	mph

Phone: Fax:  
E-mail:

-----Merge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: Federal Off-Ramp/WB  
Junction: Bryant On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	55.0	mph
Volume on freeway	600	vph

-----On Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	500	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)	600	500	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	167	139	v
Trucks and buses	3	3	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.983	0.983	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	678	565	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)  
 EQ  
 P = 1.000 Using Equation 0  
 FM  
 $v_{12} = v_F (P_{FM}) = 678 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v <sub>FO</sub>	1243	4500	No
v <sub>3</sub> or v <sub>av34</sub>	0 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		No	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		No	
If yes, v <sub>12A</sub> = 678		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v <sub>R12</sub>	1243	4600	No

----- Level of Service Determination (if not F) -----

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 11.1 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence B

----- Speed Estimation -----

Intermediate speed variable,	M = 0.293	
Space mean speed in ramp influence area,	S <sub>R</sub> = 51.2	mph
Space mean speed in outer lanes,	S <sub>0</sub> = N/A	mph
Space mean speed for all vehicles,	S = 51.2	mph

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: PS  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Direction: I-25/Southbound  
From/To: South of EB US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	7900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2194	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2254	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	2254	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	49.9	mi/h
Number of lanes, N	4	
Density, D	45.2	pc/mi/ln
Level of service, LOS	F	



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10000	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2778	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2853	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	2853	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	27.6	mi/h
Number of lanes, N	4	
Density, D	103.3	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2917	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2396	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	5	
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	2396	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	46.2	mi/h
Number of lanes, N	5	
Density, D	51.8	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	12800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3556	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2921	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	5	
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	2921	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	24.0	mi/h
Number of lanes, N	5	
Density, D	121.8	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
 E-mail:

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (5)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3028	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2488	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	5	
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	2488	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	43.3	mi/h
Number of lanes, N	5	
Density, D	57.4	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (5)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	13800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3833	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	3149	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	5	
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	3149	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	10.1	mi/h
Number of lanes, N	5	
Density, D	312.7	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10900	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1800	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	10900	1800	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3028	500	0	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	12559	2034	0	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5528 \text{ pc/h}$   
FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10048	9000	Yes
$v_{FO} = v_F - v_R$	8014	9000	No
$v_R$	2034	2000	Yes
$v_3 \text{ or } v_{av34}$	2260 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5528$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	5528	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 41.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.611	
Space mean speed in ramp influence area,	S = 47.1	mph
Space mean speed in outer lanes,	S = 55.4	mph
Space mean speed for all vehicles,	S = 50.5	mph

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Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	13800	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	3000	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	13800	3000	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3833	833	0	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	



Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	15901	3390	0	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 7458 \text{ pc/h}$   
FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12721	9000	Yes
$v_{FO} = v_F - v_R$	9331	9000	Yes
$v_R$	3390	2000	Yes
$v_3 \text{ or } v_{av34}$	2631 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7458$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	7458	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 58.0 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.733	
Space mean speed in ramp influence area,	S = 45.5	mph
Space mean speed in outer lanes,	S = 54.0	mph
Space mean speed for all vehicles,	S = 48.6	mph

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Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	9100	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1800	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	9100	1200	1800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2528	333	500	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00	%	0.00	%
Length	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10485	1356	2070	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5336 \text{ pc/h}$   
FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10485	9000	Yes
$v_{FO} = v_F - v_R$	9129	9000	Yes
$v_R$	1356	2000	No
$v_3 \text{ or } v_{av34}$	2574 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5336$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	5336	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 36.6 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.550	
Space mean speed in ramp influence area,	S = 47.8	mph
Space mean speed in outer lanes,	S = 54.2	mph
Space mean speed for all vehicles,	S = 50.8	mph

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Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10800	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	800	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	3000	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	10800	800	3000	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3000	222	833	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	12444	904	3450	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5935 \text{ pc/h}$   
FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12444	9000	Yes
$v_{FO} = v_F - v_R$	11540	9000	Yes
$v_R$	904	2000	No
$v_3 \text{ or } v_{av34}$	3254 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7044$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12A}$	7044	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 51.3 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.509	
Space mean speed in ramp influence area,	S = 48.4	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 50.6	mph

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Phone: Fax:  
E-mail:

-----Merge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	7900	vph

-----On Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2600	vph
Length of first accel/decel lane	1500	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)	7900	2600	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2194	722	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	9103	2996	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)  
 EQ  
 P = -0.157 Using Equation 4  
 FM  
 $v_{12} = v_F (P_{FM}) = -1425 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v <sub>FO</sub>	12099	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	5264 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 3641		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	12099	4600	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 46.5 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	M = 3.191	
Space mean speed in ramp influence area,	S = 13.5	mph
Space mean speed in outer lanes,	S = 45.9	mph
Space mean speed for all vehicles,	S = 19.8	mph

-----

Phone: Fax:  
E-mail:

-----Merge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10000	vph

-----On Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2800	vph
Length of first accel/decel lane	1500	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)	10000	2800	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2778	778	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	



Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	11522	3226	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)  
 EQ  
 P = -0.185 Using Equation 4  
 FM  
 $v_{12} = v_F (P_{FM}) = -2136 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v <sub>FO</sub>	14748	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	6829 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 4608		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	14748	4600	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 55.7 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	M = 10.064	
Space mean speed in ramp influence area,	S <sub>R</sub> = -75.8	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 41.5	mph
Space mean speed for all vehicles,	S = 233.4	mph

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (5)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3028	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2488	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	5	
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	2488	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	43.3	mi/h
Number of lanes, N	5	
Density, D	57.4	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: North of WB US 6 Off-Ramp (5)  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	13800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3833	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	3149	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	5	
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	3149	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	10.1	mi/h
Number of lanes, N	5	
Density, D	312.7	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of WB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	9100	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2528	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2077	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	5	
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	2077	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	53.1	mi/h
Number of lanes, N	5	
Density, D	39.1	pc/mi/ln
Level of service, LOS	E	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: PS  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Direction: I-25/Southbound  
From/To: South of WB US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3000	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2465	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	5	
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	2465	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	44.1	mi/h
Number of lanes, N	5	
Density, D	55.9	pc/mi/ln
Level of service, LOS	F	

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: AM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of EB US 6 Off-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	7900	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2194	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2254	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	2254	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	49.9	mi/h
Number of lanes, N	4	
Density, D	45.2	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: PS  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: PM Peak Hour  
Freeway/Direction: I-25/Southbound  
From/To: South of EB US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10000	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2778	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2853	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	2853	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	27.6	mi/h
Number of lanes, N	4	
Density, D	103.3	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

-----Operational Analysis-----

Analyst: PS  
Agency or Company: Parsons Brinckerhoff  
Date Performed: 7/20/2012  
Analysis Time Period: AM Peak Hour  
Freeway/Direction: I-25/Southbound  
From/To: South of US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	10500	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2917	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2396	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	5	
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	2396	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	46.2	mi/h
Number of lanes, N	5	
Density, D	51.8	pc/mi/ln
Level of service, LOS	F	



Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 E-mail: \_\_\_\_\_

-----Operational Analysis-----

Analyst: PS  
 Agency or Company: Parsons Brinckerhoff  
 Date Performed: 7/20/2012  
 Analysis Time Period: PM Peak Hour  
 Freeway/Direction: I-25/Southbound  
 From/To: South of US 6 On-Ramp  
 Jurisdiction: Colorado DOT  
 Analysis Year: 2035 Build  
 Description: US 6 Bridges

-----Flow Inputs and Adjustments-----

Volume, V	12800	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	3556	v
Trucks and buses	5	%
Recreational vehicles	1	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.974	
Driver population factor, fp	1.00	
Flow rate, vp	2921	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	5	
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	2921	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	24.0	mi/h
Number of lanes, N	5	
Density, D	121.8	pc/mi/ln
Level of service, LOS	F	

Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10900	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1800	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	10900	1800	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3028	500	0	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	12559	2034	0	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5528 \text{ pc/h}$   
FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10048	9000	Yes
$v_{FO} = v_F - v_R$	8014	9000	No
$v_R$	2034	2000	Yes
$v_3 \text{ or } v_{av34}$	2260 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5528$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	5528	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 41.4 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.611	
Space mean speed in ramp influence area,	S = 47.1	mph
Space mean speed in outer lanes,	S = 55.4	mph
Space mean speed for all vehicles,	S = 50.5	mph

Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Westbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	55.0	mph
Volume on freeway	13800	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	3000	vph
Length of first accel/decel lane	1150	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	0	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1150	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	13800	3000	0	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3833	833	0	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	15901	3390	0	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 7458 \text{ pc/h}$   
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12721	9000	Yes
$v_{FO} = v_F - v_R$	9331	9000	Yes
$v_R$	3390	2000	Yes
$v_3 \text{ or } v_{av34}$	2631 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7458$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	7458	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 58.0 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.733	
Space mean speed in ramp influence area,	S = 45.5	mph
Space mean speed in outer lanes,	S = 54.0	mph
Space mean speed for all vehicles,	S = 48.6	mph

Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	9100	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1800	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	9100	1200	1800	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2528	333	500	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	10485	1356	2070	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5336 \text{ pc/h}$   
12 R F R FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	10485	9000	Yes
$v_{FO} = v_F - v_R$	9129	9000	Yes
$v_R$	1356	2000	No
$v_3 \text{ or } v_{av34}$	2574 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		No	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 5336$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12}$	5336	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 36.6 \text{ pc/mi/ln}$   
R 12 D  
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.550	
Space mean speed in ramp influence area,	S = 47.8	mph
Space mean speed in outer lanes,	S = 54.2	mph
Space mean speed for all vehicles,	S = 50.8	mph

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Phone: Fax:  
E-mail:

-----Diverge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: Eastbound US 6 Off-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10800	vph

-----Off Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	800	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

-----Adjacent Ramp Data (if one exists)-----

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	3000	vph
Position of adjacent ramp	Upstream	
Type of adjacent ramp	Off	
Distance to adjacent ramp	925	ft

-----Conversion to pc/h Under Base Conditions-----

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	10800	800	3000	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	3000	222	833	v
Trucks and buses	7	3	7	%
Recreational vehicles	1	1	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	



Heavy vehicle adjustment, fHV	0.964	0.983	0.966	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	12444	904	3450	pcph

----- Estimation of V12 Diverge Areas -----

L = (Equation 13-12 or 13-13)  
EQ  
P = 0.436 Using Equation 8  
FD  
 $v_{12} = v_R + (v_F - v_R) P = 5935 \text{ pc/h}$   
FD

----- Capacity Checks -----

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	12444	9000	Yes
$v_{FO} = v_F - v_R$	11540	9000	Yes
$v_R$	904	2000	No
$v_3 \text{ or } v_{av34}$	3254 pc/h	(Equation 13-14 or 13-17)	
Is $v_3 \text{ or } v_{av34} > 2700 \text{ pc/h?}$		Yes	
Is $v_3 \text{ or } v_{av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 7044$		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Diverge Influence Area -----

	Actual	Max Desirable	Violation?
$v_{12A}$	7044	4400	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 51.3 \text{ pc/mi/ln}$   
Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	D = 0.509	
Space mean speed in ramp influence area,	S = 48.4	mph
Space mean speed in outer lanes,	S = 53.7	mph
Space mean speed for all vehicles,	S = 50.6	mph

Phone: Fax:  
E-mail:

-----Merge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: AM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	7900	vph

-----On Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2600	vph
Length of first accel/decel lane	1500	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)	7900	2600	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2194	722	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	9103	2996	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)  
 EQ  
 P = -0.157 Using Equation 4  
 FM  
 $v_{12} = v_F (P_{FM}) = -1425 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v <sub>FO</sub>	12099	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	5264 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 3641		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	12099	4600	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 46.5 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	M = 3.191	
Space mean speed in ramp influence area,	S = 13.5	mph
Space mean speed in outer lanes,	S = 45.9	mph
Space mean speed for all vehicles,	S = 19.8	mph

Phone: Fax:  
E-mail:

-----Merge Analysis-----

Analyst: PS  
Agency/Co.: Parsons Brinckerhoff  
Date performed: 7/20/2012  
Analysis time period: PM Peak Hour  
Freeway/Dir of Travel: I-25/Southbound  
Junction: US 6 On-Ramp  
Jurisdiction: Colorado DOT  
Analysis Year: 2035 Build  
Description: US 6 Bridges

-----Freeway Data-----

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	55.0	mph
Volume on freeway	10000	vph

-----On Ramp Data-----

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	2800	vph
Length of first accel/decel lane	1500	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)	10000	2800	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	2778	778	v
Trucks and buses	7	7	%
Recreational vehicles	1	1	%
Terrain type:	Level	Level	
Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Heavy vehicle adjustment, fHV	0.964	0.964	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	11522	3226	pcph

----- Estimation of V12 Merge Areas -----

L = (Equation 13-6 or 13-7)  
 EQ  
 P = -0.185 Using Equation 4  
 FM  
 $v_{12} = v_F (P_{FM}) = -2136 \text{ pc/h}$

----- Capacity Checks -----

	Actual	Maximum	LOS F?
v <sub>FO</sub>	14748	9000	Yes
v <sub>3</sub> or v <sub>av34</sub>	6829 pc/h	(Equation 13-14 or 13-17)	
Is v <sub>3</sub> or v <sub>av34</sub> > 2700 pc/h?		Yes	
Is v <sub>3</sub> or v <sub>av34</sub> > 1.5 v <sub>12</sub> / 2		Yes	
If yes, v <sub>12A</sub> = 4608		(Equation 13-15, 13-16, 13-18, or 13-19)	

----- Flow Entering Merge Influence Area -----

	Actual	Max Desirable	Violation?
v <sub>12A</sub>	14748	4600	Yes

----- Level of Service Determination (if not F) -----

Density,  $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 55.7 \text{ pc/mi/ln}$   
 Level of service for ramp-freeway junction areas of influence F

----- Speed Estimation -----

Intermediate speed variable,	M = 10.064	
Space mean speed in ramp influence area,	S <sub>R</sub> = -75.8	mph
Space mean speed in outer lanes,	S <sub>0</sub> = 41.5	mph
Space mean speed for all vehicles,	S = 233.4	mph

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## **Surface Street Intersections**

# HCM Unsignalized Intersection Capacity Analysis

## 1: W. 7th Ave & Federal Blvd

9/10/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↕	↗	↖	↕
Volume (veh/h)	0	44	1594	60	83	1559
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	49	1771	67	92	1732
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			701			796
pX, platoon unblocked	0.80	0.60			0.60	
vC, conflicting volume	2822	886			1838	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	541	0			1073	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	93			76	
cM capacity (veh/h)	285	652			386	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	49	886	886	67	92	866	866
Volume Left	0	0	0	0	92	0	0
Volume Right	49	0	0	67	0	0	0
cSH	652	1700	1700	1700	386	1700	1700
Volume to Capacity	0.07	0.52	0.52	0.04	0.24	0.51	0.51
Queue Length 95th (ft)	6	0	0	0	23	0	0
Control Delay (s)	11.0	0.0	0.0	0.0	17.2	0.0	0.0
Lane LOS	B				C		
Approach Delay (s)	11.0	0.0			0.9		
Approach LOS	B						

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		55.3%	ICU Level of Service B
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 1: W. 7th Ave & Federal Blvd

9/10/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↕	↗	↖	↕
Volume (veh/h)	0	74	1630	35	26	2058
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	82	1811	39	29	2287
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			701			796
pX, platoon unblocked	0.68	0.68			0.68	
vC, conflicting volume	3012	906			1850	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	875	0			1301	
tC, single (s)	6.9	7.0			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	89			92	
cM capacity (veh/h)	179	732			354	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	82	906	906	39	29	1143	1143
Volume Left	0	0	0	0	29	0	0
Volume Right	82	0	0	39	0	0	0
cSH	732	1700	1700	1700	354	1700	1700
Volume to Capacity	0.11	0.53	0.53	0.02	0.08	0.67	0.67
Queue Length 95th (ft)	9	0	0	0	7	0	0
Control Delay (s)	10.5	0.0	0.0	0.0	16.1	0.0	0.0
Lane LOS	B				C		
Approach Delay (s)	10.5	0.0			0.2		
Approach LOS	B						

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization		60.2%	ICU Level of Service B
Analysis Period (min)		15	



# HCM Signalized Intersection Capacity Analysis

## 2: 6th WB Ramp & Federal Blvd

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↖	↖	↖	↖↖	↖↖↖			↖↖↖	↖
Volume (vph)	0	0	0	375	100	210	340	1915	0	0	1600	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	0.97	0.91			0.91	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.97	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1665	1703	1568	3400	5036			5036	1568
Flt Permitted				0.95	0.97	1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)				1665	1703	1568	3400	5036			5036	1568
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	417	111	233	378	2128	0	0	1778	233
RTOR Reduction (vph)	0	0	0	0	0	4	0	0	0	0	0	151
Lane Group Flow (vph)	0	0	0	263	265	229	378	2128	0	0	1778	82
Turn Type				Perm		Perm	Prot					Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8						6
Actuated Green, G (s)				19.0	19.0	19.0	8.0	36.0			23.0	23.0
Effective Green, g (s)				19.0	19.0	19.0	8.0	36.0			23.0	23.0
Actuated g/C Ratio				0.29	0.29	0.29	0.12	0.55			0.35	0.35
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Grp Cap (vph)				487	498	458	418	2789			1782	555
v/s Ratio Prot							0.11	c0.42			c0.35	
v/s Ratio Perm				c0.16	0.16	0.15						0.05
v/c Ratio				0.54	0.53	0.50	0.90	0.76			1.00	0.15
Uniform Delay, d1				19.3	19.3	19.1	28.1	11.2			21.0	14.3
Progression Factor				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2				4.3	4.0	3.9	25.5	2.0			20.8	0.6
Delay (s)				23.6	23.3	22.9	53.7	13.2			41.8	14.9
Level of Service				C	C	C	D	B			D	B
Approach Delay (s)		0.0			23.3			19.3			38.7	
Approach LOS		A			C			B			D	

### Intersection Summary

HCM Average Control Delay	27.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	65.0	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

## 2: 6th WB Ramp & Federal Blvd

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↶	↷	↸	↶↷	↶↷↸			↶↷↸	↶
Volume (vph)	0	0	0	550	330	215	340	2100	0	0	2700	525
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor				0.95	0.95	1.00	0.97	0.91			0.91	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	0.99	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1665	1730	1568	3400	5036			5036	1568
Flt Permitted				0.95	0.99	1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)				1665	1730	1568	3400	5036			5036	1568
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	611	367	239	378	2333	0	0	3000	583
RTOR Reduction (vph)	0	0	0	0	0	7	0	0	0	0	0	55
Lane Group Flow (vph)	0	0	0	483	495	232	378	2333	0	0	3000	528
Turn Type				Perm		Perm	Prot					Perm
Protected Phases					8		5	2			6	
Permitted Phases				8		8						6
Actuated Green, G (s)				30.0	30.0	30.0	11.0	80.0			64.0	64.0
Effective Green, g (s)				30.0	30.0	30.0	11.0	80.0			64.0	64.0
Actuated g/C Ratio				0.25	0.25	0.25	0.09	0.67			0.53	0.53
Clearance Time (s)				5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Grp Cap (vph)				416	433	392	312	3357			2686	836
v/s Ratio Prot							c0.11	0.46			c0.60	
v/s Ratio Perm				c0.29	0.29	0.15						0.34
v/c Ratio				1.16	1.14	0.59	1.21	0.69			1.12	0.63
Uniform Delay, d1				45.0	45.0	39.6	54.5	12.4			28.0	19.7
Progression Factor				1.00	1.00	1.00	1.00	1.00			0.83	0.80
Incremental Delay, d2				96.0	88.6	6.4	121.2	1.2			56.8	2.6
Delay (s)				141.0	133.6	46.1	175.7	13.6			80.1	18.3
Level of Service				F	F	D	F	B			F	B
Approach Delay (s)		0.0			119.3			36.2			70.0	
Approach LOS		A			F			D			E	

### Intersection Summary

HCM Average Control Delay	65.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	98.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 3: 6th EB Ramp & Federal Blvd

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↔						↑↑↑		↖↗	↑↑↑	
Volume (vph)	300	10	200	0	0	0	0	1940	1060	175	1985	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Util. Factor	0.95	0.95						0.91		0.97	0.91	
Frt	1.00	0.88						0.95		1.00	1.00	
Flt Protected	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (prot)	1665	1526						4769		3400	5036	
Flt Permitted	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (perm)	1665	1526						4769		3400	5036	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	333	11	222	0	0	0	0	2156	1178	194	2206	0
RTOR Reduction (vph)	0	16	0	0	0	0	0	82	0	0	0	0
Lane Group Flow (vph)	296	254	0	0	0	0	0	3252	0	194	2206	0
Turn Type	Split						Prot					
Protected Phases	4	4						2		1	6	
Permitted Phases												
Actuated Green, G (s)	21.0	21.0						77.0		7.0	89.0	
Effective Green, g (s)	21.0	21.0						77.0		7.0	89.0	
Actuated g/C Ratio	0.18	0.18						0.64		0.06	0.74	
Clearance Time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Grp Cap (vph)	291	267						3060		198	3735	
v/s Ratio Prot	c0.18	0.17						c0.68		c0.06	0.44	
v/s Ratio Perm												
v/c Ratio	1.02	0.95						1.06		0.98	0.59	
Uniform Delay, d1	49.5	49.0						21.5		56.4	7.1	
Progression Factor	1.00	1.00						1.00		1.00	1.00	
Incremental Delay, d2	57.2	44.1						36.0		58.9	0.7	
Delay (s)	106.7	93.1						57.5		115.4	7.8	
Level of Service	F	F						E		F	A	
Approach Delay (s)		100.2			0.0			57.5			16.5	
Approach LOS		F			A			E			B	

### Intersection Summary

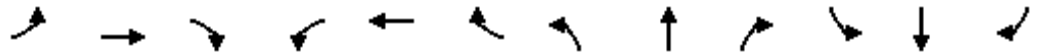
HCM Average Control Delay	45.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 3: 6th EB Ramp & Federal Blvd

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	220	10	280	0	0	0	0	2200	935	220	3050	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Util. Factor	0.95	0.95						0.91		0.97	0.91	
Frt	1.00	0.87						0.96		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1665	1511						4811		3400	5036	
Flt Permitted	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (perm)	1665	1511						4811		3400	5036	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	244	11	311	0	0	0	0	2444	1039	244	3389	0
RTOR Reduction (vph)	0	2	0	0	0	0	0	64	0	0	0	0
Lane Group Flow (vph)	220	344	0	0	0	0	0	3419	0	244	3389	0
Turn Type	Split						Prot					
Protected Phases	4	4						2		1	6	
Permitted Phases												
Actuated Green, G (s)	22.0	22.0						77.0		6.0	88.0	
Effective Green, g (s)	22.0	22.0						77.0		6.0	88.0	
Actuated g/C Ratio	0.18	0.18						0.64		0.05	0.73	
Clearance Time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Grp Cap (vph)	305	277						3087		170	3693	
v/s Ratio Prot	0.13	c0.23						c0.71		c0.07	0.67	
v/s Ratio Perm												
v/c Ratio	0.72	1.24						1.11		1.44	0.92	
Uniform Delay, d1	46.1	49.0						21.5		57.0	13.0	
Progression Factor	1.00	1.00						1.00		0.94	0.75	
Incremental Delay, d2	13.8	136.1						53.8		199.0	0.5	
Delay (s)	59.9	185.1						75.3		252.3	10.3	
Level of Service	E	F						E		F	B	
Approach Delay (s)		136.5			0.0			75.3			26.5	
Approach LOS		F			A			E			C	

### Intersection Summary

HCM Average Control Delay	56.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	98.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 4: W. 5th Ave & Federal Blvd

9/11/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	50	175	2810	175	92	1815
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	5.0	6.0		5.0	6.0
Lane Util. Factor	1.00	1.00	0.91		1.00	0.91
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	4992		1752	5036
Flt Permitted	0.95	1.00	1.00		0.05	1.00
Satd. Flow (perm)	1752	1568	4992		98	5036
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	56	194	3122	194	102	2017
RTOR Reduction (vph)	0	1	6	0	0	0
Lane Group Flow (vph)	56	193	3310	0	102	2017
Turn Type		pm+ov			pm+pt	
Protected Phases	8	1	2		1	6
Permitted Phases		8			6	
Actuated Green, G (s)	18.0	23.0	70.0		80.0	80.0
Effective Green, g (s)	18.0	23.0	70.0		80.0	80.0
Actuated g/C Ratio	0.16	0.21	0.64		0.73	0.73
Clearance Time (s)	6.0	5.0	6.0		5.0	6.0
Lane Grp Cap (vph)	287	328	3177		146	3663
v/s Ratio Prot	0.03	c0.03	c0.66		0.03	c0.40
v/s Ratio Perm		0.10			0.47	
v/c Ratio	0.20	0.59	1.04		0.70	0.55
Uniform Delay, d1	39.7	39.2	20.0		29.4	6.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.5	7.6	28.2		24.2	0.6
Delay (s)	41.3	46.8	48.2		53.6	7.4
Level of Service	D	D	D		D	A
Approach Delay (s)	45.6		48.2			9.6
Approach LOS	D		D			A

### Intersection Summary

HCM Average Control Delay	33.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 4: W. 5th Ave & Federal Blvd

9/11/2012



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖	↗	↑↑↑		↘	↑↑↑
Volume (vph)	85	340	2800	45	110	3202
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	5.0	6.0		5.0	6.0
Lane Util. Factor	1.00	1.00	0.91		1.00	0.91
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1752	1568	5024		1752	5036
Flt Permitted	0.95	1.00	1.00		0.06	1.00
Satd. Flow (perm)	1752	1568	5024		104	5036
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	94	378	3111	50	122	3558
RTOR Reduction (vph)	0	1	2	0	0	0
Lane Group Flow (vph)	94	377	3159	0	122	3558
Turn Type		pm+ov			pm+pt	
Protected Phases	8	1	2		1	6
Permitted Phases		8			6	
Actuated Green, G (s)	16.0	27.0	66.0		82.0	82.0
Effective Green, g (s)	16.0	27.0	66.0		82.0	82.0
Actuated g/C Ratio	0.15	0.25	0.60		0.75	0.75
Clearance Time (s)	6.0	5.0	6.0		5.0	6.0
Lane Grp Cap (vph)	255	385	3014		242	3754
v/s Ratio Prot	0.05	c0.10	c0.63		0.05	c0.71
v/s Ratio Perm		0.14			0.33	
v/c Ratio	0.37	0.98	1.05		0.50	0.95
Uniform Delay, d1	42.4	41.2	22.0		28.6	12.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.1	41.1	30.8		7.3	6.8
Delay (s)	46.5	82.3	52.8		35.9	18.9
Level of Service	D	F	D		D	B
Approach Delay (s)	75.2		52.8			19.5
Approach LOS	E		D			B

### Intersection Summary

HCM Average Control Delay	37.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 5: W 5th Ave &

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	15	105	15	25	25	95	200	25	55	105	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.87			0.95		1.00	0.98		1.00	0.93	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1603			1729		1752	3446		1752	3242	
Flt Permitted	0.71	1.00			0.94		0.61	1.00		0.60	1.00	
Satd. Flow (perm)	1309	1603			1638		1118	3446		1101	3242	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	100	17	117	17	28	28	106	222	28	61	117	117
RTOR Reduction (vph)	0	70	0	0	17	0	0	16	0	0	66	0
Lane Group Flow (vph)	100	64	0	0	56	0	106	234	0	61	168	0
Turn Type	Perm		Perm			Perm			Perm			
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	24.0	24.0			24.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	24.0	24.0			24.0		26.0	26.0		26.0	26.0	
Actuated g/C Ratio	0.40	0.40			0.40		0.43	0.43		0.43	0.43	
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	524	641			655		484	1493		477	1405	
v/s Ratio Prot		0.04						0.07			0.05	
v/s Ratio Perm	c0.08				0.03		c0.09			0.06		
v/c Ratio	0.19	0.10			0.09		0.22	0.16		0.13	0.12	
Uniform Delay, d1	11.7	11.2			11.2		10.6	10.3		10.2	10.2	
Progression Factor	1.00	1.00			1.00		1.00	1.00		0.50	0.24	
Incremental Delay, d2	0.8	0.3			0.3		1.0	0.2		0.5	0.2	
Delay (s)	12.5	11.6			11.4		11.7	10.6		5.7	2.6	
Level of Service	B	B			B		B	B		A	A	
Approach Delay (s)		12.0			11.4			10.9			3.3	
Approach LOS		B			B			B			A	

### Intersection Summary

HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.21		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 5: W 5th Ave &

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	5	55	15	15	25	215	335	15	20	290	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86			0.94		1.00	0.99		1.00	0.96	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1593			1709		1752	3482		1752	3360	
Flt Permitted	0.72	1.00			0.93		0.49	1.00		0.52	1.00	
Satd. Flow (perm)	1322	1593			1615		913	3482		963	3360	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	78	6	61	17	17	28	239	372	17	22	322	122
RTOR Reduction (vph)	0	42	0	0	19	0	0	5	0	0	59	0
Lane Group Flow (vph)	78	25	0	0	43	0	239	384	0	22	385	0
Turn Type	Perm		Perm			Perm			Perm			
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	19.0	19.0			19.0		31.0	31.0		31.0	31.0	
Effective Green, g (s)	19.0	19.0			19.0		31.0	31.0		31.0	31.0	
Actuated g/C Ratio	0.32	0.32			0.32		0.52	0.52		0.52	0.52	
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	419	504			511		472	1799		498	1736	
v/s Ratio Prot		0.02						0.11			0.11	
v/s Ratio Perm	c0.06				0.03		c0.26			0.02		
v/c Ratio	0.19	0.05			0.08		0.51	0.21		0.04	0.22	
Uniform Delay, d1	14.9	14.2			14.4		9.5	7.9		7.2	7.9	
Progression Factor	1.00	1.00			1.00		1.00	1.00		0.26	0.06	
Incremental Delay, d2	1.0	0.2			0.3		3.8	0.3		0.2	0.3	
Delay (s)	15.9	14.4			14.7		13.3	8.1		2.0	0.8	
Level of Service	B	B			B		B	A		A	A	
Approach Delay (s)		15.2			14.7			10.1			0.9	
Approach LOS		B			B			B			A	

### Intersection Summary

HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 6: 6th EB Ramp & Bryant St

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗						↕	↗	↖	↕	
Volume (vph)	15	5	15	0	0	0	0	195	5	28	225	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00						0.95		1.00	0.95	
Frt	1.00	0.89						1.00		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1752	1640						3491		1752	3505	
Flt Permitted	0.95	1.00						1.00		0.61	1.00	
Satd. Flow (perm)	1752	1640						3491		1130	3505	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	6	17	0	0	0	0	217	6	31	250	0
RTOR Reduction (vph)	0	11	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	17	12	0	0	0	0	0	220	0	31	250	0
Turn Type	Perm						Perm					
Protected Phases	4						6					
Permitted Phases	4						2					
Actuated Green, G (s)	20.0		20.0		20.0		30.0		21.0		21.0	
Effective Green, g (s)	20.0		20.0		20.0		30.0		21.0		21.0	
Actuated g/C Ratio	0.33		0.33		0.33		0.50		0.35		0.35	
Clearance Time (s)	5.0		5.0		5.0		5.0		5.0		5.0	
Lane Grp Cap (vph)	584		547		547		1746		396		1227	
v/s Ratio Prot			0.01		0.01		c0.06				c0.07	
v/s Ratio Perm	c0.01								0.03			
v/c Ratio	0.03		0.02		0.02		0.13		0.08		0.20	
Uniform Delay, d1	13.5		13.4		13.4		8.0		13.0		13.6	
Progression Factor	1.00		1.00		1.00		1.73		0.99		0.99	
Incremental Delay, d2	0.1		0.1		0.1		0.1		0.4		0.4	
Delay (s)	13.6		13.5		13.5		14.0		13.3		13.9	
Level of Service	B		B		B		B		B		B	
Approach Delay (s)			13.5		0.0		14.0				13.9	
Approach LOS			B		A		B				B	

### Intersection Summary

HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	30.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: 6th EB Ramp & Bryant St

8/8/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗						↕		↖	↗	
Volume (vph)	15	5	15	0	0	0	0	485	5	5	410	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0						5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00						0.95		1.00	0.95	
Frt	1.00	0.89						1.00		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1752	1640						3499		1752	3505	
Flt Permitted	0.95	1.00						1.00		0.45	1.00	
Satd. Flow (perm)	1752	1640						3499		827	3505	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	6	17	0	0	0	0	539	6	6	456	0
RTOR Reduction (vph)	0	11	0	0	0	0	0	2	0	0	0	0
Lane Group Flow (vph)	17	12	0	0	0	0	0	543	0	6	456	0
Turn Type	Perm						Perm					
Protected Phases	4						6					
Permitted Phases	4						2					
Actuated Green, G (s)	19.0		19.0				21.0		12.0		12.0	
Effective Green, g (s)	19.0		19.0				21.0		12.0		12.0	
Actuated g/C Ratio	0.38		0.38				0.42		0.24		0.24	
Clearance Time (s)	5.0		5.0				5.0		5.0		5.0	
Lane Grp Cap (vph)	666		623				1470		198		841	
v/s Ratio Prot			0.01				c0.16				c0.13	
v/s Ratio Perm	c0.01								0.01			
v/c Ratio	0.03		0.02				0.37		0.03		0.54	
Uniform Delay, d1	9.7		9.7				10.0		14.5		16.6	
Progression Factor	1.00		1.00				1.00		1.00		1.00	
Incremental Delay, d2	0.1		0.1				0.7		0.3		2.5	
Delay (s)	9.8		9.7				10.7		14.8		19.1	
Level of Service	A		A				B		B		B	
Approach Delay (s)			9.8		0.0		10.7				19.0	
Approach LOS			A		A		B				B	

### Intersection Summary

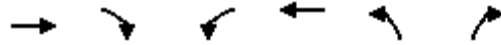
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	26.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Unsignalized Intersection Capacity Analysis

## 8: W. 7th Ave & Bryant St

8/8/2012



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Volume (veh/h)	14	312	1	13	259	24
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	16	347	1	14	288	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			362		206	189
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			362		206	189
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		63	97
cM capacity (veh/h)			1191		780	850

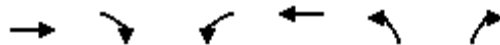
Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	362	16	288	27
Volume Left	0	1	288	0
Volume Right	347	0	0	27
cSH	1700	1191	780	850
Volume to Capacity	0.21	0.00	0.37	0.03
Queue Length 95th (ft)	0	0	43	2
Control Delay (s)	0.0	0.6	12.3	9.4
Lane LOS		A	B	A
Approach Delay (s)	0.0	0.6	12.0	
Approach LOS			B	

Intersection Summary			
Average Delay		5.5	
Intersection Capacity Utilization	41.0%		ICU Level of Service A
Analysis Period (min)	15		

# HCM Unsignalized Intersection Capacity Analysis

## 8: W. 7th Ave & Bryant St

8/7/2012



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Volume (veh/h)	8	333	22	47	418	27
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	9	370	24	52	464	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			379		295	194
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			379		295	194
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		32	96
cM capacity (veh/h)			1174		679	845

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	379	77	464	30
Volume Left	0	24	464	0
Volume Right	370	0	0	30
cSH	1700	1174	679	845
Volume to Capacity	0.22	0.02	0.68	0.04
Queue Length 95th (ft)	0	2	135	3
Control Delay (s)	0.0	2.7	20.9	9.4
Lane LOS		A	C	A
Approach Delay (s)	0.0	2.7	20.2	
Approach LOS			C	

Intersection Summary			
Average Delay		10.8	
Intersection Capacity Utilization		51.7%	ICU Level of Service A
Analysis Period (min)		15	

# **Appendix D**

## **Traffic Technical Memorandum**



# US 6 Bridges, Knox Ct. to BNSF

Design Build Procurement  
Sub. Acct. 18192 / 18202/18838/16628

June 6, 2012

Mr. Dahir Egal, PE  
Safety and Traffic Engineer  
Program Delivery, FHWA  
Colorado Division  
12300 W. Dakota Avenue  
Lakewood, CO 80228

Dear Mr. Egal:

RE: US 6 Bridges – Knox Ct to BNSF – Traffic Data (VHEIS Re-Evaluation)

The US 6 Bridges Project has various project elements (and funding sources) that will modify mainline US 6 consistent with the FEIS Preferred Alternative from Knox Court on the west through Quivas Street on the east.

This concurrence request is regarding the proposed US-6 Bridges Project and its traffic evaluation of the I-25 Valley Highway Final EIS and Record of Decision (ROD) signed on July 5, 2007.

Per your guidance, we've compared the 2025 traffic volumes forecasted at the time of the preparation of the FEIS with the 2035 DRCOG regional travel demand model and offer the following observations at the Systems Level:

1. Overall, along US 6, there was a 4% increase in traffic volume in the westbound direction and a 1% increase in the eastbound direction.
2. Along mainline I-25, there was a 20% drop in traffic volume in the northbound direction and an 18% drop in the southbound direction.
3. Eastbound US 6 to northbound I-25 shows a 22% drop in ramp traffic volume while eastbound US 6 to southbound I-25 shows substantially no change.

The above observations indicate that at the Systems Level, there is no significant increase but a notable decrease in traffic volumes when comparing the 2025 EIS Preferred Alternative with the 2035 DRCOG travel demand model.

Specifically, there should be no negative impacts to traffic operations on the eastbound US 6 to northbound and southbound I-25 ramp movements.

Our proposed approach to the FEIS re-evaluation would be to use the 2025 EIS traffic volumes, with the exception of a few areas where the 2035 DRCOG volumes are higher than the projected 2025 EIS volumes, in those areas we will use the 2035 DRCOG Volumes. We feel this conservative approach will adequately measure the impacts due to traffic volumes, while allowing us to move forward with the Re-evaluation.

In the interest of meeting the US-6 Bridges Project scope, budget and more importantly, its accelerated project delivery schedule, we propose to use the above method for the required noise and air quality analysis portion of the FEIS re-evaluation and the new ROD.

A complete re-evaluation based entirely on the new 2035 DRCOG model will delay the project by at least six months.

Your concurrence is highly appreciated. Should you have questions, please feel free to call me at 303-972-9112.

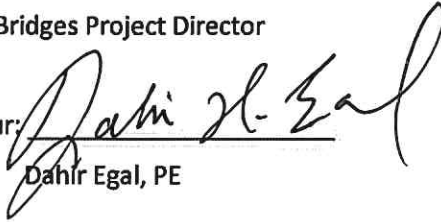
Sincerely,



Kevin Sullivan,

US-6 Bridges Project Director

Concur:



Dahir Egal, PE

Date:

6/11/2012

**To:** Jordan Rudel  
**From:** Cindy Colip  
**Date:** August 3, 2012 (updated August 9, 2012)  
**Subject:** Traffic Circulation Evaluation for US 6 Bridges - Air Quality (PM 10 and MSAT)

In response to the following request from CDOT and a coordination meeting held on Tuesday, July 31<sup>st</sup> with CDOT Region 6, this technical memorandum was developed using the best available information to document traffic circulation concerns.

Request from CDOT on July 17, 2012

**PM10 Analysis**

*Request from CDOT: Determine if there is an increase in truck traffic on 5<sup>th</sup> Avenue east of Federal due to the EB ramp relocation, slip ramp and collectors, we may have to do a full PM10 qualitative analyses. The qualitative discussion should include overall volumes and trucks as a percentage for existing and future volumes .*

**Quantitative MSAT Analysis**

*Request from CDOT: Compare Existing, No Build and Proposed Project at the Federal Boulevard portion of the project to include roadways near parks and residential area at 5<sup>th</sup> Avenue, ramps and US 6 collector. The analytical discussion should include historical context of the project traffic circulation changes as it affects Bryant Street truck traffic and 5<sup>th</sup> Avenue which is adjacent to a low income/EJ neighborhood.*



**Vehicle Mix and Traffic Circulation**

The basis for this qualitative analysis regarding traffic circulation, as it affects Bryant Street truck traffic and 5<sup>th</sup> Avenue, is a combination of:

- Traffic counts completed in late 2011 (Figures AQ-1 and AQ-2)
- June 11, 2012 FHWA direction to develop traffic projections based on the traffic data and evaluation of the I-25 Valley Highway Final EIS and Record of Decision (2007 ROD). Based on this concurrence, the traffic projections were based on :
  - Development of 2035 No-build alternative traffic volumes by projecting the 2025 EIS traffic volumes at 1 percent per year (Figures AQ-3 and AQ-4)
  - Development of 2035 Proposed Project traffic volumes by projecting the 2025 EIS Proposed Project Traffic volumes at 1 percent per year (Figures AQ-5 and AQ-6)
- Vehicle mix assumptions and traffic analysis parameters, especially related to the percentage of trucks assumed for the EIS analyses. The following information is an excerpt from the Valley Highway EIS and the highlighted row shows the truck percentage assumptions for the vehicle mix.

The traffic parameters shown in **Table 2-1** were used as the basis for the operational analyses of freeway sections and surface street intersections. LOS performance thresholds for surface street and freeway analyses are included in Appendix A.

**Table 2-1 Traffic Analysis Parameters**

Traffic Parameter	Freeway Sections		Surface Street Intersections		
	I-25 Freeway	US 6 Freeway	Bryant / 5 <sup>th</sup> / 8 <sup>th</sup> intersections	Federal Boulevard	Others
<b>% trucks and buses</b>	<b>7%</b>	<b>3%</b>	<b>30%</b>	<b>6%</b>	<b>7%</b>
% Recreation Vehicles	1%	1%	1%	1%	1%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90
Free-flow Speed	65	65	n/a	n/a	n/a
Terrain / Area Type	Level	Level	Non-CBD	Non-CBD	Non-CBD
Cycle Length	n/a	n/a	100 Seconds	100 Seconds	75, 100 Seconds

Source: "Traffic Report for the Valley Highway EIS, Denver, Colorado"; Prepared for Federal Highway Administration by Felsburg, Holt & Ullevig and the Colorado Department of Transportation, February 28, 2005 (page 2-11)

The specific areas which are addressed as part of this evaluation of vehicle mix and traffic circulation are the eastbound Bryant Street off-ramp from US 6 and the ingress and egress traffic movements from 5<sup>th</sup> Avenue at Federal Boulevard.

In the current and No-build conditions, vehicles with origins and destinations along 5<sup>th</sup> Avenue, 7<sup>th</sup> Avenue and Bryant Street have two options for access.

1. They can use the US 6 ramps at Bryant Street.
2. They can utilize Federal Boulevard at the intersections with 5<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup>.

An important point in this current configuration is that vehicles on the south side of US 6 can utilize the 5<sup>th</sup> Avenue slip ramp connection to access US 6. In the Proposed Project, this slip ramp is replaced with the braided ramp from Federal. The result is that vehicles destined to US 6 will be required to access it from Federal, via the 5<sup>th</sup> Avenue/Federal Boulevard intersection.

#### **Traffic Volumes and Projections**

The existing, eastbound US 6 off ramp at Bryant Street carries over 1,800 vehicles per day with volumes of about 140 vehicles in both the AM and PM peak periods.

In the 2035 No-build condition, the eastbound US 6 off ramp at Bryant Street is projected to increase to approximately 2,700 vehicles per day with volumes of about 220 vehicles in both the AM and PM peak periods.

#### **Estimated Truck Percentages and Traffic Circulation**

With the EIS' estimated truck percentage of 30 percent along Bryant Street, Table 1 below documents the estimated truck volumes for the existing condition, 2035 No-build, and the 2035 Proposed Project.

The table illustrates a range of impacts that were considered in order to provide a conservative, worst case analysis. First, the AM and PM peak hours were evaluated as part of a typical traffic analysis approach; however, due to the temporal nature of typical truck deliveries, the impact of mid-day truck delivery times were also estimated and evaluated for comparison purposes. The mid-day traffic volumes were estimated by reviewing the eastbound US 6 off-ramp to Bryant Street traffic volumes and identifying one additional peak hour beyond the AM and PM. For the existing conditions, the mid-day peak hour occurs around 9:30 AM and the ramp volume is approximately 155 vehicles.

**Table 1: Estimated Number of Trucks**

	Existing Number of Trucks			2035 No-build Number of Trucks			2035 Proposed Project Number of Trucks		
	AM Peak	PM Peak	Mid-day Peak Hour Delivery Time	AM Peak	PM Peak	Mid-day Peak Hour Delivery Time	AM Peak	PM Peak	Mid-day Peak Hour Delivery Time
Eastbound US 6 Off Ramp to Bryant Street	42	42	47	66	66	74	11	11	12
5th at Federal: Ingress and Egress from 5th	190	98	144	383	261	322	147	171	159

Table 2 documents the changes in the number of trucks for the alternatives in terms of the increase (or decrease) in the number of trucks and the associated percentages.

As shown in the table, when comparing the Existing Condition to the 2035 No Build Condition (1.), there is an increase in the number of trucks along the eastbound US 6 off-ramp to Bryant Street and the ingress and egress movements to and from 5<sup>th</sup> Avenue at Federal Boulevard.

When the Existing Conditions and 2035 No Build Alternatives are compared to the 2035 Proposed Project (2. and 3.), the majority of the estimates show a decrease in the projected number of trucks. For example, between the Existing and 2035 Proposed Project (2.), there is an estimated decrease of 31 trucks (74 percent) for the eastbound US 6 off-ramp to Bryant Street during the AM peak hour; there is an estimated decrease of 43 trucks (23 percent) during the same time period along 5<sup>th</sup> Avenue.

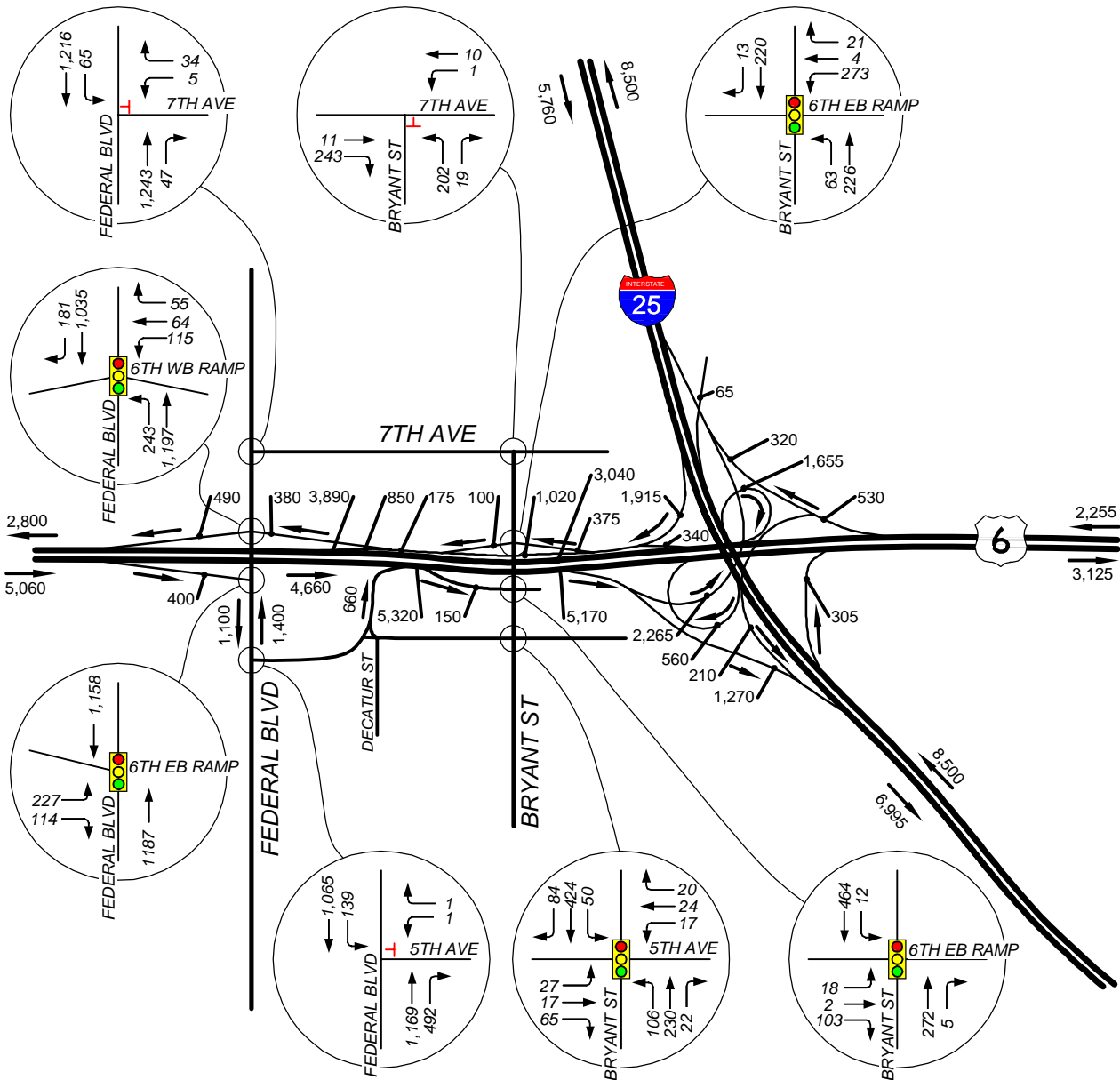
**Table 2: Truck volume/ percentage - Increase (decrease)**

	1.Existing Conditions versus 2035 No Build			2.Existing Conditions versus 2035 Proposed Project			3.2035 No Build versus 2035 Proposed Project		
	AM Peak (Difference in # and % of trucks)	PM Peak (Difference in # and % of trucks)	Mid-day Peak (Difference in # and % of trucks)	AM Peak (Difference in # and % of trucks)	PM Peak (Difference in # and % of trucks)	Mid-day Peak (Difference in # and % of trucks)	AM Peak (Difference in # and % of trucks)	PM Peak (Difference in # and % of trucks)	Mid-day Peak (Difference in # and % of trucks)
EB US 6 Off Ramp to Bryant Street	+24/ +57%	+24/ +57%	+27/ +57%	(31)/ (74)%	(31)/ (74)%	(35)/ (75)%	(55)/ (84)%	(55)/ (84)%	(62)/ (84)%
5th at Federal: Ingress and Egress from 5th	+193/ +101%	+163/ +160%	+178/ +123%	(43)/ (23)%	+73/ +75%	+15/ +10%	(236)/ (62)%	(90)/ (35)%	(163)/ (50)%




Some increase in trucks is estimated along 5<sup>th</sup> Avenue at Federal Boulevard when the Existing Conditions and 2035 Proposed Project (2.) are compared, specifically during the PM and Mid-day peak hours.

**Conclusion**

Upon construction of the Proposed Project, the current 5<sup>th</sup> Avenue access to eastbound US 6 would be eliminated and any vehicles (including trucks) accessing eastbound US 6 from Federal Boulevard would be required to use the new Federal Boulevard on-ramp, as part of the tight diamond. For example, when the northbound right turn movements for Federal Boulevard to 5<sup>th</sup> Avenue and Federal Boulevard to the eastbound US 6 on-ramp are compared (as shown in Figures AQ-4 and AQ-6), the 2035 northbound vehicular right turns from Federal to 5<sup>th</sup> Avenue decrease from 625 vehicles to 45 vehicles. These right turn vehicle volumes correspond to a reduction in northbound right turning truck traffic from 188 trucks to 14 trucks, when the traffic parameters from the EIS are applied.

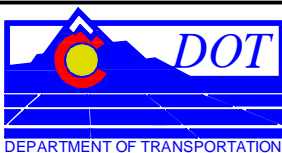


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- XXX AM PEAK HOUR TRAFFIC VOLUME
-  TRAFFIC DIRECTION



**DRAFT**

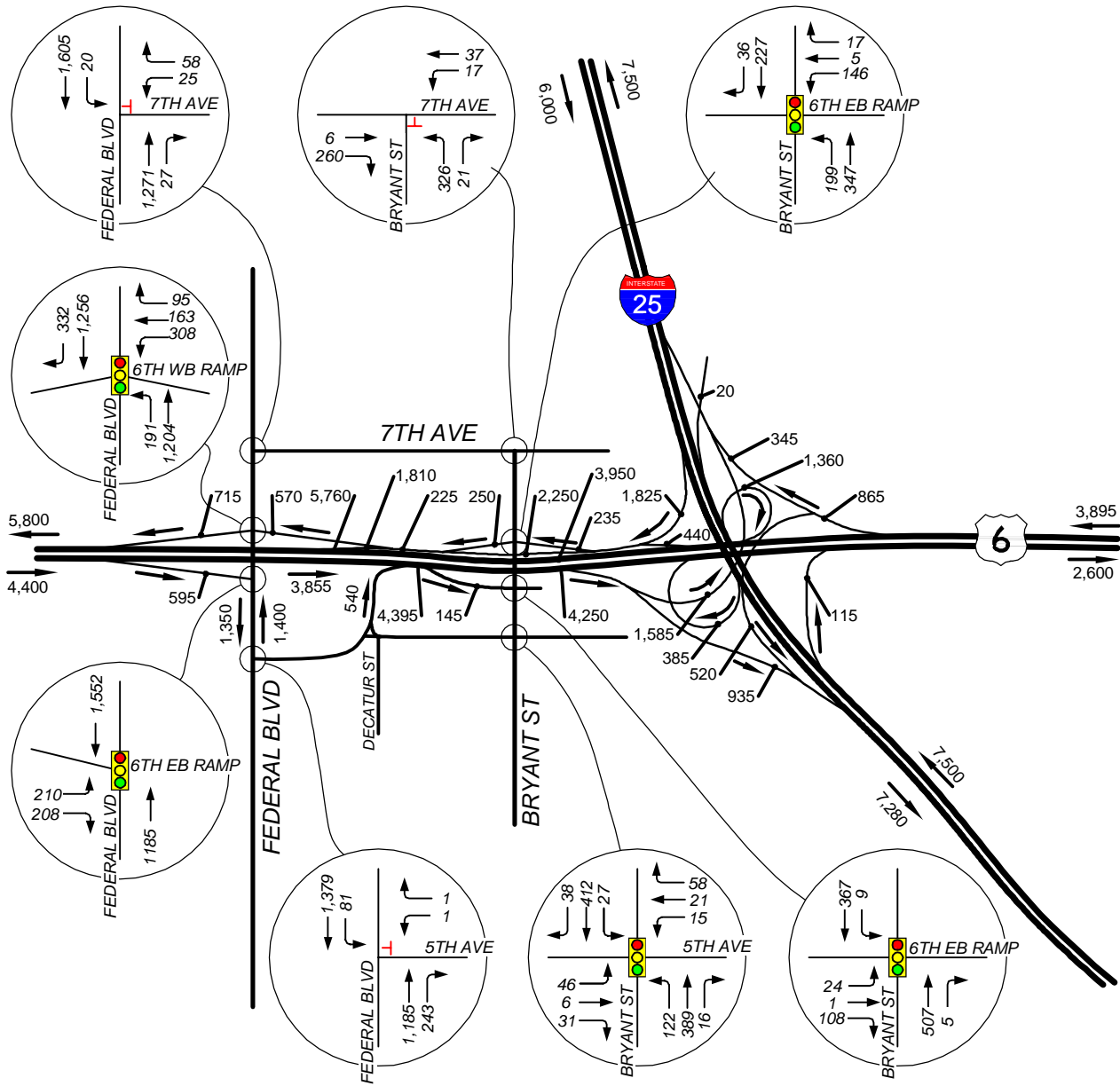


Existing  
AM Peak Hour

US 6 Transportation  
Analysis

2012

AQ-1



**LEGEND**

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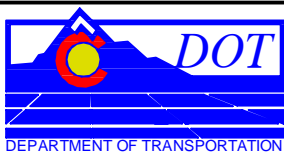
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XXX PM PEAK HOUR TRAFFIC VOLUME

TRAFFIC DIRECTION



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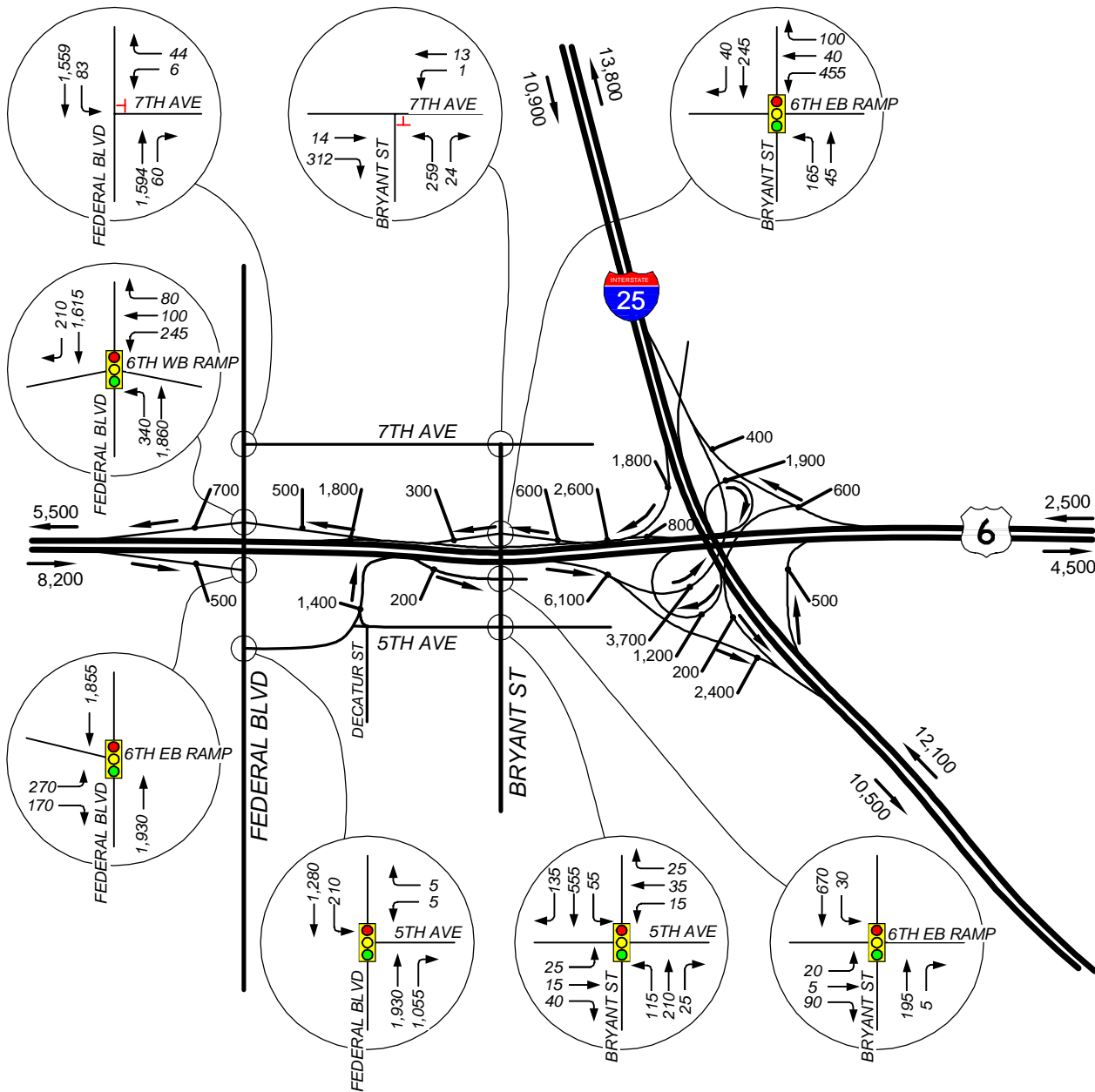


Existing  
PM Peak Hour

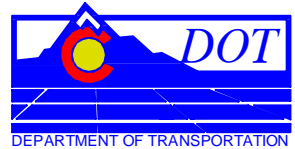
US 6 Transportation  
Analysis

2012

AQ-2



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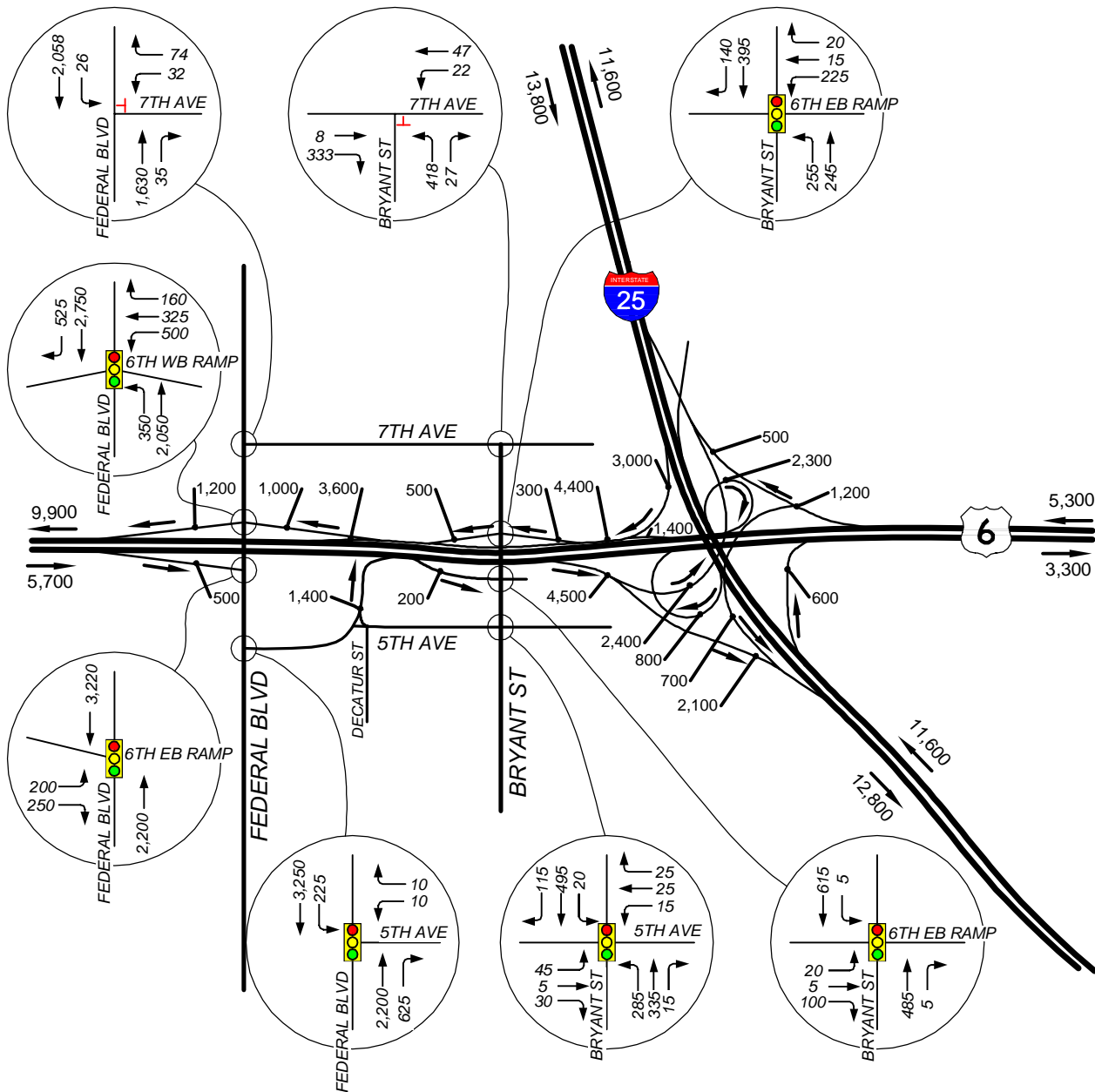


2035 No-Build  
AM Peak Hour




US 6 Transportation  
Analysis

2012

AQ-3

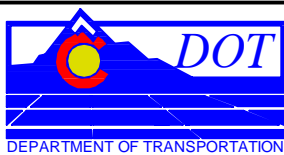


**LEGEND**

-  TRAFFIC SIGNAL
-  STOP SIGN
- XXX PM PEAK HOUR TRAFFIC VOLUME
-  TRAFFIC DIRECTION



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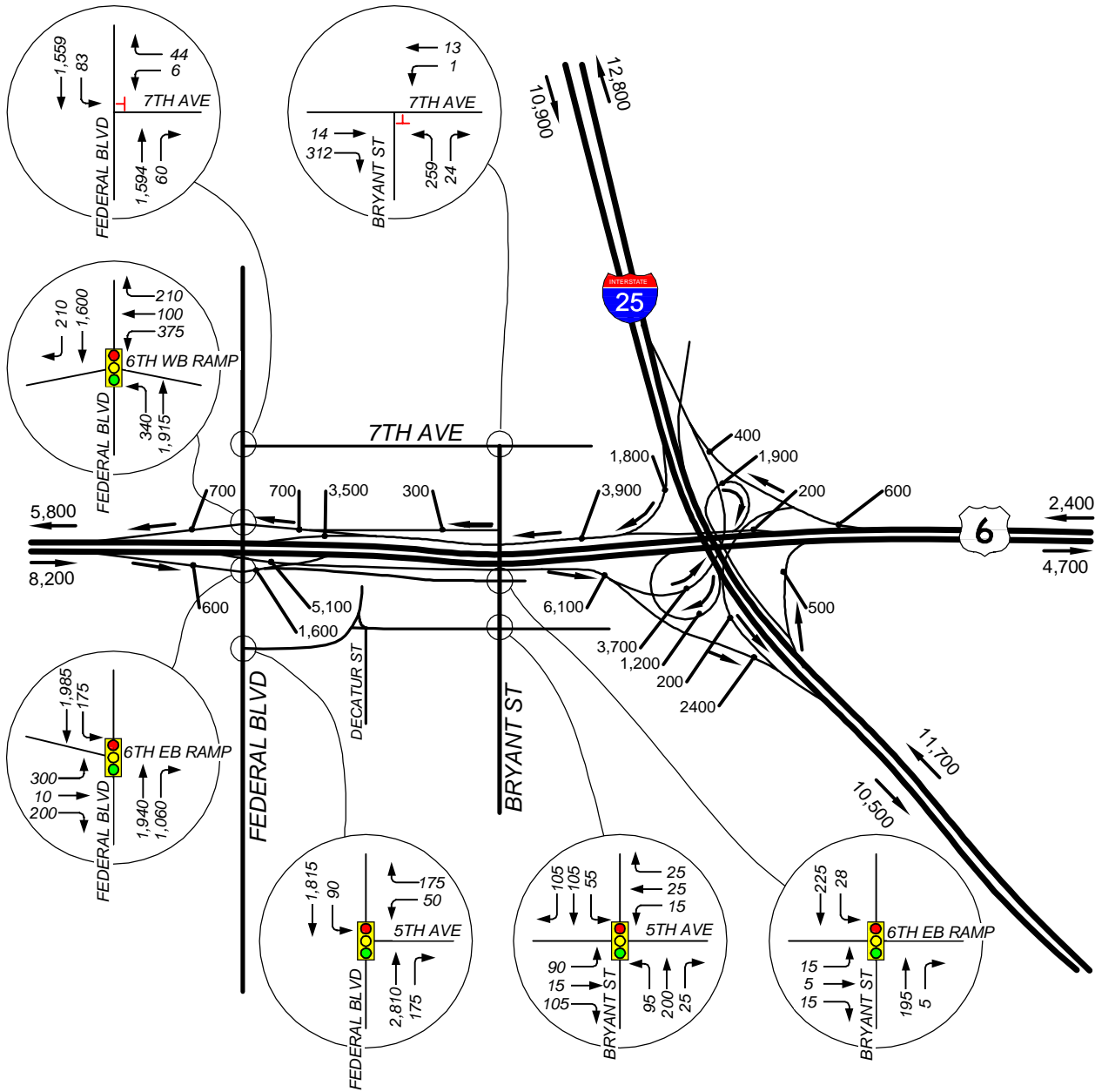
2035 No-Build  
PM Peak Hour

US 6 Transportation  
Analysis




2012

AQ-4



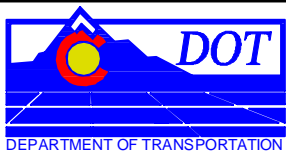


**LEGEND**

-  TRAFFIC SIGNAL
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- XXX AM PEAK HOUR TRAFFIC VOLUME
-  TRAFFIC DIRECTION



**DRAFT**

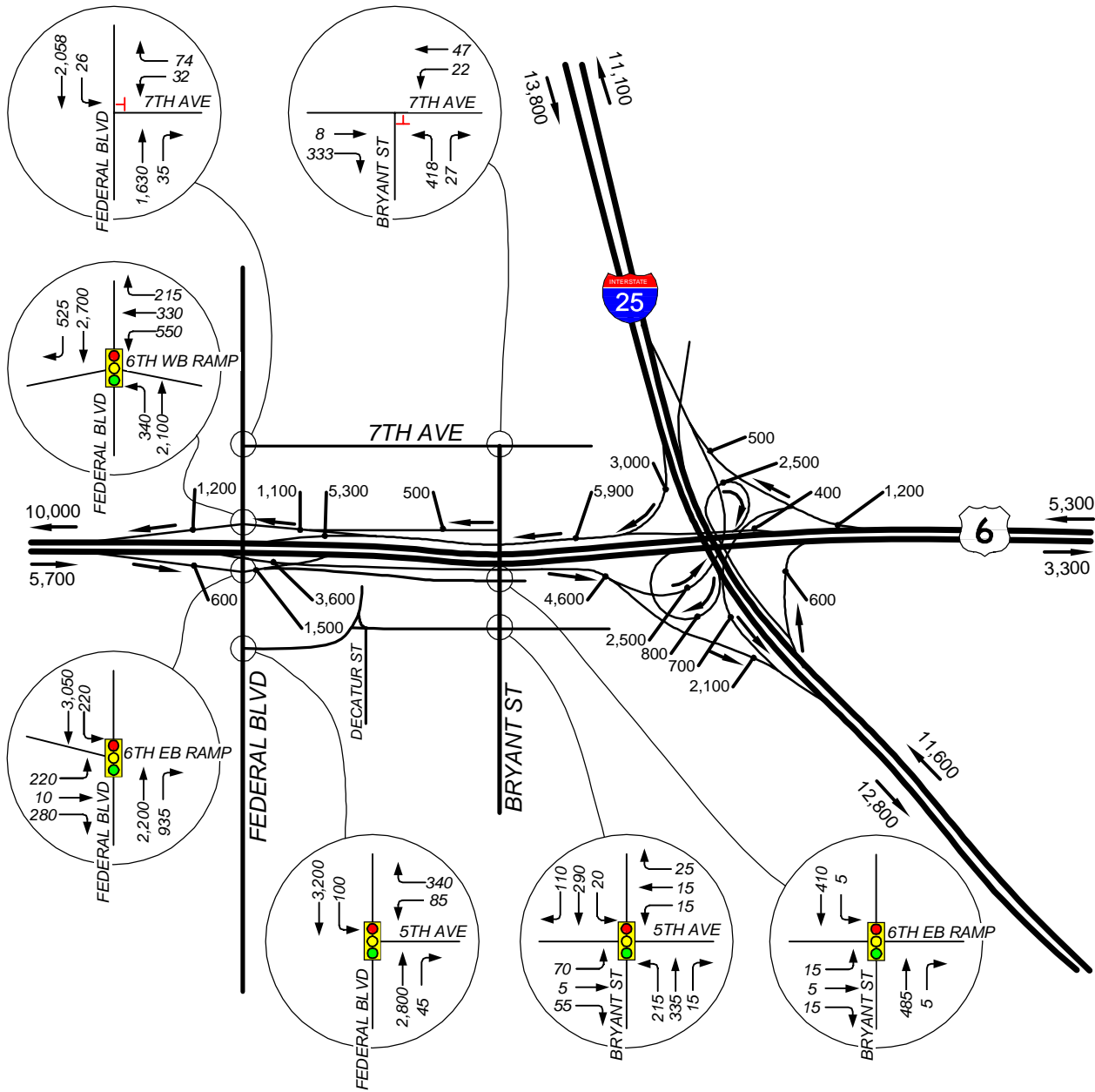



2035 Proposed Project  
AM Peak Hour

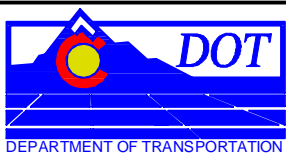
US 6 Transportation  
Analysis

2012

AQ-5



  
**DRAFT**



2035 Proposed Project  
PM Peak Hour

US 6 Transportation  
Analysis

2012

AQ-6