# US 6 Bridges Design Build Project

BR 0061-083

Sub Account Number 18838 (CN)

# Transportation Analysis Technical Report

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Colorado Department of Transportation
Federal Highway Administration

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# List of Abbreviated Terms

| | |
|---|---|
| ADA | Americans with Disabilities Act |
| ADT | average daily traffic |
| AM | morning |
| APCD | CDPHE Air Pollution Control Division |
| BMP | best management practice |
| CCD | City and County of Denver |
| CDOT | Colorado Department of Transportation |
| CDPHE | Colorado Department of Public Health and Environment |
| CDPS | Colorado Discharge Permit System |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CHS | Colorado Historical Society |
| CML | Consolidated Main Line railroad |
| CO | carbon monoxide |
| DRCOG | Denver Regional Council of Governments |
| EB | eastbound |
| EIS | Environmental Impact Statement |
| EPA | US Environmental Protection Agency |
| FHU | Felsburg, Holt & Ullevig |
| FHWA | Federal Highway Administration |
| HCM | Highway Capacity Manual |
| HCS | Highway Capacity Software |
| I-25 | Interstate 25 |
| IGA | intergovernmental agreement |
| ITS | intelligent transportation system |
| LOS | level-of-service |
| LOSS | level-of-service of safety |
| MPH | miles per hour |
| MS4 | municipal separate storm sewer system |
| NAAQS | National Ambient Air Quality Standard |
| NB | northbound |
| NEPA | National Environmental Policy Act |
| NRHP | National Register of Historic Places |
| PM | afternoon/evening |
| $PM_{10}$ | particulate matter less than 10 microns in size |
| PUC | Public Utilities Commission |
| RCRA | Resource Conservation and Recovery Act |
| ROD | Record of Decision |
| RTD | Regional Transportation District |
| RTP | Regional Transportation Plan |
| SB | southbound |
| SHPO | State Historic Preservation Officer |
| TIP | Transportation Improvement Program |
| T-REX | Transportation Expansion Project |
| US 6 | $6^{th}$ Avenue |
| USACE | US Army Corps of Engineers |

| | |
|---|---|
| USC | US Code |
| USDOI | US Department of Interior |
| USFWS | US Department of Interior Fish and Wildlife Service |
| 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 Proposed 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 Proposed Project includes modifications to the roadway, interchanges, and bridges along 6th Avenue (US 6) between Sheridan Boulevard and the BNSF Railway in Denver, Colorado. The Colorado Department of Transportation (CDOT) is preparing a Re-evaluation and ROD to document the impacts of and mitigation for the Proposed Project.

## The Valley Highway Project

The Federal Highway Administration (FHWA) and CDOT prepared a 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.

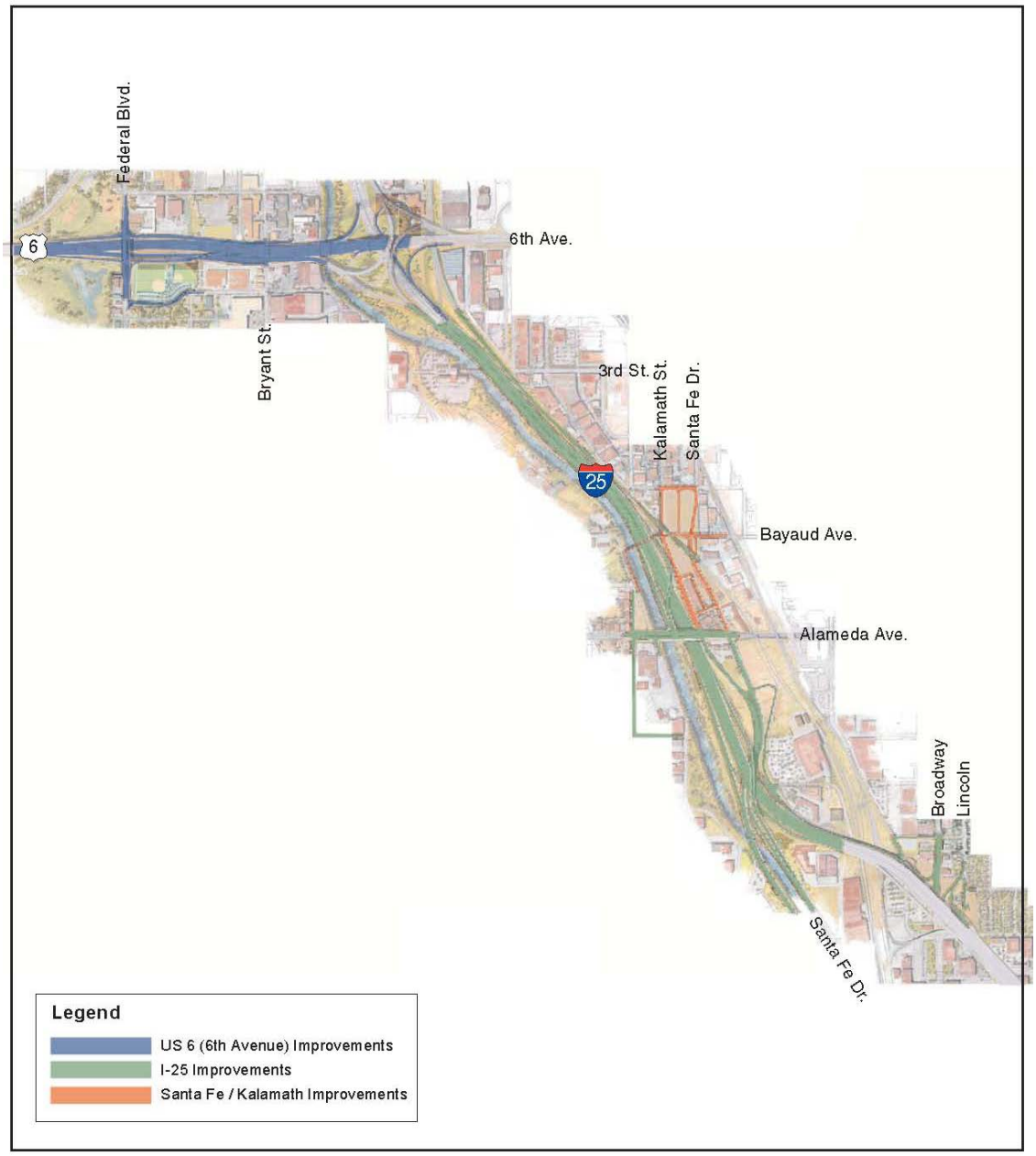


**Figure 1: I-25 Valley Highway Project Preferred Alternative**

## US 6 Bridges Design Build Project

The Proposed 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 Proposed 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$^{th}$ Avenue to two-way traffic from Federal Boulevard to Decatur Street
- Widening of Federal Boulevard, from five to six lanes, from 5$^{th}$ to 7$^{th}$ 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 Proposed Project.

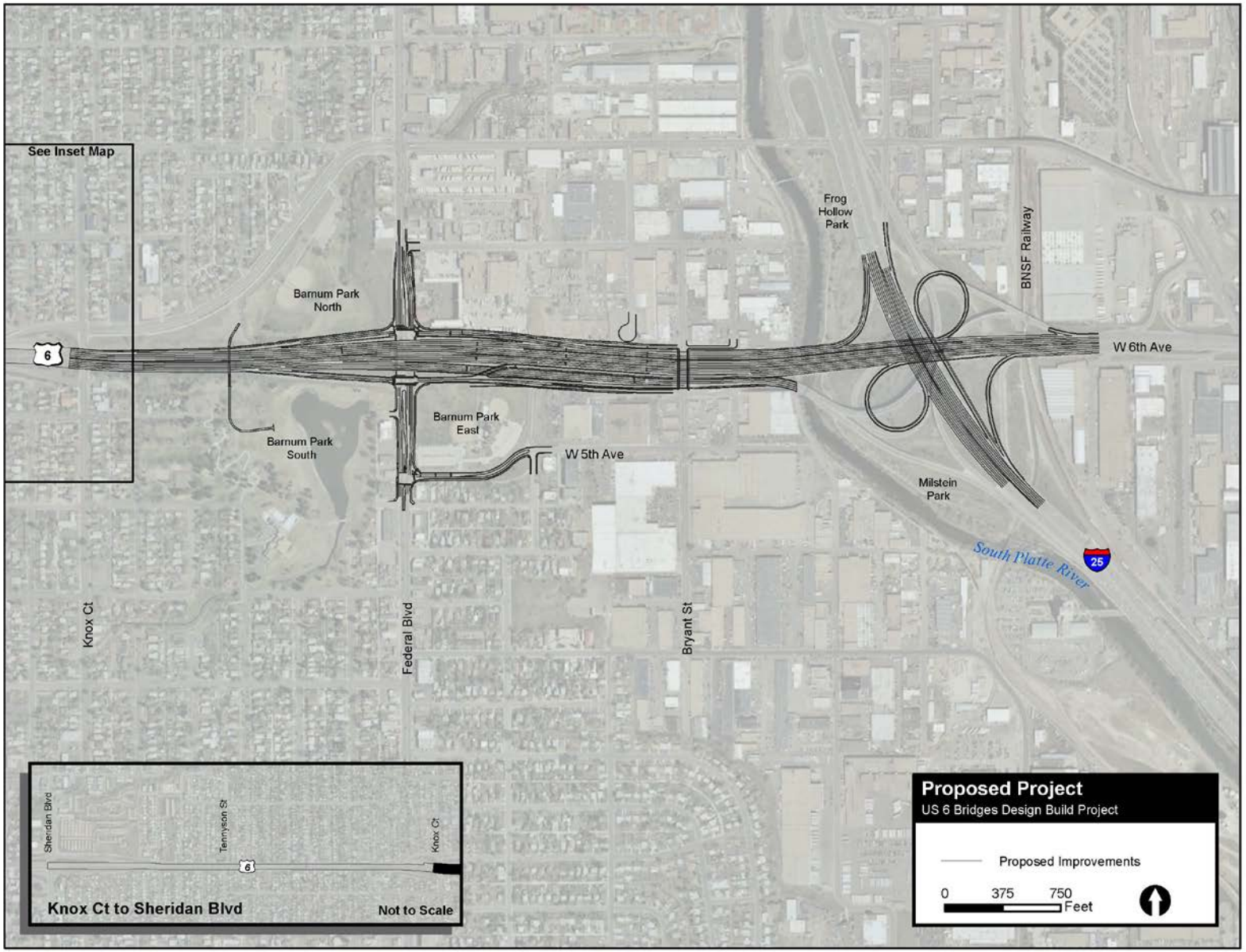


**Figure 2: Proposed Project**

## 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 Reevaluation and ROD for the Proposed Project will re-evaluate 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 Reevaluation and ROD for the Proposed Project will also address six new 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 Re-evaluation and ROD and will not affect the independent utility, logical termini, or Preferred Alternative of the Valley Highway Project.

### *Phasing of the FEIS Preferred Alternative*

The Proposed 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 Proposed Project Elements and how they relate to the FEIS phasing.

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

At this time, the Proposed 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

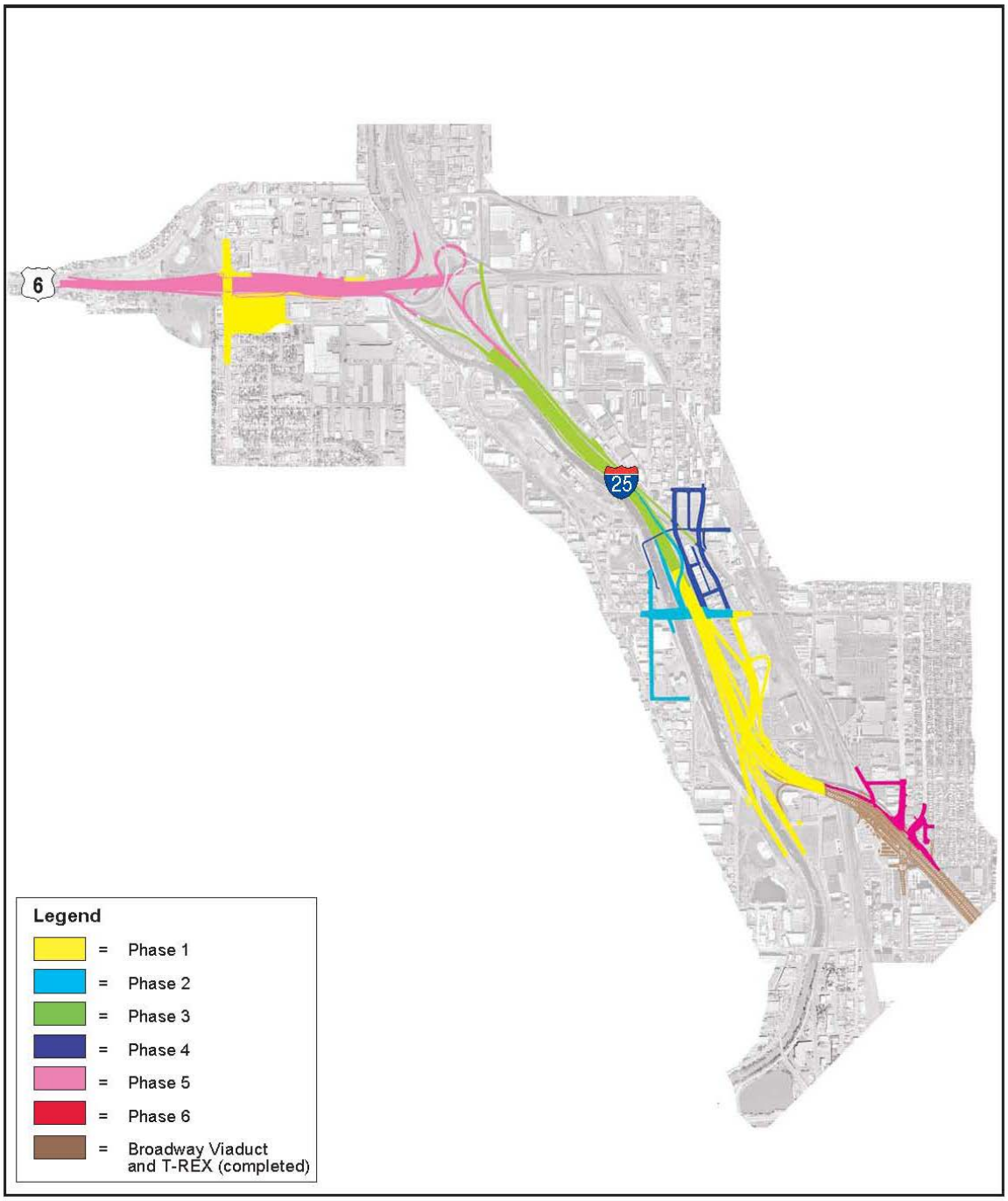


**Figure 3: Valley Highway EIS Phased Implementation of the Preferred Alternative**

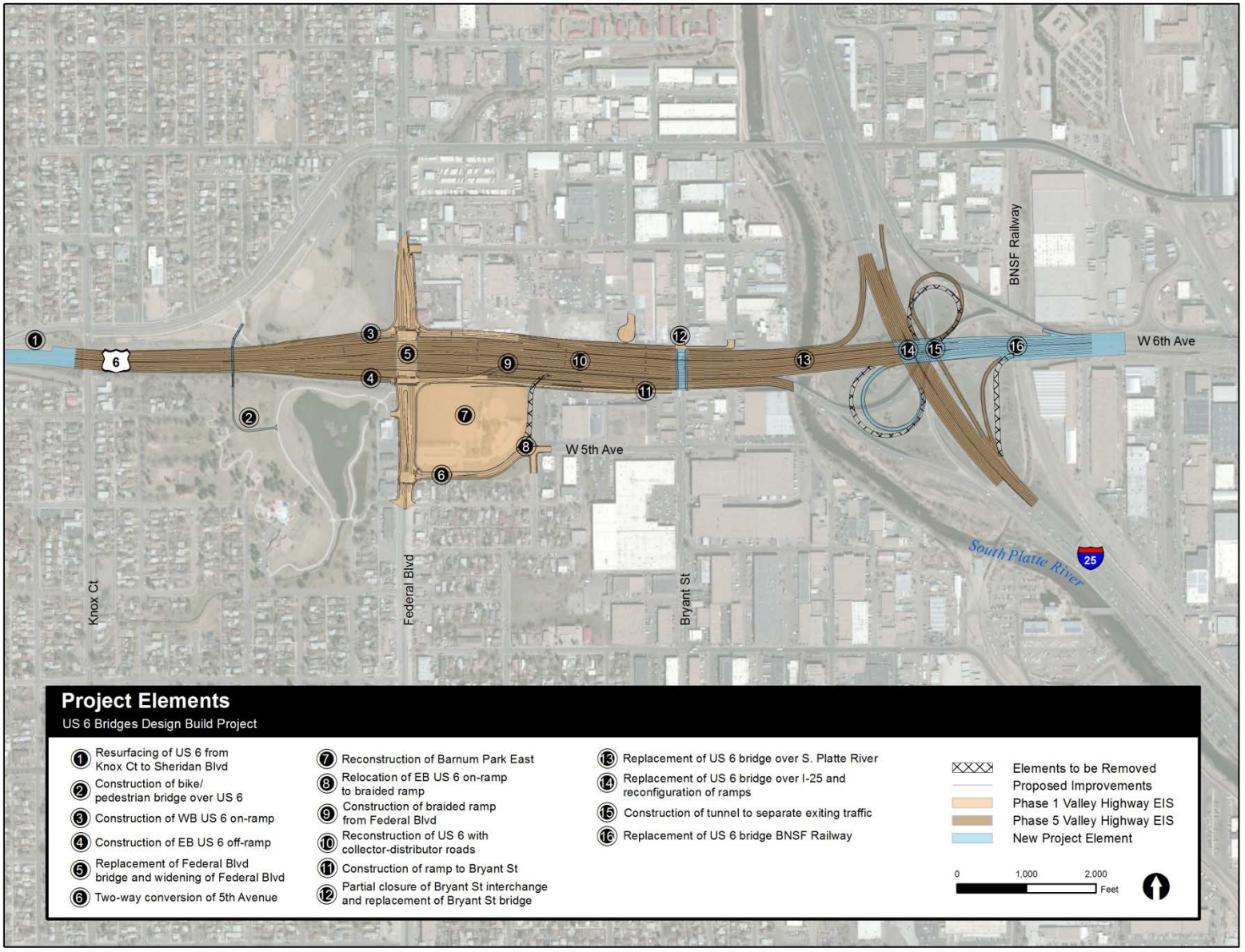


**Figure 4: Proposed Project Elements**

# Transportation Analysis Introduction

This transportation analysis report includes the following elements:

- Updated existing, 2035 No Build, and 2035 Proposed 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 Proposed Project traffic projections.
- Analyze the traffic performance of the 2035 No Build to the 2035 Proposed 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 Proposed 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$^{th}$ Avenue, 7$^{th}$ Avenue, and Decatur Street.

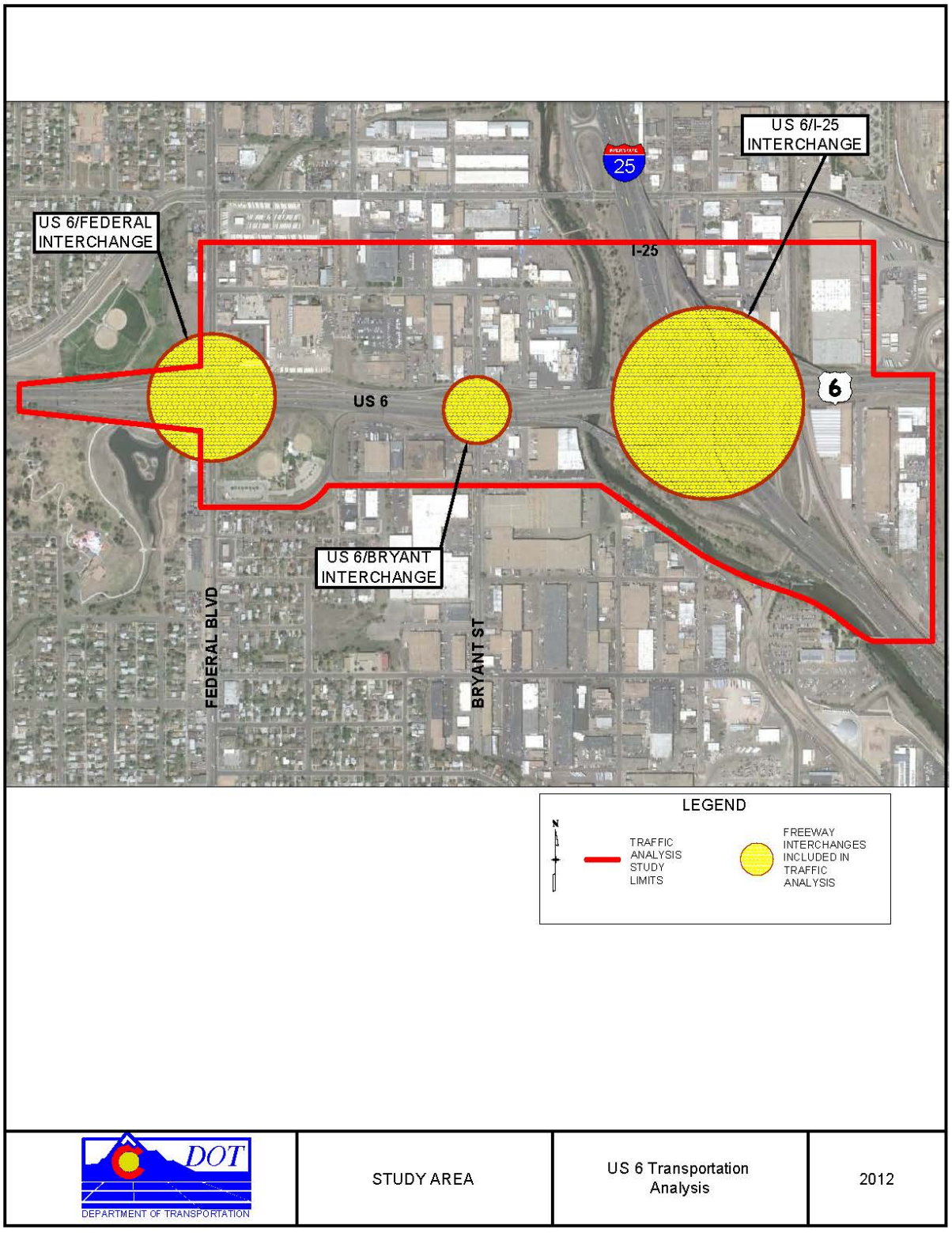


**Figure 5: Study Area**

## 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 south (vpd) 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.

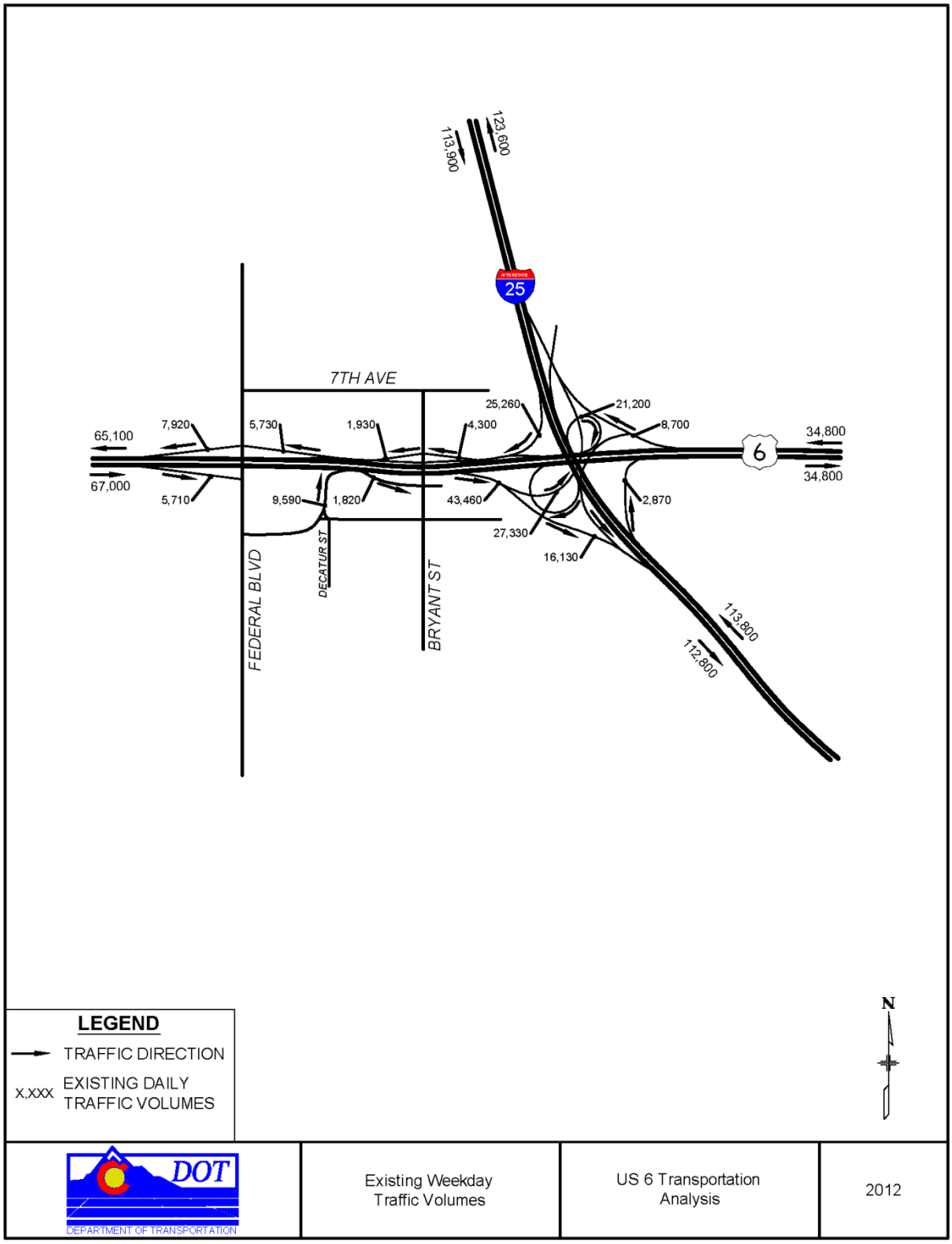


**Figure 6: Existing Weekday Traffic Volumes**

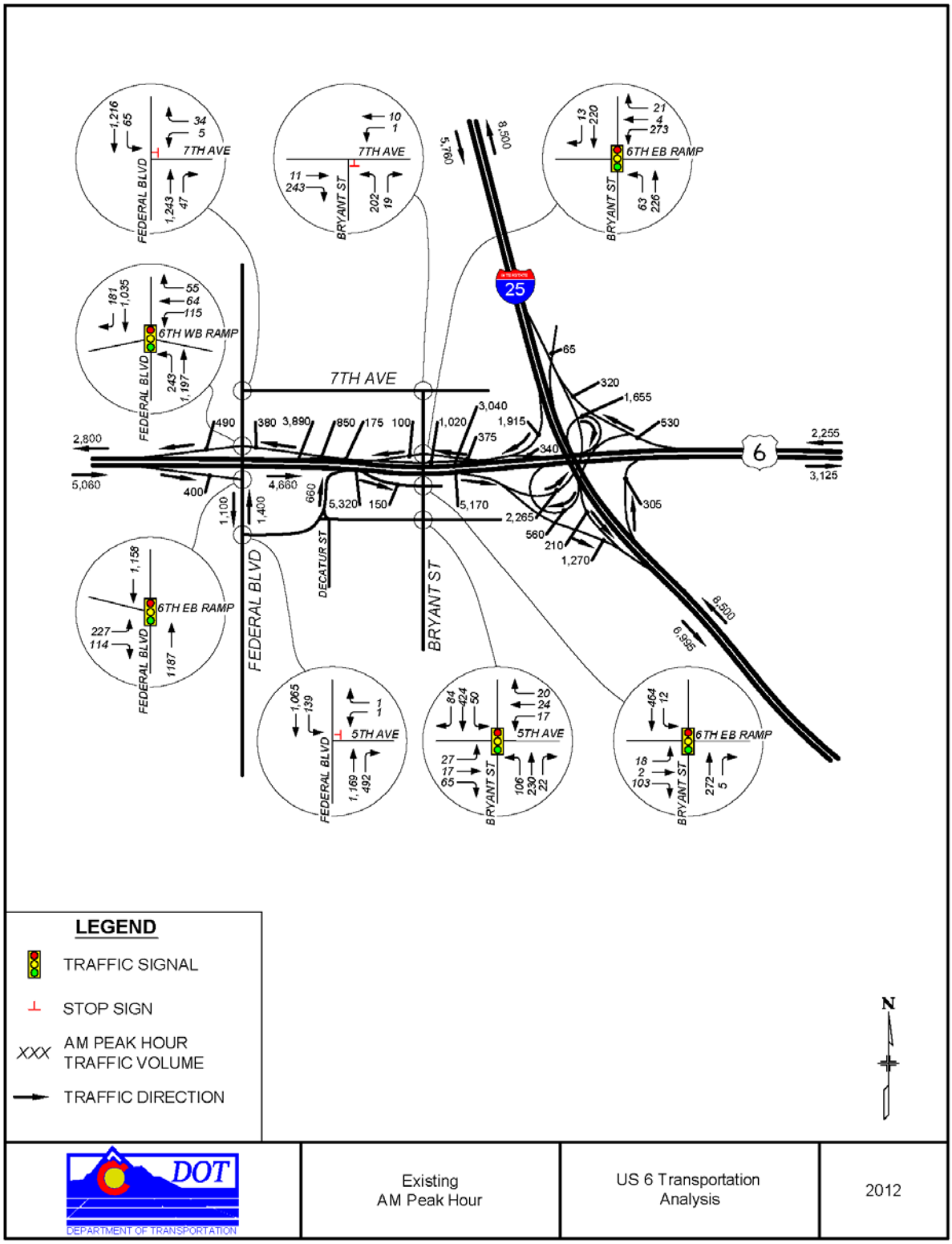


**Figure 7: Existing AM Peak Hour**

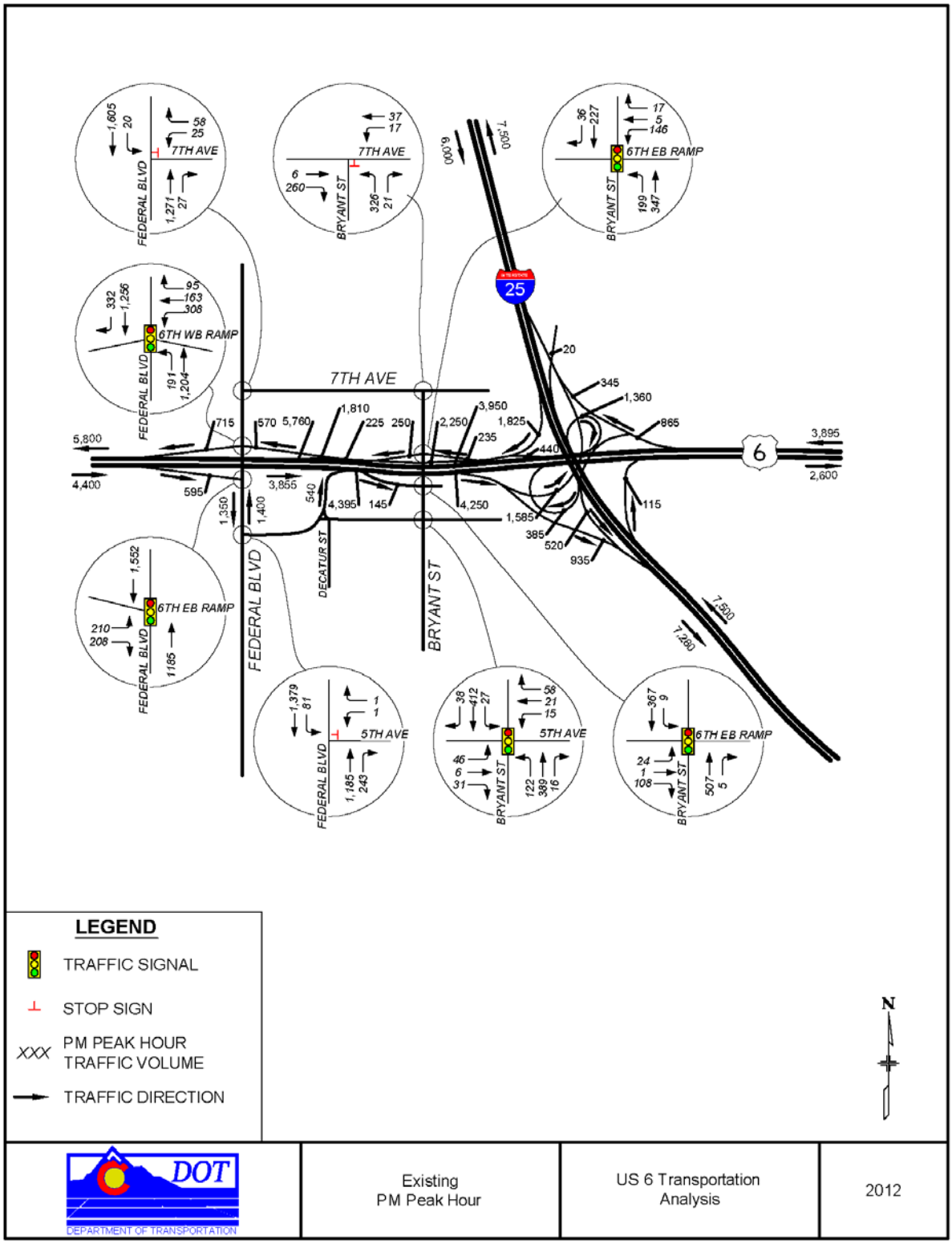


**Figure 8: Existing PM Peak Hour**

## 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$^{th}$ 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.

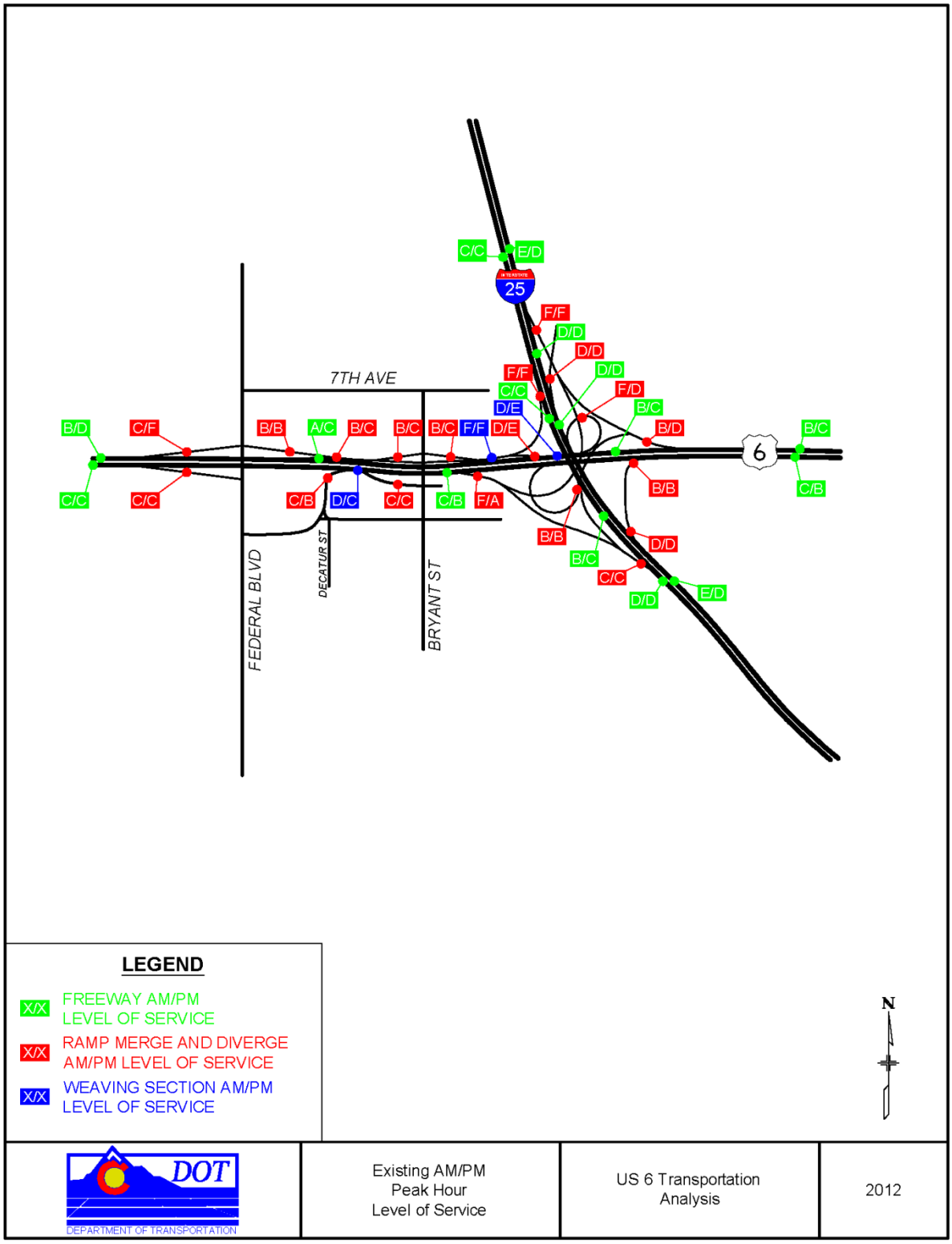


**Figure 9: Existing AM/PM Peak Hour Level of Service**

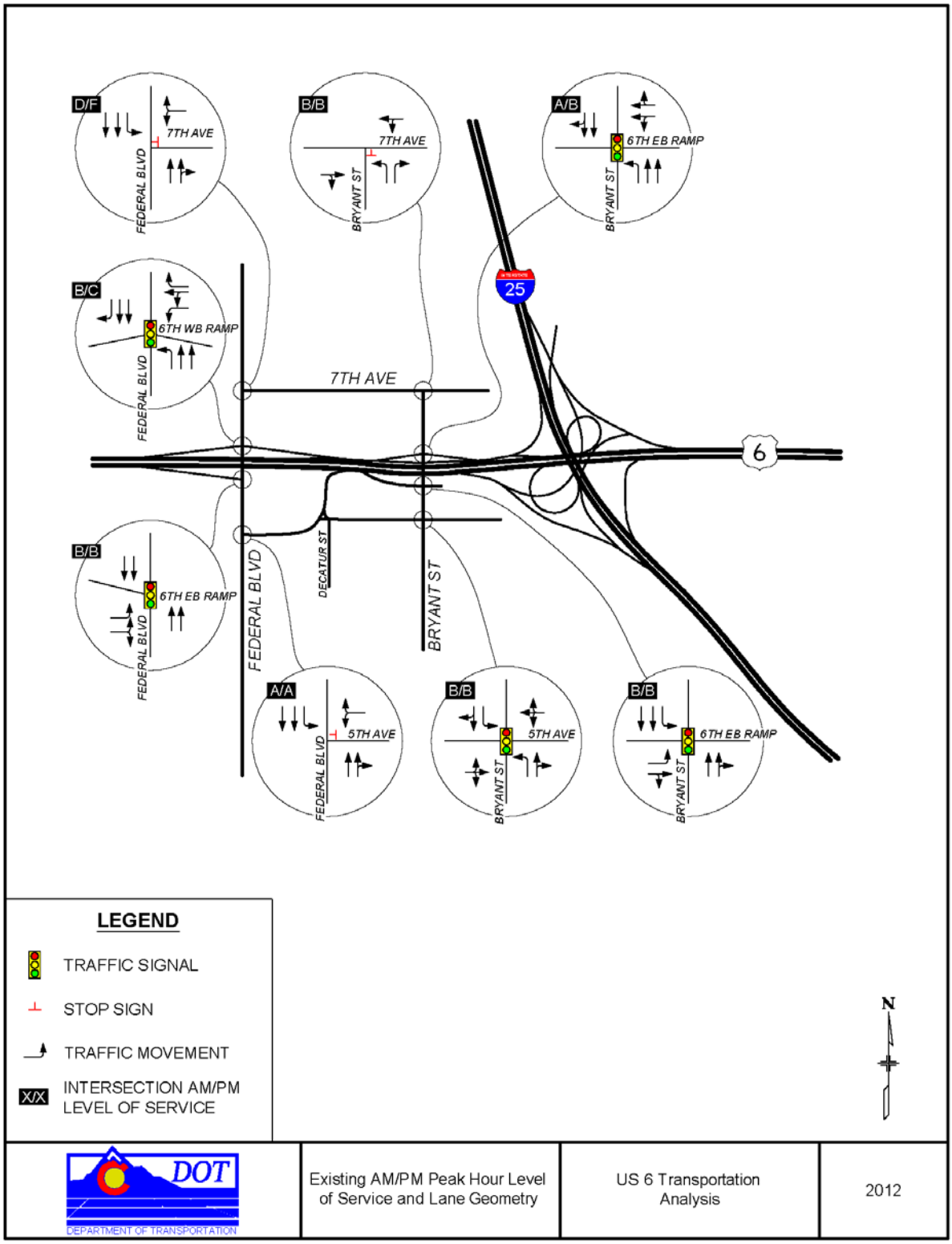


**Figure 10: Existing AM/PM Peak Hour Level of Service and Lane Geometry**

# Assessment of Future 2035 Conditions – No Build

## Traffic Projections

Using the 2025 FEIS traffic projections documented in various traffic reports[1] 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.

[1] 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.

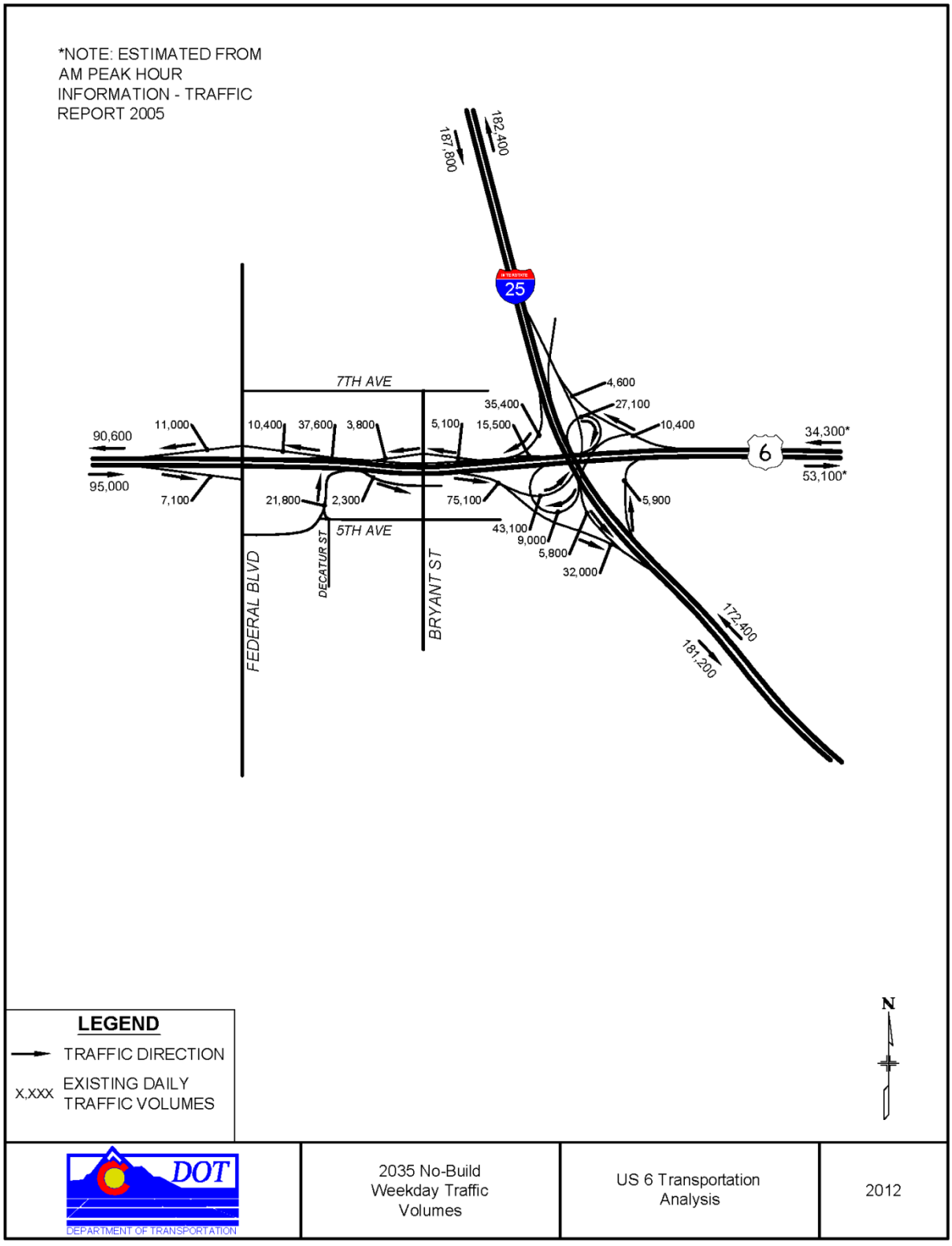


**Figure 11: 2035 No-Build Weekday Traffic Volumes**

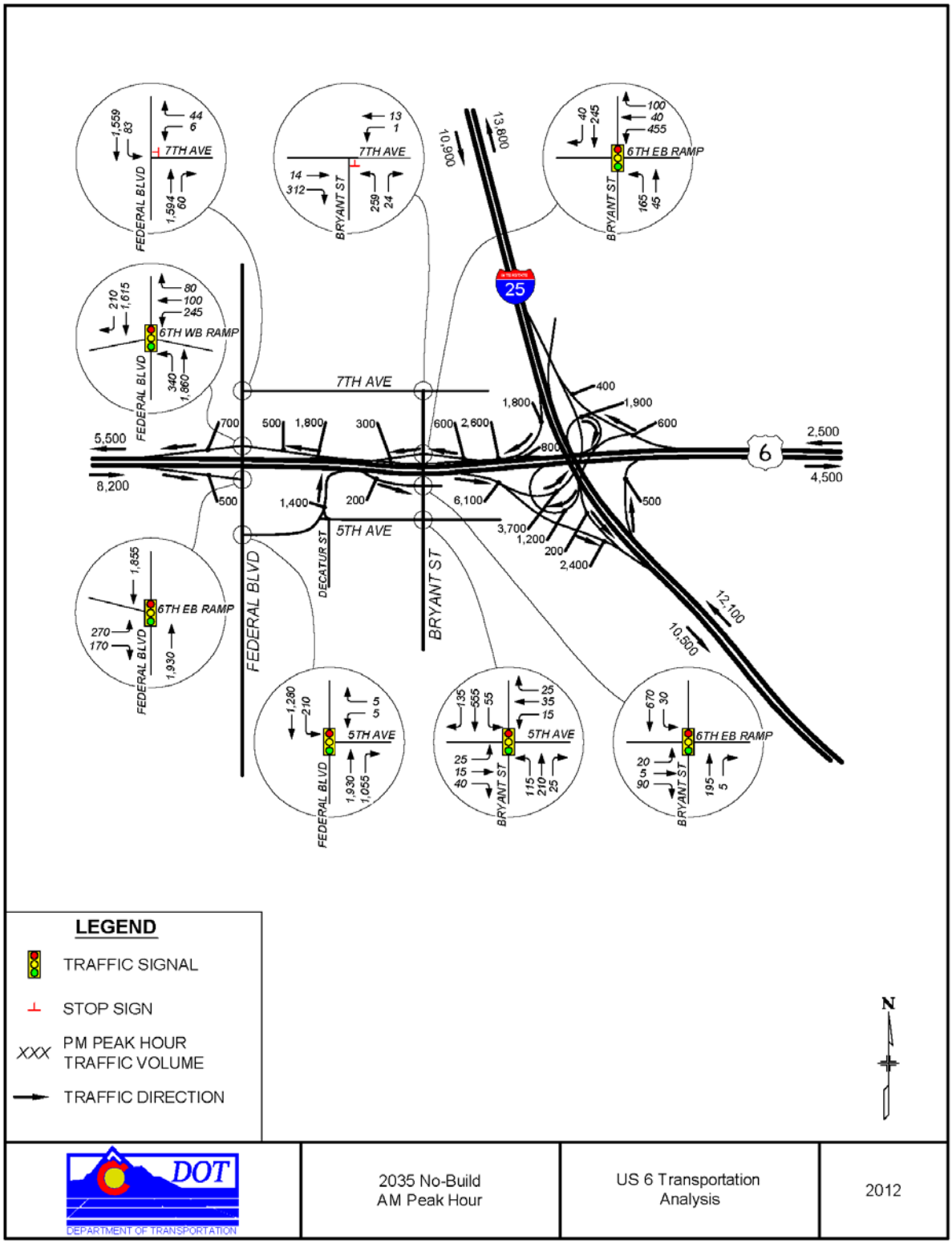


**Figure 12: 2035 No-Build AM Peak Hour**

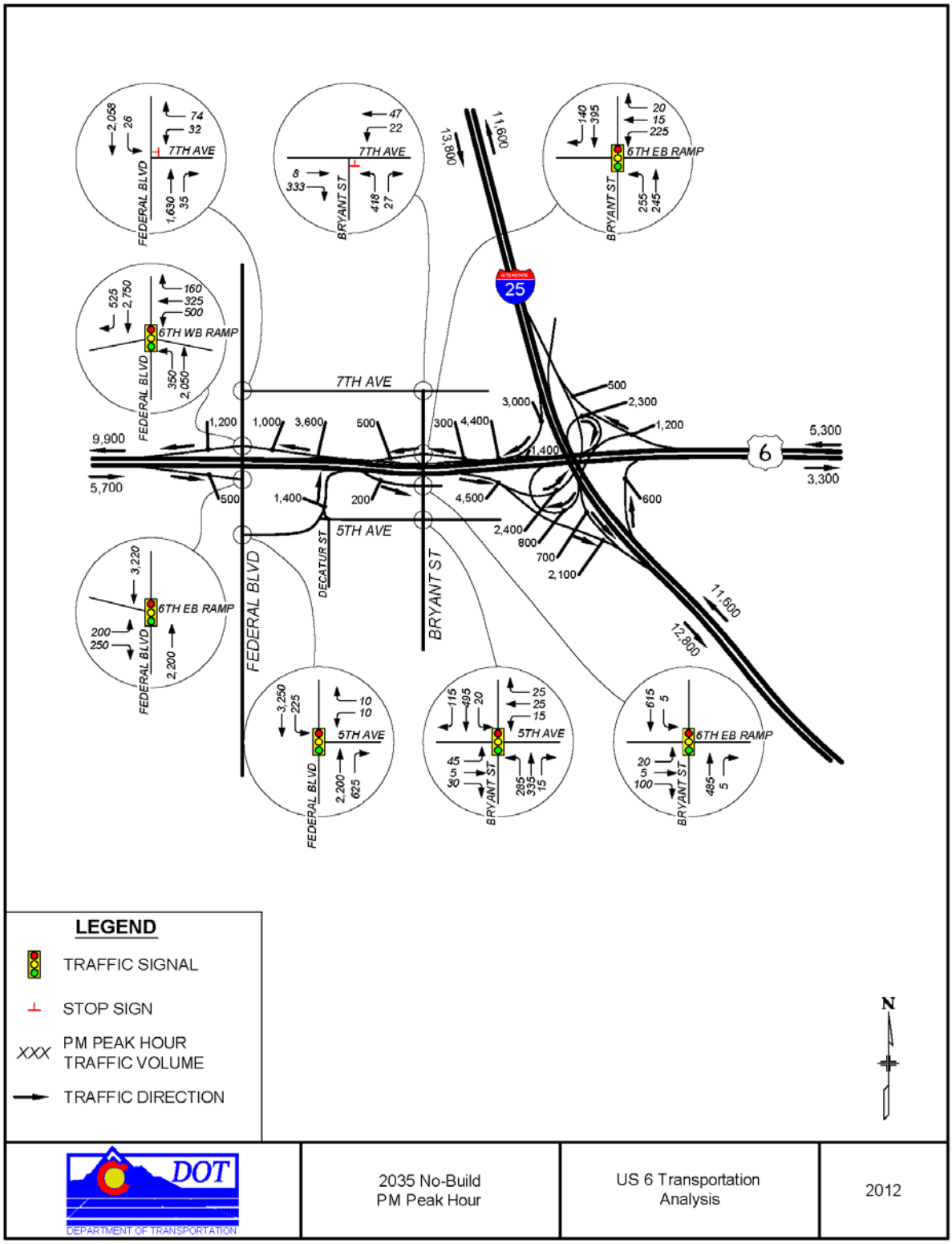


**Figure 13: 2035 No-Build PM Peak Hour**

## 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.

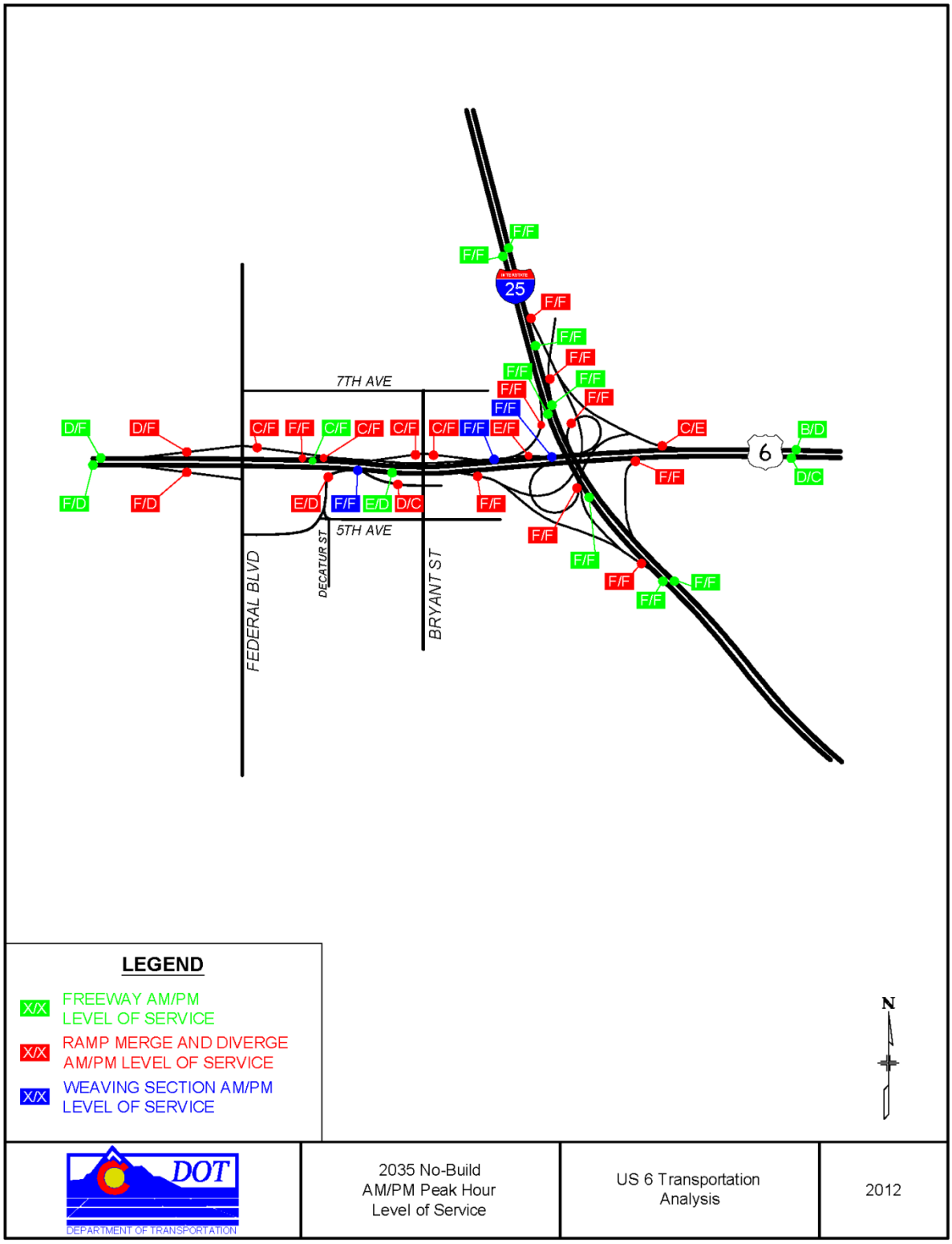


**Figure 14: 2035 No-Build AM/PM Peak Hour Level of Service**

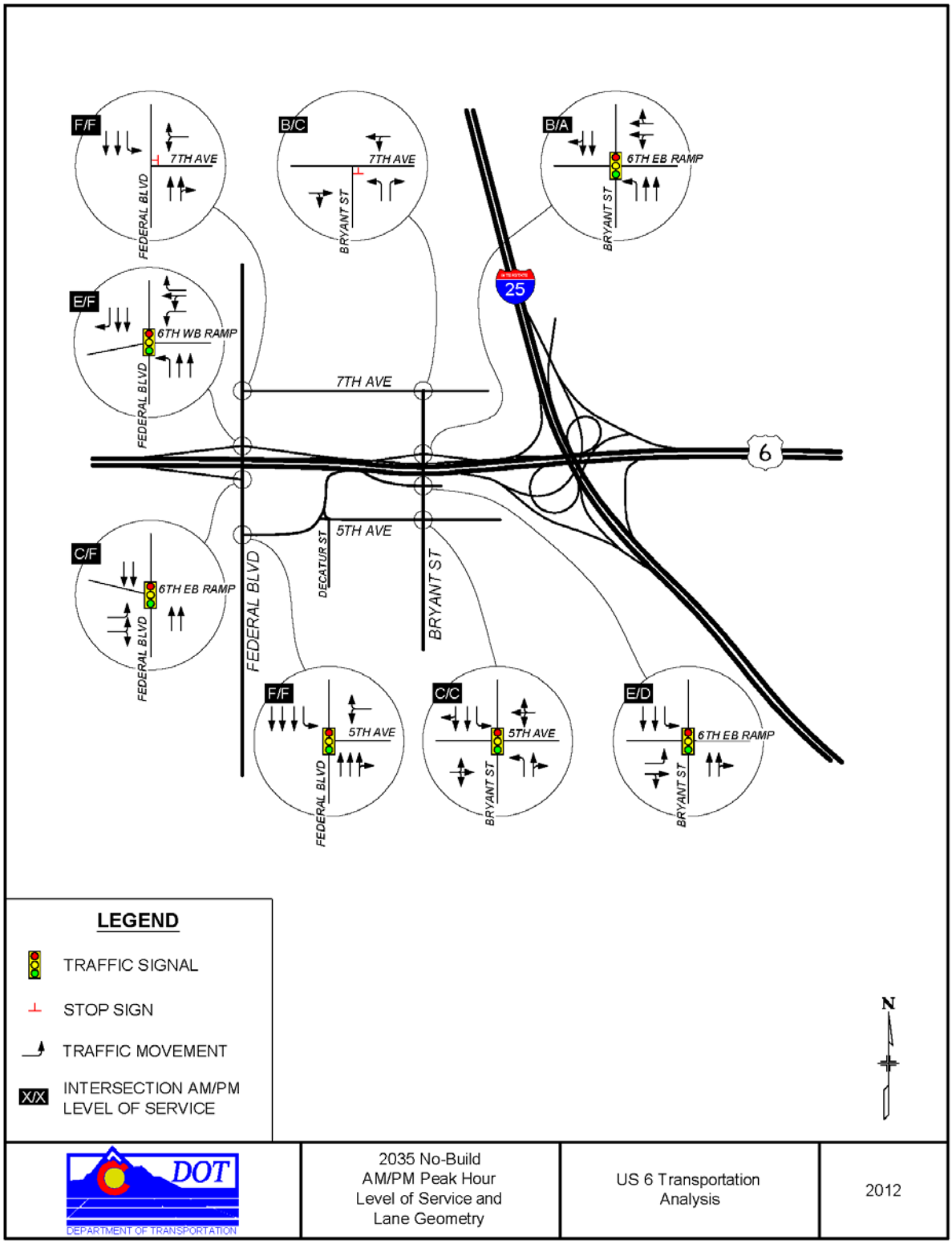


**Figure 15: 2035 No-Build AM/PM Peak Hour Level of Service and Lane Geometry**

# Assessment of Proposed Project

## Future Travel Demand – Future 2035 Proposed Project

**Figure 16** illustrates year 2035 Proposed 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 Proposed Project AM and PM Peak Hour turning movements respectively.

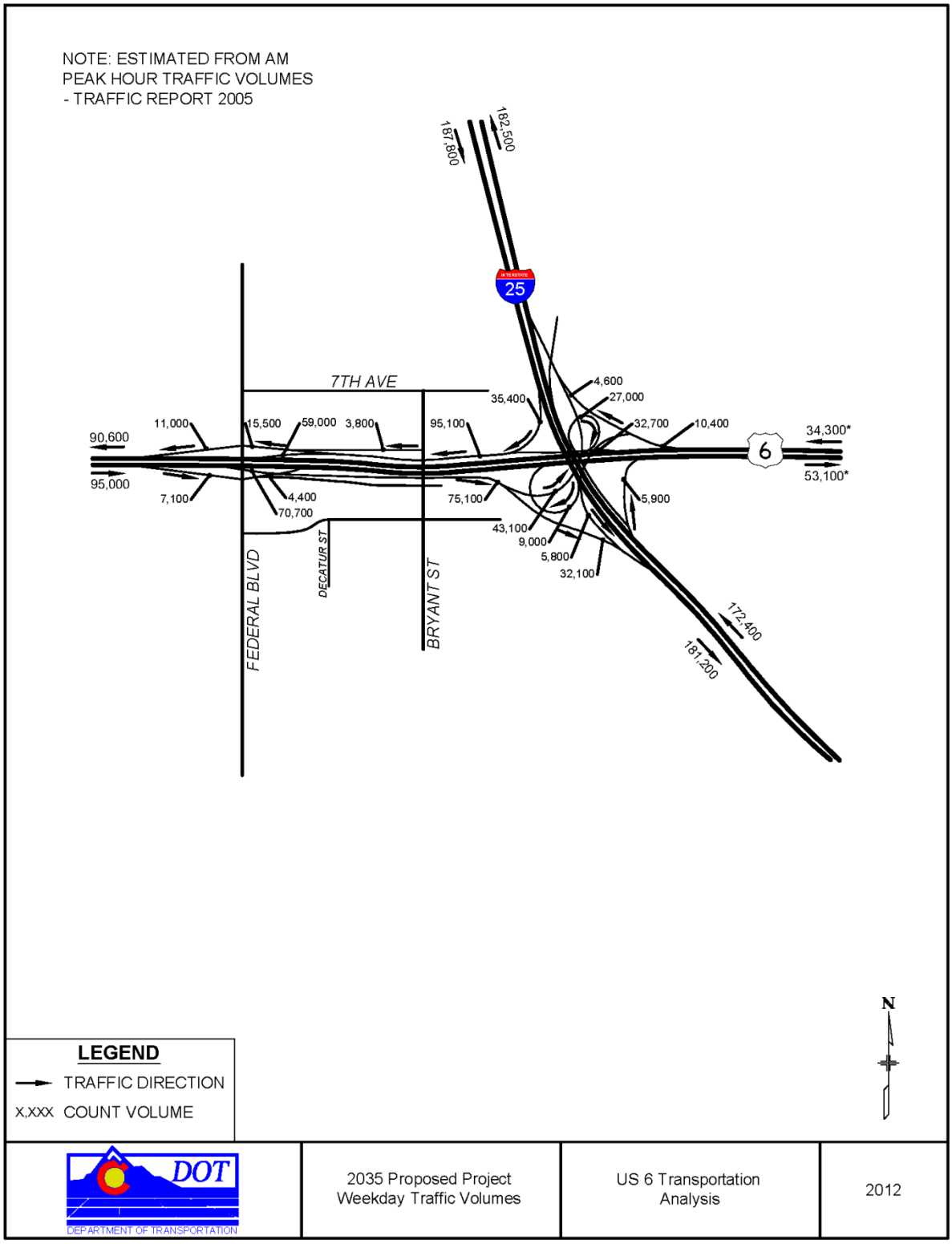


**Figure 16: 2035 Proposed Project Weekday Traffic Volumes**

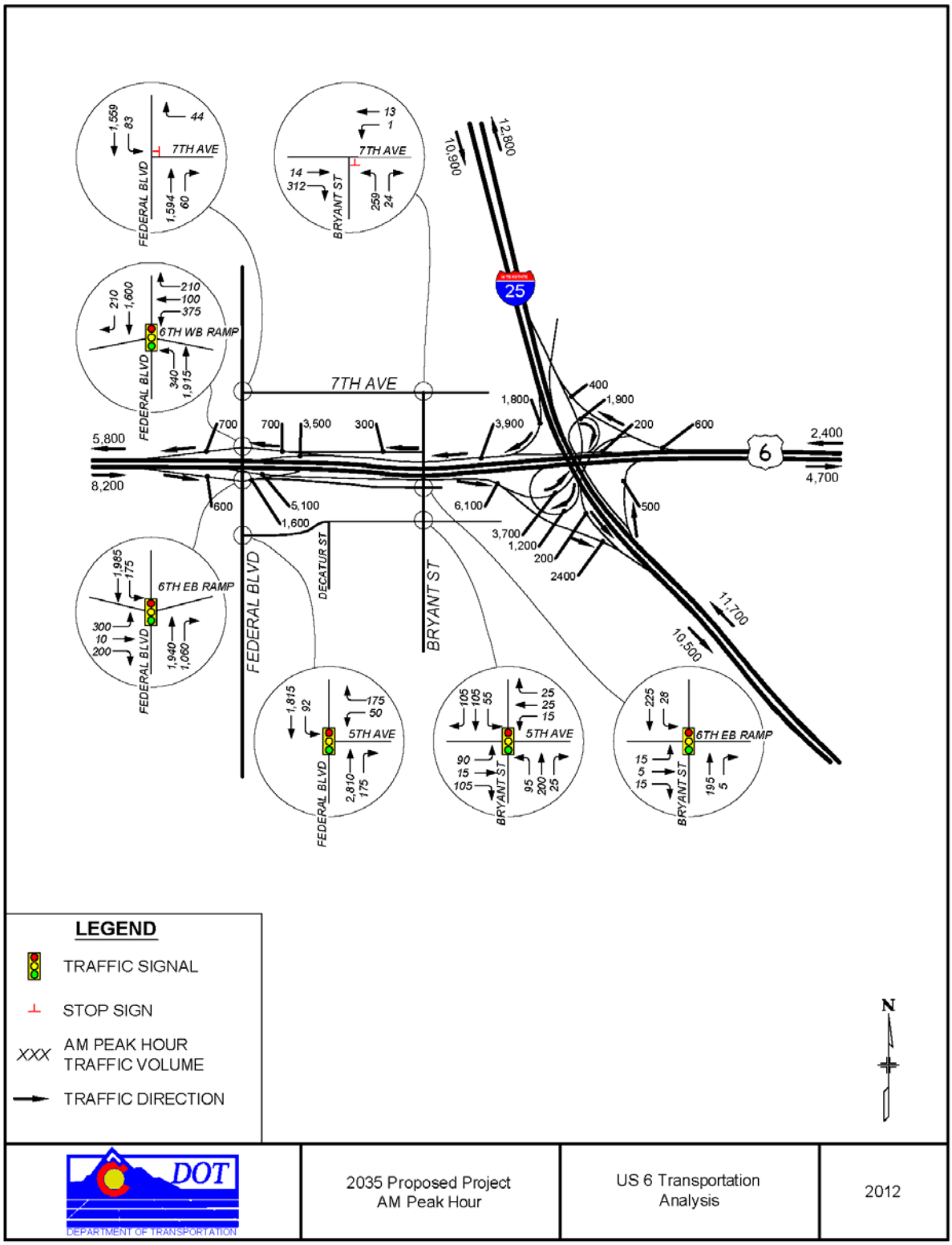


**Figure 17: 2035 Proposed Project AM Peak Hour**

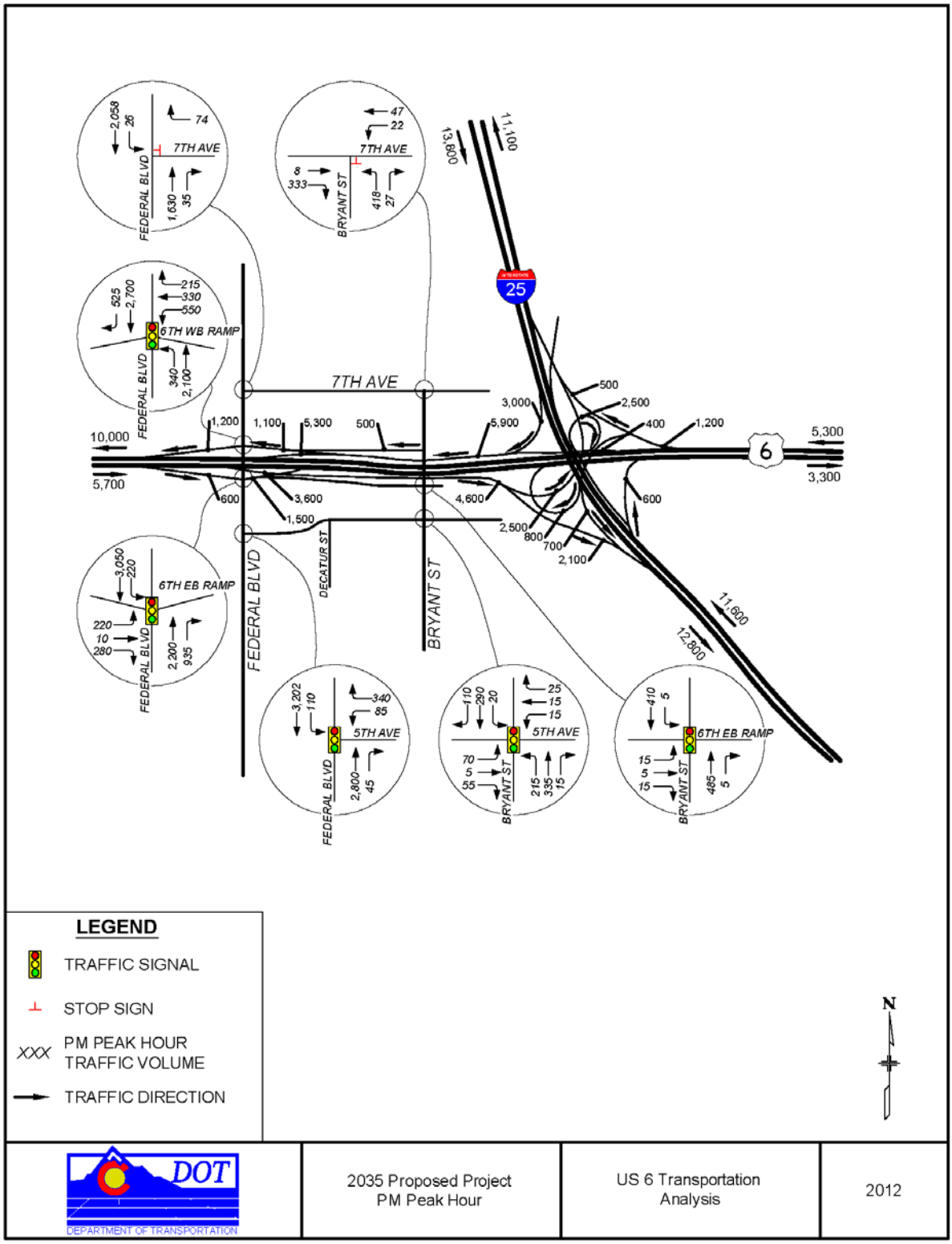


**Figure 18: 2035 Proposed Project PM Peak Hour**

## Capacity Analysis Year 2035 Proposed 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 Proposed Project traffic volumes. The resulting AM and PM Peak hour LOS for 2035 Proposed Project traffic volumes are shown in **Figure 19** (Freeway Facilities) and **Figure 20** (Surface Street Intersections).

### *Freeway Sections*

As in the FEIS report the Proposed 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 Proposed 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$^{th}$ Avenue would improve operations at the intersection.

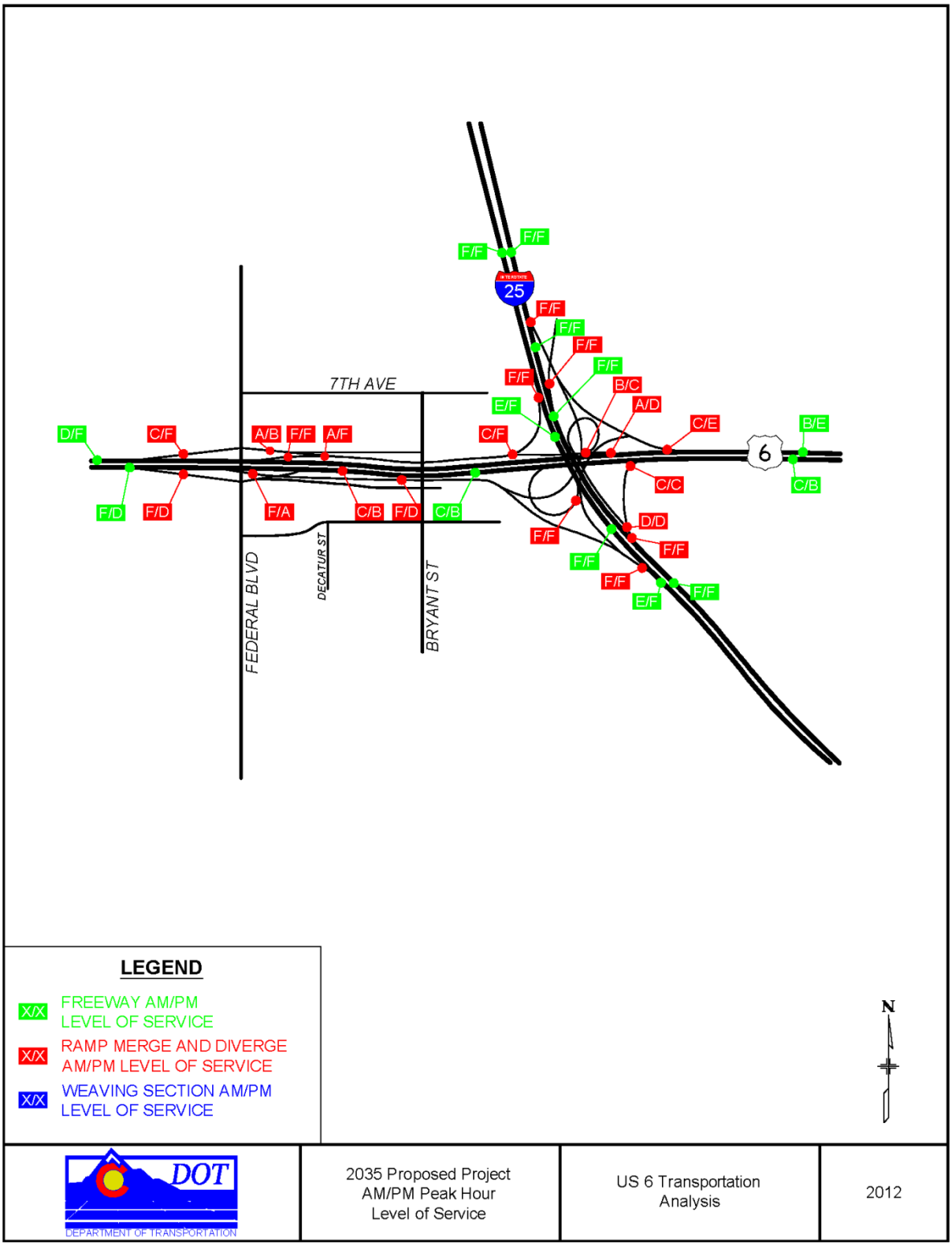


**Figure 19: 2035 Proposed Project AM/PM Peak Hour Level of Service**

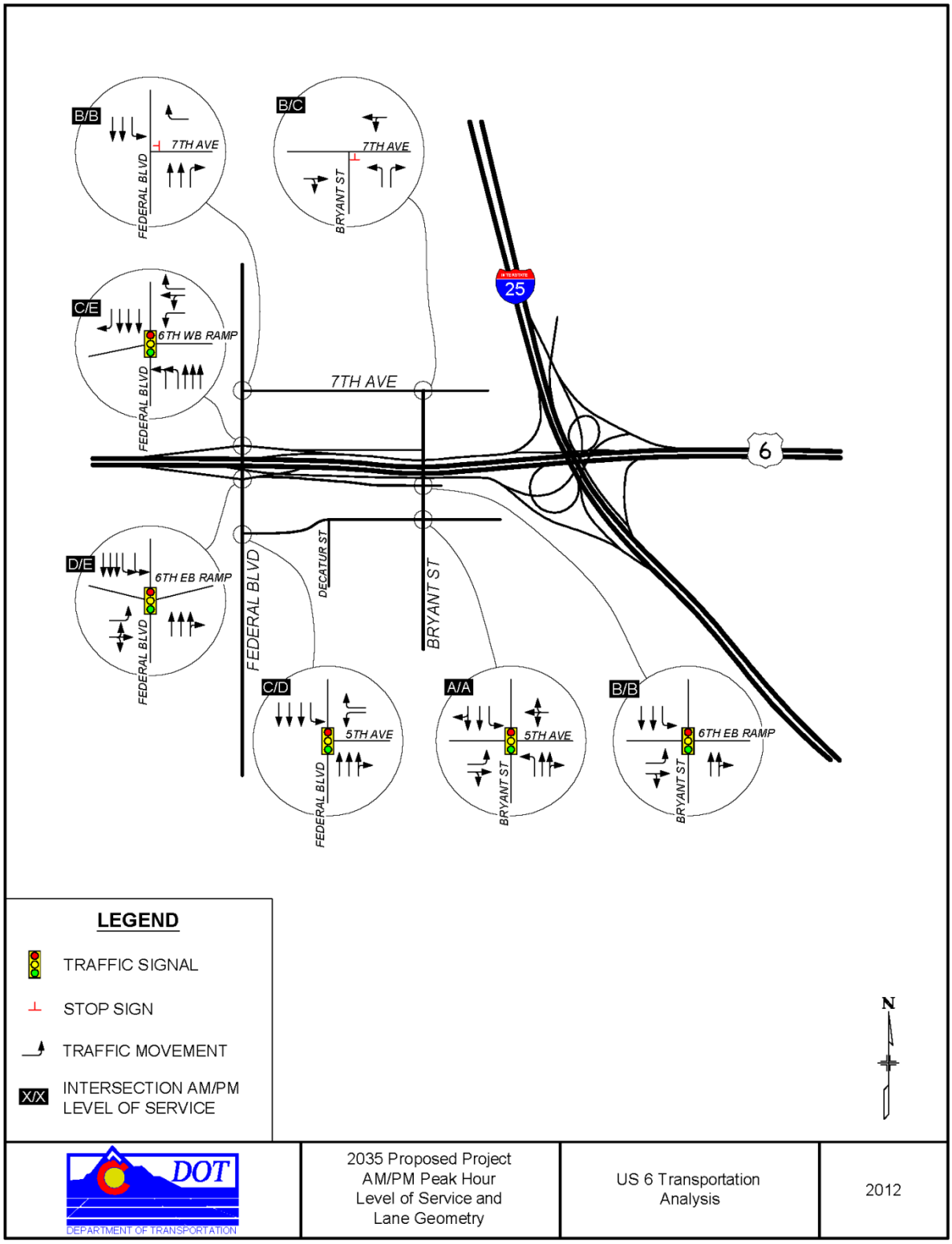


**Figure 20: 2035 Proposed Project AM/PM Level of Service and Lane Geometry**

# Operational Analysis Comparison Summary

## Freeway Sections

### *Mainline Freeway Sections*

In both the 2035 No Build and 2035 Proposed 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 Proposed 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 |
| | **US 6 Freeway Section Operations** | | | | | | |
| 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** | - | - |
| | **I-25 Freeway Section Operations** | | | | | | |
| 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 Proposed 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 |
| | **US 6 Freeway Section Operations** | | | | | | |
| 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 Proposed 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 Proposed 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 Proposed Project. There are several intersections that operate with deficient levels of service for the No Build scenario. With the Proposed 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 Proposed 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 Proposed 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 Proposed 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 Proposed Project versus FEIS

This transportation analysis of the Proposed 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 Proposed 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 Proposed 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, $f_{HV}$ | 0.983 | 0.983 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 5718 | 452 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2748 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 |
| $v_3$ or $v_{av34}$ | 1485 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 26.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.469 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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 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 | 4972 | 616 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2515 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 |
| $v_3$ or $v_{av34}$ | 1228 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 24.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.483 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.7 | mph |
| Space mean speed in outer lanes, | $S_0$ = 59.4 | mph |
| Space mean speed for all vehicles, | $S$ = 53.5 | 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/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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.125 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 512 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 4854 | 9000 | No |
| $v_3$ or $v_{av34}$ | 1798 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 | Yes | |

If yes, $v_{12A}$ = 1643 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 4854 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 22.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.352 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 52.4 | mph |
| Space mean speed for all vehicles, | $S$ = 51.4 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.142 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 481 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 4008 | 9000 | No |
| $v_3$ or $v_{av34}$ | 1458 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 | Yes | |

If yes, $v_{12A}$ = 1359 (Equation 13-15, 13-16, 18, or 19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 4008 | 4600 | No |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 19.5 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.337 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 53.1 | mph |
| Space mean speed for all vehicles, | $S$ = 51.9 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2324 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 5111 | 9000 | No |
| $v_{FO} = v - v_R$ | 4941 | 9000 | No |
| $v_R$ | 170 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1393 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 22.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.443 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 58.8 | mph |
| Space mean speed for all vehicles, | $S$ = 54.0 | mph |

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2041 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 4470 | 9000 | No |
| $v_{FO} = v - v_R$ | 4306 | 9000 | No |
| $v_R$ | 164 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1214 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 20.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.443 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4533 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 654 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 7.2 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.795

Space mean speed in ramp influence area, $S_R$ = 44.7 mph

Space mean speed in outer lanes, $S_0$ = 60.3 mph

Space mean speed for all vehicles, $S$ = 47.4 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3398 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 |
| $v_3$ or $v_{av34}$ | 702 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = -2.5 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.689 | |
| Space mean speed in ramp influence area, | $S_R$ = 46.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.3 | mph |
| Space mean speed for all vehicles, | $S$ = 49.5 | mph |

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
E-mail:

## 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: | 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 | | | | |
|---|---|---|---|---|---|
| | VFF | VRF | VFR | VRR | |
| Volume, V | 5320 | 660 | 150 | 5 | veh/h |
| 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 |

## Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.417

| | | |
|---|---|---|
| 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1968 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 0.705 | 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.

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
E-mail:

## 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 | | | | |
|---|---|---|---|---|---|
| | VFF | VRF | VFR | VRR | |
| Volume, V | 4395 | 540 | 145 | 5 | veh/h |
| 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 | |

| | | |
|---|---|---|
| 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1966 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 0.585 | 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: | 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 | |

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/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 | |

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: | 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 | |

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/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 | |

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 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 | |

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 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 | |

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: | 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

$L_{EQ}$ = 0.00 (Equation 13-12 or 13-13)

$P_{FD}$ = 0.668 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1905 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 643 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 19.4 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.483

Space mean speed in ramp influence area, $S_R$ = 48.7 mph

Space mean speed in outer lanes, $S_0$ = 60.3 mph

Space mean speed for all vehicles, $S$ = 51.2 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/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

$L_{EQ}$ = 0.00 (Equation 13-12 or 13-13)

$P_{FD}$ = 0.604 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3053 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 1348 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 29.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.518 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.3 | mph |
| Space mean speed in outer lanes, | $S_0$ = 59.0 | mph |
| Space mean speed for all vehicles, | S = 51.1 | 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/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

$L_{EQ}$ = 14423.11 Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 6

$v_{12} = v_R + (v - v_F) P_{FD}$ = 3819 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 3819 | 6750 | No |
| $v_{FO} = v - v_R$ | 3435 | 6750 | No |
| $v_R$ | 384 | 2000 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | No | |

If yes, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 32.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.463 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.3 | mph |
| Space mean speed for all vehicles, | $S$ = 49.0 | 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/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

$L_{EQ}$ = 10432.29 Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 6

$v_{12} = v_R + (v - v_F) P_{FD} = 4961$ pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 4961 | 6750 | No |
| $v_{FO} = v - v_{FR}$ | 4464 | 6750 | No |
| $v_R$ | 497 | 2000 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}/2$ | No | |

If yes, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 42.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.473 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.619 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2723 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 4950 | 6750 | No |
| $v_3$ or $v_{av34}$ | 1673 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, $v_{12A}$ = 2723 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 4950 | 4600 | No |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 21.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.319 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 50.8 | mph |
| Space mean speed for all vehicles, | $S$ = 50.8 | 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: | 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.619 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 4032 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 7317 | 6750 | Yes |

$v_3$ or $v_{av34}$ 2477 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, $v_{12A}$ = 4032 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 7317 | 4600 | Yes |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 33.5 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.709 | |
| Space mean speed in ramp influence area, | $S_R$ = 45.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 47.4 | mph |
| Space mean speed for all vehicles, | S = 46.3 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v - v_F) P_{FD}$ = 1599 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 1599 | 4500 | No |
| $v_{FO} = v - v_F - v_R$ | 1175 | 4500 | No |
| $v_R$ | 424 | 2000 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | No | |

If yes, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 15.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.466 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 48.9 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2616 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}/2$ | No | |

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 24.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.452 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.1 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 49.1 | 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 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1153 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 13.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.442 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.3 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 49.3 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2543 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 2543 | 4500 | No |
| $v_{FO} = v - v_R$ | 2289 | 4500 | No |
| $v_R$ | 254 | 2000 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | No | |

If yes, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 25.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.451 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.1 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 49.1 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1153 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 1266 | 4500 | No |

$v_3$ or $v_{av34}$ 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 1153 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 1266 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 15.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.335 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM}) =$ 2543 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 2797 | 4500 | No |

$v_3$ or $v_{av34}$ 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 2543 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 2797 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 27.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.385 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 50.0 | mph |

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
E-mail:

## 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: | 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1800 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 0.939 | 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.

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
E-mail:

## 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: | 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1867 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 0.937 | 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.

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
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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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1565 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 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.

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
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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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1699 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 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.

Phone: Fax:
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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 | |

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: | 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 | |

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: | 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 | |

Phone: Fax:
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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 | |

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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 3611 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 7836 | 9000 | No |
| $v_{FO} = v - v_{FR}$ | 7491 | 9000 | No |
| $v_R$ | 345 | 2000 | No |
| $v_3$ or $v_{av34}$ | 2112 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 34.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.459 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = 56.0 | mph |
| Space mean speed for all vehicles, | $S$ = 52.6 | 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/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 | | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3088 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 |
| $v_3$ or $v_{av34}$ | 1913 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 29.9 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.440 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.3 | mph |
| Space mean speed in outer lanes, | $S_0$ = 56.8 | mph |
| Space mean speed for all vehicles, | $S$ = 53.2 | 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/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, $f_{HV}$ | 0.964 | 0.983 | 0.964 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 9442 | 1870 | 576 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5171 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2135 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 39.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.596 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 4577 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 8509 | 9000 | No |
| $v_{FO} = v - v_F - v_R$ | 6972 | 9000 | No |
| $v_R$ | 1537 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1966 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 34.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.566 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 56.6 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3328 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2104 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 31.5 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.435

Space mean speed in ramp influence area, $S_R$ = 49.3 mph

Space mean speed in outer lanes, $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3040 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 1951 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 29.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.430 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1559 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 10439 | 9000 | Yes |
| $v_3$ or $v_{av34}$ | 2951 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | Yes | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | Yes | |

If yes, $v_{12A}$ = 2984 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 10439 | 4600 | Yes |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 29.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 1.598 | |
| Space mean speed in ramp influence area, | $S_R$ = 34.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 48.7 | mph |
| Space mean speed for all vehicles, | $S$ = 39.2 | 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/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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1446 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 9039 | 9000 | Yes |
| $v_3$ or $v_{av34}$ | 2736 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 2767 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 9039 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 21.3 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $M_S$ = 0.600

Space mean speed in ramp influence area, $S_R$ = 47.2 mph

Space mean speed in outer lanes, $S_0$ = 49.3 mph

Space mean speed for all vehicles, $S$ = 48.2 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 (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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 3655 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 5583 | 9000 | No |
| $v_{FO} = v - v_F - v_R$ | 3419 | 9000 | No |
| $v_R$ | 2164 | 2000 | Yes |

$v_3$ or $v_{av34}$ = 964 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 25.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.623 | |
| Space mean speed in ramp influence area, | $S_R$ = 46.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.3 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 3725 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 5877 | 9000 | No |
| $v_{FO} = v - v_{FR}$ | 3815 | 9000 | No |
| $v_R$ | 2062 | 2000 | Yes |
| $v_3$ or $v_{av34}$ | 1076 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 25.9 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.614 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.0 | mph |
| Space mean speed for all vehicles, | $S$ = 51.1 | mph |

| | | | | |
|---|---|---|---|---|
| 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2288 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 4430 | 9000 | No |
| $v_{FO} = v - v_R$ | 3797 | 9000 | No |
| $v_R$ | 633 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1071 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 10.4 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.485

Space mean speed in ramp influence area, $S_R$ = 48.7 mph

Space mean speed in outer lanes, $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2288 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 4430 | 9000 | No |
| $v_{FO} = v - v_R$ | 3797 | 9000 | No |
| $v_R$ | 633 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1071 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 10.4 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.485

Space mean speed in ramp influence area, $S_R$ = 48.7 mph

Space mean speed in outer lanes, $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2343 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 4811 | 9000 | No |
| $v_{FO} = v - v_F - v_R$ | 4376 | 9000 | No |
| $v_R$ | 435 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1234 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 10.9 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.467 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 59.4 | mph |
| Space mean speed for all vehicles, | S = 53.8 | 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: | 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.005 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 18 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 5490 | 9000 | No |
| $v_3$ or $v_{av34}$ | 1883 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 Yes

If yes, $v_{12A}$ = 1514 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 5490 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 20.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.314 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 52.7 | mph |
| Space mean speed for all vehicles, | S = 51.6 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.008 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 36 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 6043 | 9000 | No |
| $v_3$ or $v_{av34}$ | 2165 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 | Yes | |

If yes, $v_{12A}$ = 1746 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 6043 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 22.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.335 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 52.1 | mph |
| Space mean speed for all vehicles, | $S$ = 51.3 | mph |

# Surface Street Intersections

| 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 | |

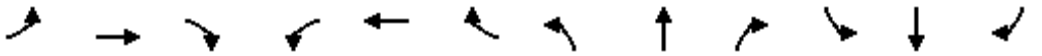
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|
| Volume Total | 43 | 921 | 513 | 72 | 676 | 676 |
| Volume Left | 6 | 0 | 0 | 72 | 0 | 0 |
| Volume Right | 38 | 0 | 52 | 0 | 0 | 0 |
| cSH | 199 | 1700 | 1700 | 528 | 1700 | 1700 |
| Volume to Capacity | 0.22 | 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 | | |

| 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 | | | | | |

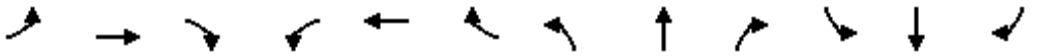
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.6 | | |
| Intersection Capacity Utilization | 56.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |



| 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 | | |

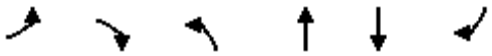
c Critical Lane Group



| 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 | | |

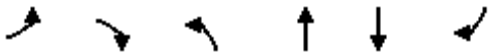
c Critical Lane Group



| 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



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| 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

| 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 | |

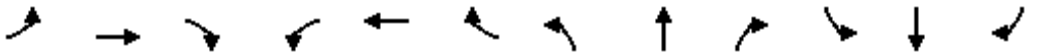
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|
| Volume Total | 0 | 847 | 958 | 151 | 579 | 579 |
| Volume Left | 0 | 0 | 0 | 151 | 0 | 0 |
| Volume Right | 0 | 0 | 535 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 333 | 1700 | 1700 |
| Volume to Capacity | 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 | | |

| 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 | | | | | |

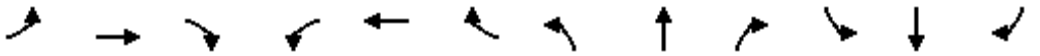
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.5 | | |
| Intersection Capacity Utilization | 51.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| 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 | | |

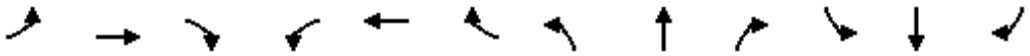
c Critical Lane Group



| 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 | | |

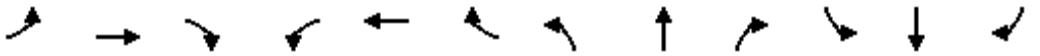
c Critical Lane Group



| 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 | | | 2 | |
| 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 | | |

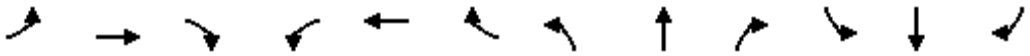
c Critical Lane Group



| 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 | | | 2 | |
| 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 | | | c0.12 | |
| 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 | 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 | | |

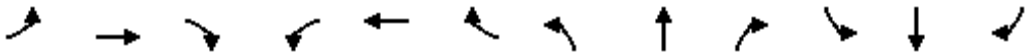
c Critical Lane Group



| 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



| 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

| 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 | | |

| 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4359 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2453 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 40.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.479 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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 | | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3127 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 |
| $v_3$ or $v_{av34}$ | 1657 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 30.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.479 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 57.8 | mph |
| Space mean speed for all vehicles, | S = 53.0 | 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/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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.020 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 124 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 7783 | 9000 | No |
| $v_3$ or $v_{av34}$ | 3038 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | Yes | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | Yes | |

If yes, $v_{12A}$ = 2480 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 7783 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 35.4 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $M_S$ = 0.536

Space mean speed in ramp influence area, $S_R$ = 48.0 mph

Space mean speed in outer lanes, $S_0$ = 50.1 mph

Space mean speed for all vehicles, $S$ = 49.0 mph

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.020 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 90 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 6048 | 9000 | No |
| $v_3$ or $v_{av34}$ | 2188 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 | Yes | |

If yes, $v_{12A}$ = 1786 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 6048 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 30.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.422 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.5 | mph |
| Space mean speed in outer lanes, | $S_0$ = 52.0 | mph |
| 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 3714 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 8227 | 9000 | No |
| $v_{FO} = v - v_R$ | 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 34.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.448 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2729 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 5967 | 9000 | No |
| $v_{FO} = v - v_F - v_R$ | 5741 | 9000 | No |
| $v_R$ | 226 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1619 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 26.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.448 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 57.9 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 7816 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 1120 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 35.5 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 1.061 | |
| Space mean speed in ramp influence area, | $S_R$ = 41.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 59.9 | mph |
| Space mean speed for all vehicles, | $S$ = 44.3 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5717 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 757 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 17.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.895 | |
| Space mean speed in ramp influence area, | $S_R$ = 43.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.3 | mph |
| Space mean speed for all vehicles, | $S$ = 46.1 | mph |

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
E-mail:

## 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1955 | c |
| | | Maximum | Analyzed | |
| 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.

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
E-mail:

## 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: | 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 | 6600 | 1400 | 200 | 5 | veh/h |
| 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1920 | c |
| | | Maximum | Analyzed | |
| 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 | |

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/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 | |

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: | 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 | |

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/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 | |

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 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 | |

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 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

$L_{EQ}$ = 0.00 (Equation 13-12 or 13-13)

$P_{FD}$ = 0.658 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2094 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 731 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 21.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.490 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.3 | mph |
| Space mean speed for all vehicles, | $S$ = 51.2 | 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/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

$L_{EQ}$ = 0.00 (Equation 13-12 or 13-13)

$P_{FD}$ = 0.542 Using Equation 5

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3978 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2192 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 37.2 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.552

Space mean speed in ramp influence area, $S_R$ = 47.8 mph

Space mean speed in outer lanes, $S_0$ = 55.7 mph

Space mean speed for all vehicles, $S$ = 50.3 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/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

$L_{EQ}$ = 21245.22 Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 6

$v_{12} = v_R + (v - v_F) P_{FD}$ = 4294 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 4294 | 6750 | No |
| $v_{FO} = v - v_R$ | 3390 | 6750 | No |
| $v_R$ | 904 | 2000 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 36.9 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.509 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.3 | mph |
| Space mean speed for all vehicles, | $S$ = 48.4 | 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/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

$L_{EQ}$ = 21712.07 Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 6

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 7345 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}/2$ | No | |

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 63.1 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.570 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.619 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 3360 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 6215 | 6750 | No |

$v_3$ or $v_{av34}$ 2064 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, $v_{12A}$ = 3360 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 6215 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{R12} - 0.00627 L_A$ = 28.1 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.464 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = 49.4 | mph |
| Space mean speed for all vehicles, | $S$ = 49.1 | 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/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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.619 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 6090 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 11187 | 6750 | Yes |

$v_3$ or $v_{av34}$ 3741 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 7131 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 11187 | 4600 | Yes |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 61.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 19.136 | |
| Space mean speed in ramp influence area, | $S_R$ = -193.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 46.1 | mph |
| Space mean speed for all vehicles, | $S$ = 755.5 | 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 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2938 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 2938 | 4500 | No |
| $v_{FO} = v - v_R$ | 2260 | 4500 | No |
| $v_R$ | 678 | 2000 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | No | |

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 27.1 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.489 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 48.6 | mph |

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4972 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 44.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.459 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 49.0 | 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 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2260 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$/2 No

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 22.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.448 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4633 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | No | |

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 43.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.479 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2260 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 2599 | 4500 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | No | |

If yes, $v_{12A}$ = 2260 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 2599 | 4600 | No |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 25.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.373 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.1 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 4633 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 5198 | 4500 | Yes |

$v_3$ or $v_{av34}$ = 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 4633 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 5198 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 45.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 1.027 | |
| Space mean speed in ramp influence area, | $S_R$ = 41.7 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 41.7 | mph |

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Phone: Fax:
E-mail:

## 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1762 | c |
| | | Maximum | Analyzed | |
| 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: Fax:
E-mail:

## 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1807 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 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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Phone: Fax:
E-mail:

## 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1691 | c |
| | | Maximum | Analyzed | |
| 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.

HCS 2010: Freeway Weaving Release 6.1

Phone: Fax:
E-mail:

## 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: | 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 | |

## 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 |
| | | Maximum | Analyzed | |
| Density-based capacty, cIWL (pc/h/ln) | | 2250 | 1736 | c |
| | | Maximum | Analyzed | |
| v/c ratio | | 1.00 | 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.

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: | 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 | |

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: | 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 | |

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: | 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 | |

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: | 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 | |

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: | 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 | |

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: | 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 | |

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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5142 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2960 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 52.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.479 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 53.7 | mph |
| Space mean speed for all vehicles, | S = 51.1 | 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: | 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 | | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5045 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 |
| $v_3$ or $v_{av34}$ | 2824 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | Yes | |
| Is $v_3$ 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 48.9 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.489 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 53.7 | mph |
| Space mean speed for all vehicles, | S = 51.1 | 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/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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 7038 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 13366 | 9000 | Yes |
| $v_{FO} = v - v_F - v_R$ | 11219 | 9000 | Yes |
| $v_R$ | 2147 | 2000 | Yes |
| $v_3$ or $v_{av34}$ | 3164 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | Yes | |
| Is $v_3$ 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 63.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.621 | |
| Space mean speed in ramp influence area, | $S_R$ = 46.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 53.7 | mph |
| Space mean speed for all vehicles, | $S$ = 49.4 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 6992 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2841 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 57.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.662 | |
| Space mean speed in ramp influence area, | $S_R$ = 46.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 53.7 | mph |
| Space mean speed for all vehicles, | $S$ = 49.3 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4906 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 3135 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | Yes | |
| Is $v_3$ 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 52.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.433 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4390 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2817 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 42.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.431 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 53.7 | mph |
| Space mean speed for all vehicles, | $S$ = 51.6 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2324 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 15843 | 9000 | Yes |

$v_3$ or $v_{av34}$ 4397 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 4447 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 15843 | 4600 | Yes |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 53.5 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $M_S$ = 37.579

Space mean speed in ramp influence area, $S_R$ = -433.5 mph

Space mean speed in outer lanes, $S_0$ = 42.3 mph

Space mean speed for all vehicles, S = 115.9 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/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

$L_{EQ}$ = (Equation 25-2 or 25-3)

$P_{FM}$ = 0.209 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2088 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 13331 | 9000 | Yes |
| $v_3$ or $v_{av34}$ | 3951 pc/h | (Equation 25-4 or 25-5) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | Yes | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | Yes | |
| If yes, $v_{12A}$ = 3996 | | (Equation 25-8) | |

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 3996 | 4600 | Yes |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 39.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 6.074 | |
| Space mean speed in ramp influence area, | $S_R$ = -24.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5528 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2260 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 41.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.611 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.1 | mph |
| Space mean speed in outer lanes, | $S_0$ = 55.4 | mph |
| Space mean speed for all vehicles, | $S$ = 50.5 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 7458 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 12721 | 9000 | Yes |
| $v_{FO} = v - v_F - v_R$ | 9331 | 9000 | Yes |
| $v_R$ | 3390 | 2000 | Yes |
| $v_3$ or $v_{av34}$ | 2631 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 58.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.733 | |
| Space mean speed in ramp influence area, | $S_R$ = 45.5 | mph |
| Space mean speed in outer lanes, | $S_0$ = 54.0 | mph |
| Space mean speed for all vehicles, | $S$ = 48.6 | 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: | 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, $f_{HV}$ | 0.964 | 0.983 | 0.985 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 10485 | 1356 | 2030 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5336 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2574 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 36.6 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.550

Space mean speed in ramp influence area, $S_R$ = 47.8 mph

Space mean speed in outer lanes, $S_0$ = 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, $f_{HV}$ | 0.964 | 0.983 | 0.985 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 12444 | 904 | 3383 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5935 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 3254 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 51.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.509 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = -0.157 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -1425 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 12099 | 9000 | Yes |
| $v_3$ or $v_{av34}$ | 5264 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 3641 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 12099 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 46.5 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 3.191 | |
| Space mean speed in ramp influence area, | $S_R$ = 13.5 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = -0.185 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -2136 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 14748 | 9000 | Yes |

$v_3$ or $v_{av34}$ 6829 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 4608 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 14748 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 55.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 10.064 | |
| Space mean speed in ramp influence area, | $S_R$ = -75.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 41.5 | mph |
| Space mean speed for all vehicles, | S = 233.4 | mph |

# Surface Street Intersections

| 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 | |

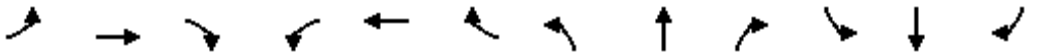
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|
| Volume Total | 56 | 1181 | 657 | 92 | 866 | 866 |
| Volume Left | 7 | 0 | 0 | 92 | 0 | 0 |
| Volume Right | 49 | 0 | 67 | 0 | 0 | 0 |
| cSH | 52 | 1700 | 1700 | 430 | 1700 | 1700 |
| Volume to Capacity | 1.08 | 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 | | |

| 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 | | | | | |

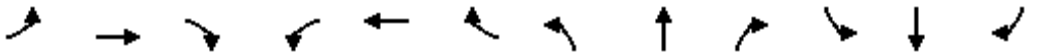
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 275.0 | | |
| Intersection Capacity Utilization | 69.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |



| 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 | | |

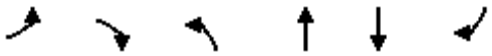
c Critical Lane Group



| 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 | | |

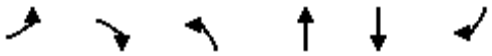
c Critical Lane Group



| 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



| 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

| 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 | |

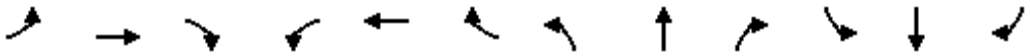
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|
| Volume Total | 11 | 1430 | 1887 | 233 | 711 | 711 |
| Volume Left | 6 | 0 | 0 | 233 | 0 | 0 |
| Volume Right | 6 | 0 | 1172 | 0 | 0 | 0 |
| cSH | 0 | 1700 | 1700 | 82 | 1700 | 1700 |
| Volume to Capacity | 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 | | |

| 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 | | | | | |

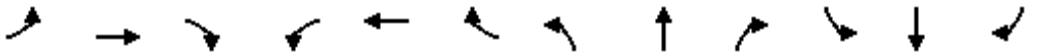
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | Err | | |
| Intersection Capacity Utilization | 106.6% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |



| 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 | | |

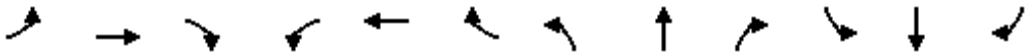
c Critical Lane Group



| 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 | | |

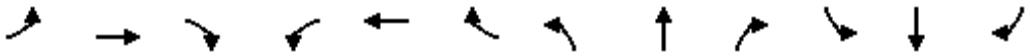
c Critical Lane Group



| 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 | | | 2 | |
| 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 | | |

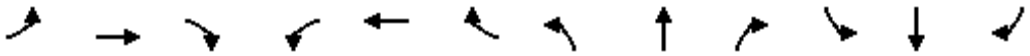
c Critical Lane Group



| 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 | | | 2 | |
| 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

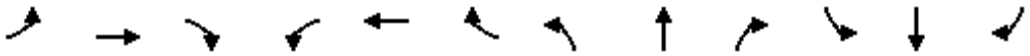


| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 0 | 0 | 455 | 40 | 100 | 165 | 45 | 0 | 0 | 245 | 40 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 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



| 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 | | c0.36 | | | | | |
| 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

| 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 | | |

| 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 | | 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

$L_{EQ}$ = (Equation 25-8 or 25-9)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4422 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2422 pc/h | (Equation 25-15 or 25-16) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}/2$ | No | |

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 40.8 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.489

Space mean speed in ramp influence area, $S_R$ = 48.6 mph

Space mean speed in outer lanes, $S_0$ = 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

$L_{EQ}$ = (Equation 25-8 or 25-9)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3191 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 6441 | 9000 | No |
| $v_{FO} = v_F - v_R$ | 5763 | 9000 | No |
| $v_R$ | 678 | 2000 | No |
| $v_3$ or $v_{av34}$ | 1625 pc/h | (Equation 25-15 or 25-16) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$/2 No

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 30.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.489 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 25-8 or 25-9)

$P_{FD}$ = 0.450 Using Equation 0

$v_{12} = v_R + (v - v_F) P_{FD}$ = 7096 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 8588 | 6750 | Yes |
| $v_{FO} = v - v_{FR}$ | 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 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 24.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.697 | |
| Space mean speed in ramp influence area, | $S_R$ = 45.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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, $f_{HV}$ | 0.983 | 0.964 | 1.000 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 5763 | 4148 | 667 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 25-8 or 25-9)

$P_{FD}$ = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4875 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 5763 | 6750 | No |
| $v_{FO} = v_F - v_R$ | 1615 | 6750 | No |
| $v_R$ | 4148 | 4400 | No |
| $v_3$ or $v_{av34}$ | 888 pc/h | (Equation 25-15 or 25-16) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$/2 No

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 5.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.541 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.0 | mph |
| Space mean speed in outer lanes, | $S_0$ = 60.3 | mph |
| Space mean speed for all vehicles, | $S$ = 49.5 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2825 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 3390 | 4500 | No |

$v_3$ or $v_{av34}$ = 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 2825 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 3390 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 22.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.332 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.7 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 50.7 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1695 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 2147 | 4500 | No |

$v_3$ or $v_{av34}$ = 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 1695 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 2147 | 4600 | No |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 12.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.249 | |
| Space mean speed in ramp influence area, | $S_R$ = 51.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 51.8 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 3421 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 7028 | 6750 | Yes |

$v_3$ or $v_{av34}$ 2455 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, $v_{12A}$ = 3421 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 7028 | 4600 | No |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 39.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.687 | |
| Space mean speed in ramp influence area, | $S_R$ = 46.1 | mph |
| Space mean speed in outer lanes, | $S_0$ = 47.5 | mph |
| Space mean speed for all vehicles, | $S$ = 46.6 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.582 Using Equation 1

$v_{12} = v_F (P_{FM})$ = 2415 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 5300 | 6750 | No |
| $v_3$ or $v_{av34}$ | 1733 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, $v_{12A}$ = 2415 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 5300 | 4600 | No |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 31.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.448 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = 274.77 (Equation 13-12 or 13-13)

$P_{FD}$ = 0.663 Using Equation 7

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2031 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 2712 | 6750 | No |
| $v_{FO} = v - v_R$ | 2021 | 6750 | No |
| $v_R$ | 691 | 2000 | No |
| $v_3$ or $v_{av34}$ | 681 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 20.8 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $D_S$ = 0.490

Space mean speed in ramp influence area, $S_R$ = 48.6 mph

Space mean speed in outer lanes, $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.547 Using Equation 5

$v_{12} = v_R + (v - v_F) P_{FD}$ = 3901 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 5989 | 6750 | No |
| $v_{FO} = v - v_R$ | 4606 | 6750 | No |
| $v_R$ | 1383 | 2000 | No |
| $v_3$ or $v_{av34}$ | 2088 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, $v_{12A}$ = 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 36.9 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.552 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 56.1 | mph |
| Space mean speed for all vehicles, | $S$ = 50.4 | 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/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, $f_{HV}$ | 0.983 | 0.964 | 1.000 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 2034 | 230 | 667 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2034 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$/2 No

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 8.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.449 | |
| Space mean speed in ramp influence area, | $S_R$ = 49.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 49.2 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4407 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}/2$ | No | |

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 28.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.469 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 48.9 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.119 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 685 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 6554 | 9000 | No |
| $v_3$ or $v_{av34}$ | 2539 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 | Yes | |

If yes, $v_{12A}$ = 2305 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 6554 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 24.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.356 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 50.6 | mph |
| Space mean speed for all vehicles, | $S$ = 50.5 | 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/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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 0.048 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 480 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 11300 | 9000 | Yes |
| $v_3$ or $v_{av34}$ | 4732 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | Yes | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | Yes | |

If yes, $v_{12A}$ = 3977 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 11300 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 41.9 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $M_S$ = 1.077

Space mean speed in ramp influence area, $S_R$ = 41.0 mph

Space mean speed in outer lanes, $S_0$ = 44.4 mph

Space mean speed for all vehicles, $S$ = 42.7 mph

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 226 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 2373 | 4500 | No |

$v_3$ or $v_{av34}$ 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 226 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 2373 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 13.6 pc/mi/ln

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

## Speed Estimation

| | | | |
|---|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.258 | | |
| Space mean speed in ramp influence area, | $S_R$ = 51.6 | mph | |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 452 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 3277 | 4500 | No |

$v_3$ or $v_{av34}$ = 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 452 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 3277 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 20.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.319 | |
| Space mean speed in ramp influence area, | $S_R$ = 50.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 50.8 | mph |

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 4407 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 |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}/2$ | No | |

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 8.8 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.469 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.9 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 1.000 Using Equation 0

$v_{12} = v_R + (v - v_F) P_{FD}$ = 6667 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 6667 | 4500 | Yes |
| $v_{FO} = v - v_F - v_R$ | 5989 | 4500 | Yes |
| $v_R$ | 678 | 4000 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 28.2 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.489 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.6 | mph |
| Space mean speed in outer lanes, | $S_0$ = N/A | mph |
| Space mean speed for all vehicles, | $S$ = 48.6 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 452 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 452 | 4500 | No |
| $v_3$ or $v_{av34}$ | 0 pc/h | (Equation 13-14 or 13-17) | |
| Is $v_3$ or $v_{av34}$ | > 2700 pc/h? | No | |
| Is $v_3$ or $v_{av34}$ | > 1.5 $v_{12}$ /2 | No | |

If yes, $v_{12A}$ = 452 (Equation 13-15, 13-16, 18, or 19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 452 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 7.1 pc/mi/ln

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

## Speed Estimation

Intermediate speed variable, $M_S$ = 0.306

Space mean speed in ramp influence area, $S_R$ = 51.0 mph

Space mean speed in outer lanes, $S_0$ = N/A mph

Space mean speed for all vehicles, $S$ = 51.0 mph

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 678 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 1243 | 4500 | No |

$v_3$ or $v_{av34}$ 0 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? No

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 No

If yes, $v_{12A}$ = 678 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{R12}$ | 1243 | 4600 | No |

## Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 11.1 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 0.293 | |
| Space mean speed in ramp influence area, | $S_R$ = 51.2 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5528 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2260 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 41.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.611 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.1 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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 | |
| Trucks and buses PCE, ET | 1.5 | 1.5 | 1.5 | |
| Recreational vehicle PCE, ER | 1.2 | 1.2 | 1.2 | |

| | | | | |
|---|---|---|---|---|
| Heavy vehicle adjustment, $f_{HV}$ | 0.964 | 0.983 | 0.966 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 15901 | 3390 | 0 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 7458 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2631 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 58.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.733 | |
| Space mean speed in ramp influence area, | $S_R$ = 45.5 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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, $f_{HV}$ | 0.964 | 0.983 | 0.966 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 10485 | 1356 | 2070 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 5336 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 10485 | 9000 | Yes |
| $v_{FO} = v - v_F - v_R$ | 9129 | 9000 | Yes |
| $v_R$ | 1356 | 2000 | No |
| $v_3$ or $v_{av34}$ | 2574 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 36.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.550 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 54.2 | mph |
| Space mean speed for all vehicles, | $S$ = 50.8 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 5935 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 12444 | 9000 | Yes |
| $v_{FO} = v - v_R$ | 11540 | 9000 | Yes |
| $v_R$ | 904 | 2000 | No |
| $v_3$ or $v_{av34}$ | 3254 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 51.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.509 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = -0.157 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -1425 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 12099 | 9000 | Yes |
| $v_3$ or $v_{av34}$ | 5264 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 3641 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 12099 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 46.5 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 3.191 | |
| Space mean speed in ramp influence area, | $S_R$ = 13.5 | mph |
| Space mean speed in outer lanes, | $S_0$ = 45.9 | mph |
| Space mean speed for all vehicles, | $S$ = 19.8 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = -0.185 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -2136 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 14748 | 9000 | Yes |

$v_3$ or $v_{av34}$ 6829 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 4608 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 14748 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 55.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 10.064 | |
| Space mean speed in ramp influence area, | $S_R$ = -75.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 5528 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2260 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 41.4 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.611 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.1 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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 | |
| Trucks and buses PCE, ET | 1.5 | 1.5 | 1.5 | |
| Recreational vehicle PCE, ER | 1.2 | 1.2 | 1.2 | |

| | | | | |
|---|---|---|---|---|
| Heavy vehicle adjustment, $f_{HV}$ | 0.964 | 0.983 | 0.966 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 15901 | 3390 | 0 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 7458 pc/h

## 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 |
| $v_3$ or $v_{av34}$ | 2631 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 58.0 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.733 | |
| Space mean speed in ramp influence area, | $S_R$ = 45.5 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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, $f_{HV}$ | 0.964 | 0.983 | 0.966 | |
| Driver population factor, $f_P$ | 1.00 | 1.00 | 1.00 | |
| Flow rate, $v_p$ | 10485 | 1356 | 2070 | pcph |

## Estimation of V12 Diverge Areas

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 5336 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 10485 | 9000 | Yes |
| $v_{FO} = v - v_F - v_R$ | 9129 | 9000 | Yes |
| $v_R$ | 1356 | 2000 | No |
| $v_3$ or $v_{av34}$ | 2574 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, $v_{12A}$ = 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, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 36.6 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.550 | |
| Space mean speed in ramp influence area, | $S_R$ = 47.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 54.2 | mph |
| Space mean speed for all vehicles, | $S$ = 50.8 | 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: | 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

$L_{EQ}$ = (Equation 13-12 or 13-13)

$P_{FD}$ = 0.436 Using Equation 8

$v_{12} = v_R + (v - v_F) P_{FD}$ = 5935 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{Fi} = v_F$ | 12444 | 9000 | Yes |
| $v_{FO} = v - v_R$ | 11540 | 9000 | Yes |
| $v_R$ | 904 | 2000 | No |
| $v_3$ or $v_{av34}$ | 3254 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ 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, $D = 4.252 + 0.0086\ v_R - 0.009\ L_D$ = 51.3 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $D_S$ = 0.509 | |
| Space mean speed in ramp influence area, | $S_R$ = 48.4 | mph |
| Space mean speed in outer lanes, | $S_0$ = 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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = -0.157 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -1425 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 12099 | 9000 | Yes |
| $v_3$ or $v_{av34}$ | 5264 pc/h | (Equation 13-14 or 13-17) | |

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 3641 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 12099 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 46.5 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 3.191 | |
| Space mean speed in ramp influence area, | $S_R$ = 13.5 | mph |
| Space mean speed in outer lanes, | $S_0$ = 45.9 | mph |
| Space mean speed for all vehicles, | $S$ = 19.8 | mph |

# HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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

$L_{EQ}$ = (Equation 13-6 or 13-7)

$P_{FM}$ = -0.185 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -2136 pc/h

## Capacity Checks

| | Actual | Maximum | LOS F? |
|---|---|---|---|
| $v_{FO}$ | 14748 | 9000 | Yes |

$v_3$ or $v_{av34}$ 6829 pc/h (Equation 13-14 or 13-17)

Is $v_3$ or $v_{av34}$ > 2700 pc/h? Yes

Is $v_3$ or $v_{av34}$ > 1.5 $v_{12}$ /2 Yes

If yes, $v_{12A}$ = 4608 (Equation 13-15, 13-16, 13-18, or 13-19)

## Flow Entering Merge Influence Area

| | Actual | Max Desirable | Violation? |
|---|---|---|---|
| $v_{12A}$ | 14748 | 4600 | Yes |

## Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 55.7 pc/mi/ln

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

## Speed Estimation

| | | |
|---|---|---|
| Intermediate speed variable, | $M_S$ = 10.064 | |
| Space mean speed in ramp influence area, | $S_R$ = -75.8 | mph |
| Space mean speed in outer lanes, | $S_0$ = 41.5 | mph |
| Space mean speed for all vehicles, | S = 233.4 | mph |

# Surface Street Intersections

| 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 | |

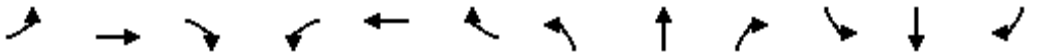
| Direction, Lane # | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|
| Volume Total | 49 | 886 | 886 | 67 | 92 | 866 | 866 |
| Volume Left | 0 | 0 | 0 | 0 | 92 | 0 | 0 |
| Volume Right | 49 | 0 | 0 | 67 | 0 | 0 | 0 |
| cSH | 652 | 1700 | 1700 | 1700 | 386 | 1700 | 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 | | |

| 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 | | | | | | |

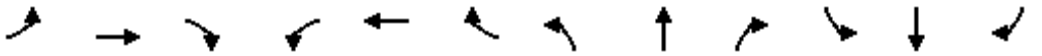
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 0.3 | | |
| Intersection Capacity Utilization | 60.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |



| 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 | | | |

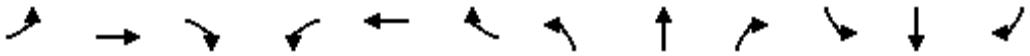
c Critical Lane Group



| 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 | | | |

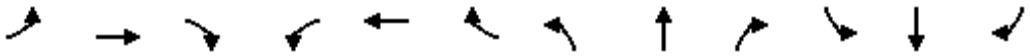
c Critical Lane Group



| 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 | | |

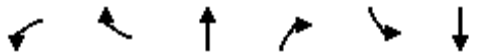
c Critical Lane Group



| 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



| 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 |

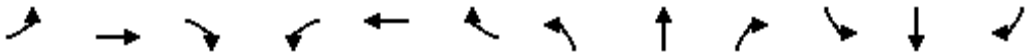
| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 33.7 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 17.0 |
| Intersection Capacity Utilization | 80.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| 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 | | |

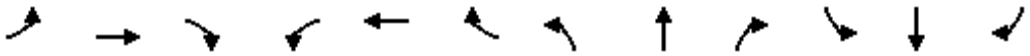
c Critical Lane Group



| 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 | | |

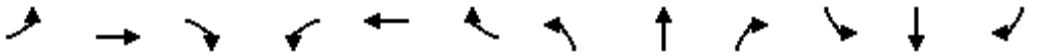
c Critical Lane Group



| 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 | | |

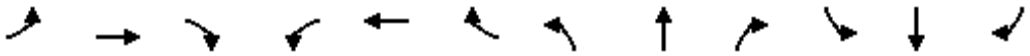
c Critical Lane Group



| 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 | | | 2 | |
| Permitted Phases | 4 | | | | | | | | | 2 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | | | | 30.0 | | 21.0 | 21.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | | | | 30.0 | | 21.0 | 21.0 | |
| Actuated g/C Ratio | 0.33 | 0.33 | | | | | | 0.50 | | 0.35 | 0.35 | |
| Clearance Time (s) | 5.0 | 5.0 | | | | | | 5.0 | | 5.0 | 5.0 | |
| Lane Grp Cap (vph) | 584 | 547 | | | | | | 1746 | | 396 | 1227 | |
| v/s Ratio Prot | | 0.01 | | | | | | c0.06 | | | c0.07 | |
| v/s Ratio Perm | c0.01 | | | | | | | | | 0.03 | | |
| v/c Ratio | 0.03 | 0.02 | | | | | | 0.13 | | 0.08 | 0.20 | |
| Uniform Delay, d1 | 13.5 | 13.4 | | | | | | 8.0 | | 13.0 | 13.6 | |
| Progression Factor | 1.00 | 1.00 | | | | | | 1.73 | | 0.99 | 0.99 | |
| Incremental Delay, d2 | 0.1 | 0.1 | | | | | | 0.1 | | 0.4 | 0.4 | |
| Delay (s) | 13.6 | 13.5 | | | | | | 14.0 | | 13.3 | 13.9 | |
| Level of Service | 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



| 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 | | | 2 | |
| 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

| 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 | | |

| 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: _____ Date: 6/11/2012

Dahir Egal, PE

PARSONS BRINCKERHOFF

**Memorandum**

**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 31st 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 5th 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 5th 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 5th Avenue which is adjacent to a low income/EJ neighborhood.***

PARSONS BRINCKERHOFF

**Vehicle Mix and Traffic Circulation**

The basis for this qualitative analysis regarding traffic circulation, as it affects Bryant Street truck traffic and 5th 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 / 5th / 8th intersections | 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 (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 5th Avenue at Federal Boulevard.

In the current and No-build conditions, vehicles with origins and destinations along 5th Avenue, 7th 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 5th, 7th and 8th.

An important point in this current configuration is that vehicles on the south side of US 6 can utilize the 5th 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 5th 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 5th 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 5th Avenue.

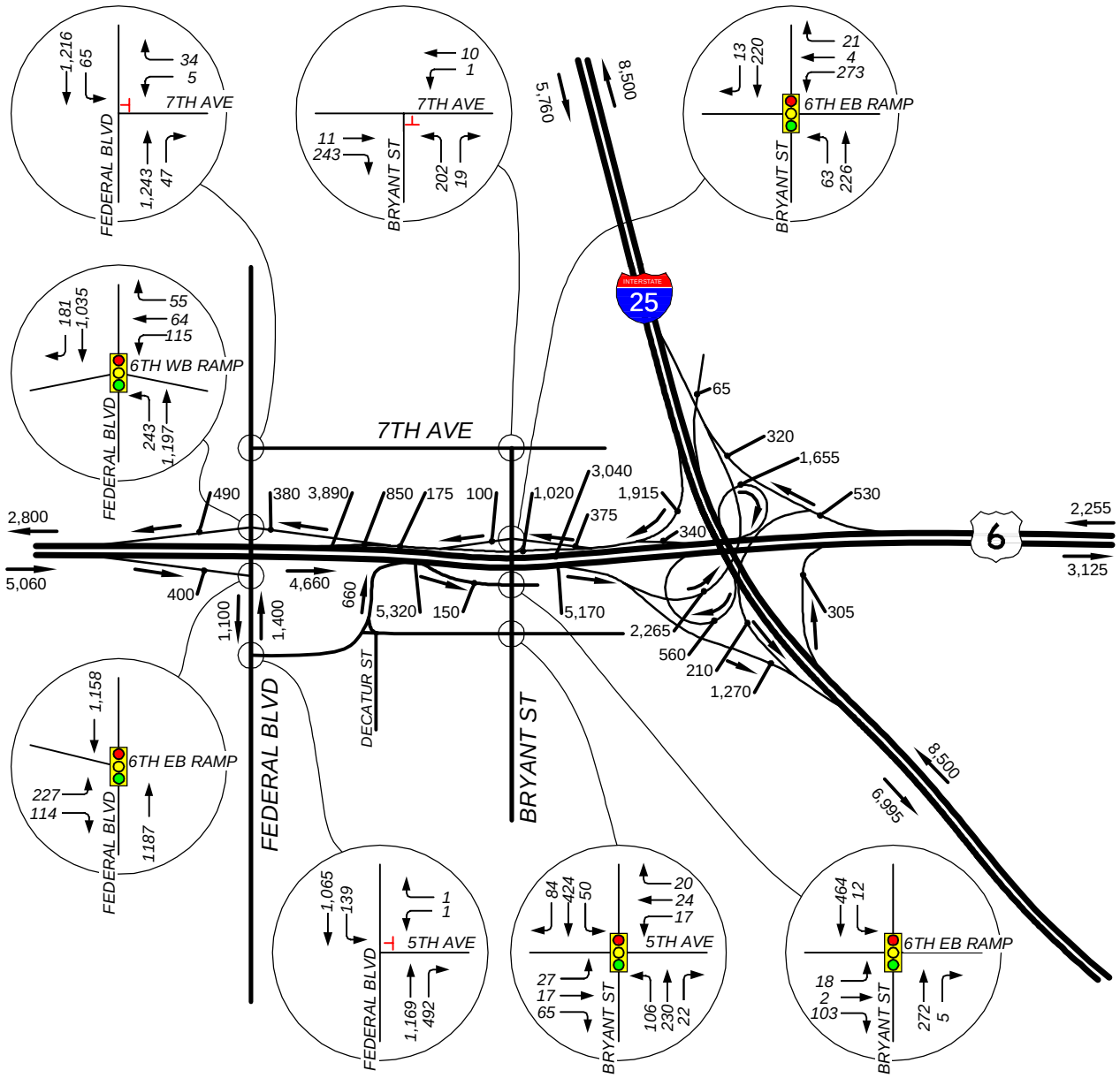
**Table 2: Truck volume/ percentage - Increase (decrease)**

| | 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 5th 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 5th 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 5th 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 5th 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.



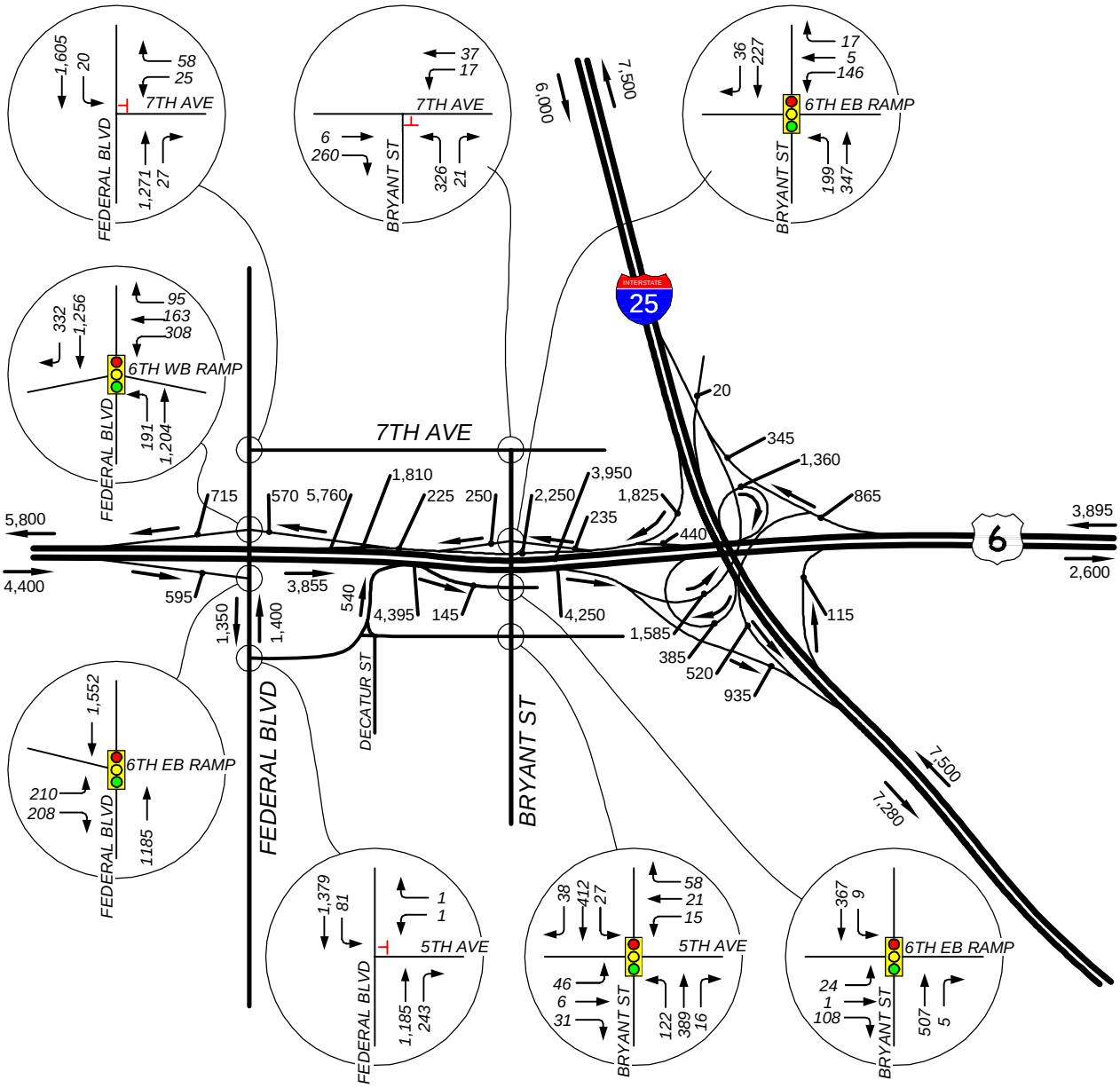

## LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- XXX — AM PEAK HOUR TRAFFIC VOLUME
- TRAFFIC DIRECTION

N

DRAFT

| | | | | |
|---|---|---|---|---|
| DOT DEPARTMENT OF TRANSPORTATION | Existing AM Peak Hour | US 6 Transportation Analysis | 2012 | AQ-1 |




## LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- XXX — PM PEAK HOUR TRAFFIC VOLUME
- TRAFFIC DIRECTION

N

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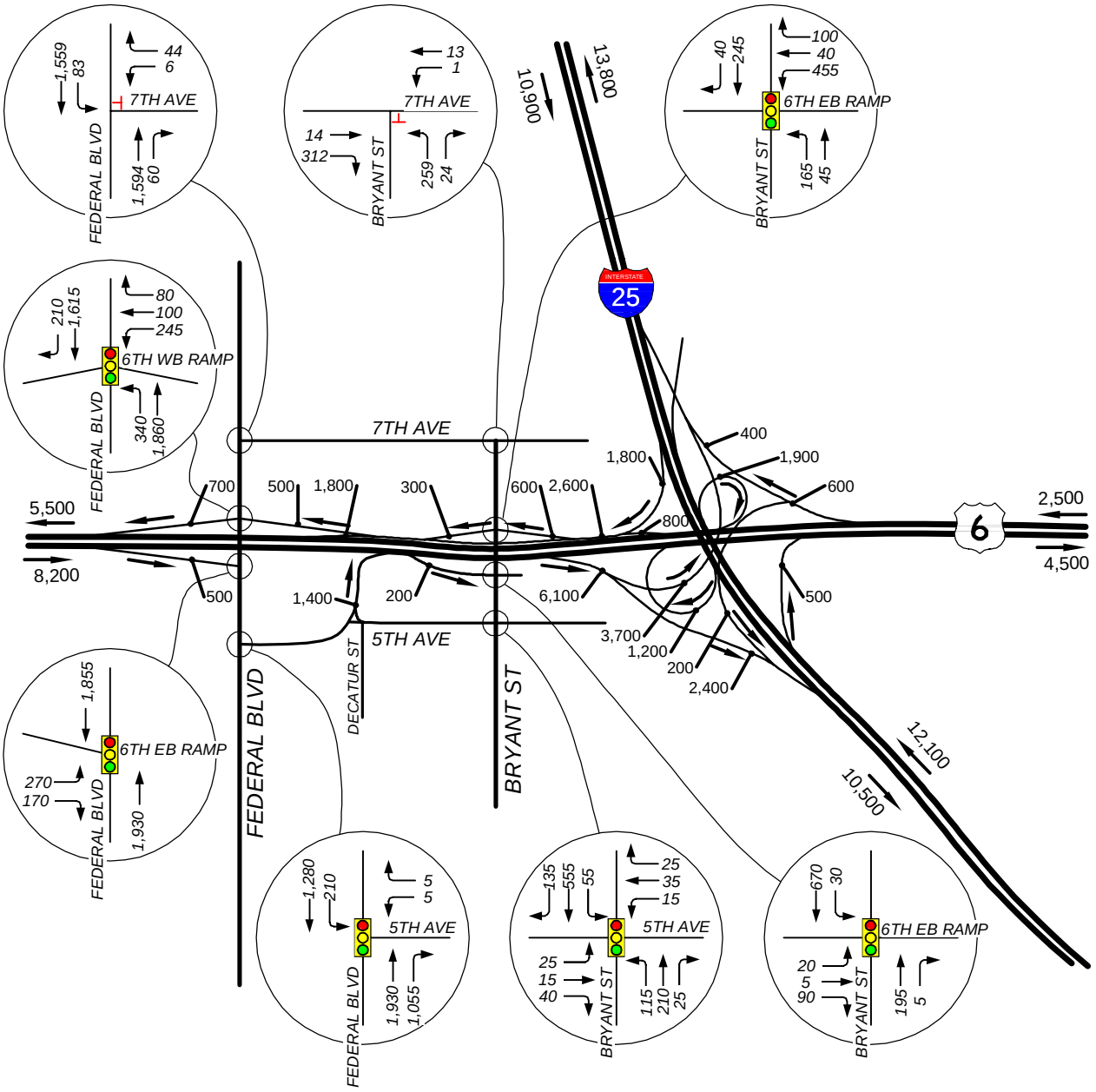
|---|---|---|---|---|
| DOT DEPARTMENT OF TRANSPORTATION | Existing PM Peak Hour | US 6 Transportation Analysis | 2012 | AQ-2 |




## LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- XXX — PM PEAK HOUR TRAFFIC VOLUME
- TRAFFIC DIRECTION

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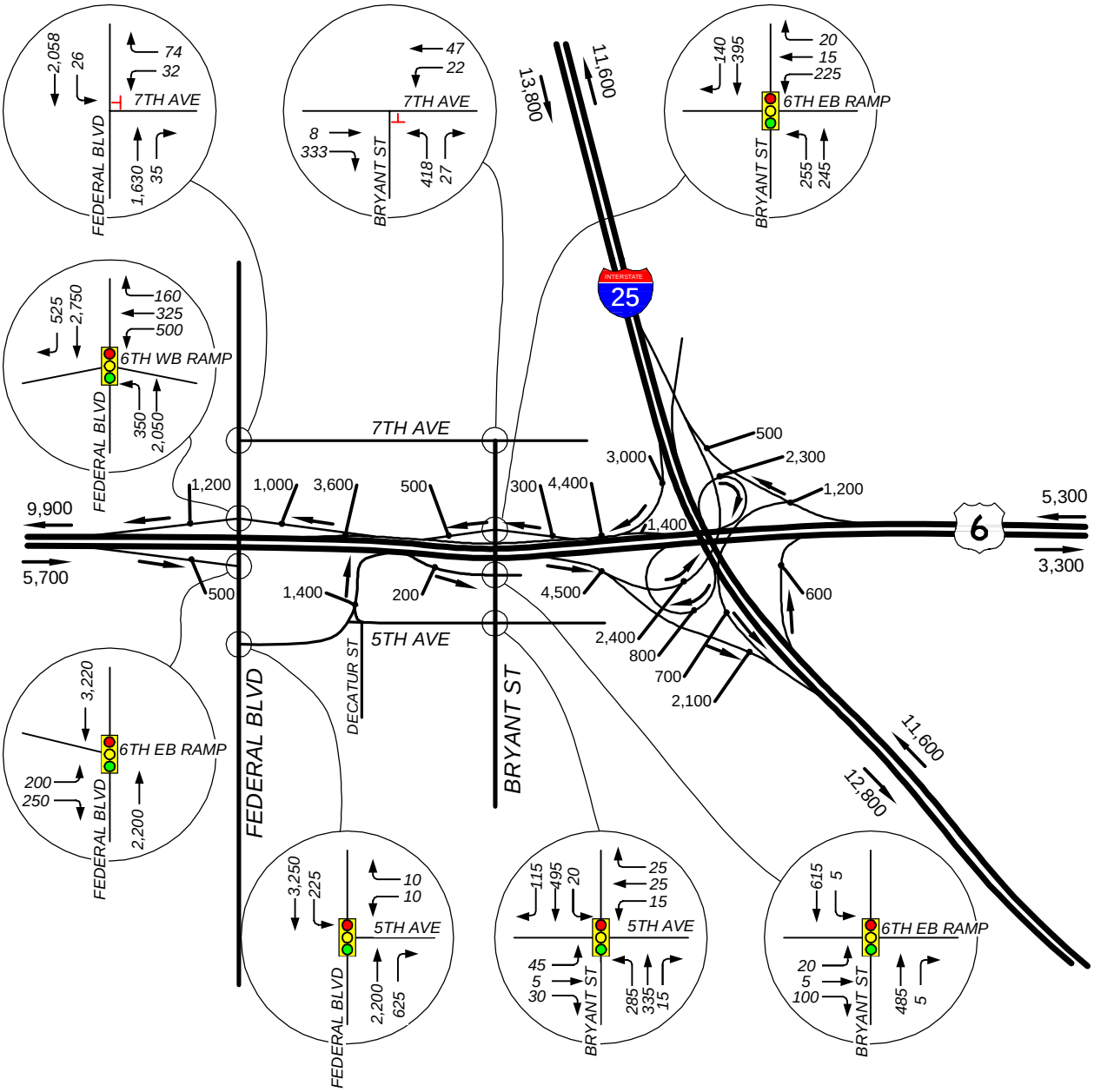
|---|---|---|---|---|
| DOT DEPARTMENT OF TRANSPORTATION | 2035 No-Build AM Peak Hour | US 6 Transportation Analysis | 2012 | AQ-3 |




## LEGEND

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- STOP SIGN
- XXX — PM PEAK HOUR TRAFFIC VOLUME
- TRAFFIC DIRECTION

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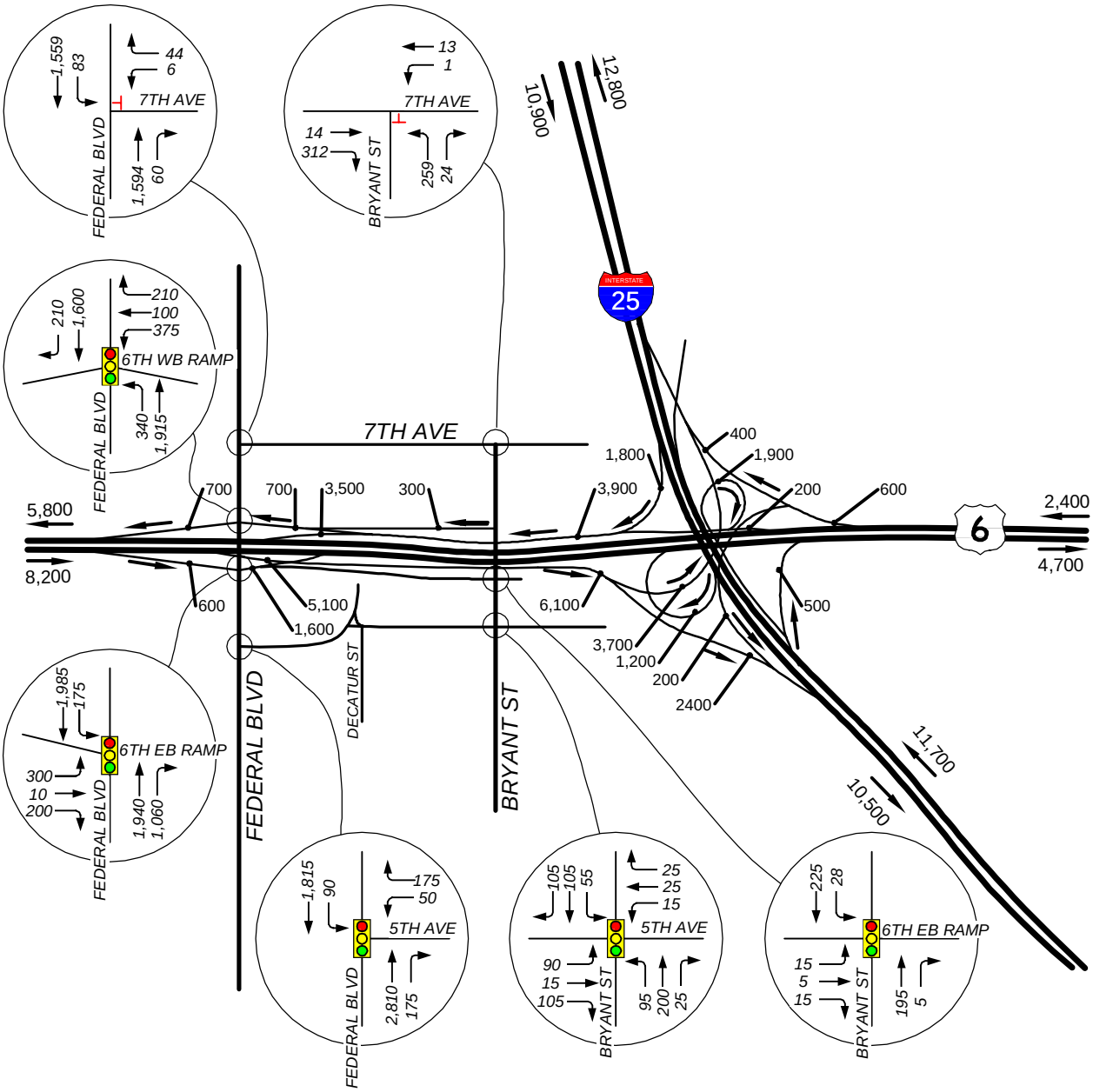
|---|---|---|---|---|
| DEPARTMENT OF TRANSPORTATION | 2035 No-Build PM Peak Hour | US 6 Transportation Analysis | 2012 | AQ-4 |




## LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- XXX — AM PEAK HOUR TRAFFIC VOLUME
- TRAFFIC DIRECTION

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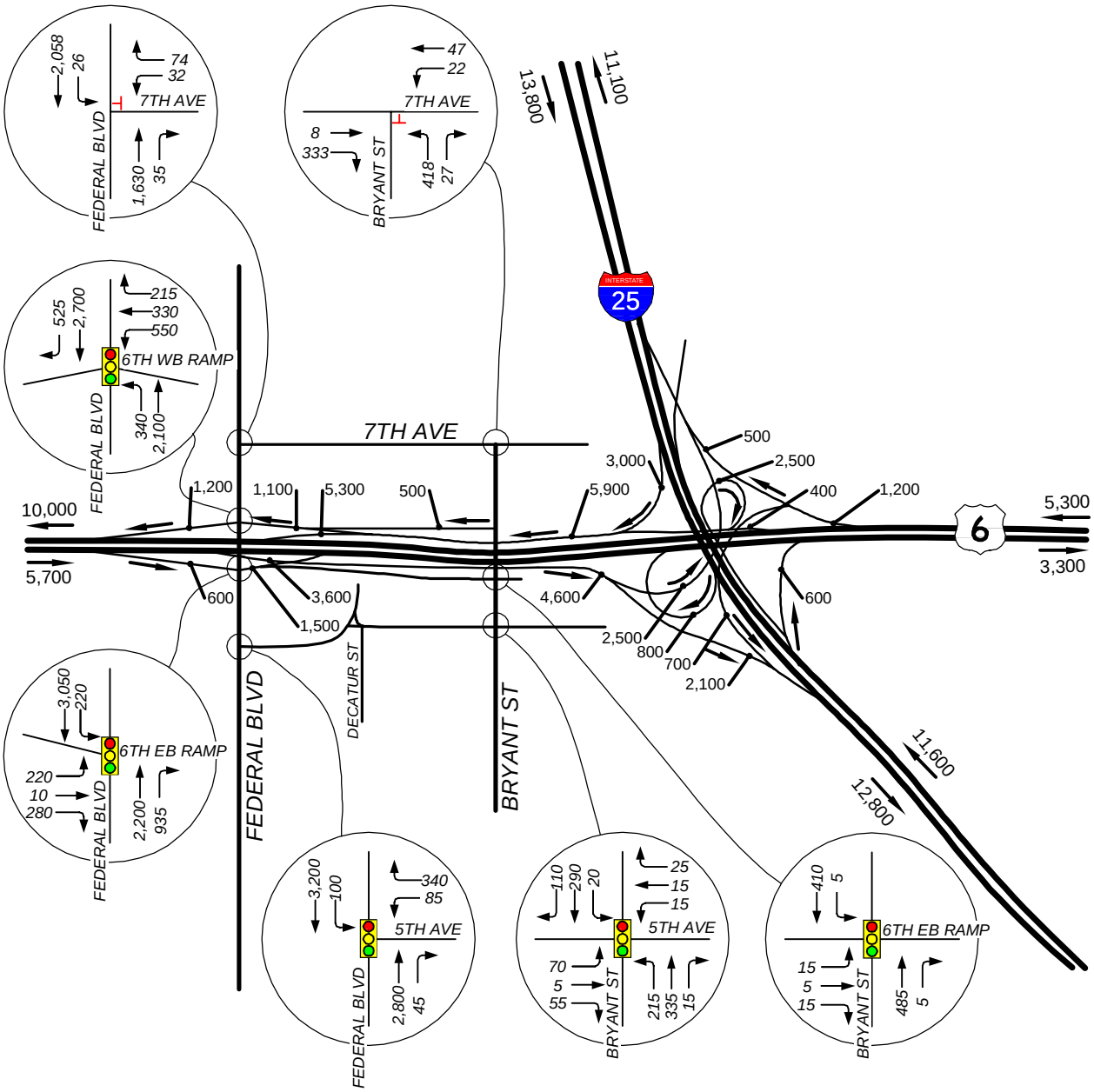
| | | | | |
|---|---|---|---|---|
| DEPARTMENT OF TRANSPORTATION | 2035 Proposed Project AM Peak Hour | US 6 Transportation Analysis | 2012 | AQ-5 |




## LEGEND

- TRAFFIC SIGNAL
- STOP SIGN
- XXX — PM PEAK HOUR TRAFFIC VOLUME
- TRAFFIC DIRECTION

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|---|---|---|---|---|
| DEPARTMENT OF TRANSPORTATION | 2035 Proposed Project PM Peak Hour | US 6 Transportation Analysis | 2012 | AQ-6 |