Traffic Report
Technical Memorandum

New Pueblo Freeway

CDOT Project No. IM 0251-165

Project Control No. 12831

Colorado Department of Transportation

February 2005

In some cases, information in this Environmental Technical Report may have been refined or updated as preparation of the DEIS advanced. In such cases, the information and conclusions presented in the DEIS supersede all previous background material included in this Technical Report.

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Project Description

The Federal Highway Administration (FHWA), in cooperation with the Colorado Department of Transportation (CDOT), is preparing an Environmental Impact Statement (EIS) for the New Pueblo Freeway project, a proposal to improve a 7-mile segment of Interstate 25 (I-25) through Pueblo, Colorado. Improvements are necessary to address an outdated roadway and bridges with inadequate geometrics, safety issues, and existing and future traffic demand.

Alternatives under consideration include taking no action (No Action Alternative), reconstruction of the interstate on essentially the existing alignment (Existing I-25 Alternative), and reconstruction of the interstate on existing and new alignments (Modified I-25 Alternative). The alternatives are further described as follows:

- **No Action Alternative –** This alternative provides only for minor improvements, repairs, and other maintenance actions. The existing four-lane highway will otherwise remain unchanged.
- **Existing I-25 Alternative –** This alternative consists of reconstructing I-25 to six lanes on essentially the same location, reconfiguring and eliminating access points to the interstate to improve safety, and providing other improvements to the local street system to enhance system connectivity and traffic movement near the interstate.
- **Modified I-25 Alternative –** This alternative consists of rebuilding I-25 to six lanes and providing the other improvements included in the Existing Alternative, except the alignment would be shifted to accommodate different interchange configurations.

Transportation Management strategies and design variations of grade and alignment are incorporated into the build alternatives.

1.0 Executive Summary

This report summarizes the traffic analysis completed to support the evaluation of design and operational alternatives for the Interstate 25 (I-25) New Pueblo Freeway project. The analysis included travel demand forecasting and the evaluation of traffic operations for the preferred alternatives for the I-25 corridor. These alternatives were the product of an extensive screening and evaluation process that used a broad range of community, environmental, and technical criteria.

The purpose of the traffic analysis was three-fold:

- To create a set of reasonable, defensible, and reproducible travel demand estimates;
- To establish the operational needs for improvements; and
- To analyze traffic in a consistent way to identify differences between alternatives.

Current average annual daily traffic (AADT) volumes on I-25 within the project limits vary from 26,000 to 58,000. Heavy vehicles comprise five to ten percent of the traffic. While freeway segments within the project limits are currently operating at level of service (LOS) D or better, there are localized operational issues. Accidents rates are 28% higher than

statewide averages, with injury and fatality rates even higher. AADT volumes on other state highways in the I-25 corridor vary from 13,600 to 31,500.

The future year evaluation focused on a comparison between no action and two build alternatives for the 2025 design year. PM peak traffic was analyzed on a network of the I-25 corridor from US 50/SH 57 to Pueblo Boulevard, including all interchanges and major crossroads and parallel arterials. The improvements for the alternatives included widening I-25 to six basic lanes and interchange realignments throughout the corridor.

The first step in the process was travel demand forecasting using the Pueblo Area Council of Governments (PACOG) travel demand model. The first task was to convert the existing model (developed in 1993) to a new software platform (TransCAD) and to complete testing of the new model. Forecasts were developed for the no action and build alternatives using existing traffic counts as a base. Then, traffic analysis was undertaken, using the CORSIM simulation model to estimate measures of effectiveness (e.g., level of service (LOS) and delay). Throughout the modeling process, interim results were reviewed by a technical group of City of Pueblo and Colorado Department of Transportation (CDOT) staff.

The operations analysis of the No Action Alternative suggested some operational deficiencies will occur by 2025. Most of the problems are predicted for the mainline freeway:

- On southbound I-25, LOS F is predicted from 1st to Ilex. LOS D or worse is predicted north of US 50B, between the 29th ramps, from US 50B to Ilex and from Abriendo to Central.
- On northbound I-25, LOS D or worse is predicted from Central Avenue to Abriendo Avenue and between the 13th Street ramps.

The Highway Capacity Manual (HCM) analysis output from Synchro predicted that the following intersections will operate at LOS E or F during the PM peak in 2025: US50-SH47/Elizabeth (LOS E), SH47/Dillon (LOS F), the 29th/SB I-25 ramp terminal (LOS F), and US 50B/Bonforte (LOS E).

The two build alternatives, Existing I-25 Alignment and Modified I-25 Alignment, were found to provide improved operations compared to the No Action Alternative. The two build alternatives provided very similar operations, both on the freeway and surface streets, to each other. For both build alternatives, all freeway segments are predicted to operate at LOS C or better.

For the surface streets all intersections will operate at LOS D or better except for one. The HCM analysis output predicts that the intersection of 8th/Santa Fe will operate at LOS E for the Modified I-25 Alternative[1]. The only major operational issue for the build scenarios was the over-capacity northbound loop ramp at Pueblo Boulevard, which caused congestion at the southbound I-25 ramp terminal intersection at Pueblo Boulevard. For the operational analysis, the loop ramp was widened to two lanes to prevent queuing on Pueblo Blvd and to allow the traffic to filter through the model network. This issue will be resolved in the design phase.

[1] The CORSIM analysis predicted that this intersection will operate at LOS C. Since the HCM analysis is overly conservative in predicting delay with high right-turn volumes, it is likely that this intersection will operate at the CORSIM predicted LOS.

System performance for the build alternatives is better than no action, using measures of effectiveness like average speed, total delay, and delay per mile. For example, mainline freeway speeds improve by 10%, total system delay (minutes/vehicle miles traveled) decreases by 3%, and total vehicle-miles served increases by 8% with the build alternatives. A sensitivity analysis was also conducted that illustrates that the system improvements are consistent even if 2025 demand is higher than predicted.

Additionally, a separate analysis was conducted along US 50B to determine the effect of a future intersection at Erie Avenue. The results of the analysis showed that adding the Erie intersection would not adversely affect US 50B and that the intersections along US 50B would operate at LOS D or better in the Year 2025.

2.0 Introduction

This report describes work undertaken as a portion of the evaluation of design and operational alternatives for the Interstate 25 (I-25) New Pueblo Freeway project in Pueblo, CO. Specifically, it addresses existing corridor conditions, travel demand forecasting, and the evaluation of traffic conditions for the I-25 corridor arising from the alternative analysis . These alternatives resulted from an extensive process of screening and evaluation on a broad range of community, environmental and technical criteria .

The purpose of the traffic analysis was to provide a screening-level view of the operations of the alternatives. To that end, the goals of the traffic analysis were set as follows:

- Establish the existing operational deficiencies.
- Create a set of reasonable, defensible, and reproducible travel demand estimates for various corridor alternatives.
- Analyze traffic in a consistent way to identify, at a high level, differences between alternatives.

In general, the screening and evaluation process, focused on sets of alternatives, resulted in two alternatives, which were compared based on a number of different types of evaluation criteria and measures. For the traffic evaluation, descriptions of both alternatives (as well as a “No Action” scenario for comparative purposes) were coded into both travel demand estimation models and traffic simulation models.

The PM peak hour in the year 2000 was selected for analysis of existing conditions. The PM peak hour in the year 2025 was selected as the analysis period for each modeled alternative. Each corridor alternative was modeled along I-25 from US Highway 50/State Highway 47 to Pueblo Blvd. For each alternative, all interchanges and main crossroads were modeled to gauge what kind of impact the change in traffic volumes had on the freeway and on the arterial street network. The major north-south streets that parallel I-25, Santa Fe Ave. and Dillon Dr., were also included in the models.

Outputs from the travel demand estimation process (traffic volumes stratified by turning movements) were translated into inputs to the traffic simulation models, which were in turn used to assess operational implications of the expected traffic volumes and movements. The traffic simulation process resulted in a variety of measures of effectiveness (MOEs). The

specific MOEs included intersection delay and level of service (LOS), freeway speeds and LOS, and system performance (e.g., total delay, vehicle miles traveled).

In this report, Section 3 describes the existing conditions for the corridor. Sections 4 and 5 describe the sets of alternatives evaluated throughout the project. Sections 6 and 7 document the detailed process and parameters used in developing both the traffic forecasts using the travel demand models and the traffic simulations that provided the operational results and comparisons between alternatives. This process was repeated four separate times, to evaluate interim build alternatives (labeled A and B, then A1, A2, and B1, then C1 and C2), and then a final set of alternatives (existing alignment and modified alignment). Section 8 summarizes the analysis results, and Section 9 highlights the impacts and mitigations that will be addressed in the Environmental Impact Statement (EIS).

3.0 Existing Conditions

3.1 Existing Transportation System

The existing transportation system provides for four modes of travel in Pueblo: private vehicles and transit, which operate on the existing freeway corridor and the arterial street network; and bicycles and pedestrians, which operate via bicycle trails or the arterial street network. The freeway network, transit system and bicycle and pedestrian facilities are described in the following sections.

3.1.1 Freeway Network

I 25 through the City of Pueblo is among the oldest segments of the interstate system in Colorado. This segment of I 25 was constructed between 1949 and 1959 and predates the National Interstate Program.

Figure 3-1 provides information on the existing I-25 interchanges within the study corridor.

3.1.2 Transit System

Pueblo Transit operates 12 routes as identified below:

- Route 1 Eastside
- Route 2 Bessemer
- Route 3 Irving Place
- Route 4 Berkley/Beulah
- Route 5 Fairmont Park
- Route 6 Pueblo Mall
- Route 7 Highland Park
- Route 8 Centennial
- Route 9 University
- Route 10 Belmont
- Route 11 Red Creek Ride
- Route 12 Lake Avenue

These routes originate at the Pueblo Transit Center at 1st and Court Streets.

Figure 3-2 displays the existing transit service routes as of September 2003.

Span of Service

Table 3-1 below displays the span of service for Pueblo transit routes.

TABLE 3-1
Pueblo Transit Service: Span of Service

Route	Days of Service	Begin Service	End Service
Route 1--Eastside	Monday-Saturday	6:30 AM	6:00 PM
Route 2--Bessemer	Monday-Friday	6:30 AM	6:30 PM
	Saturday	7:00 AM	6:30 PM
Route 3—Irving Place	Monday-Saturday	6:30 AM	6:00 PM
Route 4—Berkley/Beulah	Monday-Friday	6:30 AM	6:30 PM
	Saturday	7:00 AM	6:30 PM
Route 5—Fairmont Park	Monday-Saturday	6:30 AM	6:30 PM
Route 6—Pueblo Mall	Monday-Saturday	6:30 AM	6:00 PM
Route 7—Highland Park	Monday-Saturday	6:30 AM	6:30 PM
Route 8--Centennial	Monday-Saturday	7:00 AM	6:30 PM
Route 9--University	Monday-Saturday	6:30 AM	6:30 PM
Route 10--Belmont	Monday-Saturday	6:00 AM	6:30 PM
Route 11—Red Creek Ride	Monday-Saturday	6:00 AM	6:00 PM
Route 12—Lake Avenue	Monday-Saturday	6:30 AM	6:30 PM

Source: City of Pueblo website: http://www.pueblo.us/cgi-bin/gt/tpl_page.html,template=1&content=183&nav1=1&

Fares

Fares for regular service are 75 cents for adults; children 0-6, accompanied by an adult are free; student's ages 7 to 18 are 50 cents and seniors, the disabled and Medicare recipients are 35 cents. Citi-Lift service is offered at $1.50 per trip. Monthly passes are available and range from $10 to $20.

Other Service

Pueblo Transit operates a door-to-door demand response paratransit service known as Citi-Lift. Citi-Lift provides service to those who are Americans with Disabilities Act (ADA) certified from Monday through Saturday, 6:00 AM to 6:30 PM.

FIGURE 3-1
Existing Configuration of the I-25 Freeway Corridor

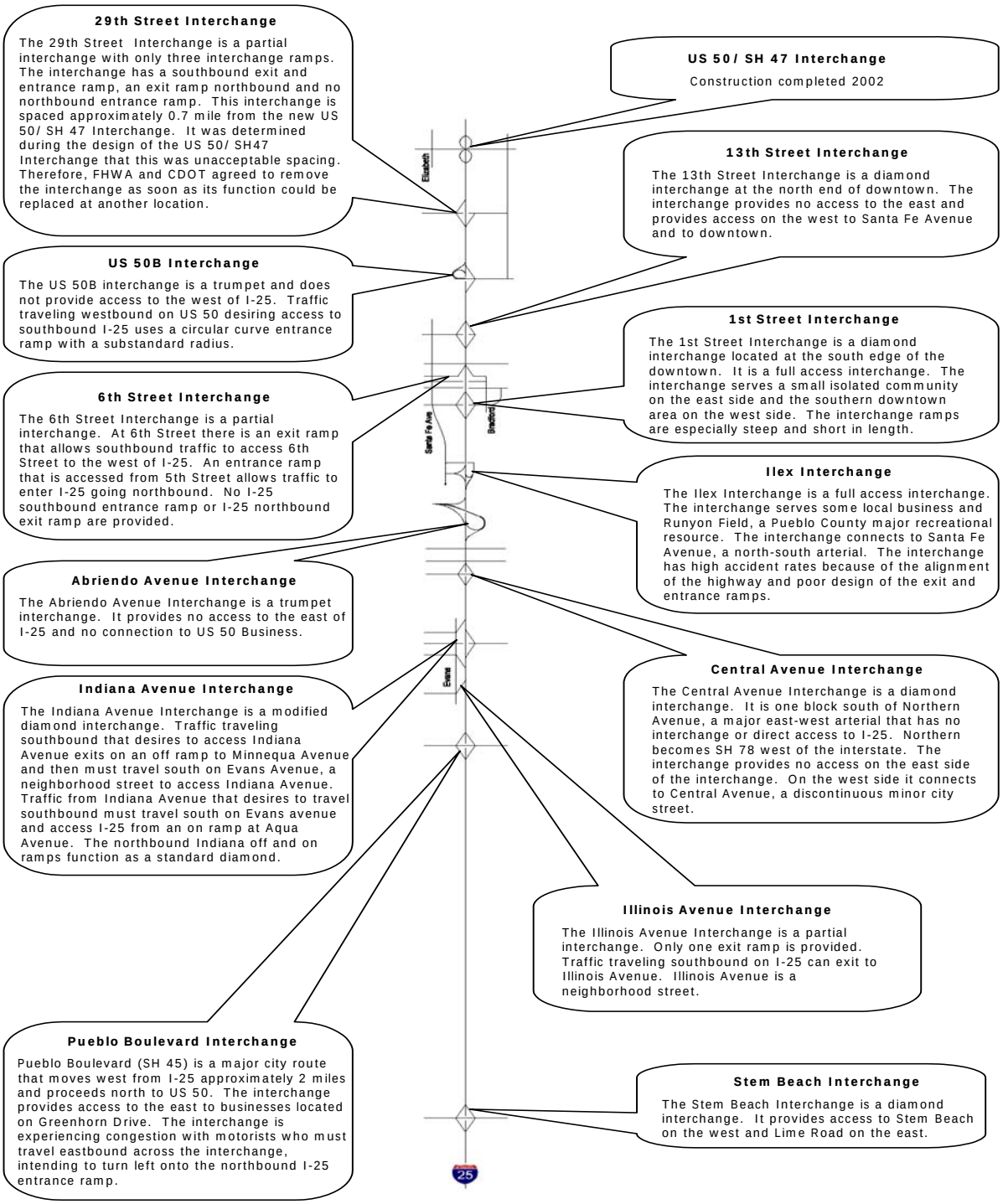
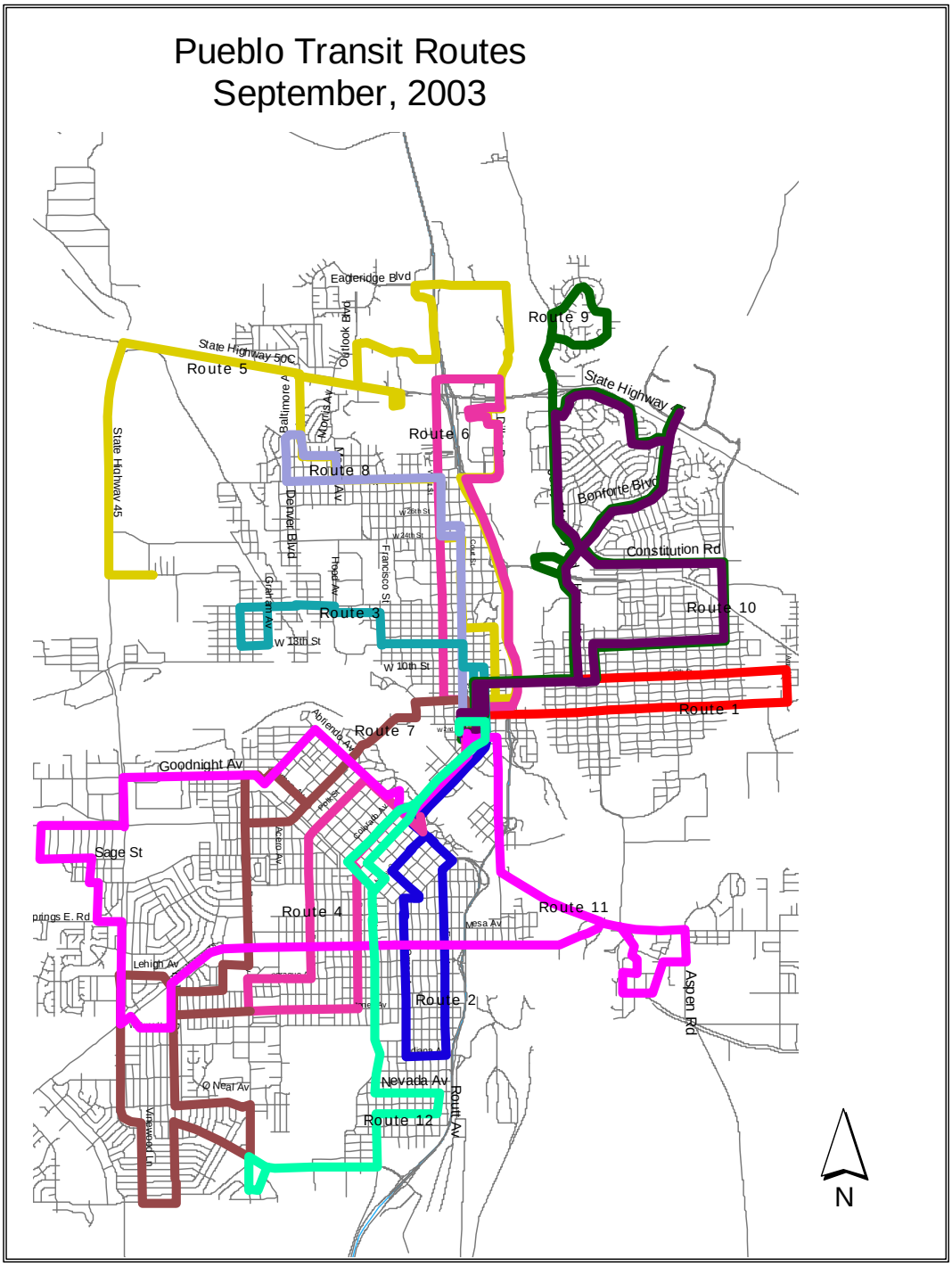


FIGURE 3-2
2003 Transit Service



3.1.3 Bicycle and Pedestrian Facilities

The existing on-street bicycle trails, shown in Figure 3-3, follow Fountain Creek north, go to the northwest through the Historic Arkansas Riverwalk to Union Historic District along the Arkansas and then west to Lake Pueblo, and go south and west from the Arkansas to Beulah and Pueblo Mountain Park.

The Pueblo Area Council of Governments (PACOG) published bicycle and pedestrian priorities (October, 2000) as part of the Interstate 25 Corridor Study. Priorities for bicycle and pedestrian improvements were ranked according to low, medium or high.

The high priorities included:

- Constructing a new crossing at the Arkansas River and I-25 (if I-25 is realigned);
- Constructing a bridge from Mineral Palace Park across I-25, the railroad and Fountain Creek;
- If the Abriendo interchange connects with roadways to the east, a bike/pedestrian connection should be included to link neighborhoods with existing trails;
- The provision of a trail from Pueblo Boulevard and I-25 to the entrance of St. Charles Lakes;
- The provision of a trail from Pueblo Boulevard and I-25 to Minnequa Lake;
- The construction of a trail that links from the northern end of the HARP project to 4th Street;
- Information, safety, and mileage markers systemwide.

3.2 Existing Travel Conditions in the Corridor

The following sections outline the existing travel conditions in the study corridor, including daily volume, percent trucks and accident rates.

3.2.1 Corridor Traffic

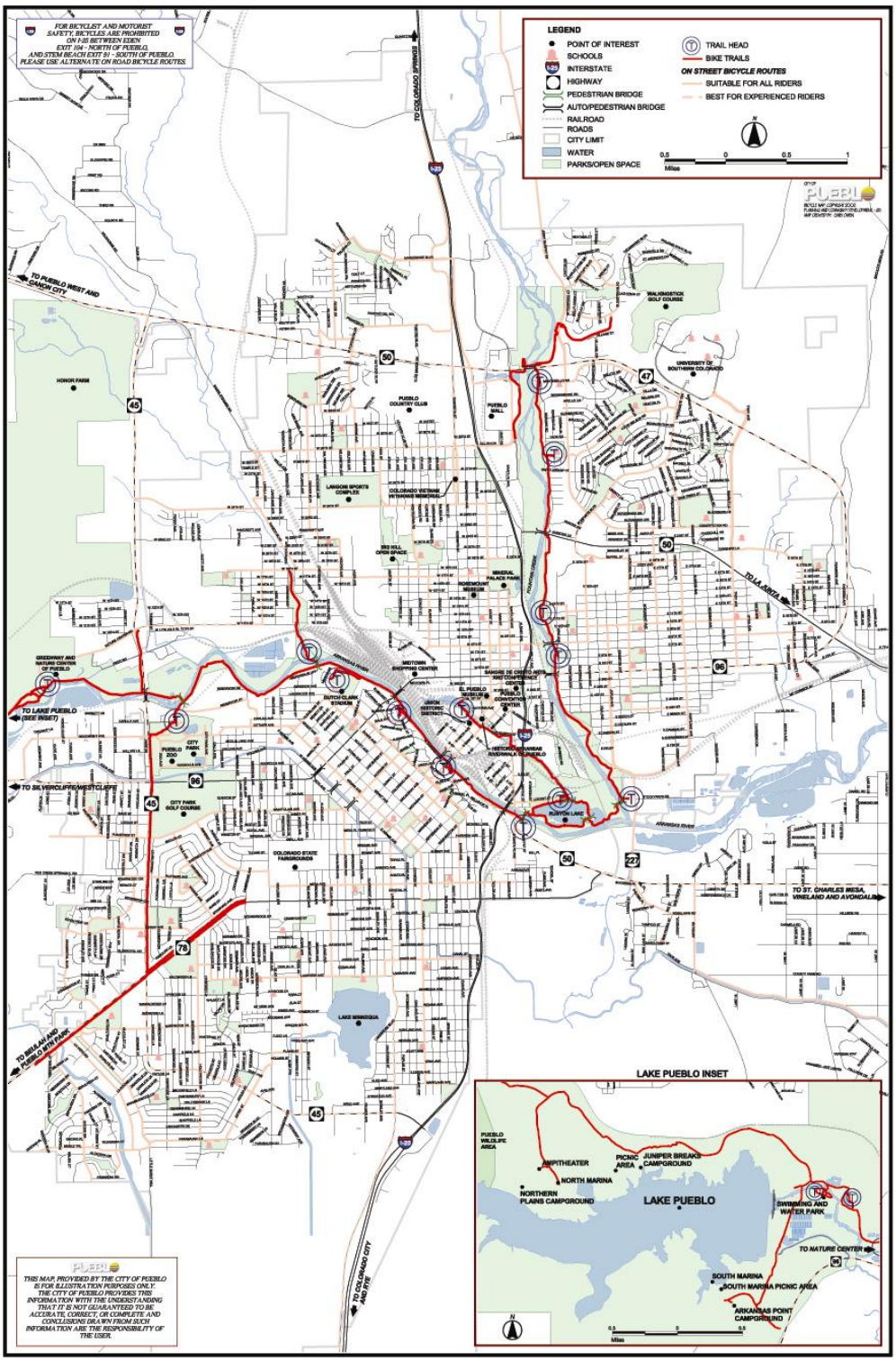
Table 3-2 and Figure 3-4 shows the 2002 Average Annual Daily Traffic (AADT) on the I-25 corridor. AADT (two-way) on I-25 ranges from a low of 25,882 from the Illinois interchange to the Pueblo Boulevard interchange to the high of 67,455 in the segment from 50B to 13th Street.

TABLE 3-2
Existing (2002) AADT (both directions) on the I-25 Corridor

From US 50/47 to 29th Street	From 29th Street to 50B	From 50B to 13th Street	From 13th Street to 1st Street	From 1st Street to Ilex	From Abriendo to Central	From Central to Minnequa	From Illinois to Pueblo Boulevard
40,915	59,323	67,455	45,708	46,893	48,100	31,392	25,882

* Source: Colorado Department of Transportation

FIGURE 3-3
2002 Bicycle Trails



* Source: City of Pueblo Planning and Community Development - GIS

FIGURE 3-4
Existing Annual Average Daily Traffic

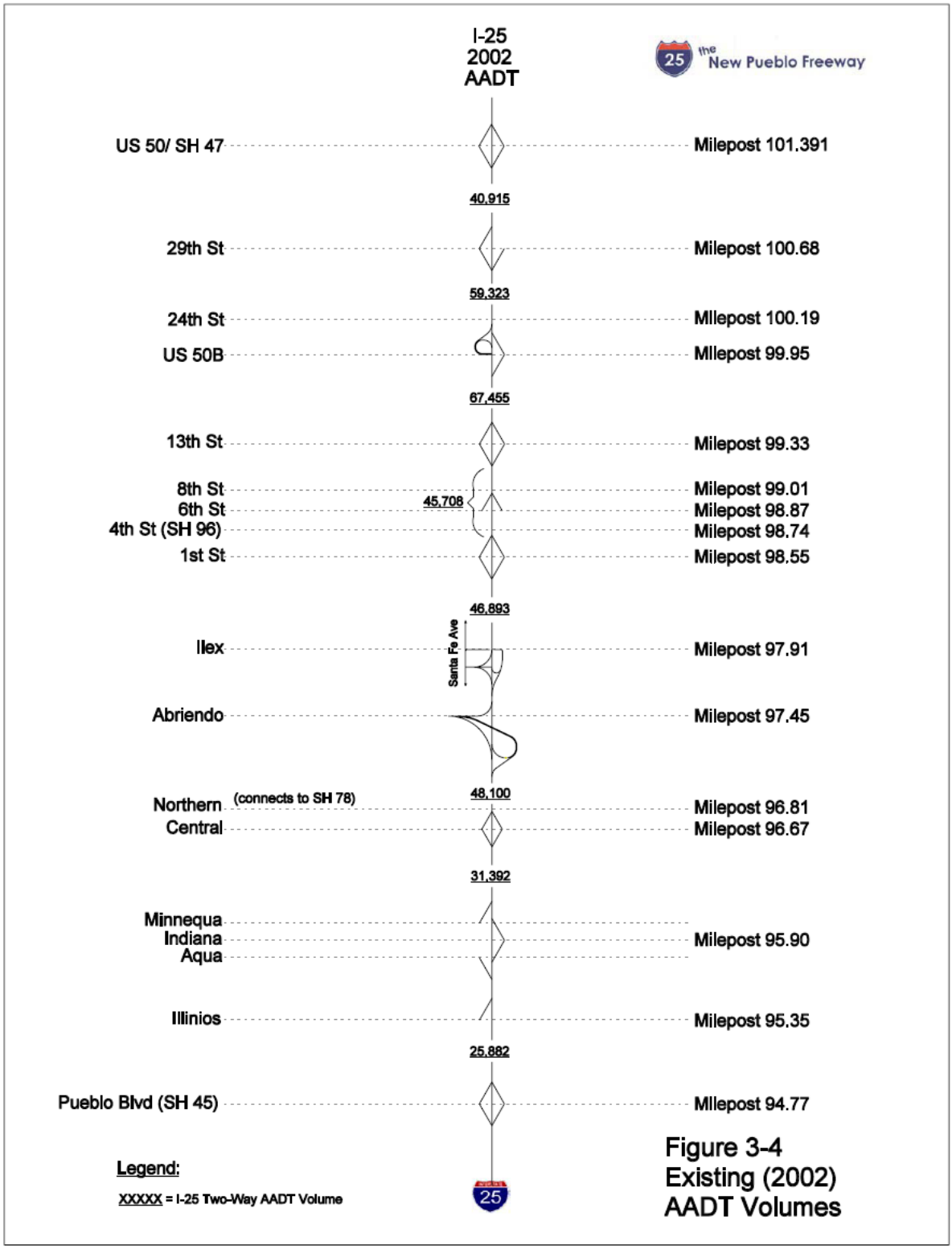


Table 3-3 displays the Vehicle Miles of Travel (VMT) and the Vehicle Hours of Travel (VHT) for the PM peak hour and all day for the Pueblo Region (modeled year 2000).

TABLE 3-3
Existing Modeled VMT and VHT in the Pueblo Region (2000)

VMT in the PM peak hour	VMT all day	VHT in the PM peak hour	VHT all day
208,500	2,469,000	6,500	76,500

* Source: CH2M HILL

According to the I-25 Corridor Incident Management Final Report (October 1997), 45% of the vehicles using I-25 in the Pueblo region are "through" trips (having origins and destinations outside of the city limits) and 9% of the total traffic traveling through Pueblo are heavy truck trips.

Information obtained from CDOT (2001) indicates that truck traffic ranges from 5% to 10% of daily traffic. The percentage of truck traffic on I-25 in Pueblo is shown in Table 3-4.

TABLE 3-4
Existing (2001) Truck Traffic on I-25 as a Percent of All Day Traffic

50/47 to 29th Street	29th Street to 50 B	50B to 13th Street	13th Street to 1st Street	1st Street to Ilex	Abriendo to Central	Central to Minnequa	Illinois to Pueblo Boulevard
10%	7%	6%	6%	6%	5%	6%	7%

* Source: Colorado Department of Transportation

3.2.2 Accident History

An accident analysis was conducted on I-25 over a 3-year period from 1/1/2000 to 12/31/2002. Beginning at milepost 94.77 (Pueblo Boulevard Interchange) and ending at milepost 100.68 (29th Street Interchange Overpass), there were 696 total accidents during the three-year period. Of these, 460 were property damage only accidents and 236 accidents involved some injury. Table 3-5 summarizes the accident data for nine segments on I-25 within the project limit from 1/1/2000 to 12/31/2002.

TABLE 3-5
I -25 New Pueblo Freeway Bi-Directional Accident Rates

	Segment	Segment Length	ADT	#PDO	#INJ	#TOTAL	Rate	EVALUATION RATING
1	Pueblo Blvd. To Indiana Ave. Milepost 94.77 to 95.9	1.13	25,882	19	5	24	0.75	Good
2	Indiana Ave. to Central Ave. Milepost 95.9 to 96.67	0.77	31,386	31	10	41	1.55	Good
3	Central Ave. to Abriendo Ave. Milepost 96.67 to 97.45	0.78	36,596	66	43	109	3.49	Poor

TABLE 3-5
I -25 New Pueblo Freeway Bi-Directional Accident Rates

	Segment	Segment Length	ADT	#PDO	#INJ	#TOTAL	Rate	EVALUATION RATING
4	Abriendo Ave. to Ilex St. Milepost 97.45 to 97.91	0.46	40,424	71	40	111	5.45	Poor
5	Ilex St. to 1st St. Milepost 97.91 to 98.55	0.64	43,285	59	35	94	3.10	Poor
6	1st St. to 6th St. milepost 98.55 to 98.88	0.33	47,482	44	13	57	3.32	Poor
7	6th St. to 13th St. milepost 98.88 to 99.33	0.45	57,894	40	17	57	2.03	Fair
8	13th St. to SH 50B milepost 99.33 to 99.95	0.62	67,457	21	13	34	0.74	Good
9	SH 50B to 29th St. Milepost 99.95 to 100.68	0.73	59,322	109	60	169	3.56	Poor

* Accidents per 100 million vehicle miles of travel

** Source: CDOT

Comparative data for the entire state (for the period between 1997 and 2001, the latest data available for statewide accidents) indicate that I-25 in Pueblo has a 28% overall higher rate of accidents than statewide; with a 60% higher property damage only rate and a 45% higher injury rate for that time period.

4.0 Description of No Action Alternative

The scope of the I-25 New Pueblo Freeway project includes both the I-25 freeway corridor and connecting and supporting ramps and surface streets. The project extends from the US50/SH47 interchange south to the Pueblo Boulevard interchange. The No Action Alternative was developed in coordination with project stakeholders, the City of Pueblo, and PACOG. The No Action Alternative consists of no capital improvements in the corridor study area and an anticipated existing plus committed network outside of the study area.

4.1 Planning Context

The following documents were reviewed to determine the existing planning environment and the appropriate elements for the No Action Alternative:

- Downtown Pueblo and I-25 Realignment Coordination Study, August 2002
- The Southwest Quadrant Transportation Study, February 2003
- The Northwest Quadrant Transportation Study, August 2002
- The Southeast Quadrant Transportation Study, October 2003
- The State Transportation Improvement Plan (STIP)

- The Long Range Plan (LRP)
- The Pueblo MPO/TPR Transportation Improvement Program FY 2003-2008 (TIP)

4.1.1 Downtown Pueblo and I-25 Realignment Coordination Study

The purpose of this study was to determine how traffic flow may change in and out of the downtown Pueblo area and to recommend an action plan. This action plan would include a transportation plan that balances the needs of transit, trails, pedestrians, and vehicles. The plan was divided into a major roadway plan, a secondary roadway plan, a trail plan, and a transit/trolley plan. Each of these plan elements emphasized one or two transportation elements and identified steps required to implement the plans.

The Major Roadway Plan section defined the principle traffic flow roadways in the downtown area as Santa Fe Avenue, Main Street (1st Street to Abriendo), Grand Avenue, Elizabeth Street, 13th Street (I-25 to Elizabeth), 8th Street, 4th Street/SH 96 (I-25 to Abriendo), 1st Street and D Street. The following improvements were recommended for these roadways:

- Develop a local parking plan to identify locations, number of spaces, and pedestrian access;
- Develop a parking signage program;
- Remove on-street parking to increase roadway capacity if necessary. The parking plan should identify new parking that would compensate for the loss of on-street parking;
- Reduce the number of curb cuts to improve traffic flow and improve sidewalks;
- Add medians where width is available;
- Improve sidewalks and add curb ramps;
- Keep two-way streets with left turn ability for access to auto oriented businesses;
- Add bike lanes where possible.

The Secondary Roadway Plan section identified secondary roadways including:

- Main Street (13th to 1st)
- Court Street (13th to 1st)
- 12th Street (I-25 frontage road to Santa Fe)
- 7th Street (I-25 frontage road to Santa Fe)
- 6th Street (Santa Fe Avenue to Midtown Circle)
- 5th Street (I-25 to Midtown Circle)
- 4th Street/SH96 (I-25 to Midtown Circle) and
- 2nd Street (Santa Fe to Court Street)

Recommendations for these roadways included changing some roadways to two-way, closing or limiting access to some roadways, adding streetscaping, and urban design features.

The Transit Plan for this study recommended a downtown trolley with circulator-type service looping through downtown sites and the historic district.

The Trails Plan recommended on-street bicycle routes on the following roadways: Santa Fe, Main Street, Court Street, Grand Avenue, 5th Street, 4th Street, 2nd Street and D Street.

4.1.2 The Southwest Quadrant Transportation Study

This study also made recommendations in the areas of roadways, transit, and trails. The improvements recommended in the study were estimated at $95 million (2002 dollars).

The following roadways were recommended for improvements:

- Provide a new interchange at I-25 and Purcell to avoid having to construct 6 lanes on Purcell;
- Provide a Purcell road connection under I-25 to provide secondary access to land uses as an interim solution to the new interchange recommendation above;
- Reclassify Lake Avenue to a major arterial from Pueblo Boulevard to SH 96;
- Retain Bandera as a minor arterial;
- Reclassify Hollywood Drive to a collector from Lake Avenue to Jones Avenue;
- Because of safety and operational concerns on Pueblo Boulevard (Prairie Avenue from Bridal Trail to Northern, the entire length of Lake Avenue and the intersections of Pueblo/Prarie Avenue and Pueblo/Lake Avenue) the following changes were recommended: add northbound and southbound right turn lanes, improve the capacities at the Lake Avenue approaches to S. Pueblo Boulevard, improve the capacities on the Prairie Avenue approaches to S. Pueblo Boulevard, northbound and southbound right turn lanes at Pueblo Boulevard and Red Creek Springs Road/Rutgers and a left turn lane for the eastbound lefts onto Pueblo Boulevard;
- No change in classification for St. Clair Avenue, but enhancements to the pedestrian crossing adjacent to the schools and parks;
- Improving the Broadway intersection with Adams/Berkeley;
- Because of concerns to impacts to the Bessemer neighborhoods related to Santa Fe changes, the study recommended: 1) The classification of the New Santa Fe alignment as a minor arterial; 2) The addition of connections to Jones Avenue and Bay State Avenue; 3) The improvement of the intersections for through movements and eastbound lefts to Prairie and Northern; and 4) The reclassification of Beulah (from Orman to Lakeview) from a minor arterial to a collector; and
- For Highway 78 the recommendation was to follow the CDOT Highway 78 Access Control Plan.

Transit recommendations included the extension of Route 12 to Prairie and Lake, and the elimination of the Hollywood/O'Neil stop and the PDI stop. On Route 7 the recommendation was to add a Hollywood/O'Neil stop and PDI stop. Other transit recommendations included the implementation of a call-and-ride service to developing areas until fixed route service could be justified and to investigate a circulator service in the new development areas south of Pueblo Boulevard.

The study recommended the consideration of trails/bicycle routes along Prairie, and the addition of these to the Pueblo Trails Plan. This would ensure that bicycle and pedestrian facilities are included in any of the reconstruction plans for Prairie.

4.1.3 The Northwest Quadrant Transportation Study

The purpose of this study was to develop a 20-year transportation plan for the northwest quadrant of the Pueblo region. This plan contained the same elements as the above quadrant plans including roadway, transit and trails recommendations for the study area.

This quadrant study identified key transportation issues that included:

- The potential need for the Pueblo West area to have a more direct route to downtown than US 50;
- Identification that the plan should incorporate new ideas for I-25 interchange locations and types;
- The potential need for a north to south route across the Lake Pueblo State Park;
- The deemphasis of residential roadways as through streets;
- The determination of whether or not an I-25 connection is indicated in the east to west section between Pueblo West to east of I-25; and
- The question of how to connect the central business district with Pueblo Boulevard.

The roadway recommendations included new roadway classifications, identified CDOT recommendations for interchange access and expressway improvements, and made recommendations for principal arterials, minor arterials, and collector facilities.

The study indicated that existing neighborhood roadways could not be considered for major changes like widening or removal of on-street parking. It was recommended that where new roadways can be built, the focus be on the development of minor and principal arterial roadway classifications.

The study outlined the planned interchange access for I-25 (pending the environmental assessment) as: County Line Road, Young Hollow, between Young Hollow and Pinon, Pinon, Bragdon, Porter Draw, Platteville/Dillon, Eagleridge, US 50/SH 47, US 50 east, 13th to 1st split diamond with additional slip ramps at 4th and 8th, Abriendo to Northern split diamond and other interchanges south of the study area for this project.

Recommendations for expressways included CDOT's future plans to develop interchanges on US 50, at appropriate locations, in order to upgrade to freeway status, CDOT's conceptual designs for Pueblo Boulevard/SH 45 for an extension from US 50 north to I-25 at Bragdon and a conceptual idea to have an outer loop road that ties to I-25 at Pinon and US 50 at McCulloch Boulevard.

The plan notes that there are few opportunities to develop principal arterials in this study area as most of the area is already developed. The following principal arterials were recommended:

- Joe Martinez Boulevard Extension to Pueblo Boulevard
- 11th Street improvements from Pueblo Boulevard to Greenwood Street

- Purcell Boulevard from US 50 to Joe Martinez Boulevard
- Purcell Boulevard from US 50 to the future Pueblo Boulevard
- Linda Avenue/Porter Boulevard (a new roadway)
- Eagleridge/47th Street (future Pueblo Boulevard to I-25 interchange) also a new roadway

Also recommended was the elimination of all on-street parking on Santa Fe Avenue from 15th Street to Abriendo Avenue as recommended in the draft Downtown Pueblo and I-25 Realignment Coordination Studies.

Minor arterials that are new or modified from the 2020 Roadway Corridor Preservation plan are as follows:

- McCulloch Boulevard (new road) from Pueblo West to 11th Street;
- A Spaulding Avenue Extension (Purcell Boulevard to Pueblo Boulevard 11th and 18th Streets);
- Partial new construction from the proposed 11th Street to 1st Street and under I-25 on D Street;
- Reclassification of portions of 13th Street and an extension of 13th Street to the proposed 11th Street to 1st Street principal arterial;
- A reclassification of 8th Street and an extension of 8th Street to the proposed 11th Street to 1st Street arterial, from Ft. Carson south to the Arkansas River a new roadway (Stone City Road);
- A new road across Lake Pueblo State Park; and
- An 11th Street Extension from Purcell to Pueblo Boulevard.

Collector facilities for undeveloped areas were determined to need to remain flexible to best serve the specific needs of communities under specific development proposals.

No new transit routes were recommended as a part of this study.

The plan made several recommendations with regards to trails including:

- The inclusion of a 20-year trails master plan in the long-range regional plan;
- The maintenance and preservation of the existing trail system;
- The maintenance and preservation of the existing and new sidewalk system and walking paths;
- The encouragement of pedestrian and bicycle travel as viable modes of transportation;
- Address engineering, education, enforcement, encouragement and parking in the development of the 20 year trails master plan;
- Maintain and construct a pedestrian system that is ADA compliant;
- Develop bicycle connectivity within each mode;
- Consideration should be given to connectivity between neighboring transportation planning regions (i.e. statewide);

- The addition of bicycle and pedestrian elements to the subdivision process;
- Conduct a "safe routes to school" study for any neighborhood that desires one.

4.1.4 The Southeast Quadrant Transportation Study

The purpose of this study was to examine existing transportation network plans for the southeast portion of the Pueblo Area and to provide recommendations for changes based on future land-use assumptions and projected traffic needs. Major recommendations included:

- The realignment of SH-227 on the Corridor Preservation Plan
- The realignment of SH-233 on the Corridor Preservation Plan
- Improvements to pedestrian crossings of US-50

This quadrant study focuses on seven issues identified by staff and residents of the Eastside neighborhood including:

1. SH-227 Re-alignment and Erie Extension: Limited north-south connectivity through the Eastside neighborhood. Lack of alternatives to Santa Fe Avenue connection and the possibility of increased traffic on Joplin, thereby impacting the Eastside neighborhood. Potential for connectivity between US 50C and US 50B without bisecting the Eastside neighborhood. Multi-modal approach recommended.
2. 1st Street River Crossing: Currently no direct connection between the Eastside, downtown, and the I-25 Interchange.
3. William White Boulevard Extension: Currently only one connection to Pueblo Memorial Airport and airport industrial park.
4. Aspen Street Extension & River Crossing: No river crossing for a five-mile stretch between SH 227 and SH 233. Mesa topography and river valley prevent an obvious connection across the Arkansas River. The need for this crossing should be examined and compared to other potential crossing locations before further design decisions or cost estimates are completed.
5. Pedestrian Connectivity in Eastside Neighborhood: US 50 acts as a barrier for pedestrian access to schools, recreation facilities, and shopping centers.
6. Recommend improvements to existing culvert underpass under US 50 at Portland Avenue.
7. 27th Lane Extension: Growth east of the airport and along the east side of St Charles Mesa may require an additional Arkansas River Crossing.

The I-25 downtown slip ramps and the east-west transit circulator service to the University will be studied as a part of the Long Range Transportation Plan.

The study indicated that the addition of major roadways to the Corridor Preservation plan in this quadrant was unlikely. However, many roadways in the study area will likely require capacity improvements over the next twenty years, specifically access control improvements to US 50C and SH 46.

The greatest level of improvement to the study area would result from realignment of SH 227 and SH 233. This would provide an alternative route for local traffic currently using the interstate, improved access to the Pueblo Mall sites, and would protect the Eastside neighborhood from increased traffic by downgrading Joplin to a minor arterial roadway once realignment is completed.

The proposed conceptual design alternatives that were recommended from the study for SH 227 and the Eastside/Belmont subarea included:

- Alternative "A": Uses existing railroad underpass and turns west at Catalpa Street. Joplin intersection is reconfigured to a "T" configuration.
- Alternative "B": Requires the construction of an additional grade-separated railroad crossing west of Joplin Avenue, and has a lesser impact upon residential areas.

Specific alignment details for both alternatives include:

- North of Catalpa: Sectional floodwalls and substantial grading will be required to reduce the change in vertical alignment between the park and roadway;
- North of East 4th Street: SH 227 would be extended along the current Erie Avenue alignment. Improvements would include at-grade pedestrian crossings and streetscapes at 6th and 11th streets. These pedestrian improvements would be consistent with the Eastside Neighborhood Plan that is under development by the City Neighborhood Planning office;
- North of 18th Street: Erie Avenue extended to intersect with US 50 west of Hudson Avenue. Coordinated intersection with Dillon Street extension (under consideration with the I-25 EIS) to provide continuous north-south connectivity between US 50C and US 50A;
- Access: Vertical alignment and potential designation as a state-highway of the realigned roadway would limit access and keep traffic out of adjacent neighborhoods.

4.1.5 The State Transportation Improvement Program

The Statewide Transportation Improvement Program (STIP) is the project-programming document for CDOT. It contains projects from the statewide transportation plan that are scheduled for implementation in the next six years. This document is updated every two years and can be amended as needed following the Transportation Improvement Plan/Statewide Transportation Improvement Plan Amendment Guidelines.

Programming for the 2003 STIP for the Pueblo region includes I-25 through Pueblo. There is $22 million earmarked for the years from 2006 to 2008 for this project. Reconstruction and capacity projects include: SH 47 Bacalite Mesa to US 50/SH 96, US 50 Pueblo to La Junta within the Pueblo TPR, and SH 47 at William White.

The plan includes various bridge replacement projects: SH 96 (4th Street) bridge replacement, I-25 bridges in the Pueblo TPR and US 50 bridges in the Pueblo TPR. Additionally, there are bus purchase projects, ITS, transit and trail projects.

4.1.6 The Long Range Plan

The fiscally constrained Long Range Plan (LRP) for Pueblo includes two projects: the I-25 and the US 50 corridors.

4.1.7 The Pueblo MPO/TPR Transportation Improvement Program FY 2003-2008

The Pueblo 2003-2008 Transportation Improvement Program (TIP) includes Section 5309 capital transit funds for the procurement of transit vehicles including buses, paratransit vans and bicycle racks to equip the existing fleet. From 2003 to 2008, $4,708,000 is programmed for these procurements.

The one roadway widening project in the TIP is a project to widen County Farm Road. $350,000 is programmed for this project in 2003. System improvements include improvements to Library Traffic Rotary and Main/Broadway/Abriendo improvements for a total of $935,000.

4.2 No Action Alternative Description

Those projects that would improve the region's mobility (short of a major investment on I-25 within the study area) were included in the No Action Alternative. The No Action Alternative includes other projects as projected by the City, County, CDOT, and collectively, PACOG. These projects include upgrading the 13th, Central and Pueblo stop-controlled ramp terminal intersections to signals. Also, the no action alternative assumes that the northbound freeway on-ramp from 29th Street will be removed by the year 2025. Of course, the no action alternative does not include any major improvements (e.g., widening) to I-25 or other interchange improvements. Table 4-1 describes in detail additional projects that were included in the No Action Alternative for traffic forecasting.

TABLE 4-1
New Pueblo Freeway DEIS 2025 No Action Projects

Street or Facility	Extent		Improvement/Change
	From	To	
Eden Interchange	North of Eagleridge on I-25		Eden Interchange on I-25
Bragdon Interchange	North of Eden Interchange on I-25		Bragdon Interchange on I-25
New Roadway	I-25/Eden Interchange west	Platteville Boulevard	Roadway 2 lanes each direction
Platteville Boulevard	West of I-25		Capacity Improvement 1 to 2 lanes
North Dillon Drive extension	East of I-25 from northern terminus of Dillon Drive	Platteville Boulevard	New facility 2 lanes each direction
Dillon Drive	50/47	Eagleridge Interchange	Capacity Improvement 1 to 2 lanes

TABLE 4-1
New Pueblo Freeway DEIS 2025 No Action Projects

Street or Facility	Extent		Improvement/Change
	From	To	
SH 47	East of I-25 from Bonforte	Troy Street	Capacity Improvement 1 to 2 lanes
Court Street extension	West of I-25 north from 27th Street	29th Street	1 lane each direction
Spalding extension	From existing termini	Wildhorse Street	2 lanes each direction
Joe Martinez Boulevard extension	From existing termini	W. 24th Street	2 lanes each direction
Thatcher	West of Goodnight	Red Creek Springs Road	Capacity improvement 1 to 2 lanes
New outside loop road	West of I-25 north of Stem Beach interchange	Thatcher Road	2 lanes each direction
Hollywood Road extension	South from existing termini	New loop road	1 lane each direction
Prairie extension	South from existing termini	New loop road	2 lanes each direction
Lake Avenue	From existing Pueblo Boulevard south	Approximately .5 miles	Capacity improvement 1 to 2 lanes
Intersection at Dynamics and Industrial	Bayfield Drive	US 50 West	Upgrade the intersection connecting to Dynamics Road on the north to Industrial Boulevard to a full movement intersection
Purchell Boulevard	From the Bragdon Interchange	The proposed Pueblo Boulevard	Downgrade to a major arterial
Eden Interchange	From Platteville Boulevard on the north	The Dillon extension on the south	Split diamond configuration
Joe Martinez	From Pueblo West	Pueblo Boulevard	Shift alignment north to join Spalding west of Pueblo Boulevard
24th Street extension	From the intersection at Pueblo Boulevard	Joe Martinez extension	T intersection with Joe Martinez at a point west of where Joe Martinez reaches the Spalding alignment
Tuxedo Boulevard	From Desert Cove	To 11th	Upgrade to a major arterial
11th Street	From Pueblo Boulevard	To Tuxedo	Upgrade to a major arterial
11th Street	From existing termini	To 13th Street and 1st Street	Extended east and then split into two major arterials; one to 13th St./I-25 and one to 1st Street/I-25

TABLE 4-1
New Pueblo Freeway DEIS 2025 No Action Projects

Street or Facility	Extent		Improvement/Change
	From	To	
William White Boulevard	From current termini	CO 47 in line with an extension of Constitution from the west of 47	Extend roadway east and connect
Nolan Trace	From existing termini	Bandera Boulevard	Extend roadway and connect
Pueblo Boulevard	From I-25	East	Shift southward and include in build alternatives not in the No Action

5.0 Description of Build Alternatives

The study area for this project includes both the I-25 freeway corridor and connecting and supporting ramps and surface streets. The project extends from the US50/SH47 interchange south to Pueblo Boulevard interchange. The final alternatives include reconstruction of the freeway itself plus a series of coordinated improvements to ramps, the frontage road system, and the addition of key arterial connections and improvements.

Four separate analyses were performed, initially to compare the sets of preliminary alternatives (traffic was a part of the ongoing screening and evaluation process used to develop and refine alternatives), then finally to assess two preferred alternatives. The No Action Alternative was also analyzed during all four traffic evaluations.

5.1 Preliminary Alternatives

Three sets of preliminary alternatives were evaluated for traffic operations. All of the alternatives include widening of I-25 to six basic lanes, and the background improvements described in Section 4.2.

5.1.1 Alternatives A and B

The first evaluation includes two basic alternatives (A and B), illustrated in Figure 5-1. Alternative A has a split diamond interchange downtown, with ramps at 1st Street and 8th Street (closing the 13th Street interchange). South of downtown, there are diamond interchanges at Northern, and Indiana, all changes from the current configurations. A parallel arterial system (Dillon Drive to the north and south, connecting to Santa Fe through downtown) follows the length of the freeway from US 50/SH 47 to Pueblo Blvd.

Alternative B has a split diamond interchange between 13th Street and 1st Street downtown, with no intermediate ramps. There are new diamond interchanges at Abriendo/Santa Fe Drive and Indiana. Dillon Drive is extended as a parallel arterial from US 50/SH 47 to Pueblo Blvd.

FIGURE 5-1
Alternatives A and B

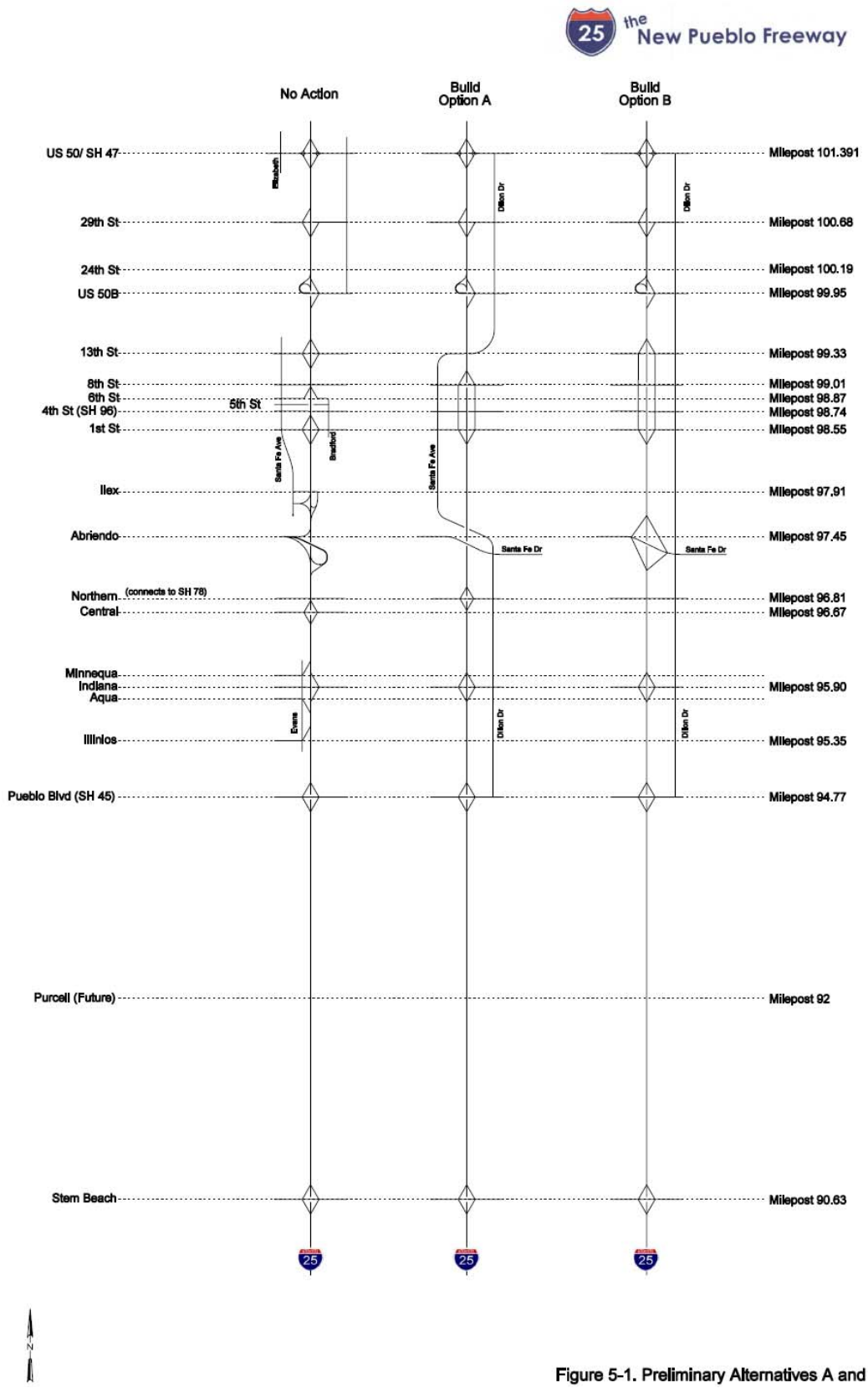


Figure 5-1. Preliminary Alternatives A and B

5.1.2 Alternatives A1, A2, and B1

The results of the traffic analysis (presented in August 2001) were considered, along with other evaluations, to develop a second set of alternatives. These alternatives, variations of Alternatives A and B, are presented in Figure 5-2.

Alternatives A1 and A2 are similar to the original Alternative A, except that Alternative A1 does not connect Santa Fe and Dillon at 13th Street. Also, Alternative A2 extends Dillon Drive from Northern to Pueblo Blvd. Alternative B1 has the same basic interchange design as Alternative B, although some details of the crossroads were changed.

The traffic analysis for these alternatives (presented in September 2001) were used as input (again, along with other factors) to develop the third set of preliminary alternatives, described in the section below.

5.1.3 Alternatives C1 and C2

The alternatives included two build alternatives (C1 and C2) in addition to the no action. The two build alternatives are illustrated in Figure 5-3. In general, build alternatives C1 or C2 include the background improvements described earlier, plus the following elements:

- Widening of I-25 to six lanes from the Eagle Ridge interchange to the Pueblo Blvd. interchange;
- Revising the 29th Street interchange to create an underpass;
- Extending Dillon Drive south to intersect with US 50B;
- A split diamond interchange and one way frontage road system from 13th Street to 1st Street;
- Eliminating the Ilex interchange;
- A split diamond interchange and one way frontage road system from Abriendo to Northern;
- A single point urban interchange at Indiana;
- Addition of an eastbound Pueblo Blvd. to northbound I-25 directional loop ramp at the Pueblo Blvd. interchange;
- Realignment of I-25 to the east from Ilex Avenue to Pueblo Blvd.; and
- Extension of Santa Fe Avenue following the existing I-25 alignment south to Minnequa.

Note that alternatives C1 and C2 differ only in their treatment of the US 50B/I-25 interchange. Alternative C1 proposes a diamond interchanges with a new pair of one way frontage roads connecting 29th Street and US50B. Alternative C2 proposes a trumpet interchange at US 50B with no frontage road connections. A schematic of this interchange is provided in Figure 5-4. Since the evaluation of the preliminary alternatives were only used to refine the alternatives, detailed results are not presented in this report, but are available in other project documentation.

FIGURE 5-2
Alternatives A1, A2 and B1

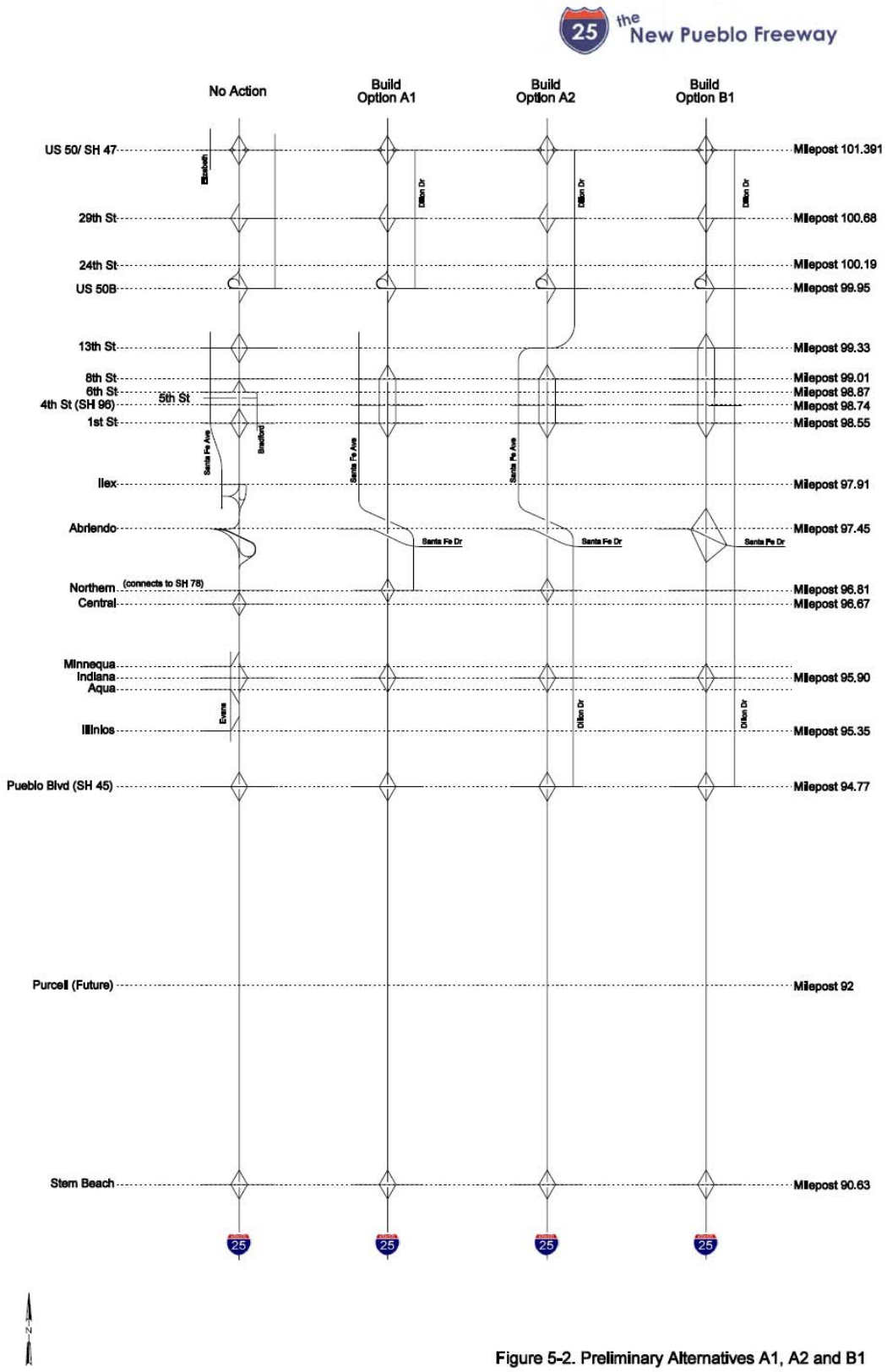


Figure 5-2. Preliminary Alternatives A1, A2 and B1

FIGURE 5-3
Alternatives C1 and C2

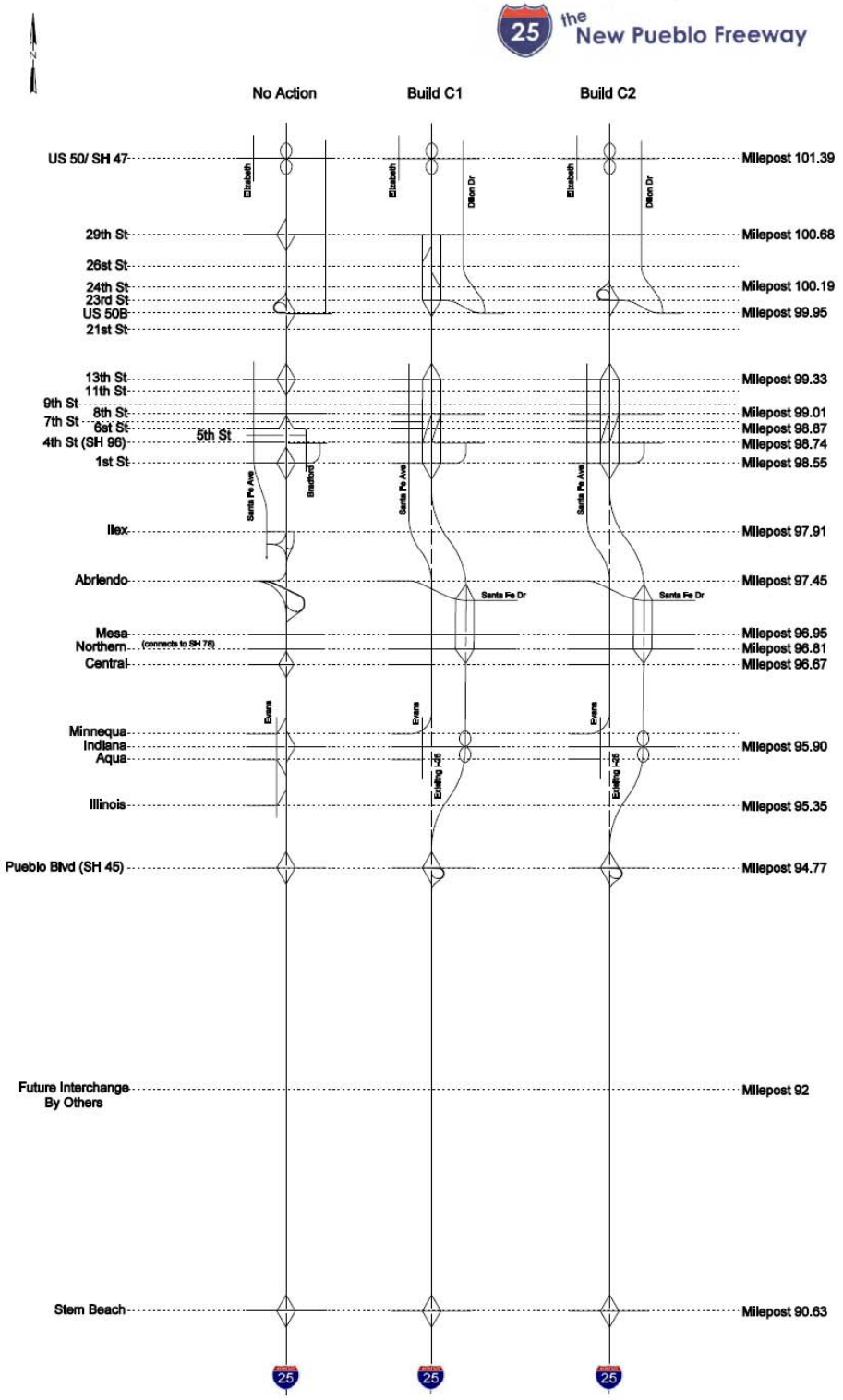
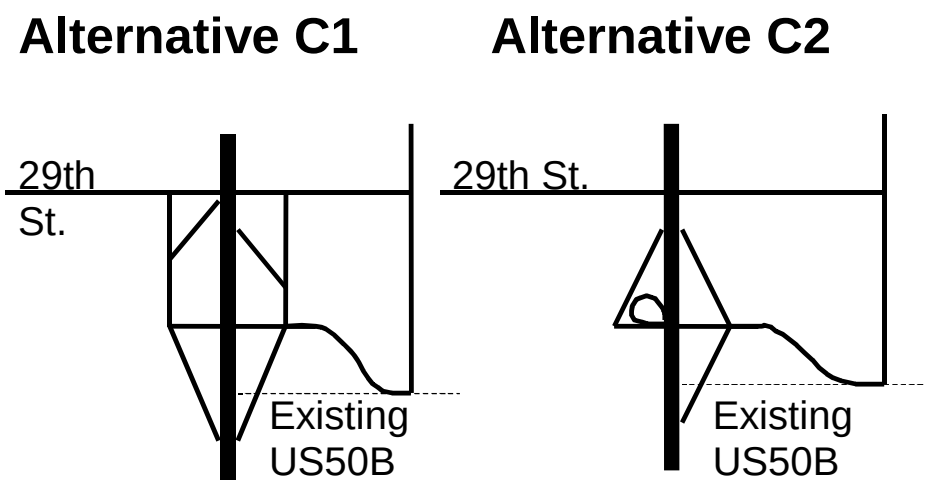


Figure 5-3. Preliminary Alternatives C1 and C2

FIGURE 5-4
Intersection LOS Comparison at US 50B Interchange for Alternatives C1 and C2



5.2 Preferred Alternatives

For the final evaluation (the focus of this report), the alternatives analysis included two variations of the Build C1 Alternative in addition to the No Action Alternative. For the Modified I-25 Alternative, the modification included adding Stanton Avenue between Santa Fe Avenue and Santa Fe Drive. For the Existing I-25 Alternative, I-25 will follow along its existing alignment instead of shifting to the east. It is also proposed to connect Santa Fe Avenue to Santa Fe Drive on the east side of I-25, as shown in Figure 5-5.

Note that in the previous analyses the Stem Beach interchange was included; however, no changes south of the Pueblo Blvd. interchange were proposed as part of the preliminary alternatives. Therefore, the traffic operations model network was modified to end just south of the Pueblo Blvd. interchange, instead of extending to Stem Beach. A bullet list of the elements included for each build alternative follows.

5.2.1 Existing I-25 Alternative Description

The Existing I-25 Alternative was built on the No Action Alternative as described in Section 4.2. The major elements or projects that were added to the No Action Alternative to comprise the Existing I-25 Alternative include:

- Addition of one lane in each direction on I-25 for a total of six lanes (three lanes in each direction) on I-25 from Eagleridge to Pueblo Boulevard (there will be four lanes, two lanes in each direction, south of Pueblo Boulevard);
- One way Frontage road system connecting 29th and 50B;
- Diamond interchange at 50B;
- “Texas” turnaround at the 50B interchange;
- South Dillon Drive extension to US 50B;

FIGURE 5-5
Preferred Alternatives

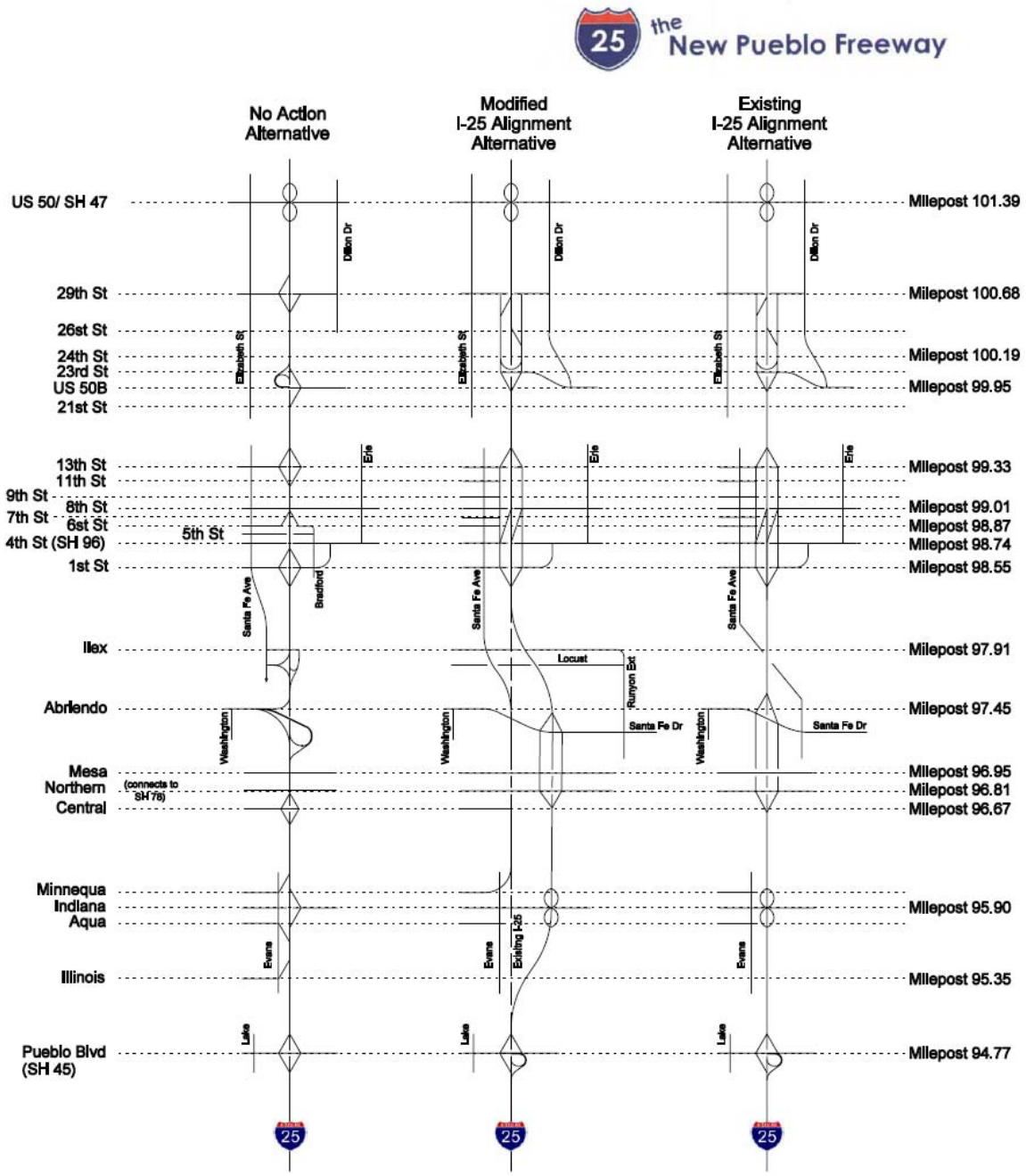


Figure 5-5. Preferred Alternatives

- Split diamond interchange with ramp junctions at 1st and 13th and slip ramps at 6th. One way frontage roads connecting 1st and 13th;
- Split diamond interchange with ramp junctions at Abriendo and Northern and one-way frontage roads connecting Northern and Abriendo;
- A Santa Fe Drive to Abriendo connection;
- A single point urban interchange at Indiana;
- Addition of an eastbound Pueblo Blvd. to northbound I-25 directional loop ramp at the Pueblo Blvd. interchange.

5.2.2 Modified Alternative Description

The Modified I-25 Alternative was built on the No Action Alternative as described in Section 4.2. The major elements or projects that were added to the No Action Alternative to create the Modified I-25 Alternative include:

- Addition of one lane on I-25 in each direction for a total of six lanes (three lanes in each direction) on I-25 from Eagleridge to Pueblo Boulevard (there will be four lanes, two lanes in each direction, south of Pueblo Boulevard);
- One way Frontage road system between 29th and 50B;
- Diamond interchange at US 50B;
- "Texas" turnaround at the US 50B interchange;
- South Dillon Drive extension to US 50B;
- Split diamond interchange with ramp junctions at 1st and 13th and slip ramps at 6th. One way frontage roads connecting 1st and 13th;
- Stanton Avenue extension from Runyan Field to Santa Fe Drive (US 50C);
- I-25 shifted alignment from Ilex to Indiana Avenue;
- New Santa Fe Avenue extension along current I-25 alignment south of Ilex
- Split diamond interchange with ramp junctions at Abriendo, Mesa and Northern and one way frontage roads connecting Abriendo, Mesa, and Northern;
- Santa Fe Drive/Abriendo connection;
- A single point urban interchange at Indiana;
- Addition of an eastbound Pueblo Blvd. to northbound I-25 directional loop ramp at the Pueblo Blvd. interchange.

6.0 Travel Demand Forecasts

Travel demand forecasting was performed using the PACOG Travel Demand Model. The sections below outline the process for developing the forecasts used to assess the alternatives.

6.1 Original (1993) Travel Demand Model Development

The 1993 PACOG Travel Demand Model was developed by Barton-Aschman Associates based on a household travel survey completed in 1993 supplemented by 1990 census information. The survey was administered to 1,032 households, or about 2.3 percent of the households in Pueblo County at the time. The 1993 model is a traditional four-step travel demand model including: trip generation, trip distribution, mode split and time-of-day traffic assignment. It is an auto-traffic-only model, so the purpose of the mode split component is to estimate auto occupancy and home-to-school walking trips. The model was implemented using the MINUTP travel modeling software package.

The PACOG model validation process demonstrated that 1993 observed traffic counts and model volume projections could be reliably validated using screenline and statistical analyses. The results indicated that both traffic flows across selected cordon lines and the regional distribution of trips were reasonable. The model performance was also validated by comparing estimated and observed VMT on roadway sections by facility types and area types, and by statistically comparing observed versus model generated link volumes by volume group and facility type. All measures demonstrated that the 1993 PACOG model performed well within FHWA standards.

In 1998, the model was refreshed by the TranSystems Corporation. Updates included:

- Updating land use and network assumptions to 1998;
- Increasing the number of traffic analysis zones (TAZ) from 175 to 240; and
- Adding 1998 traffic count information to the travel network database.

6.2 Travel Demand Model Conversion

Prior to starting traffic forecasting, and as the first task of the New Pueblo Freeway project, the PACOG Travel Demand Model was converted to a new software platform (TransCAD) and extensively tested. The TranSystems 1998 model was converted directly and comparisons between the resulting MINUTP and TransCAD outputs were used to evaluate the converted model's performance. Following demonstration of successful performance of the converted model chain (documented in Appendix A: "Conversion and Verification of PACOG Travel Demand Forecasting Model"), updates were made to the roadway network and the socioeconomic projections. Transportation Analysis Zone (TAZ) boundaries were revised to conform to the 2000 census block and block group boundaries. This resulted in an increase in the number of TAZs from 240 (based on the TranSystems update) to 313. New model databases were developed for both a Year 2000 base conditions model and a 2025 forecast model. Land use forecasts, the allocation of land use to the revised TAZ system and travel network assumptions were developed by PACOG jointly with other area agencies and with consultant assistance.

The "Conversion and Verification of PACOG Travel Demand Forecasting Model" technical memorandum (Appendix A) includes discussion of screenline analyses: comparing parallel results from TransCAD and MINUTP model chains. As part of the verification process, TransCAD assignment model results were compared to available traffic counts. The memo also documents all modeling and procedural changes required to implement the PACOG model structure using TransCAD and provides comparison of results of the 1998 MINUTP based model versus the 1998 TransCAD model for the various steps making up the PACOG modeling chain. Based on this review of the modeling process and results and supplemental documentation, PACOG formally approved use of the model for forecasting traffic for this project.

6.3 Alternatives Forecasting

To forecast the expected traffic conditions for the alternatives described in Section 5, street and highway system characteristics were coded to represent each network, and using the set of approved 2025 road network and development assumptions, travel forecasts were developed for each alternative. The travel demand model forecast outputs were then used as traffic simulation model inputs to generate detailed information regarding traffic conditions and operations for each network alternative. To provide the necessary inputs to traffic simulation, the PACOG Travel Demand Model was used to generate PM peak hour turning movements for roads and intersections in the immediate vicinity of the project corridor.

The PACOG model does produce separate forecasts for PM peak hour traffic based on direct assignment of an PM peak hour trip table developed by estimating the percentage and directional distribution of traffic for each defined trip purpose. Factors and a detailed discussion of how they are applied is discussed in the technical memorandum, "Conversion and Verification of PACOG Travel Demand Forecasting Model" (Appendix A) and in the original model development report, Pueblo Area Travel Model – Draft Report (February 1994).

To improve quality of the forecasts, it was decided not to use the travel model outputs directly. To produce the most reliable turning movements, turning movement volumes taken from the model's 2000 and 2025 forecasts were used to estimate expected traffic growth from 2000 to 2025. This incremental growth was then added to existing PM peak hour turning movement count information, where available. Because there were intersections where counts were unavailable, and because of the demands for consistent/balanced travel forecasts required as input to the traffic simulation model, a hybrid process was utilized to generate the traffic simulation model inputs. This hybrid process involved both growth factoring and direct application of the travel model and is illustrated below in Figure 6-1.

FIGURE 6-1
Process for Developing Traffic Simulation Inputs from TransCAD

2025 PM Peak Model Volumes	**(Minus)**	**2000 PM Peak Model Volumes**	**(Equals)**	**Estimated PM Peak Traffic Growth**
Estimated PM Peak Traffic Growth	**(Plus)**	**2000 PM Peak Actual Turning Movements**	**(Equals)**	**Target 2025 PM Peak Turn Volumes**
2025 PM Peak Model Turn Volumes	**(Adjusted to Match)**	**Target 2025 PM Peak Turn Volumes**	**(Equals)**	**Balanced Turn Volumes for Simulation Input**

Travel model forecasts were selectively factored so they could be used as direct inputs to the traffic simulation. The way such forecasts were developed required:

- First, *target numbers* were estimated representing the sum of existing counts with travel model estimated growth for all individual intersection turning movements. These target numbers, while providing the best available estimate of expected traffic, were not internally consistent due to the limited count information available and the fact that various counts were from different days and times of the year. The traffic simulation required inputs from a consistent source to ensure that inbound and outbound traffic volumes at each intersection and between intersections could be matched and balanced.
- Next, to generate the required consistent volume forecasts, localized adjustments were made in the travel demand model inputs (i.e., forecast trip distribution) to more closely approximate the target numbers which were estimated by summing counts with model growth. Such adjustments were made on a cumulative and iterative basis until reasonable approximations of the volume targets was achieved. By adjusting/factoring trip tables before assignment, this process is reproducible and effects of network congestion are correctly reflected in the traffic simulation inputs. Appendix B includes tables that document the target values and the comparison of the target values to the final model estimated turning movements using the adjusted trip distribution. The final outputs of the hybrid process are separately documented as the inputs to the traffic simulation model in Section 7.0.

Table 6-1 documents the factors applied to particular locations within the study area. For each location requiring adjustment, a selected link analysis provided information about the origins and destinations of the trips at that location. Trips using the identified link

werefactored to achieve better correspondence to the associated target value. For each factor applied, the target and model generated turning movement volumes were compared throughout the study area to determine the next location to be factored and the appropriate factor to use. This process was repeated until adequate correspondence was achieved between the target values and direct model forecasts. A summary of the factors used and the locations associated with them is provided below.

TABLE 6-1
Turning Movement Adjustment Factors

Location	Factor
Santa Fe south of 6th Street (Northbound)	2.81
Santa Fe south of 6th Street (Southbound)	1.41
Santa Fe west of 1st Street (Eastbound)	1.54
Santa Fe west of 1st Street (Eastbound)	1.44

Once the adjustments to the trip distribution table were completed, equilibrium traffic assignments were made for each of the alternatives under study. Turning movements were output from each alternative's traffic assignment and reformatted for input to the traffic simulation and operational evaluation process described in Section 7.

The following sections describe the results of the travel demand forecasting for 2025 for the No Action and two build alternatives. While these data were not used for a formal evaluation of the build alternatives, the data do provide a general basis for comparing the alternatives, as well as a validation of the forecasting process.

The first section describes the socioeconomic changes and resultant travel patterns in 2025 followed by VMT and vehicle hours of travel (VHT) by alternative.

6.3.1 Socioeconomic Changes and Resultant Travel Patterns

The 2025 PACOG model includes socioeconomic inputs as determined by the City and the Regional Council of Governments based on land use planning completed in 2001. These socioeconomic inputs were left, unchanged, and were used for the travel demand forecasting for this project.

The new socioeconomic forecasts include continuing residential growth in the outlying or suburban areas of the region and also new employment centers at the periphery of the region. Figures 6-2 and 6-3 illustrate these changes.

Although significant travel still occurs on I-25 through the region, and in the central business district, the result of the socioeconomic changes is a change in the existing travel patterns. Travel is significantly increased in outlying areas, and some commuter trips stay within an area closer to the home based end of the trip. The percentage of all day trips coming from each subarea in the region is shown in Figure 6-4.

FIGURE 6-2
Population Changes 2000 to 2025 (Percent)

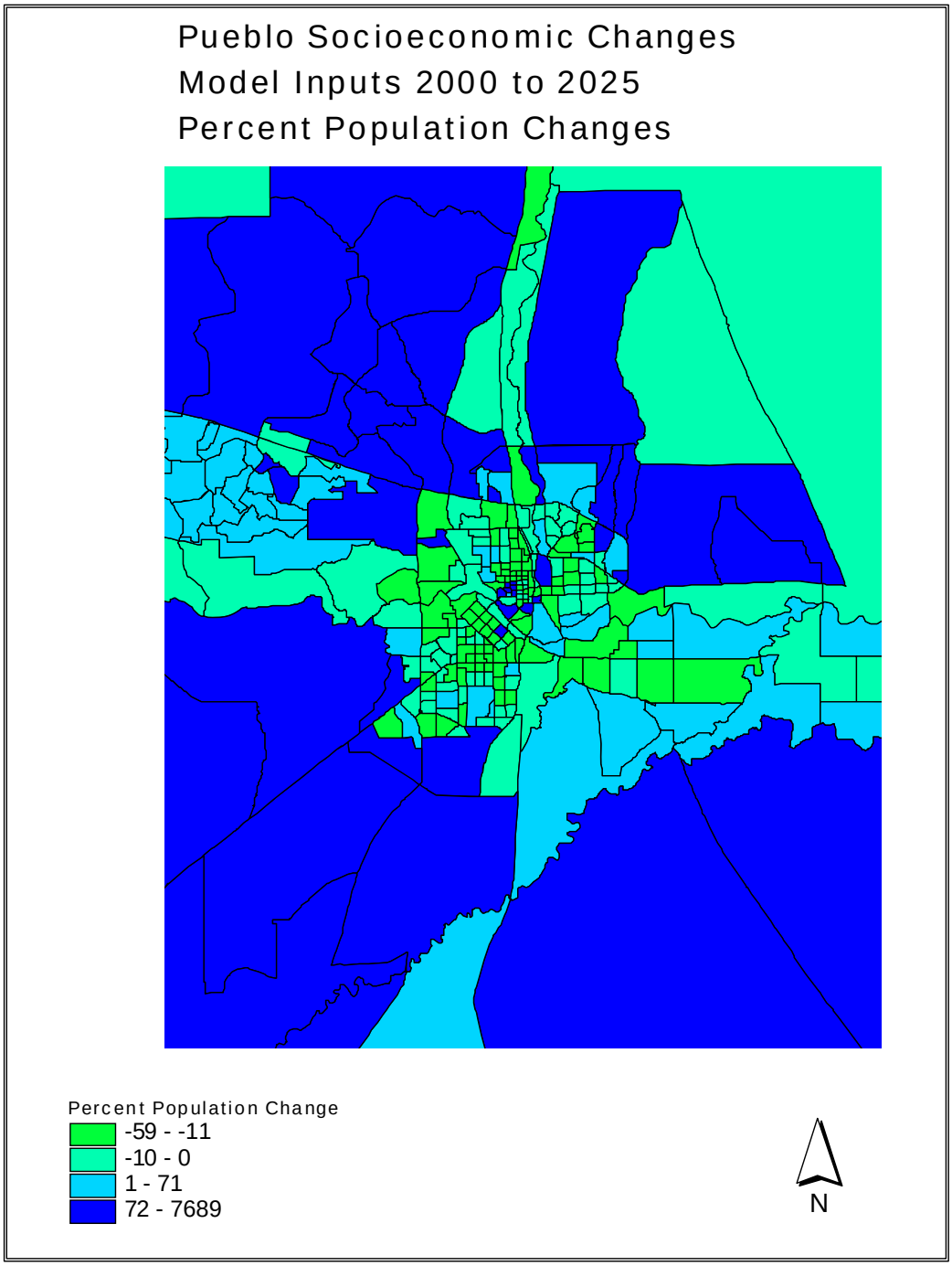


FIGURE 6-3
Employment Changes 2000 to 2025 (Percent)

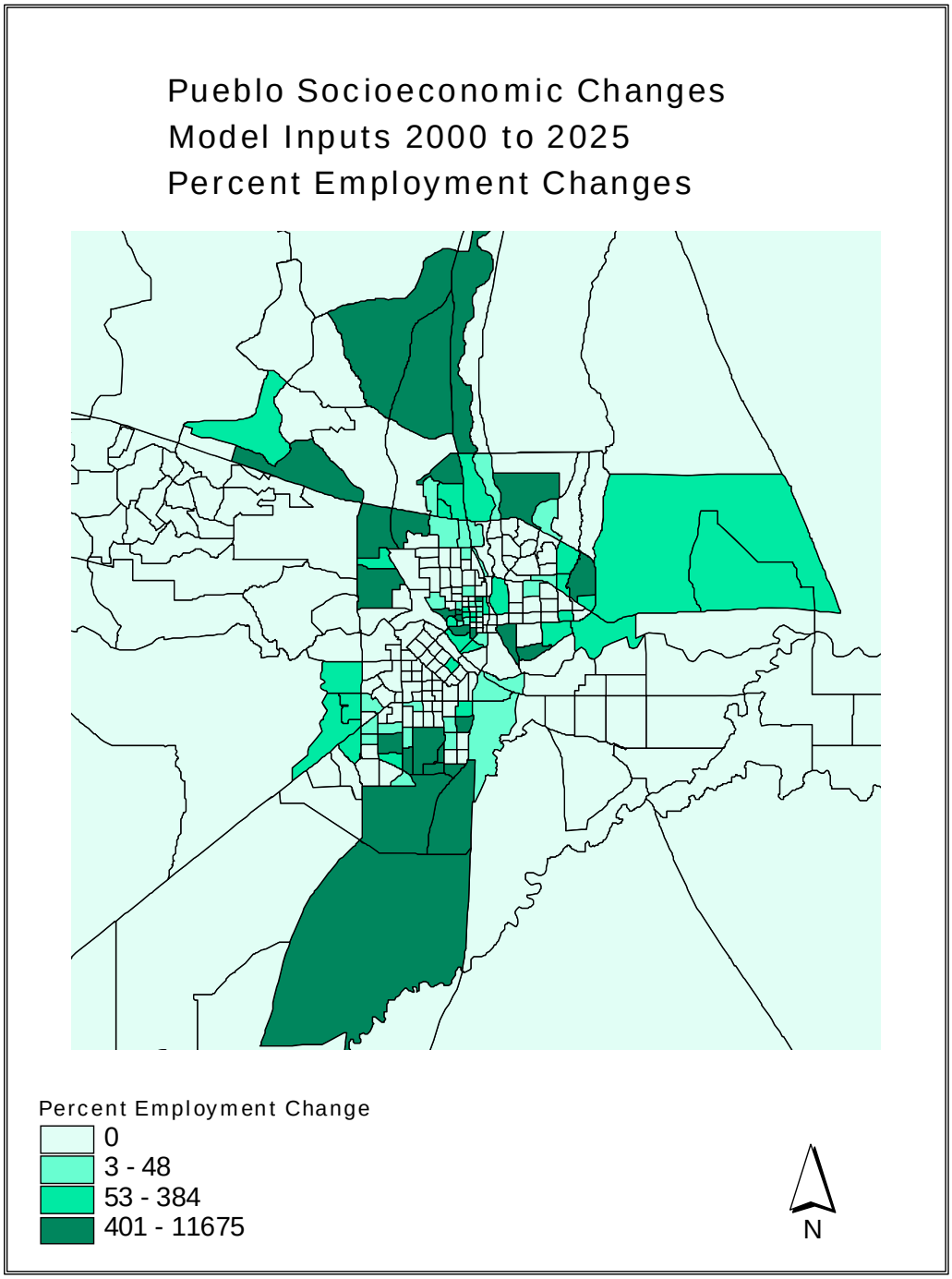
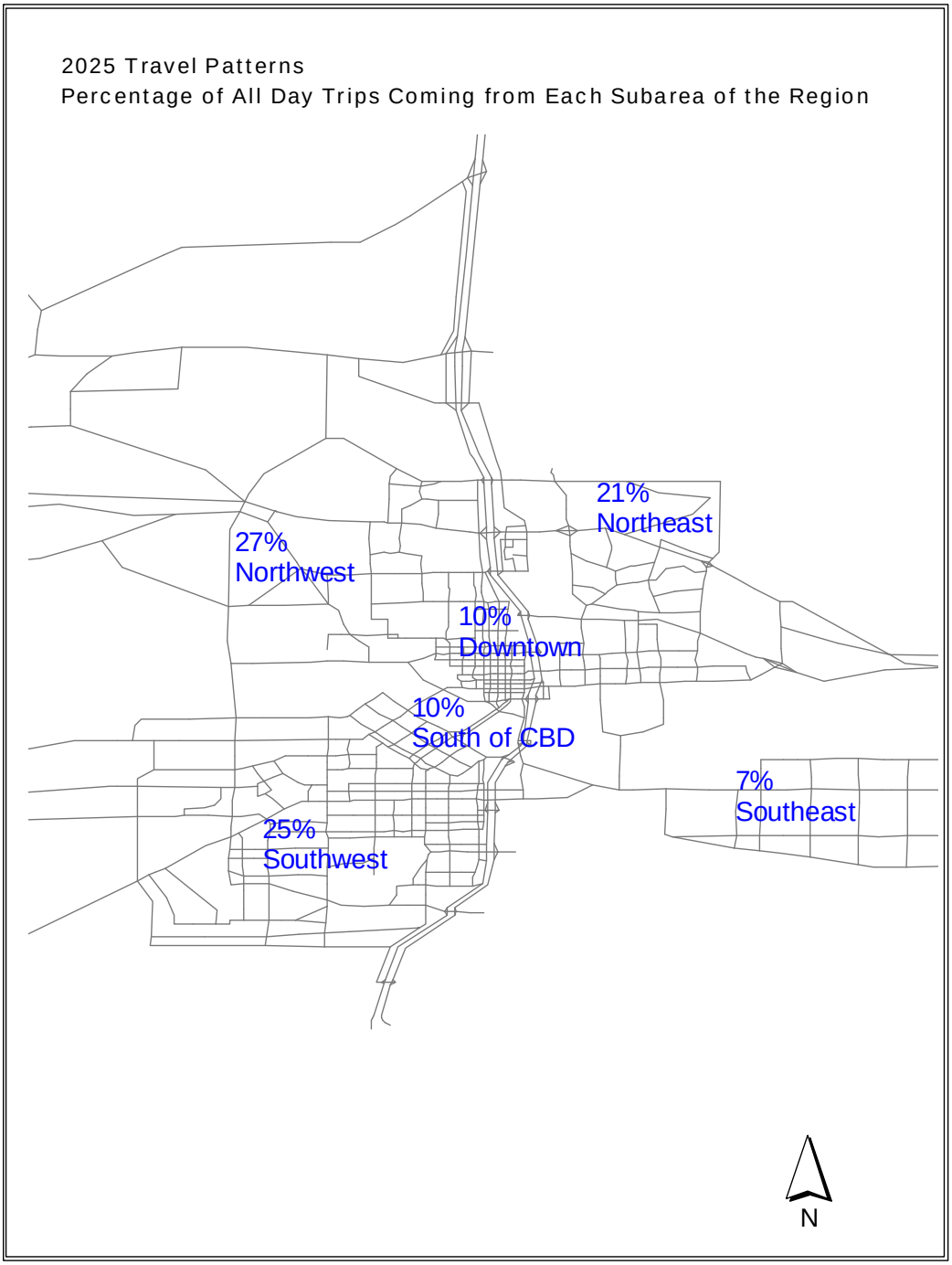


FIGURE 6-4
Trips from all Subregions (2025)



In addition to a significant number of trips coming from suburban subregions, at least 50% of all trips within the region remain within the subareas of the region (both the origins and destinations of the trip) because of increased employment opportunities closer to growing suburban residential areas. This allows residents of the region to work closer to their home. The exception to this trend is the Southeast region because this subarea is not projected to have the same employment opportunities in 2025 as the other subareas. Table 6-2 shows the percentage of trips that stay within subareas of the region.

TABLE 6-2
Percentage of Trips Staying Within Subareas in the Pueblo Region in 2025

	Downtown	South of Downtown	Northwest	Northeast	Southwest	Southeast
Percent	50%	56%	56%	55%	59%	35%

6.3.2 Comparison of Vehicle Miles of Travel, Vehicle Hours of Travel, and General Travel Demand Increases

Table 6-3 compares the 2000 base year with the 2025 alternatives relative to overall growth, vehicle miles traveled (VMT) and vehicle hours traveled (VHT). Compared to the 2000 base, the 2025 No Action alternative shows a 94% increase in VMT for the PM peak period and 69% increase in VMT for all day. The 2025 No Action alternative shows a 131% increase in VHT for the PM peak period and a 93% increase in VHT for all day over the year 2000 Base condition. The build alternatives are comparable to each other and to the 2025 No Action Alternative with regards to VMT and VHT in the PM peak period. The build alternatives offer some travel time savings (decreases in all day VHT) over the No Action alternative.

The average annual percent growth, compounded, in VMT, assumed to be a measure of the general rate of growth of travel overall, is about 2.13% for the No Action alternative, for the 2025 Modified I-25 Alternative, and the 2025 Existing I-25 Allternative. These average annual growth rates are comparable to the rate of traffic volume growth in major urban areas around the state, somewhere between 1.5% and 2%, and are somewhat higher than CDOT AADT projections for this corridor which range from about 1% to 1.5%.

TABLE 6-3
VMT, VHT, Total Link Volumes and Annual Percent Growth for 2025 Compared to 2000 (modeled)

Alternative	PM VMT	All Day VMT	PM VHT	All Day VHT	Annual % Growth in VMT (from 2000 Base)
2000 Base	208,500	2,469,000	6,500	76,500	N/A
2025 No Action	405,400	4,184,500	14,900	147,700	2.13%
2025 Modified Alignment	406,000	4,186,900	14,800	147,000	2.13%
2025 Existing Alignment	405,500	4,181,800	14,800	146,200	2.13%

6.3.3 Travel Time Costs

To estimate the costs of travel, costs associated with auto and truck travel were assumed to be $7.20 and $19.20 respectively (the same as assumed for the I-25 Corridor Incident Management Report) per vehicle hour of travel. A weighted average of these costs results in an estimated cost of $8.40 per vehicle hour of travel.

In 2025, the cost of travel is $598,080 more (No Action Alternative) than in the 2000 base year. The Modified I-25 Alternative results in a decrease of VHT over the No Action Alternative of 700 vehicle hours. The Existing I-25 Alternative results in a decrease of VHT over the No Action Alternative of 1500 vehicle hours. The travel cost savings of the build alternatives, over the No Action Alternative, range from $5,880 (Modified Alignment) to $12,600 (Existing Alignment) per day. On an annual basis, these savings are $1,581,720 and $3,389,400 respectively.

Overall, for all day traffic, the build alternatives carry comparable amounts of traffic and the No Action alternative carries slightly more traffic between 50/47 and 13th Street and between 13th to Abriendo. South of Northern, the build alternatives tend to carry slightly more traffic than the No Action Alternative.

All alternatives carry essential the same amount of traffic in the PM peak hour with the exception of a segment south of 13th, in the northbound direction, in which the build alternatives carry about 1,000 fewer trips than the No Action alternative. This is because the northbound traveler has the option of traveling on the split diamond in this section in the build alternatives. Between US 50/SH 47 and 13th Street, the build alternative carries significantly fewer trips all day. This occurs because the traveler has an alternate choice using the South Dillon extension instead of I-25. The new frontage road system provides additional options.

6.3.4 Summary

The results of the travel demand forecasts suggest that in 2025 congestion will be significant enough, to require an additional lane on I-25. Both of the build alternatives provide this additional travel lane and relieve congestion.

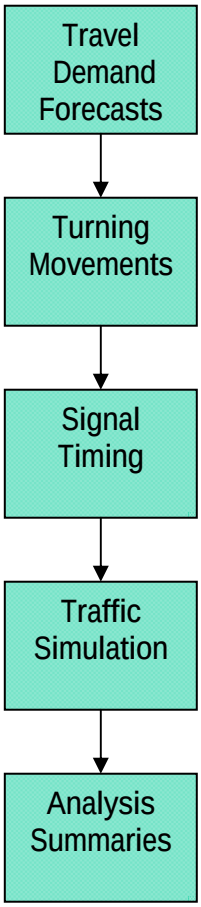
In addition, both of the build alternatives decrease VHT in the region, providing for travel time-savings. Estimated annual cost savings due to reduced travel times and reduced congestion projected for both build alternatives are as high as $3 million per year. The build alternatives also allow for a significantly improved distribution of traffic between the local network and the regional system.

7.0 Traffic Simulation and Operational Analysis Process

This section describes the traffic analysis approach used to assess the traffic operations of the various corridor alternatives. Graphical and tabular summaries of the results are also included.

7.1 Five-Step Traffic Analysis Approach

A five-step approach was used to conduct the traffic analysis process, shown in the graphic on the right. The steps are described below.



7.1.1 Travel Demand Forecasts

The travel demand forecasts (projected volumes on each network segment) were the basic input to the process. Section 6 provides a complete explanation of this step. Figures 7-1 through 7-4 show the 2025 freeway and ramp ADT and peak-hour forecasted volumes for the analyzed alternatives.

7.1.2 Turning Movements

The second step of the process was validating the forecasted intersection turning movement counts (TMCs) obtained from the TransCAD model. As noted in Section 2, one of the goals of the traffic analysis was to create a set of reasonable, defensible, and reproducible travel demand estimates for various corridor alternatives. To reach this goal, the predicted TMCs needed to be adjusted to be consistent with the patterns of existing TMCs supplied by the City of Pueblo. The process of going through the TMC adjustments and checks are detailed in the next two sections. The same general process was applied to both the No Action Alternative and the Build alternatives.

The TransCAD steps for estimating TMCs were described in Section 6, but additional checks were conducted as part of the model post-processing steps. To begin the review process the existing TMCs + deltas were compared to the TransCAD TMCs. The two values were compared for the following key features:

- *Consistent growth with field data.* Forecast volumes should be reviewed to confirm that the predicted TMCs are not lower than field data or a great deal higher than field data, without justification due to the network modifications.
- *Inflows/outflows match travel demand model screenlines.* Traffic flow in and out of each intersection must be consistent with screenline volumes from the TDM. Also each movement, approach and intersection total needed to be verified for consistency.
- *Sink/source data are realistic.* The number of vehicles that are added or subtracted between intersections needs to be reasonable when compared to the type of land use that exists between the intersections. Also, sections of streets between intersections where no sink or source should exist (e.g., between ramp terminal intersections) needed to be verified as having no sink or source present.

Changes were then identified from the above listed checks, field traffic data and professional judgment. As necessary, new assignments were run and the process was repeated until the predicted TMCs were reasonable (as described in Section 6.3).

Note that manual post-processing was performed at the intersection of Pueblo and Lake. The no action volumes were used as the build model volumes because the forecast model was predicting more traffic exiting at Pueblo and continuing south on Lake Avenue to access the Stem Beach area. The no action volumes predicted that the traffic would stay on the freeway to access the Stem Beach area, which logically makes more sense. The final set of TMCs are provided in Tables 7-1 to 7-3.

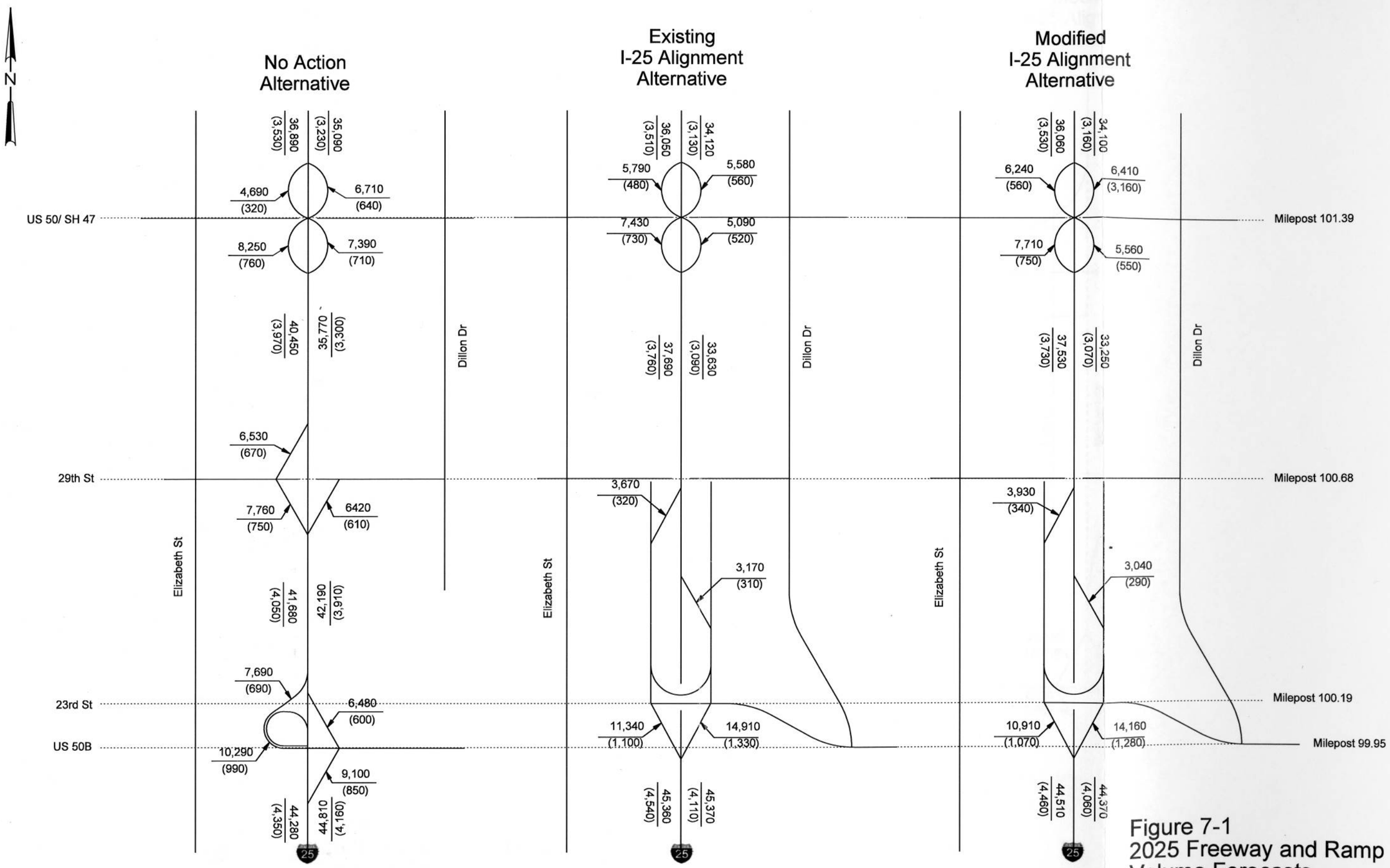


Figure 7-1
2025 Freeway and Ramp Volume Forecasts By Alternative (US 50 to US 50B)

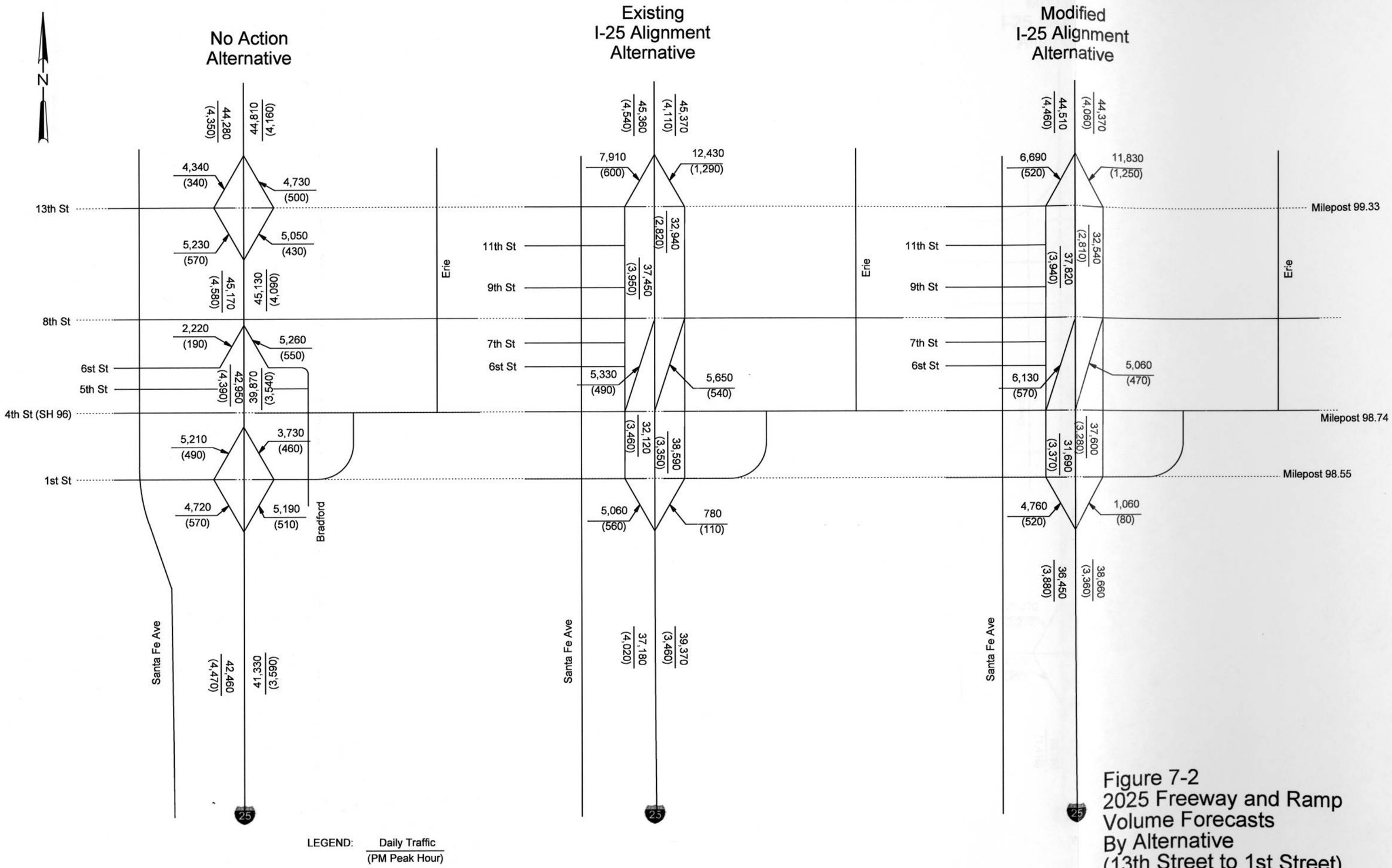


Figure 7-2
2025 Freeway and Ramp Volume Forecasts By Alternative
(13th Street to 1st Street)

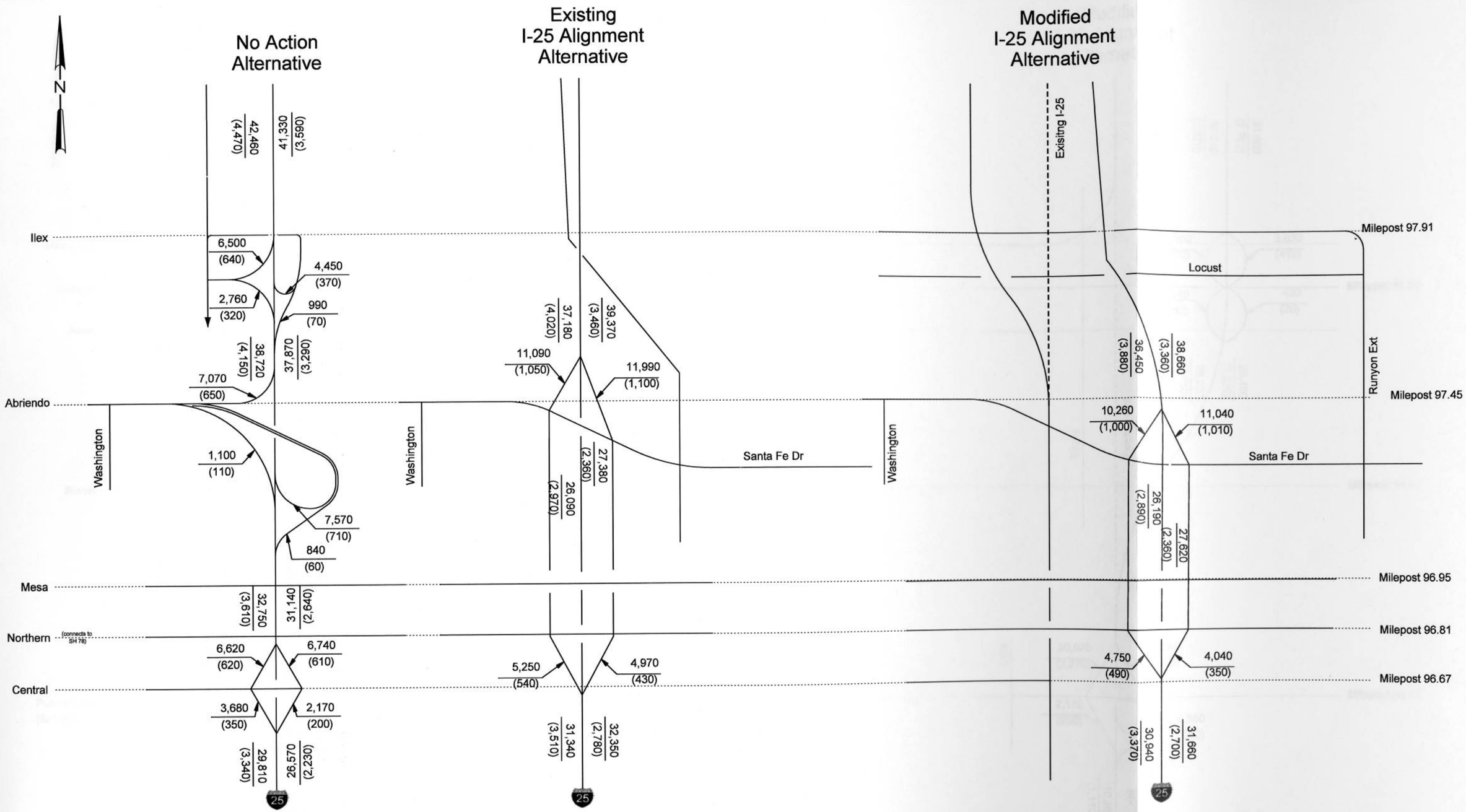


Figure 7-3
2025 Freeway and Ramp Volume Forecasts By Alternative (Ilex to Central)

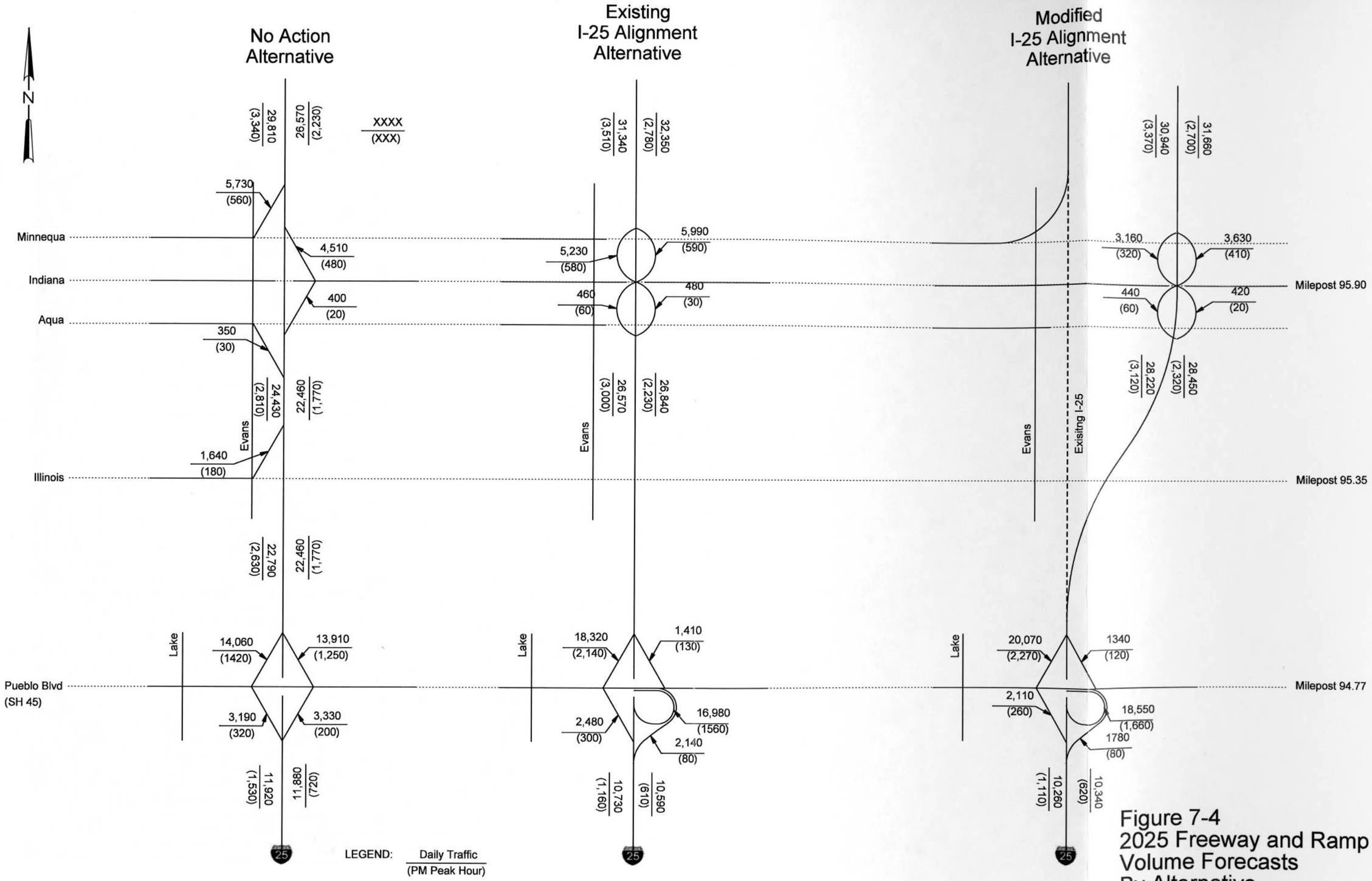


Figure 7-4
2025 Freeway and Ramp Volume Forecasts By Alternative (Minnequa to Pueblo Blvd.)

TABLE 7-1
2025 No Action Alternative Forecasted Turning Movement Counts by Intersection

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
US 50 & Elizabeth	10	2150	210	590	2610	0	330	190	750	20	90	10
US 50 & I-25 SB		2290	630		2900							290
US 50 & I-25 Mid	590	1700		130	2290		610			30		
US 50 & I-25 NB		1730			2430	50			100			
US 50 & Dillon	20	1720	90	150	2340	550	130	80	200	890	60	0
US 50B & Bonforte	620	700	220	100	820	30	200	450	110	50	430	580
29th & Elizabeth	390	480	60	410	670	130	120	770	80	320	430	220
29th & I-25 SB		140	580	180	620					0	0	670
29th & I-25 NB	140	0			0	0	430	180	0	0		370
29th & Dillon	0		0				0	0			0	0
US 50B & I-25 SB						990				690		
US 50B & I-25 NB		690			990	600			850			
13th & Santa Fe	0	230	0	180	120	470	0	80	290	550	110	0
13th & I-25 SB		500	570	0	430					0	0	340
13th & I-25 NB	500						430	0				
11th & Santa Fe	100	0	0	0	0	0	0	270	0	0	260	60
9th & Santa Fe	50	0	0	0	0	0	0	160	0	0	150	80
8th & Santa Fe	60	330	110	320	280	60	70	40	470	130	10	0
8th & Erie	0	890	0	0	650	0	0	0	0	0	0	0
6th & Santa Fe				140	50	0	140	570			560	0
6th & I-25 SB off				0	190	0	0	30			120	0
5th & Santa Fe	110	100	0	0		0		580	0	0	700	
5th & I-25 NB On/Bradford	150		40				20	400				
4th & Santa Fe	190	490	120	260	400	0	70	390	220	0	550	50
4th & Bradford	120	610	0	290	680	290	0	0	360	30	0	0
1st and 4th		990	0	0	1230		0		0			
4th & Erie	0	990			1230	0				0		0
1st & Santa Fe	250	460	0	20	420	140	0	280	0	280	370	330
1st & I-25 SB		460	300	270	140					40	0	450
1st & I-25 NB	450	50			290	20	130	0				
1st & Bradford	350	30			20	20			380	40		260
Ilex (N) & Santa Fe				10		70		530	330	40	890	
Ilex (N) & I-25 NB			370					70				
Ilex (S) & Santa Fe/SB				610		40		820	80	230	660	
Abriendo & Washington		410	130	310	360		60		350			
Abriendo & I-25 SB Off		820			60							650
Abriendo & I-25 SB On		710	110		60							
Abriendo & I-25 NB	710						60					
Central & I-25 SB		610	350	0	200					0	0	620
Central & I-25 NB	610						200	0				
Minnequa & Evans	0		40	170	390	0	10	50			20	0
Indiana & Evans	30	380	0	10	40	20	0	0	0	60	10	160
Indiana & I-25 NB	410	30			60	70	10	0	10			
Aqua & Evans	0	0	0				0	0	10	20	0	0
Illinois & I-25 SB Off					140	40						
Pueblo & Lake	120	1310	0	210	1390	80	0	0	20	180	70	140
Pueblo & I-25 SB		1200	310	10	330					70	0	1350
Pueblo & I-25 NB	1130	130			150	120	190	0	10			

TABLE 7-2
2025 Existing I-25 Alternative Forecasted Turning Movement Counts by Intersection

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
US 50 & Elizabeth	10	2070	270	730	2610	0	340	180	700	10	140	10
US 50 & I-25 SB		2240	550		2900							440
US 50 & I-25 Mid	510	1730		180	2410		490			40		
US 50 & I-25 NB		1770			2590	50			20			
US 50 & Dillon	30	1560	200	250	2260	540	350	110	380	830	140	30
29th & Elizabeth	290	450	100	180	520	120	150	830	100	330	610	280
29th & SB Frontage Road		150	560	0	860							
29th & NB Frontage Road	150	0			0	0	640	0	0	0		220
29th & Dillon	0		0				0	650			510	0
US 50B SB Off Ramp & SB Frontage Road				320							560	
US 50B NB On Ramp & NB Frontage Road							310	640				
US 50B & SB Frontage Road/SB On Ramp				940						710	170	
US 50B & NB Frontage Road/NB Off Ramp		710			930	760	10	190	1140			
US 50B & Dillon	270	1580			1570	380				380		120
US 50B & Bonforte	590	990	390	100	1100	20	300	480	90	50	350	560
13th & Santa Fe	0	390	0	200	240	350	0	50	510	240	260	0
13th & I-25 SB Off Ramp/SB Frontage		1140	0	0	210					0	20	580
13th & I-25 NB On Ramp/NB Frontage	1140						210	150				
11th & Santa Fe	60	0	70	0	0	0	50	510	0	0	430	30
11th & SB Frontage Road			0								20	0
9th & Santa Fe	80	60	30	0	0	0	80	480	0	190	270	50
9th & SB Frontage Road			250								20	0
8th & Santa Fe	60	290	70	150	330	100	30	340	210	20	200	40
8th & SB Frontage Road		420	80	20	580					180	80	0
8th & NB Frontage Road	10	590			360	220	230	120	240			
8th & Erie	30	630	180	450	360	0	230	50	200	0	0	0
6th & Santa Fe				0	0	0	60	580			530	0
6th & SB Frontage Road											180	0
6th SB Off Ramp & SB Frontage Road				490							180	
6th NB Off Ramp & NB Frontage Road	540							60				
5th & Santa Fe	170	0	0	80		0		330	50	0	450	
4th & Santa Fe	50	660	80	60	500	0	40	330	280	40	360	70
4th & NB Frontage Road	0	980			1200	30	0	30	160			
4th & SB Frontage Road		920	100	750	460					60	480	130
1st and 4th		1100	20	40	1180		20		10			
4th & Erie	270	850			750	230				170		470
1st & Santa Fe	410	120	0	150	700	10	0	200	10	30	360	110
1st & I-25 SB On Ramp/SB Frontage Road		90	90	10	30					20	470	830
1st & I-25 NB Off Ramp/NB Frontage Road	80	30			20	30	20	80	10			
Abriendo & Washington		460	160	240	380		80		280			
Santa Fe Drive & Santa Fe Ave				50		230	270		60	580		350
Abriendo & Santa Fe Drive		480	170	380	220		70		430			
Abriendo & I-25 SB		640	100	60	250					320	340	400
Abriendo & I-25 NB	460	500			270	280	50	360	0			
Northern & SB I-25 On Ramp/SB Frontage		1120	110	280	980					0	160	340
Northern & NB I-25 Off Ramp/NB Frontage	360	760			1240	0	20	50	360			
Minnequa & Evans	0	0	70	0	0	0	60	50	0	0	80	0
Indiana & Evans	0	420	0	70	440	100	0	0	20	120	10	20
Indiana & I-25 SB		530	30		50							550

TABLE 7-2
2025 Existing I-25 Alternative Forecasted Turning Movement Counts by Intersection

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Indiana & I-25 Mid	520	10		30	40		20			20		
Indiana & I-25 NB		40			60	70			10			
Aqua & Evans	0	0	0	0	0	0	0	0	0	0	0	0
Pueblo & Lake	120	1310	0	210	1390	80	0	0	20	180	70	140
Pueblo & I-25 SB		1620	290	10	200					80	0	2060
Pueblo & I-25 NB Off Ramp		140			260		70		0			
Pueblo & I-25 NB On Ramps		140	1560		210	120						

TABLE 7-3
2025 Modified I-25 Alternative Forecasted Turning Movement Counts by Intersection

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
US 50 & Elizabeth	10	2140	270	730	2710	0	270	200	690	20	130	10
US 50 & I-25 SB		2270	570		2910							530
US 50 & I-25 Mid	570	1700		190	2360		550			30		
US 50 & I-25 NB		1730			2540	70			0			
US 50 & Dillon	30	1530	180	260	2240	530	340	110	390	830	120	30
29th & Elizabeth	340	470	80	170	570	130	120	720	100	380	540	280
29th & SB Frontage Road		140	620	0	910							
29th & NB Frontage Road	140	0			0	0	710	0	0	0		200
29th & Dillon	0		0				0	650			490	0
US 50B SB Off Ramp & SB Frontage				340							620	
US 50B NB On Ramp & NB Frontage							290	710				
US 50B & SB Frontage Road/SB On				870						760	200	
US 50B & NB Frontage Road/NB Off		760			870	760	0	240	1040			
US 50B & Dillon	280	1520			1490	370				350		140
US 50B & Bonforte	520	950	390	100	1050	20	280	550	90	50	390	540
13th & Santa Fe	0	190	0	110	120	390	0	50	180	450	70	10
13th & I-25 SB Off Ramp/SB Frontage		590	240	0	290					0	190	330
13th & I-25 NB On Ramp/NB Frontage	590						290	660				
11th & Santa Fe	0	0	60	0	0	0	30	180	40	0	180	0
11th & SB Frontage Road			40								420	0
9th & Santa Fe	80	0	0	0	0	0	0	140	0	50	160	50
9th & SB Frontage Road			50								470	0
8th & Santa Fe	0	420	90	230	420	40	60	50	640	0	110	10
8th & SB Frontage Road		970	60	60	570					260	160	100
8th & NB Frontage Road	500	730			430	280	190	170	170			
8th & Erie	10	580	310	370	460	0	250	40	270	0	0	0
6th & Santa Fe				0	0	0	80	750			540	0
6th & SB Frontage Road											280	0
6th SB Off Ramp & SB Frontage Road				570							280	
6th NB Off Ramp & NB Frontage Road	470							70				
5th & Santa Fe	170	0	0	70		0		530	50	0	460	
4th & Santa Fe	130	690	80	100	520	0	40	450	240	30	370	70
4th & NB Frontage Road	0	960			1200	30	0	30	280			
4th & SB Frontage Road		920	90	780	420					40	580	240
1st and 4th		1200	20	40	1190		20		10			
4th & Erie	320	890			830	250				310		400
1st & Santa Fe	380	200	0	390	620	10	0	300	70	20	420	120

TABLE 7-3
2025 Modified I-25 Alternative Forecasted Turning Movement Counts by Intersection

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
1st & I-25 SB On Ramp/SB Frontage		240	70	10	40					20	450	990
1st & I-25 NB Off Ramp/NB Frontage	230	30			20	30	20	60	10			
Santa Fe Ave & Runyon Ext	0	0	450	0	0	0	270	380	0	0	800	0
Locust & Runyon Ext	0	0	0	0	0	0	0	0	0	0	0	0
Abriendo & Washington		520	100	110	440		70		70			
Abriendo & Santa Fe Ave	40	460	110	0	430	110	80	470	0	230	940	80
Abriendo & I-25 SB		690	0	20	300					280	480	240
Abriendo & I-25 NB	250	720			290	220	30	540	20			
Santa Fe Drive & Runyon Ext	20	720	0	0	490	0	0	0	0	0	0	20
Mesa & SB Frontage Road		270	0	60	30					50	280	180
Mesa & NB Frontage Road	190	130			90	100	0	290	60			
Northern & SB I-25 On Ramp/SB		1310	200	260	1250					0	30	310
Northern & NB I-25 Off Ramp/NB	320	990			1420	0	90	20	240			
Central & Santa Fe Ave	220		0				0	420			440	320
Minnequa & Evans	0	150	50	100	160	0	50	20	50	0	40	0
Indiana & Evans	20	280	0	20	240	80	0	20	10	90	50	40
Indiana & I-25 SB		370	30		40							300
Indiana & I-25 Mid	350	20		40	30		10			20		
Indiana & I-25 NB		30			70	60			10			
Aqua & Evans	0	0	0	0	0	0	0	40	0	0	80	0
Pueblo & Lake	120	1310	0	210	1390	80	0	0	20	180	70	140
Pueblo & I-25 SB		1720	250	10	210					70	0	2200
Pueblo & I-25 NB Off Ramp		140			260		80		0			
Pueblo & I-25 NB On Ramps		140	1660		210	120						

7.1.3 Signal Timing

The TMCs obtained from Step 2 were used with the Synchro (version 5.0) traffic signal optimization program to develop a signal timing plan for each corridor alternative. Existing signal timing plans were provided by the City of Pueblo, but these timing plans will almost certainly change, as future traffic volumes and new roadway geometry dictate new control strategies. The rationale for using Synchro instead of hand modifying the signal timing for each modeled alternative is as follows:

1) The existing surface street model was already available from the City of Pueblo in Synchro, which contained the base roadway network and all the signalized intersection information.

2) It was necessary to create a signal timing plan for each alternative. Since the existing model was already available, it could be easily modified for each alternative using Synchro optimization functions. In this way, reasonable signal timing plans could be obtained efficiently.

3) Input from the TMC spreadsheet was transferred to Synchro using its data transfer functions. Once the signal timing plan was created in Synchro, transferring the volume and signal timing information to CORSIM was easily accomplished.

Once the TMC information was transferred from the spreadsheet to Synchro, each stop-controlled intersection was evaluated to determine if a signal was needed. This was not a formal warrant process, but based on operations. Where the LOS for a stop-controlled intersection degraded to LOS E or F in a particular alternative, it was assumed that a signal would be warranted at that location. Assuming that a traffic signal would be installed once the warrant was met, the alternative was modified with a signal at the intersection. For a detailed list of intersections that met signal warrants refer to Appendix C.

Signalization was included at all new intersections. After the new signals were coded, all signals were optimized on a network basis using pre-timed signals with a cycle length between 60 and 110 seconds.

Finally, each intersection was evaluated for possible signal timing and geometric improvements. Each intersection was evaluated by approach and movement. Where the signal timing of an approach could be adjusted to give a better overall LOS, the signal timing was modified. Also, the volume to capacity ratio (V/C ratio) was evaluated for each turn lane and, where traffic volumes will change due to the proposed project, the following rules were established for adding new turn lanes:

- If the left-turn volume exceeded 300 vehicles per hour (vph), then the intersection would need a dual left-turn lane
- If the right-turn volume exceeded 50 vph, then an exclusive right-turn lane would be added

A detailed list of turn-lane mitigations is provided in Section 9.

7.1.4 Traffic Simulation

The CORSIM traffic simulation program (TSIS version 5.1, developed and maintained by FHWA) was used to simulate and assess the traffic operations of each alternative. CORSIM provides a detailed simulation of freeways and surface streets (including signalized and unsignalized intersections). With CORSIM, it is straightforward to analyze a complete system for all alternatives.

Coding Inputs

The no action CORSIM network was coded using as-built information. Where modifications were made for the build alternatives, such as acceleration and deceleration lane length, the AASHTO design guide and professional judgment were used to determine the length. In the build alternatives, each new intersection was assumed to have two through on the major road and the number of turning lanes was determined by evaluating V/C ratios and overall intersection LOS in Synchro.

All signal timing information and turning movement volumes were transferred from Synchro to CORSIM. Once the transfer process was complete, all volumes and signal timings were checked against the original Synchro file.

CORSIM Adjustments

Once the initial CORSIM run was complete, the simulation was reviewed for any queuing or operational problems at on-ramps and at intersections. CORSIM has some different

simulation parameters than Synchro, which sometimes required modifying the signal timing to provide more realistic operations.

For the build alternatives, the southbound ramp terminal at Pueblo Boulevard showed LOS F. The LOS F was actually due to a capacity constraint at the loop ramp to northbound I-25 at Pueblo Boulevard. The projected demand for that ramp is about 1650 vehicles/hour, exceeding the capacity of about 1500 vehicles/hour. The bottleneck at the entrance ramp backed up traffic on eastbound Pueblo Blvd. and queued through the southbound ramp terminal intersection.

For the operations analysis, a second lane was added to the loop ramp; however, it was reduced to one lane before merging with I-25 northbound. Furthermore, an additional through lane was added to Pueblo Blvd and channelized as a shared right/through lane at the ramp terminal intersection. Therefore, the lane configuration eastbound on Pueblo Boulevard was modeled as through, through/right, exclusive right.

These modifications eliminated the queuing problem along Pueblo Boulevard and allowed the vehicles to continue through the model network. However, this solution was only created to assist in the operations analysis and the final resolution for this issue will be determined during the design phase of the project.

7.1.5 Analysis Summaries

The last step in the traffic analysis process was to transfer the CORSIM output to an Excel spreadsheet to compare the operational characteristics for each alternative. The following data were reported for each alternative:

- LOS for each intersection
- LOS for each freeway segment
- Network/system measures including vehicle-miles traveled, percent of travel time delayed, average speeds, seconds per mile of delay, the number of intersections with LOS E or F and the percent of freeway miles with LOS E or F.

In addition, the Highway Capacity Manual (HCM) analysis output from Synchro was evaluated and served as a conservative comparison to the CORSIM intersection output. The HCM output was used as the basis for the reported intersection LOS. For the purposes of comparison, Appendix D contains the CORSIM intersection LOS output.

Section 8 provides a discussion of the results.

8.0 Results and Conclusions

8.1 Summary of LOS Results

Tables 8-1 and 8-2 show the freeway LOS results by direction. Table 8-3 shows the HCM intersection LOS results and Table 8-4 shows the overall network/system measures by alternative. CORSIM was used to determine the freeway and system measures because it can analyze the system effects of the potential changes. At the intersections, the HCM analysis (using the reports from Synchro) was used as the basis for comparison.

TABLE 8-1
Northbound Freeway Segment LOS

Freeway Segment	Direction	No Action LOS	Existing LOS	Modified LOS
North of US 50	NB	B	B	B
Between US 50 Ramps	NB	C	B	B
US 50B to US 50	NB		B	B
29th Off to US 50	NB	C		
US 50 B to 29th Off	NB	C		
Between US 50 B ramps	NB	C	B	B
13th to US 50 B	NB	C	B	B
Between 13th Ramps	NB	D		
5th to 13th	NB	C		
6th Off to 13th	NB		B	B
1st to 6th Off	NB		C	C
1st to 5th On	NB	D		
Between 1st Ramps	NB	D		
Ilex to 1st	NB	D		
Between Ilex Ramps	NB	E		
Abriendo to Ilex	NB	D		
Abriendo to 1st	NB		B	B
Between Abriendo Ramps	NB	D		
Central to Abriendo	NB	C		
Northern to Abriendo	NB		B	B
Between Central ramps	NB	C		
Indiana to Northern	NB		B	B
Indiana to Central	NB	B		
Between Indiana Ramps	NB	B	B	B
Pueblo to Indiana	NB	B	A	A
Between Pueblo Ramps	NB	A		
Pueblo On (Loop) to Pueblo On (Slip)	NB		B	B
Pueblo Off to Pueblo On (Loop)	NB		A	A
South of Pueblo	NB	A	A	A

TABLE 8-2
Southbound Freeway Segment LOS

Freeway Segment	Direction	No Action LOS	Existing LOS	Modified LOS
North of US 50	SB	D	B	B
Between US 50 Ramps	SB	D	B	B
US 50 to 29th	SB	C		
Between 29th Ramps	SB	D		
29th to US 50 B off	SB	C		
US 50 to US50B Off	SB		C	C
Between US 50B Ramps	SB	D	C	C
US 50B to 13th	SB	D	C	C
Between 13th Ramps	SB	E		
13th to 6th Off	SB	D	C	C
6th Off to 1st	SB	E	C	C
Between 1st Ramps	SB	F		
1st to Ilex	SB	F		
Between Ilex Ramps	SB	E		
1st to Abriendo	SB		C	C
Ilex to Abriendo	SB	C		
Between Abriendo Ramps	SB	D		
Abriendo to Northern	SB		B	B
Abriendo to Central	SB	D		
Between Central ramps	SB	D		
Central to Minnequa Off	SB	C		
Northern to Indiana	SB		B	B
Minnequa Off to Aqua On	SB	C		
Between Indiana Ramps	SB		B	B
Indiana to Pueblo	SB		B	B
Aqua On to Illinois Off	SB	B		
Illinois Off to Pueblo	SB	B		
Between Pueblo Ramps	SB	A	A	A
South of Pueblo	SB	A	A	A

TABLE 8-3
Intersection LOS using the HCM Methodology

Intersection	No Action Scenario	Existing Alignment	Modified Alignment
	HCM LOS	HCM LOS	HCM LOS
US 50 & Elizabeth	E	D/E	D/E
US 50 & I-25 SPUI	C	C	C
US 50 & Dillon	F	D	D
29th & Elizabeth	D	C/D	D
29th & I-25 SB	F	A*	A*
29th & I-25 NB	D/E	D	C
29th & Dillon	A	B	B
US 50B & I-25 SB	A*	A/B	B
US 50B & I-25 NB	A*	A/B	A/B
US 50B & Dillon		B	B
US 50B & Bonforte	E	D	D
13th & Santa Fe	C	B/C	C/D
13th & I-25 SB	C/D	B	B
13th & I-25 NB	B	B	A
11th & Santa Fe	B	C	B
9th & Santa Fe	B	B	B
8th & Santa Fe	D	C	E**
8th & Erie	B	C	C/D
8th & SB Frontage Road		B	B
8th & NB Frontage Road		C	C
6th & Santa Fe	B	B	B
5th & Santa Fe	B	A	A
4th & Santa Fe	C	C	C
4th & Bradford/4th and NB Frontage Road	D/E	A	A
4th & SB Frontage Road		C	C/D
1st and 4th	A/B	A	A
4th & Erie	A/B	D	D
1st & Santa Fe	C	C	C
1st & I-25 SB	A	B	A/B

TABLE 8-3
Intersection LOS using the HCM Methodology

Intersection	No Action Scenario	Existing Alignment	Modified Alignment
	HCM LOS	HCM LOS	HCM LOS
1st & I-25 NB	B/C	B	B
1st & Bradford	A*		
Ilex (N) & Santa Fe	A/B		
Ilex (S) & Santa Fe/SB Ramps	C		
Runyon Ext & Santa Fe Ave			C
Santa Fe Ave & Santa Fe Ave		B	C
Santa Fe Drive & Runyon Ext			B
Abriendo/Abriendo/Washington	B	C	B/C
Abriendo and Santa Fe Drive (Existing I-25 Alternative Only)		D	
Northern & SB Frontage Road		C	C
Northern & NB Frontage Road		C	C
Abriendo & I-25 SB		B	B/C
Abriendo & I-25 NB		C	A/B
Central & I-25 SB or Central & Santa Fe	D		B
Central & I-25 NB	A/B		
Minnequa & Evans	A*	A*	C
Indiana & Evans	B*	B	A/B
Indiana & I-25 SPUI		C	C
Aqua & Evans	A*	A*	A*
Pueblo & Lake	D	C/D	C/D
Pueblo & I-25 SB	B	B	B/C
Pueblo & I-25 NB	B	A/B	A/B

Denotes unsignalized intersection

** The CORSIM analysis predicts that this intersection will operate at LOS C (see Appendix D). Since the HCM analysis is overly conservative in its estimate of delay with high right-turning volume, the intersection is likely to operate similar to LOS C as CORSIM predicted.

Figures 8-1 through 8-4 graphically show intersection LOS. In Appendices G, H, and I, HCM reports are provided for each signalized intersection for each alternative to show the final lane configurations at the analysis intersections.

FIGURE 8-1
PM Peak-Hour Intersection LOS by Alternative from US 50 to 50B

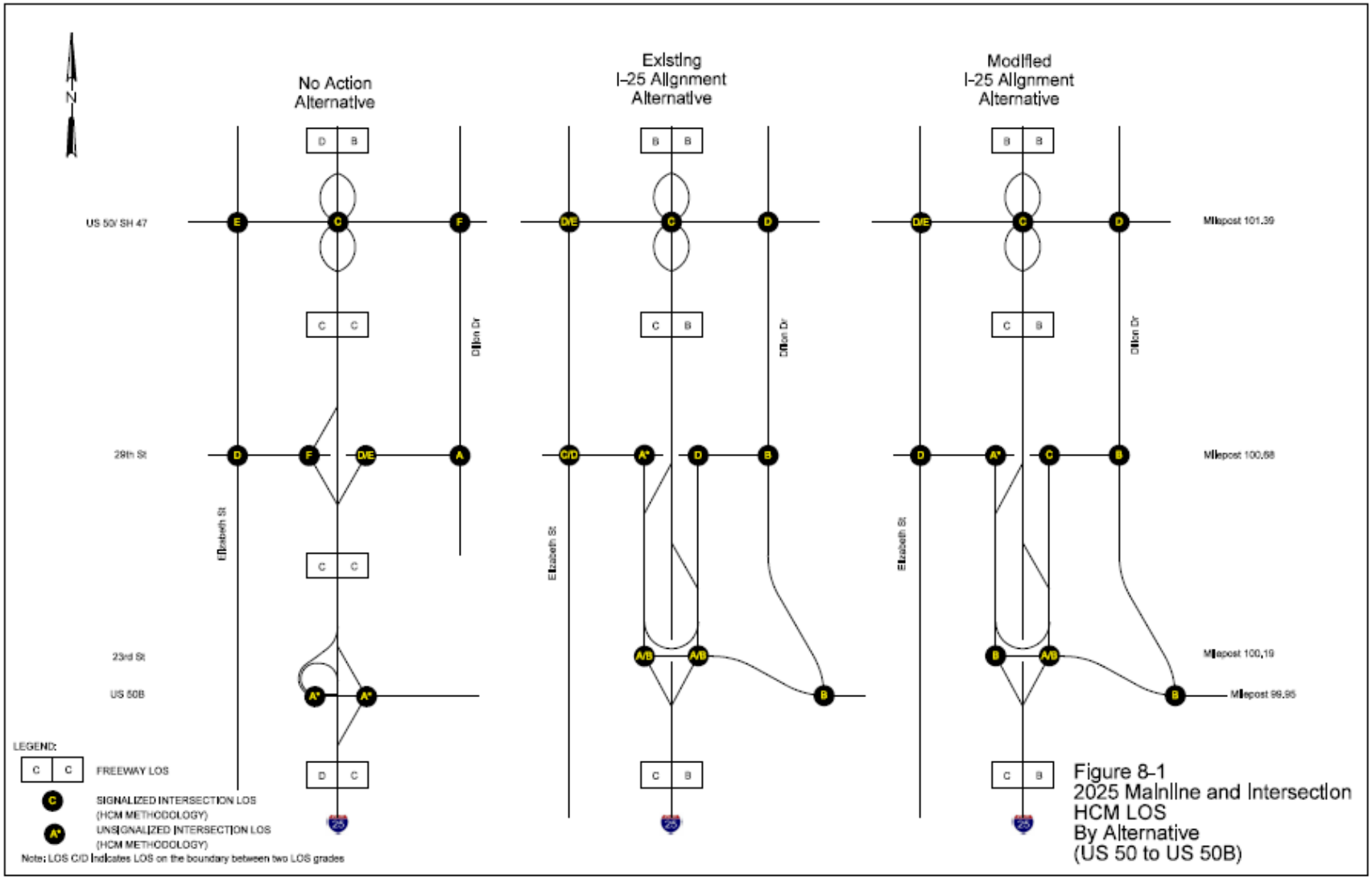


FIGURE 8-2
PM Peak-Hour Intersection LOS by Alternative from 13th Street to 1st Street

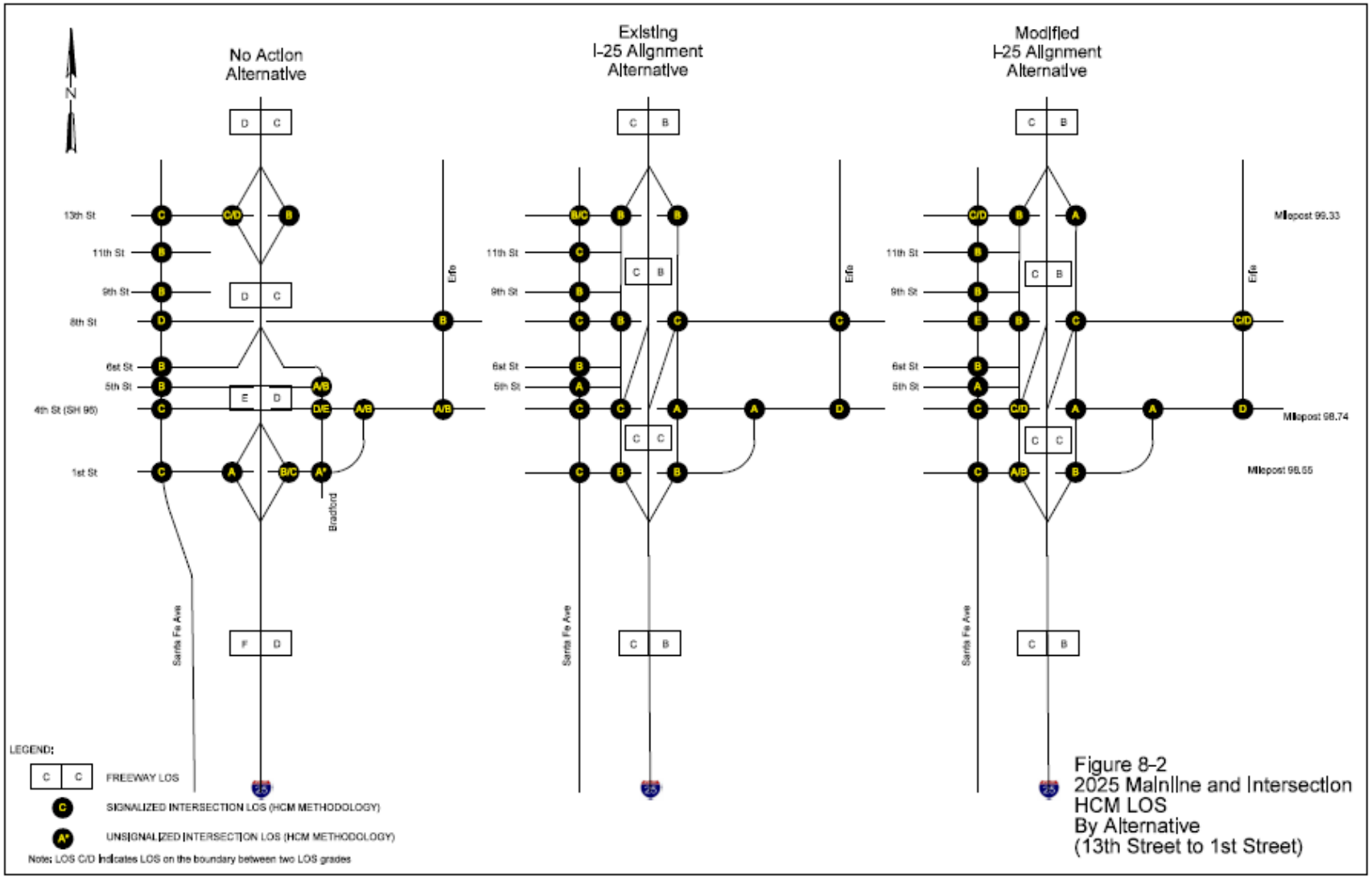


FIGURE 8-3
PM Peak-Hour Intersection LOS by Alternative from Ilex to Central

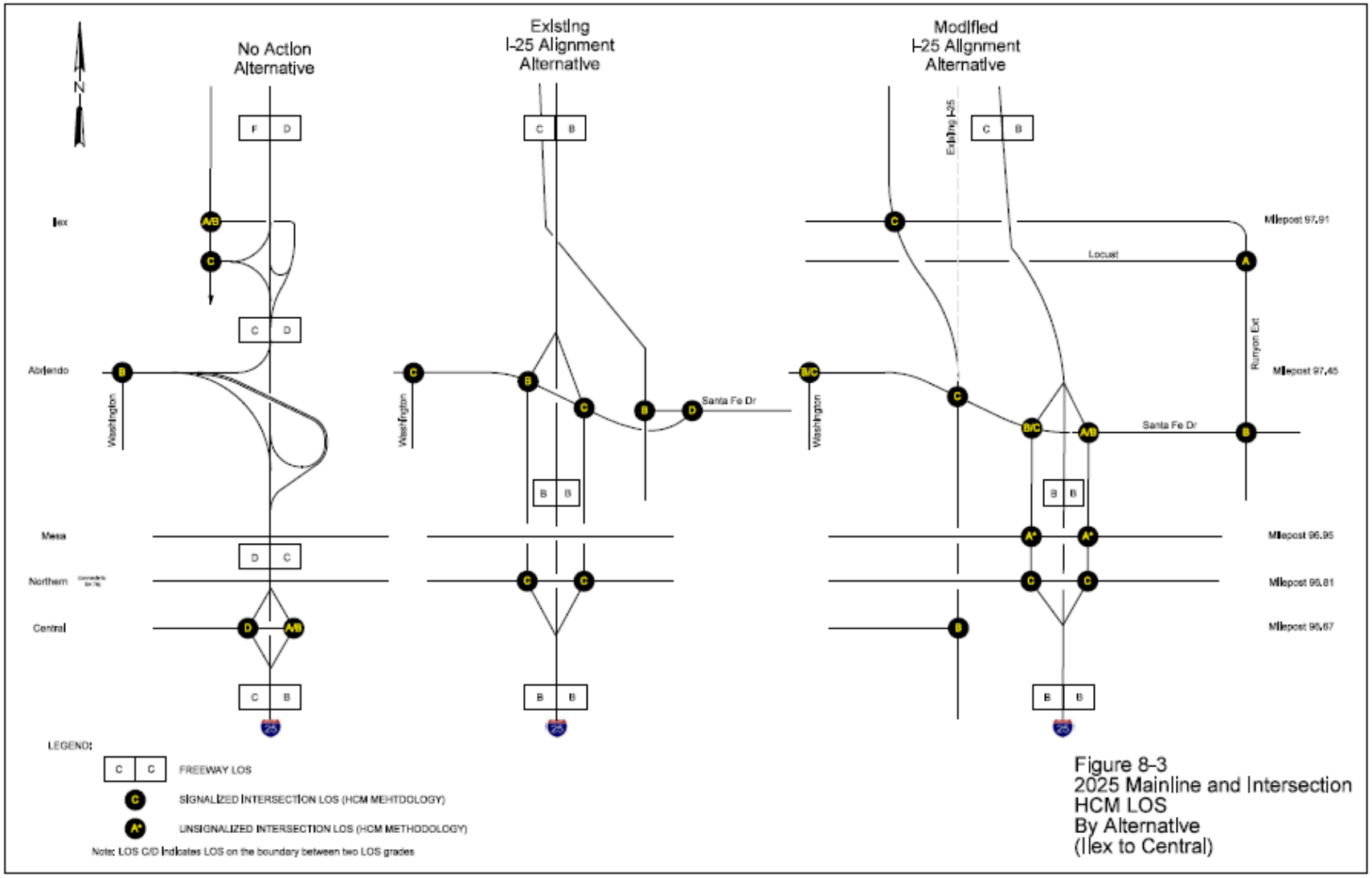


FIGURE 8-4
PM Peak-Hour Intersection LOS by Alternative from Minnequa to Pueblo Boulevard

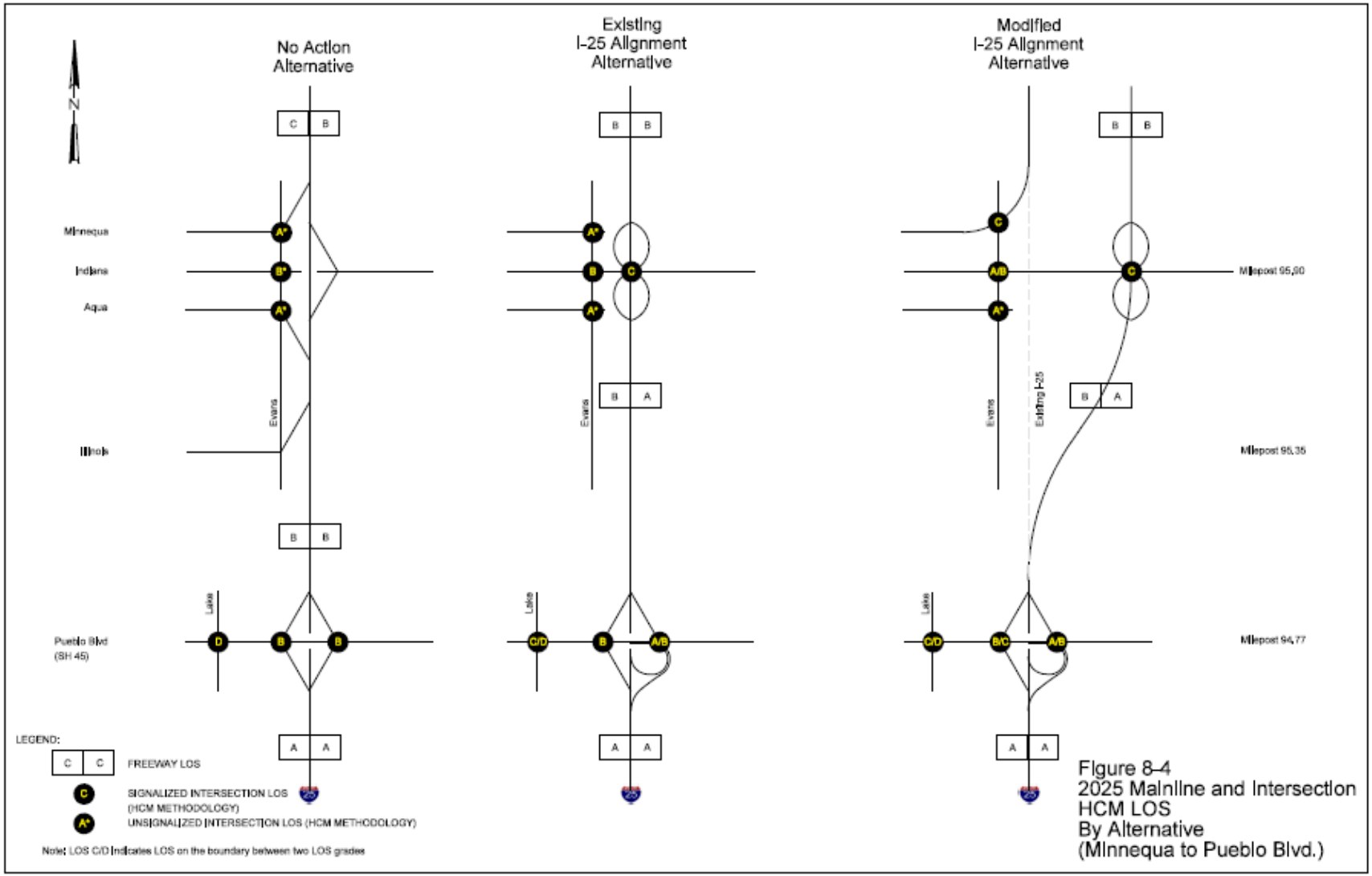


TABLE 8-4
Network/System Measures

System Data	No Action	Existing	Modified
Total Vehicle-Mile	66,251	69,619	71,706
Veh Hrs of Move Time	1,417	1,547	1,629
Veh Hrs of Delay Time	893	884	934
% of Travel Time Delayed	39%	36%	36%
Veh Hrs of Total Time	2,310	2,431	2,563
Average Speed (mph)	29	29	28
Move/Total	0.61	0.64	0.64
Min/Mile of Delay Time	0.81	0.76	0.78
Number of Intersections w/ E (HCM)	2	0	1
Number of Intersections w/ F (HCM)	2	0	0
Percentage of Freeway Miles at LOS C or better	64%	100%	100%
Percentage of Freeway Miles at LOS D	26%	0%	0%
Percentage of Freeway Miles at LOS E	7%	0%	0%
Percentage of Freeway Miles at LOS F	2%	0%	0%
Average Speed NB	56	57	57
Average Speed SB	53	57	57

8.2 No Action Analysis

The operational analysis of the No Action Alternative suggested some operational deficiencies will occur by the year 2025. These issues include LOS D to F conditions on both the freeway and intersections:

- On SB I-25, LOS F is predicted from 1st to Ilex. LOS D or worse is predicted north of US 50, between the 29th ramps, from US 50B to Ilex and from Abriendo to Central.
- On NB I-25, LOS D or worse is predicted from Central to Abriendo and between the 13th ramps.
- The intersections will generally operate at an acceptable LOS (D or better). The exceptions are the intersections at: US 50/Elizabeth (LOS E), US 50/Dillon (LOS F), 29th/SB ramp terminal (LOS F) and US 50B/Bonforte (LOS E).

Refer to Section 8.1 for the detailed tables of the analysis results.

8.3 Existing I-25 Alternative and Modified I-25 Alternative

In general, the Existing I-25 Alternative and Modified I-25 Alternative will provide very similar operations on the freeway and at the signalized intersections.

8.3.1 Freeway Performance

Both of the build alternatives provide better performance than the no action scenario (see Figure 8-5). While the no action alternative has several sections operating at LOS E or F, all of the build alternative freeway segments operate at LOS C or better.

8.3.2 Intersection Performance

Like the no action alternative, most of the intersections will operate at LOS D or better. This is a positive benefit, because the build alternative will remove interchanges and encourage short trips to use the surface street network. Even with the additional traffic, only one intersection is predicted to operate at LOS E (using the HCM output): 8th/Santa Fe for the Modified I-25 Alignment only. However, the CORSIM analysis predicts that this intersection will operate at LOS C (see Appendix D). Since the HCM analysis is overly conservative in its estimate of delay with high right-turning volume, the intersection is likely to operate similar to LOS C as CORSIM predicted.

8.3.3 System Performance

Figure 8-6 illustrates a comparison of system performance on a wide variety of measures of effectiveness (MOEs). These include average speed, delay (overall and per mile), and total travel. The figure indicates that the Build Alternative (either Modified I-25 Alignment or Existing I-25 Alignment) provides operational benefits over the no action alternative.

At the predicted volumes, the benefits between no action and build are not very notable due to the fact that the roadway network is only moderately congested. However, a sensitivity analysis was also conducted to determine if the benefits of the build alternatives were consistent at higher volumes. Traffic volumes were increased by ten and twenty percent (over projected 2025 volumes). Figure 8-7 illustrates that the reduction in delay is consistent at the higher demand levels and as the volumes increase, the build alternative provides greater operations benefit over the no action alternative.

8.3.4 US 50B Sensitivity Analysis

A technical memorandum was prepared to summarize the consequences of adding an intersection at Erie along US 50B. The full text of the memo is contained in Appendix E. The outcome of the sensitivity analysis showed that the intersection of Erie and US 50B would operate at LOS D or better conditions even if the forecasts are off by as much as 20 percent. Additionally, a large buffer exists between the base forecasts and intersection failure, supporting the conclusion that the LOS of the intersections along US 50B will operate at an acceptable LOS for Year 2025.

FIGURE 8-5
Freeway LOS Comparison

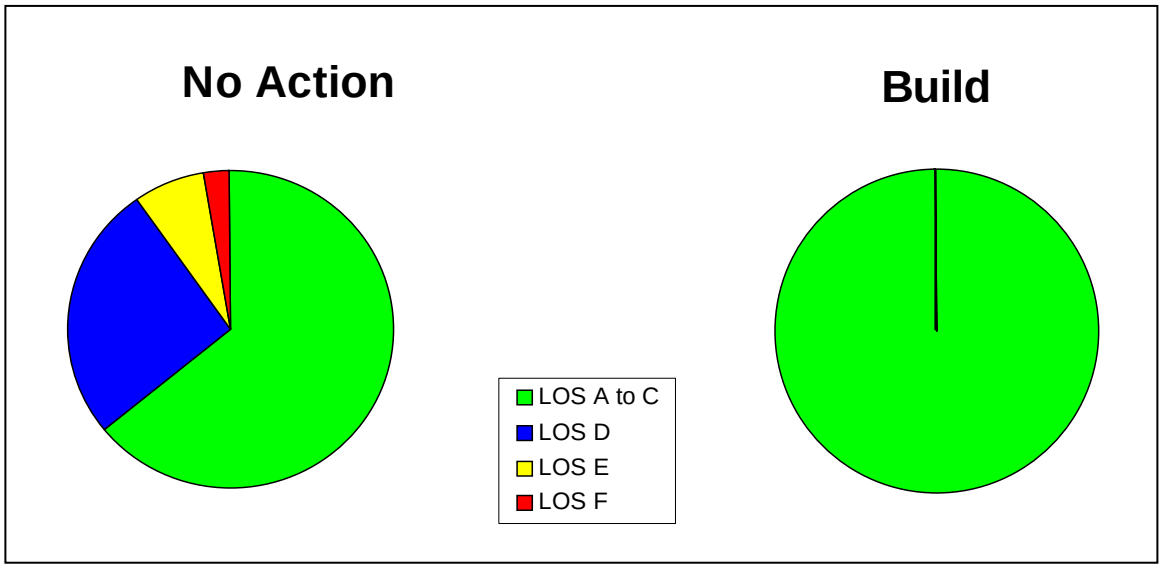
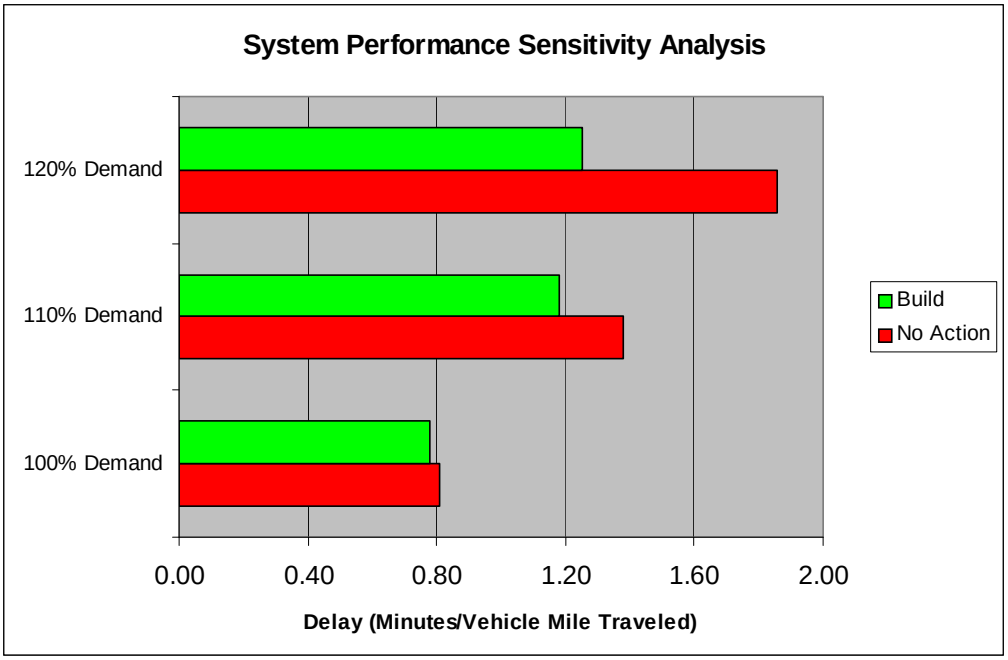


FIGURE 8-6
System Performance

System Data	**No Action**	**Exst Align**	**Mod Align**	Ave	No Action
Total Vehicle-Mile	66251	69619	71706	70663	0.94
% of Travel Time Delayed	39%	36%	36%	36%	0.94
Total Vehicle Hours	2310	2431	2563	2497	0.93
Average Speed (mph)	29	29	28	28	0.99
% of Time Moving	0.61	0.64	0.64	0.64	0.95
Min/Mile of Delay Time	0.81	0.76	0.78	0.77	1
Avg. Speed Northbound	56	57	57	57	0.98
Avg. Speed Southbound	53	57	57	57	0.93

FIGURE 8-7
System Performance Sensitivity



9.0 Impacts and Mitigations

During preliminary design, the Technical Leadership Team identified potential traffic impacts resulting from the new traffic patterns for the build alternatives. The design has been updated to mitigate those impacts and provide needed capacity, storage, and safety elements. Therefore, no additional mitigations are needed for traffic operations. Some of the identified operations issues (impacts) and associated design changes (mitigations) are presented below:

TABLE 9-1
Lane Configuration Modifications Made to Improve Traffic Operations

Alternative	Intersection	Modification
No Action	4th Street/Santa Fe	Right-turn bay added northbound.
No Action	Ilex SB Ramps/Santa Fe Avenue	Left-turn bay added southbound.
No Action	Pueblo Boulevard/I-25 NB Ramps	Between the ramp terminal intersections, Pueblo Boulevd. in the westbound direction was modeled as one through lane and a left-turn lane.
Existing\ Modified	Pueblo Boulevard/I-25 SB Ramps	Added additional westbound through lane west of the southbound ramp; added additional southbound right-turn lane
Existing\ Modified	1st Street/I-25 SB Ramps	Added exclusive right-turn lane
Existing\ Modified	8th Street/NB Frontage Rd	Added additional eastbound left-turn lane

To address uncertainties in demand, a number of capacity improvements were added as a safety factor at the direction of the City of Pueblo. These lane configuration modifications are listed by location in Appendix F. The process to identify and accept these locations was as follows:

- If the left-turn volume exceeded 300 vehicles per hour (vph), then the intersection would need a dual left-turn lane
- If the right-turn volume exceeded 50 vph, then an exclusive right-turn lane would be added
- Other locations the City of Pueblo deemed a potential “hotspot” or an intersection of concern

The project team met to reach consensus regarding the lane configuration modifications suggested by the City of Pueblo. Generally, the lane configuration modifications were accepted as long as the modification would not create additional/new right-of-way or environmental impacts.

Given that the alternatives were designed (and improved in an iterative review process), no further traffic mitigations are deemed necessary. The team did identify some potential

Appendix A

Conversion and Verification Memo for the PACOG Travel Demand Forecasting Model

Conversion and Verification of PACOG Travel Demand Forecasting Model

PREPARED FOR: Bill Moore, PACOG

PREPARED BY: EF Granzow

DATE: February 27, 2002 Revised from earlier version

This technical memorandum describes the process of converting the Pueblo Area Council of Governments' (PACOG) travel demand forecasting model's operation and procedures to a new software platform. As a portion of the Colorado Department of Transportation's I-25: New Pueblo Freeway project, the PACOG travel demand model was converted from the Minutp application software environment to the TransCAD application software environment; a package recently adopted as a standard by PACOG. As part of that conversion process, a set of scripts and procedures which parallel Minutp operation were developed and the results of exercising those scripts and procedures was compared to similar results from the Minutp based process.

This memo documents the changes in procedures and parameters that were necessary to implement the PACOG model in the TransCAD environment and also provides summary comparisons of results for the different steps in the modeling process.

Minutp/TransCAD – Discussion of Model Differences

The PACOG travel demand model consists the following major steps (See Figure 1):

- Generate trips (TripGen.exe/Program 0)– the process of generating the number of trips entering and leaving each traffic analysis zone stratified by trip purpose and based on zone characteristics;
- Highway network building (NETBLD/Program 1 or HNP1.rsc)– create a representation to the roadway network including traffic analysis zone access; and, definition of assumed speeds and capacities for roads based on type and location;
- Compute highway travel times between zones (PTHBLD/Program 2 or HNP2.rsc) – develop a table of zone-to zone travel times based on assumed network speeds;
- Add additional intrazonal and terminal times (PTHBLD/Program 2 or HNP3.rsc) - add additional time representing access times to/from the network and develop assumptions for travel times for trips remaining in their origin zone;
- Distribute trips (TRPDST HBW and Other Trips/Programs 3-13 or TD1.rsc and TD2.rsc and FRATAR for school and external trips/Programs 14-17 or TD3.rsc and TD4.rsc) – use calculated zone-to-zone travel times and results of trip

TRIPGEN.EXE (Program 0)		TRIPGEN.EXE
NETBLD (Program 1)	Highway network building	HNP1.RSC
PTHBLD (Program 2)	Compute travel times between zones	HNP2.RSC
PTHBLD (Program 2)	Add intrazonal/ terminal times	HNP3.RSC
TRPDST- HBW (Programs 3-6)	Distribute trips by gravity model	TD1.RSC
TRPDST- Other (Programs 7-13)		TD2.RSC
FRATAR/MATRIX (Programs 14-16)	Distribute school trips by growth factoring	TD3.RSC
FRATAR (Program 17)	Distribute external trips by growth factoring	TD4.RSC
MATRIX (Program 18)	Compute home-work vehicle trips from person trips	MS1.RSC
MATRIX (Program 19)	Compute home-school vehicle trips from person trips	MS2.RSC
MATRIX (Program 20)	Compute other vehicle trips from person trips	MS3.RSC
MATFAC/MATRIX (Program 21)		TOD1.RSC (AM Peak Hour)
MATFAC/MATRIX (Program 21)		TOD2.RSC (PM Peak Hour)
MATFAC/MATRIX (Program 21)		TOD3.RSC (Offpeak Hours)
ASSIGN-AM Peak (Program 22)	Assign trips to highway network	TA1.RSC
ASSIGN-PM Peak (Program 23)		TA2.RSC
ASSIGN-Offpeak (Program 23)		TA3.RSC

Figure 1 – Process Flowchart for Minutp and TransCAD

generation to estimate number of trips made between different zones stratified by trip purpose;

- Compute vehicle trips from person trips (MATRIX/Programs 18-20 or MS1.rsc, MS2.rsc and MS3.rsc)– to produce estimates of roadway traffic, factor the estimated person trips by assumed auto occupancy and diversion to other modes to obtain vehicle driver (or vehicle) trips;

- Compute trips by time of day (MATFAC/MATRIX/Program 21 or TOD1.rsc, TOD2.rsc and TOD3.rsc)– factor total daily vehicle trips to represent specific times of day and specific associated directional orientation;

- Assign trips to highway network (ASSIGN/Programs 22-23 or TA1.rsc, TA2.rsc and TA3.rsc)– using assumed speeds and capacities of the roadways, compute most likely paths through the network and estimate time-of-day vehicle flows for all links in the highway network.

In implementing all of these steps, the goal was to use the facilities of TransCAD to replicate the Minutp procedures and results as closely as possible. Due to the differences in the manner that specific features and capabilities were implemented in each of the two packages, this did result in some differences. Based on the results presented here, it appears that all differences between the two platform's outputs result either from necessary changes because of the way that certain functions and models are supported by each platform or differences in the manner in which the internal logic for data and calculations were implemented with each package The specific impacts of these differences has been analyzed and documented as a part of the conversion process and those results are presented here.

Summary of Required Model Changes

This section summarizes by the above steps the specific changes made in converting the model to TransCAD operation. As part of this section, the results of the analyses conducted regarding comparative performance for each model step are presented. For further detail regarding the implementation, Appendix A documents and summarizes each of the developed TransCAD procedures; Appendix B presents similar information for the original Minutp procedures. Figure 1 provides a roadmap indicating the relationship between the two sets.

Generate Trips

The original program which is standalone and not a part of the Minutp package was used with no modification.

Highway network building

TransCAD highway network building and maintenance facilities required that the network be derived from a map in the TransCAD GIS (geographic information system) environment. To update the map file with speeds, capacities and travel times; and to build a network based on that file, a TransCAD script was written to apply a speed-capacity table to the GIS map file and, subsequently, to generate a TransCAD highway

network file. A separate interactive process (using the TransCAD interface) was required to designate traffic analysis zones in the network. This separate process is more fully described in Appendix A.

No significant differences in the representation of the network or characteristics between Minutp and TransCAD were identified.

Compute highway travel times between zones

Both Minutp and TransCAD use a similar process for finding and computing zone-to-zone minimum paths. For the PACOG model, it was possible to specify the same parameters in each case. Any differences in the comparative results stems from specific differences in the internal implementation of the algorithms.

Add additional intrazonal and terminal times

The previously estimated intrazonal and terminal access travel values were reformatted for TransCAD input and a script written to add them to the zone-to-zone travel time table. The procedures used for TransCAD closely parallel those implemented for Minutp.

The summary table below compares results from building the travel time table and adding in intrazonal and terminal times from Minutp and TransCAD. Detailed review of the tables indicates that the higher total from Minutp results primarily from rounding real numbers to the nearest integer. These differences are widely distributed through the table, so their expected impact on trip distribution is minimal. However, spot checks of the path finding in Minutp and TransCAD does indicate that Minutp travel times tend to be higher. For comparison purposes, both the rounded results and the real results for TransCAD are presented below.

	Sum of Zone-to-Zone Travel Times (in Minutes)
Minutp	**851318.00**
TransCAD (real)	**769777.47**
TransCAD (rounded to integer)	**770069.00**

Table 1 – Comparison of 1998 Network Estimated Zone-to-Zone Travel Times

Distribute trips – Gravity model

For performing trip distribution, significant changes were required to adapt the Minutp process to be TransCAD compatible. In the original Minutp implementation, the "gravity model" formulation was used to distribute home-based-work; home-based-shop; home-based-university; nonhome-based-work; home-based-other; nonhome-based-other; truck; and, internal-external trip purposes. This original Minutp model was "row constrained". This means that the model uses an iterative process to move toward closure with the trip production totals by zone. In the table, this represents the sum of all row entries.

The only comparable iterative procedure available for TransCAD uses a "doubly constrained" model (TransCAD's row constrained process is not iterative and makes no effort to match input control totals). In a doubly constrained model, both productions/rows and attractions/columns are used as control totals. This can produce significant changes in model distribution. Also, TransCAD's procedure does not distribute residual trips unless an adequate number of iterations is specified to ensure that those trips are distributed. This required that the number of iterations specified had to be significantly increased for the TransCAD model.

Table 2 below indicates the differences in the parameters used for the Minutp and TransCAD model. Table 3 summaries the overall difference observed in total distributed trip volumes by trip purpose.

Parameter	Minutp	TransCAD
Maximum Iterations	9	99
Minimum Convergence	N/A	.001
Constraint Type	Row	Double

Table 2 – Differences in Trip Distribution Parameters (Gravity Model)

Trip Purpose	Minutp	TransCAD
HBW	79581	79572
HBU	7355	7355
HBS	59693	59706
HBO	183209	183216
NHBW	49114	49120
NHBO	100734	100734
TRUCK	3206	3206
Int-Ext	62694	62694
Total	544586	545603

Table 3 – Differences in Number of Trips Distributed by Trip Purpose (1998) (Gravity Model Only)

As noted above, a consideration is not simply the volume of trips distributed but also the comparative distribution of those trips between the two procedures. The set of scattering diagrams presented as Appendix D indicates the deviation in the distribution of the two models for each trip purpose. In these diagrams, the diagonal represents the same value for a given table cell in both models, data points located above and below the diagonal indicate the degree of difference. General clustering along the diagonal is an indication of greater consistency in the two models. Conversely, more dispersion away from the diagonal indicates greater differences in the two trip distributions.

Distribute trips – Growth factor (Fratar) model

The PACOG model utilizes a different type of trip distribution process to distribute home-based-school (elementary and secondary) and external-external trips. This type

is called a Fratar or growth factoring model. The model assumes that growth in tripmaking between two zones is directly dependent on the growth on both ends, and, unlike the gravity model, is not influenced by travel time.

A new TransCAD script was written to prepare data for and exercise the TransCAD implementation of the Fratar process. The procedure obtained for use in the script was programmed by TransCAD's developers by is not generally available for outside user application. The summary documentation of this procedure is included as Appendix C of this memo.

Input parameters for the Minutp and TransCAD versions of the Fratar model are identical. Table 4 shows the summary comparison of results.

Trip Purpose	Minutp	TransCAD
HBSC (Elem)	17185	17129
HBSC (Sec)	7784	7758
Ext-Ext	10453	10449
Total	35422	35336

Table 4 – Differences in Number of Trips Distributed by Trip Purpose (1998) (Fratar Model Only)

Compute vehicle trips from person trips

This step converts the person trips derived from trip generation and output by the distribution models to vehicle trips for eventual assignment to the highway network. For all purposes, except the home-based-school purposes, this is done by simple factoring.

The home-based-elementary school trip purpose use airline distance separation to assign different factors. A TransCAD script was written to emulate this methodology. To implement this methodology, the spatial separation between the origin and destination had to be calculated. This required developing a procedure to calculate airline miles from latitudinal and longitudinal coordinates of the two zones. A factor representing relative weight of latitude vs. longitude was derived specifically for the Pueblo region. As can be noted in the home based elementary school totals, this did result in some differences in estimation of percent of trip using vehicles.

Note: A complicating consideration for both this and all other matrix based operations is that the Minutp software rounds all trip numbers to integer at the end of each processing step while TransCAD stores them as floating point numbers up to and through traffic assignment. This could introduce increasing differences particularly for cells and zones with small trip volumes.

Table 5 shows resulting totals for each package and the relative differences.

Trip Purpose	Minutp	TransCAD	% Diff
HBW	77318	73511	-5.18%
HBU	7109	7077	-0.45%
HBS	44971	44378	-1.34%
HBO	135767	135771	0.00%
NHBW	48590	47642	-1.99%
NHBO	80812	75588	-6.91%
TRUCK	3206	3206	0.00%
IE	62694	62694	0.00%
HBSCE	8960	11665	23.19%
HBSCS	5736	6784	15.45%
EE	10449	10449	0.00%
Total	485612	478765	-1.43%

Table 5 – Totals for Vehicle Trip Factoring by Purpose and Percent Difference

Compute trips by time of day

The procedure to compute number of trips and their directional orientation for each trip purpose by time-of-day closely parallels the simple factoring used for computing vehicle trips. One additional step is that to obtain directional orientation, the matrix and it's transpose must be used. Adding the transpose operation, a similar script to the vehicle trip script was written and applied. Table 6, below, summarizes total trips by time period for each software package.

Time Period	Minutp	TransCAD	% Diff
AM Peak Hr.	46924	48194	2.71%
PM Peak Hr.	40577	39662	-2.31%
Offpeak Hrs.	397529	391033	-1.66%
Total	485030	478889	-1.28%

Table 6 – Total Trips for AM Peak Hour, PM Peak Hour and Offpeak Period

The three figures below compare the values of individual trip interchanges in the Minutp model to those generated by TransCAD for the AM peak hour, PM peak hour and offpeak hours respectively. In these charts, the greater the deviation of a point from the diagonal, the greater the difference in volume predicted for that interchange between the two models.

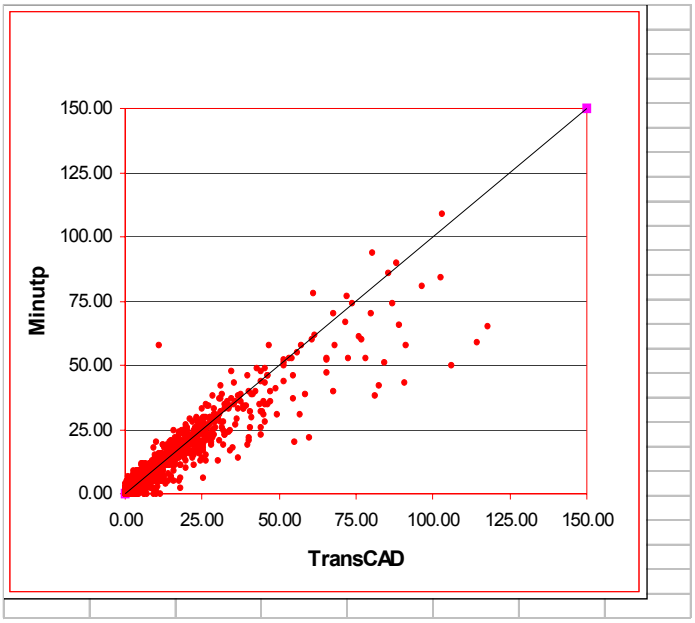


Figure 1 – 1998 AM Peak Hour Trip Interchanges (Minutp and TransCAD)

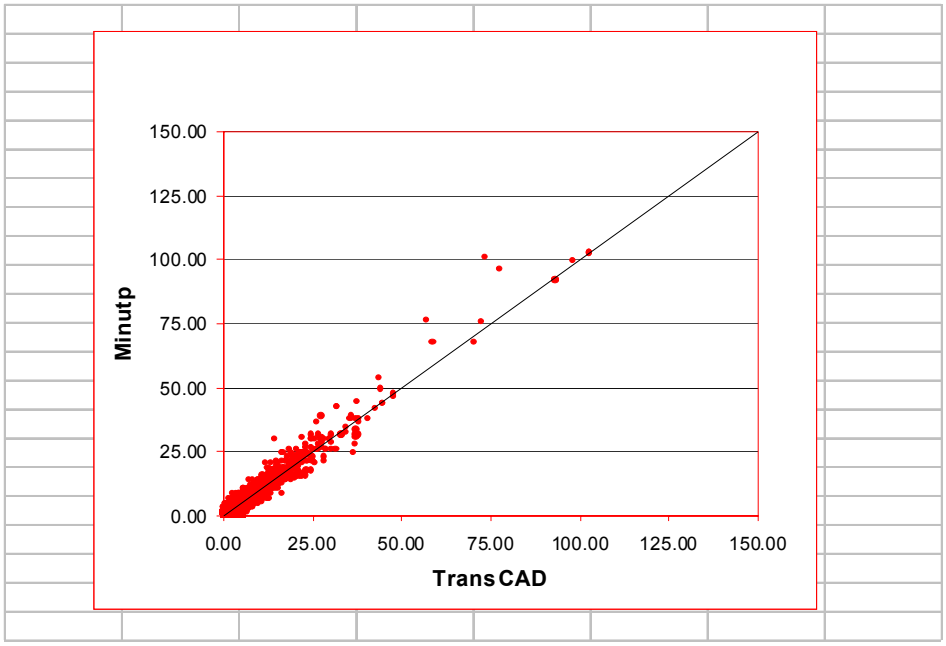


Figure 2 – 1998 PM Peak Hour Trip Interchanges (Minutp and TransCAD)

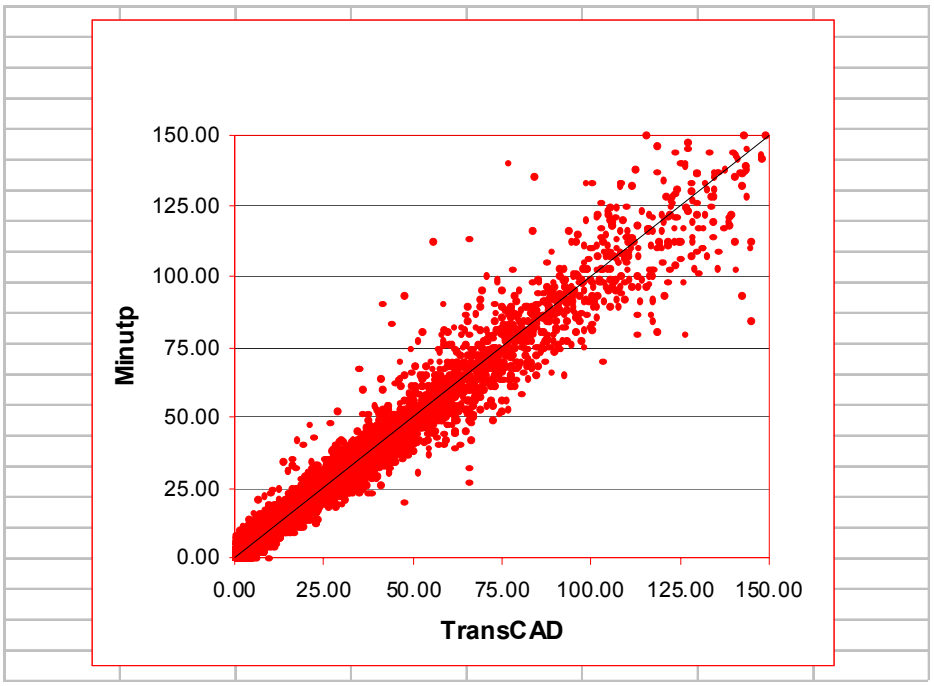


Figure 3 – 1998 Off Peak Trip Interchanges (Minutp and TransCAD)

Assign trips to highway network

The final step in the PACOG model sequence is estimation of cumulative trip volumes on each roadway and roadway segment. This is done using a traffic assignment model. The assignment model used by the PACOG model is called "user equilibrium assignment". This same model formulation was used for both Minutp and TransCAD. Table 7 provides a comparison of the input parameters used for each of the two models.

Parameter	Minutp	TransCAD
Maximum Iterations	5	25
Minimum Convergence	.001	.01

Table 7 – Comparison of Traffic Assignment Input Parameters

As well as being the culmination of the entire modeling process, the results of comparing assignments generated using the two different packages also provides a measure of the difference accumulated through all the model steps.

To analyze and measure this difference, traffic volumes were compared in a number of different ways. First, the set of screenlines developed during the original 1993 model calibration (Figure 4) were used to analyze both link by link and overall volume differences. Tables 8 through 17 compare 24 hour traffic volumes for Minutp and TransCAD generated projections for 1998.

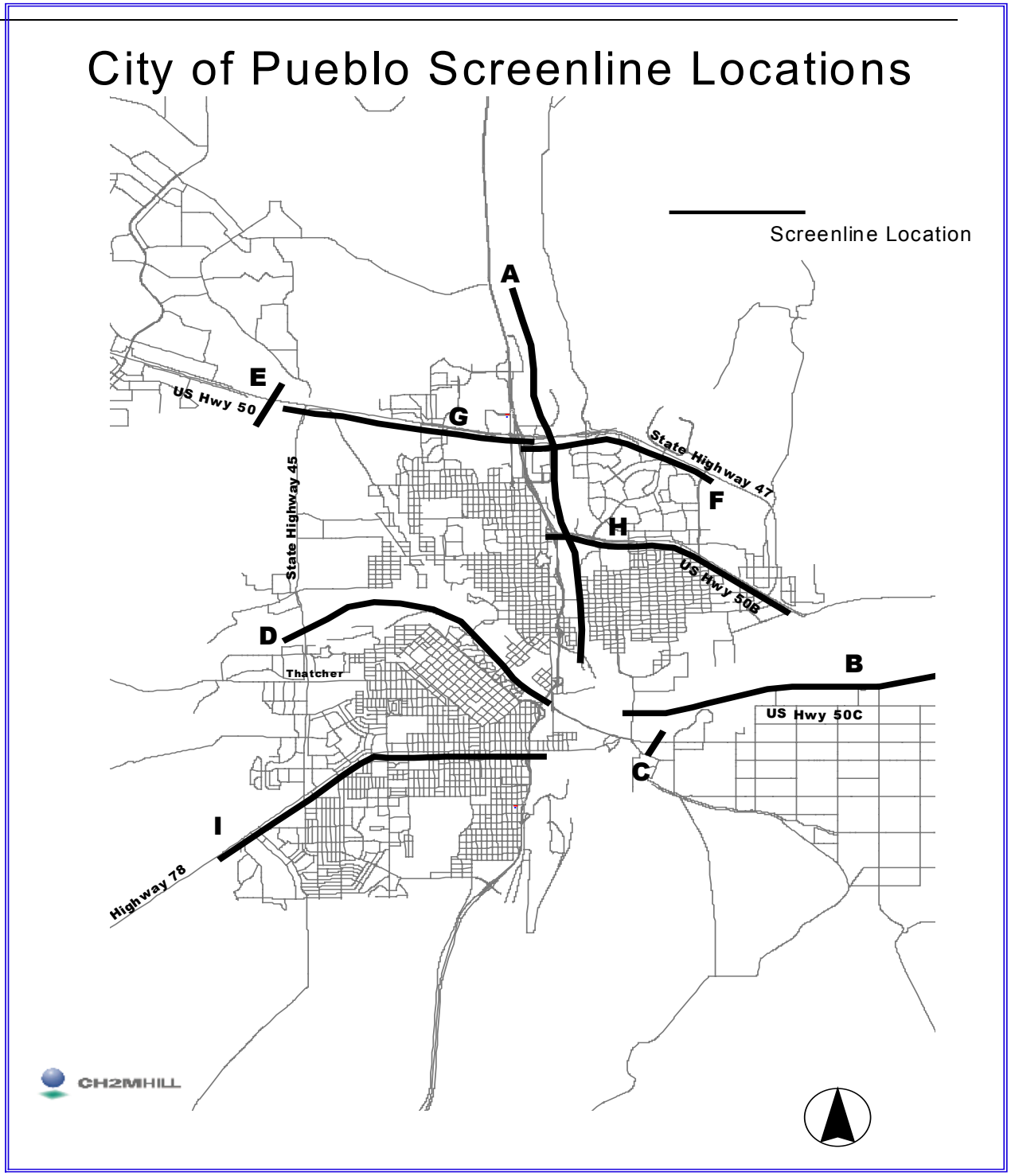


Figure 4 – Location of PACOG Travel Model Screenlines

	Eastbound			Westbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
State Highway 47	19748	18052	-8.59	17805	16496	-7.94
US Hwy 50B	14275	16238	13.75	17188	17261	0.42
8th St	6237	5815	-7.26	4407	4948	10.93
4th St	9533	7072	-34.80	10605	7401	-43.29
Total	49793	47177	-5.55	50005	46106	-8.46

Table 8 – Comparison of Traffic Assignments (Screenline A)

	Northbound			Southbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
Hwy 223	5166	5700	9.37	4104	5656	27.44
Hwy 227	3923	4301	8.79	4389	4320	-1.60
Total	9089	10001	9.12	8493	9976	14.87

Table 9 – Comparison of Traffic Assignments (Screenline B)

	Eastbound			Westbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
US Hwy 50C	15494	15287	-1.35	16000	15658	-2.18
Total	15494	15287	-1.35	16000	15658	-2.18

Table 10 – Comparison of Traffic Assignments (Screenline C)

	Northbound			Southbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
Pueblo Blvd	13454	13421	-0.25	12434	12926	3.81
Lincoln	12179	12021	-1.31	12994	13114	0.92
Union Ave	4493	1336	-236	4266	1878	-127
Main St	2018	4311	53.19	1807	3020	40.17
I-25	29083	25409	-14.46	27290	27694	1.46
Santa Fe Ave	8874	8010	-10.79	12022	8862	-35.66
Total	70101	64508	-8.67	70813	67494	-4.92

Table 11 – Comparison of Traffic Assignments (Screenline D)

	Eastbound			Westbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
US Hwy 50	11275	8768	-28.59	11348	10571	-7.35
Total	11275	8768	-28.59	11348	10571	-7.35

Table 12 – Comparison of Traffic Assignments (Screenline E)

	Northbound			Southbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
	2917	4568	36.14	3189	7386	56.82
Apache St	5413	3924	-37.95	4173	434	-862
Jerry Murphy	7974	5120	-55.74	10952	6437	-70.14
Bonforte Bl	3752	4174	10.11	3458	3645	5.13
Troy Ave	3942	3121	-26.31	3722	3651	-1.94
Total	23998	20907	-14.78	25494	21553	-18.29

Table 13 – Comparison of Traffic Assignments (Screenline F)

	Northbound			Southbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
	11242	11223	-0.17	10612	10677	0.61
Baltimore	2814	2337	-20.41	2928	2483	-17.92
32nd St	757	1147	34.00	684	1111	38.43
Elizabeth	5836	5495	-6.21	6466	6211	-4.11
I-25	18371	18190	-1.00	17480	17469	-0.06
Total	39020	38392	-1.64	38170	37951	-0.58

Table 14 – Comparison of Traffic Assignments (Screenline G)

				Southbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
	32950	32330	-1.92	34221	31771	-7.71
Hudson Ave	6602	6415	-2.92	5954	5751	-3.53
Norwood Av	4777	4304	-10.99	4861	3925	-23.85
Troy Ave	2380	2214	-7.50	2408	2190	-9.95
4th St	5845	5343	-9.40	4474	4853	7.81
Total	52554	50606	-3.85	51918	48490	-7.07

Table 15 – Comparison of Traffic Assignments (Screenline H)

	Northbound			Southbound		
Location	Minutp	TransCAD	%△	Minutp	TransCAD	%△
	2076	1833	-13.26	2140	1953	-9.58
Surfwood	402	402	0.00	404	398	-1.51
Pueblo Blvd	8992	7813	-15.09	8991	7769	-15.73
Vinewood	0	1664	0.00	0	1761	0.00
Hollywood	4265	4926	13.42	3621	4697	22.91
Prairie	7888	7183	-9.81	7837	7234	-8.34
Beulah	1158	2628	55.94	1154	2771	58.35
Berkeley	0	0	0.00	0	0	0.00
Lake Ave	2080	1907	-9.07	1314	1593	17.51
Orman	3758	4091	8.14	3549	3069	-15.64
Evans	850	6134	86.14	4596	5482	16.16
Abriendo	695	656	-5.95	884	1596	44.61
I-25	22190	20004	-10.93	24801	21640	-14.61
Total	54354	59241	8.25	59291	59963	1.12

Table 16 – Comparison of Traffic Assignments (Screenline I)

The other comparison that was undertaken was to examine vehicle miles of travel and vehicle hours of travel for the two models by time period. The combination of the additional iterations required in the TransCAD assignment to obtain closure and TransCAD's policy of maintaining all information (including distances, travel times and traffic volume as floating point numbers all contribute to divergence in results between the two packages. However, as the tables below illustrate, the results are still quite similar.

Time Period	Minutp	TransCAD	% Diff
AM Peak Hour	209,360	202,931	-3.07
PM Peak Hour	183,806	169,375	-7.85
Offpeak	1,780,840	1,686,410	-5.30
Total	2,174,006	2,058,716	-6.22

Table 17 – Comparison of 1998 Travel Model Vehicle Miles of Travel by Time Period

Time Period	Minutp	TransCAD	% Diff
AM Peak Hour	6,596	6,820	3.40
PM Peak Hour	5,685	5,463	-3.91
Offpeak	54,632	54,679	0.09
Total	66,913	66,962	0.07

Table 18 – Comparison of 1998 Travel Model Vehicle Hours of Travel by Time Period (TransCAD based on last iteration travel times)

TransCAD Model vs. Ground Count Comparison

As a final check on performance of the TransCAD model, the same defined screenlines were used to compare TransCAD volumes to actual ground count data. This was done to ensure that the converted model could be used effectively for the screening and alternatives evaluation tasks required as part of the New Pueblo Freeway project. The same comparisons as presented above were performed for TransCAD output and traffic count information (where count data was available). The results of this comparison are presented in Tables 19 through 27.

	Eastbound			Westbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
State Highway 47	20415	18402	90.14	20415	17675	86.58
US Hwy 50B	17940	15004	83.63	17940	16558	92.30
8th St*	5110	6309	123.46	5110	4685	91.72
4th St	9513	7064	74.26	9513	7471	78.53
Total	52978	46779	88.30	52978	46391	87.57

Table 19 – Comparison of TransCAD Traffic Assignments and Counts (Screenline A)

	Northbound			Southbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
Hwy 223	2735	5836	213.38	2735	5717	209.03
Hwy 227	3615	4284	118.51	3615	4297	118.87
Total	6350	10120	159.37	6350	10014	157.70

Table 20 – Comparison of TransCAD Traffic Assignments and Counts (Screenline B)

	Eastbound			Westbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
US Hwy 50C	13468	15287	113.51	13468	15658	116.26
Total	13468	15287	113.51	13468	15658	116.26

Table 21 – Comparison of TransCAD Traffic Assignments and Counts (Screenline C)

	Northbound			Southbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
Pueblo Blvd	9951	13649	137.16	9951	13197	132.62
Lincoln	16996	12568	73.95	16996	13343	78.51
Union Ave	-	-	-	-	-	-
Main St	-	-	-	-	-	-
I-25	27155	24432	89.97	27155	24870	91.59
Santa Fe Ave	10112	8107	80.17	10112	10793	106.73
Total	64214	58756	91.50	64214	62203	96.87

Table 22– Comparison of TransCAD Traffic Assignments and Counts (Screenline D)

	Eastbound			Westbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
US Hwy 50	8463	8768	103.60	8463	10571	124.91
Total	8463	8768	103.60	8463	10571	124.91

Table 23-Comparison of TransCAD Traffic Assignments and Counts (Screenline E)

	Northbound			Southbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
	-	-	-	-	-	-
Apache St**	-	-	-	-	-	-
Jerry Murphy*	8740	7643	87.45	8740	8307	95.05
Bonforte Bl*	2218	4177	188.32	2218	3690	166.37
Troy Ave	2635	3856	146.34	2635	3879	147.21
Total	13593	15676	115.32	13593	15876	116.80

Table 24 – Comparison of TransCAD Traffic Assignments and Counts (Screenline F)

	Northbound			Southbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
	10671	11436	107.17	10671	10952	102.63
Baltimore	1580	2341	148.16	1580	2474	156.58
32nd St**	-	-	-	-	-	-
Elizabeth*	8276	6066	73.30	8276	6819	82.39
I-25	20680	16594	80.24	20680	16923	81.83
Total	41207	36437	88.42	41207	37168	90.20

Table 25 – Comparison of TransCAD Traffic Assignments and Counts (Screenline G)

				Southbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
	34025	29500	86.70	34025	31054	91.27
Hudson Ave*	5487	6751	123.04	5487	5757	104.92
Norwood Av*	3656	4270	116.79	3656	3846	105.20
Troy Ave*	2800	2319	68.21	2800	2280	67.06
4th St	3987	5708	150.65	3987	4782	126.21
Total	49955	48548	97.18	49955	47719	95.52

Table 26 – Comparison of TransCAD Traffic Assignments and Counts (Screenline H)

	Northbound			Southbound		
Location	Counts	TransCAD	%	Counts	TransCAD	%
	1293	1885	145.78	1293	1956	151.28
Surfwood	300	441	147.00	300	402	134.00
Pueblo Blvd	7247	9118	125.82	7247	9161	126.41
Vinewood	2100	1796	85.52	2100	1827	87.00
Hollywood	3437	3558	103.52	3437	3383	98.43
Prairie	8462	7495	88.57	8462	7495	88.57
Beulah*	1322	2626	198.64	1322	2774	209.83
Berkeley***	-	-	-	-	-	-
Lake Ave	4047	2019	49.89	4047	1563	38.62
Orman	2550	3519	138.00	2550	2702	105.96
Evans	1960	4134	210.92	1960	3528	180.00
Abriendo	4725	618	13.08	4725	1710	36.19
I-25	18348	18098	98.64	18348	18135	98.65
Total	54354	59241	8.25	59291	59963	1.12

*Data for count was interpolated from variable count years.
**Roadway not present in network.
***Modeled data not available.

Table 27 – Comparison of TransCAD Traffic Assignments and Counts (Screenline I)

Based on similarities in results obtained throughout the modeling process, it can be concluded that the model has been accurately and effectively transferred from the Minutp platform to the TransCAD platform. Based on the results presented here, it appears that all differences between the two platform's outputs result either from necessary changes because of the way that certain functions and models are supported by each platform or differences in the manner in which the internal logic for data and calculations were implemented with each package.

Appendix B

Comparison of the Target Values to the Final Model Estimated Turning Movements

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
US 50 & Elizabeth	14	2159	223	563	2593	0	322	179	731	15	91	6
US 50 & I-25 SB	0	2277	628	119	2870	0	0	0	0	32	0	286
US 50 & I-25 Mid	0	0	0	0	0	0	0	0	0	0	0	0
US 50 & I-25 NB	597	1713	0	0	2379	58	611	0	92	0	0	0
US 50 & Dillon	20	1694	91	146	2299	536	134	82	198	872	55	4
29th & I-25 SB	0	162	517	442	759	0	0	0	0	0	0	514
29th & I-25 NB	76	169	0	0	327	0	69	0	159	0	0	0
29th & Dillon	0	0	0	0	0	0	0	0	0	0	0	0
US 50B & I-25 SB	0	0	0	954	0	0	0	0	0	700	0	0
US 50B & I-25 NB	0	700	0	0	954	601	0	0	831	0	0	0
US 50B & Dillon	0	1531	0	0	1556	0	0	0	0	0	0	0
13th & Santa Fe	0	51	40	189	275	591	52	210	319	449	182	14
13th & I-25 SB	0	900	36	0	257	0	0	0	0	0	0	406
13th & I-25 NB	766	0	0	0	0	0	253	0	0	0	0	0
8th & Santa Fe	58	264	75	321	205	64	18	14	165	129	9	6
6th & Santa Fe	0	0	0	111	387	15	146	516	0	0	702	42
6th & I-25 SB Off	0	0	0	0	0	0	0	0	0	0	0	0
5th & Santa Fe	44	94	0	0	0	0	0	203	0	9	578	0
5th & I-25 NB On/Bradford	141	0	25	0	0	0	12	413	0	0	0	0
4th & Santa Fe	69	534	100	242	485	40	77	339	128	52	607	50
4th & Bradford	305	448	48	41	829	192	28	14	232	23	2	0
1st & Santa Fe	207	541	110	96	578	63	38	308	135	34	532	311
1st & I-25 SB	0	483	100	175	209	0	0	0	0	58	0	432
1st & I-25 NB	281	231	0	0	277	19	125	0	414	0	0	0
1st & Bradford	346	25	0	0	21	12	0	0	0	20	0	179
Ilex (N) & Santa Fe	0	0	0	43	0	63	0	604	182	29	1024	0
Ilex (N) & I-25 NB	0	0	0	0	0	360	0	0	67	0	0	0
Ilex (S) & Santa Fe/SB ramps	0	0	0	648	0	29	0	650	81	242	468	0
Abriendo & I-25 SB Off	0	804	0	0	61	0	0	0	0	0	0	668
Abriendo & I-25 SB On	0	703	101	0	61	0	0	0	0	0	0	0
Abriendo & I-25 NB	0	0	703	0	61	0	0	0	0	0	0	0
Central & I-25 SB	0	404	197	0	136	0	0	0	0	0	0	588
Central & I-25 NB	446	0	0	0	0	0	168	0	0	0	0	0
Minnequa & Evans	0	0	97	167	222	1	14	103	0	0	93	0
Minnequa & I-25 SB Off	0	0	0	0	0	0	0	0	0	0	0	0
Indiana & Evans	6	322	0	16	31	24	0	20	44	64	13	134
Indiana & I-25 NB	536	41	0	0	82	95	80	0	12	0	0	0
Indiana & I-25 NB RT turn Off	0	0	0	0	0	0	0	0	0	0	0	0
Aqua & Evans	0	4	0	0	0	0	0	90	9	41	58	0
Aqua & I-25 SB On	0	0	0	0	0	0	0	0	0	0	0	0
Illinois & I-25 SB Off	19	0	0	0	130	41	0	0	0	0	0	0
Pueblo & I-25 SB	0	1269	147	10	221	0	0	0	0	77	0	1431
Pueblo & I-25 SB RT turn Off	0	0	0	0	0	0	0	0	0	0	0	0
Pueblo & I-25 NB	1215	146	0	0	187	167	52	0	9	0	0	0
Stem Beach & I-25 SB	0	2	218	9	156	0	0	0	0	3	0	336
Stem Beach & I-25 NB	5	0	0	0	0	0	165	0	0	0	0	0

Table B-1 – Estimated Target 2025 Turn Volumes by Intersection and Movement (No Action case)

Note: No targets available at locations indicating 0 volume

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
US 50 & Elizabeth	14	2160	216	583	2609	0	321	184	746	15	101	6
US 50 & I-25 SB	0	2294	627	133	2896	0	0	0	0	33	0	296
US 50 & I-25 Mid	0	0	0	0	0	0	0	0	0	0	0	0
US 50 & I-25 NB	595	1732	0	0	2421	59	608	0	109	0	0	0
US 50 & Dillon	21	1728	91	146	2342	540	134	82	201	874	55	4
29th & I-25 SB	0	136	575	180	625	0	0	0	0	0	0	642
29th & I-25 NB	0	0	0	0	0	0	0	0	0	0	0	0
29th & Dillon	0	0	0	0	0	0	0	0	0	0	0	0
US 50B & I-25 SB	0	0	0	961	0	0	0	0	0	697	0	0
US 50B & I-25 NB	0	697	0	0	961	603	0	0	851	0	0	0
US 50B & Dillon	0	1548	0	0	1564	0	0	0	0	0	0	0
13th & Santa Fe	0	228	3	180	117	478	0	80	277	566	102	1
13th & I-25 SB	0	496	576	0	430	0	0	0	0	0	0	344
13th & I-25 NB	496	0	0	0	0	0	430	0	0	0	0	0
8th & Santa Fe	57	270	92	443	210	64	47	33	463	128	12	6
6th & Santa Fe	0	0	0	141	51	2	120	541	0	0	634	0
6th & I-25 SB Off	0	0	0	0	0	0	0	0	0	0	0	0
5th & Santa Fe	101	97	0	0	0	0	0	526	0	16	754	0
5th & I-25 NB On/Bradford	147	0	32	0	0	0	13	421	0	0	0	0
4th & Santa Fe	212	541	83	255	366	6	51	308	206	6	547	101
4th & Bradford	139	630	4	171	635	293	4	2	353	29	3	0
1st & Santa Fe	251	461	0	5	439	138	0	156	0	372	221	314
1st & I-25 SB	0	455	396	166	141	0	0	0	0	39	0	462
1st & I-25 NB	443	51	0	0	178	17	128	0	356	0	0	0
1st & Bradford	344	25	0	0	20	15	0	0	0	22	0	156
Ilex (N) & Santa Fe	0	0	0	5	0	65	0	408	331	34	757	0
Ilex (N) & I-25 NB	0	0	0	0	0	364	0	0	70	0	0	0
Ilex (S) & Santa Fe/SB ramps	0	0	0	638	0	30	0	708	81	253	509	0
Abriendo & I-25 SB Off	0	802	0	0	60	0	0	0	0	0	0	676
Abriendo & I-25 SB On	0	695	106	0	60	0	0	0	0	0	0	0
Abriendo & I-25 NB	0	0	695	0	60	0	0	0	0	0	0	0
Central & I-25 SB	0	619	361	0	211	0	0	0	0	0	0	617
Central & I-25 NB	619	0	0	0	0	0	211	0	0	0	0	0
Minnequa & Evans	0	0	38	147	391	1	7	41	0	0	22	0
Minnequa & I-25 SB Off	0	0	0	0	0	0	0	0	0	0	0	0
Indiana & Evans	6	334	0	15	32	23	0	18	45	56	14	137
Indiana & I-25 NB	403	32	0	0	61	71	9	0	12	0	0	0
Indiana & I-25 NB RT turn Off	0	0	0	0	0	0	0	0	0	0	0	0
Aqua & Evans	0	0	0	0	0	0	0	63	9	23	6	0
Aqua & I-25 SB On	0	0	0	0	0	0	0	0	0	0	0	0
Illinois & I-25 SB Off	18	0	0	0	133	41	0	0	0	0	0	0
Pueblo & I-25 SB	0	1204	300	10	327	0	0	0	0	63	0	1330
Pueblo & I-25 SB RT turn Off	0	0	0	0	0	0	0	0	0	0	0	0
Pueblo & I-25 NB	1136	131	0	0	148	114	189	0	7	0	0	0
Stem Beach & I-25 SB	0	2	218	9	158	0	0	0	0	3	0	362
Stem Beach & I-25 NB	5	0	0	0	0	0	168	0	0	0	0	0

Table B-2 – Final Estimated 2025 Turn Volumes by Intersection and Movement (No Action case)

Note: No targets available at locations indicating 0 volume

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
US 50 & Elizabeth	0	1	-7	21	16	0	-2	5	14	0	10	0
US 50 & I-25 SB	0	17	-2	14	26	0	0	0	0	1	0	11
US 50 & I-25 Mid	0	0	0	0	0	0	0	0	0	0	0	0
US 50 & I-25 NB	-1	19	0	0	42	0	-3	0	16	0	0	0
US 50 & Dillon	1	34	0	0	43	3	0	0	3	2	0	0
29th & I-25 SB	0	-26	58	-262	-134	0	0	0	0	0	0	128
29th & I-25 NB	-76	-169	0	0	-327	0	-69	0	-159	0	0	0
29th & Dillon	0	0	0	0	0	0	0	0	0	0	0	0
US 50B & I-25 SB	0	0	0	7	0	0	0	0	0	-3	0	0
US 50B & I-25 NB	0	-3	0	0	7	1	0	0	20	0	0	0
US 50B & Dillon	0	17	0	0	8	0	0	0	0	0	0	0
13th & Santa Fe	0	177	-38	-9	-158	-113	-52	-130	-42	117	-79	-13
13th & I-25 SB	0	-405	540	0	173	0	0	0	0	0	0	-62
13th & I-25 NB	-271	0	0	0	0	0	177	0	0	0	0	0
8th & Santa Fe	-1	6	17	122	5	1	29	20	298	-1	2	0
6th & Santa Fe	0	0	0	30	-336	-13	-25	25	0	0	-68	-42
6th & I-25 SB Off	0	0	0	0	0	0	0	0	0	0	0	0
5th & Santa Fe	58	2	0	0	0	0	0	323	0	6	176	0
5th & I-25 NB On/Bradford	6	0	7	0	0	0	0	8	0	0	0	0
4th & Santa Fe	143	7	-17	13	-119	-34	-26	-31	78	-46	-61	51
4th & Bradford	-166	182	-44	130	-194	101	-24	-12	122	6	1	0
1st & Santa Fe	44	-80	-110	-91	-138	75	-38	-152	-135	338	-311	3
1st & I-25 SB	0	-28	296	-9	-69	0	0	0	0	-19	0	31
1st & I-25 NB	163	-181	0	0	-99	-2	4	0	-58	0	0	0
1st & Bradford	-2	0	0	0	-1	3	0	0	0	1	0	-23
Ilex (N) & Santa Fe	0	0	0	-38	0	2	0	-197	149	5	-266	0
Ilex (N) & I-25 NB	0	0	0	0	0	4	0	0	3	0	0	0
Ilex (S) & Santa Fe/SB ramps	0	0	0	-10	0	1	0	57	0	11	41	0
Abriendo & I-25 SB Off	0	-2	0	0	-1	0	0	0	0	0	0	8
Abriendo & I-25 SB On	0	-8	5	0	-1	0	0	0	0	0	0	0
Abriendo & I-25 NB	0	0	-8	0	-1	0	0	0	0	0	0	0
Central & I-25 SB	0	215	164	0	75	0	0	0	0	0	0	29
Central & I-25 NB	173	0	0	0	0	0	43	0	0	0	0	0
Minnequa & Evans	0	0	-59	-20	169	0	-7	-62	0	0	-71	0
Minnequa & I-25 SB Off	0	0	0	0	0	0	0	0	0	0	0	0
Indiana & Evans	0	12	0	-1	1	0	0	-1	1	-8	0	3
Indiana & I-25 NB	-133	-9	0	0	-21	-24	-70	0	-1	0	0	0
Indiana & I-25 NB RT turn Off	0	0	0	0	0	0	0	0	0	0	0	0
Aqua & Evans	0	-4	0	0	0	0	0	-27	0	-18	-52	0
Aqua & I-25 SB On	0	0	0	0	0	0	0	0	0	0	0	0
Illinois & I-25 SB Off	-1	0	0	0	2	1	0	0	0	0	0	0
Pueblo & I-25 SB	0	-65	153	-1	106	0	0	0	0	-14	0	-101
Pueblo & I-25 SB RT turn Off	0	0	0	0	0	0	0	0	0	0	0	0
Pueblo & I-25 NB	-79	-15	0	0	-39	-53	137	0	-2	0	0	0
Stem Beach & I-25 SB	0	0	0	0	2	0	0	0	0	0	0	26
Stem Beach & I-25 NB	0	0	0	0	0	0	2	0	0	0	0	0

Table B-3 – Target vs. Factored Model 2025 Turn Volumes by Intersection and Movement (No Action case)

Appendix C

Intersection Control Modifications to Existing Conditions for Future Networks

The following is a summary of the assumptions related to the intersection control for the Pueblo New I-25 Freeway alternatives analysis. The information is organized by alternative.

No Action

All of the alternatives originated with the existing conditions.

Based on the City of Pueblo's Synchro files, it was determined that the following intersections are currently signalized:

- US 50(SH 47)/Elizabeth Street
- US 50(SH 47)/I-25 Ramps
- US 50(SH 47)/Dillon Drive
- 29th Street/I-25 NB Ramps
- 29th Street/I-25 SB Ramps
- 13th Street/Santa Fe Avenue
- 8th Street/Santa Fe Avenue
- 6th Street/Santa Fe Avenue
- 5th Street/Santa Fe Avenue
- 4th Street/Santa Fe Avenue
- 4th Street/Bradford Street
- 1st Street/Santa Fe Avenue
- 1st Street/I-25 NB Ramps
- Ilex Street/Santa Fe Avenue

1) Where the level of service (LOS) for a stop-controlled intersection degraded to LOS E or F, it was assumed that a signal would be warranted at that location. Assuming that the City of Pueblo would install a traffic signal once the warrant was met, the no action network modeled the intersection as a signalized intersection. In the no action network the following existing stop-controlled intersections were modeled as signalized intersections:

- 13th Street/I-25 NB Ramps
- 13th Street/I-25 SB Ramps
- Ilex NB Ramps/Santa Fe Avenue
- Central Avenue/I-25 NB Ramps
- Central Avenue/I-25 SB Ramps
- Pueblo Blvd./I-25 NB Ramps
- Pueblo Blvd./I-25 SB Ramps

2) Synchro (version 5.0) was used to optimize the no action signal network with a cycle length between 60 and 110 seconds. Therefore, all signal timing was modified for the no action analysis.

Build Alternatives

For the Preferred Build Alternatives traffic analysis, all the changes listed in the previous section were also included. In addition to the no action changes, several modifications were made to the Build networks based on the assumptions listed in the previous section. After the changes were made, Synchro was used to optimize the Build signal networks with a cycle length between 60 and 110 seconds.

1) The intersections listed in Table D-1 were modeled as stop-controlled intersections for the no action alternative, but were upgraded to signalized intersections for the build networks.

Table D-1. Stop-Controlled Intersections that Were Upgraded to Signals for the Build Networks

Intersection	Scenario
1st Street/I-25 SB Ramp	Existing/Modified
Central/Santa Fe Ave	Modified
Minnequa Avenue/Evans Avenue	Modified
Indiana Avenue/ Evans Avenue	Existing/Modified

2) The intersections of Mesa/I-25 NB Frontage Road and Mesa/I-25 SB Frontage Road were modeled as stop-controlled intersections for the Modified I-25 Alignment Alternative only.

Appendix D

CORSIM Intersection LOS Results

Table D-1. CORSIM Intersection LOS

Intersection	No Action Scenario	Existing Alignment	Modified Alignment
US 50 & Elizabeth	D	D	D
US 50 & I-25 SPUI	C	D	D
US 50 & Dillon	E/F	C	C
29th & Elizabeth	E	C	C
29th & I-25 SB	C	A*	A*
29th & I-25 NB	C	D	C
29th & Dillon	A	B	B
US 50B & I-25 SB	A*	B	C
US 50B & I-25 NB	A*	B	B
US 50B & Dillon		B/C	B/C
US 50B & Bonforte	C	D	C
13th & Santa Fe	B/C	C	C
13th & I-25 SB	B	B	B
13th & I-25 NB	B	B	B
11th & Santa Fe	C	C	B
9th & Santa Fe	B	B	B
8th & Santa Fe	C	C	C
8th & Erie	B	C	B
8th & SB Frontage Road		B	B
8th & NB Frontage Road		B	B
6th & Santa Fe	B	C	B
5th & Santa Fe	C	B	A
4th & Santa Fe	C	B	C
4th & Bradford OR 4th & NB Frontage Road	C	B	A/B
4th & SB Frontage Road		C	D
1st & 4th	B	A	A
4th & Erie	A	A	B
1st & Santa Fe	C	C/D	C
1st & I-25 SB	A	B	B
1st & I-25 NB	B	B	B
1st & Bradford	B*		
Ilex (N) & Santa Fe	A/B		
Ilex (S) & Santa Fe/SB ramps	B/C		
Runyon Ext & Santa Fe Ave			C
Locust & Runyon Ext			A
Abriendo/Abriendo/Washington	B	B	B
Santa Fe Ave & Santa Fe Dr		B	C
Abriendo & I-25 SB		C	C
Abriendo & I-25 NB		B	B
Santa Fe Drive & Runyon Ext			B
Abriendo & Santa Fe Dr		B	
Mesa & SB Frontage Road			A*
Mesa & NB Frontage Road			A*
Northern & SB Frontage Road		C	D
Northern & NB Frontage Road		C	C
Central & I-25 SB or Central & Santa Fe	B		B
Central & I-25 NB	B		
Minnequa & Evans	A*	A*	B
Indiana & Evans	A*	B	B

Intersection	No Action Scenario	Existing Alignment	Modified Alignment
Indiana & I-25 SPUI		C	C
Aqua & Evans	A*	A*	A*
Pueblo & Lake	C	C	C
Pueblo & I-25 SB	B	A	A
Pueblo & I-25 NB	B	A/B	A

* Denotes unsignalized intersection

Appendix E

US 50B Sensitivity Analysis Memo

US 50B Sensitivity Analysis for Year 2025

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Danielle Yearsley/CH2M Hill

DATE: January 22, 2004

This memorandum summarizes the traffic operations assessment completed along US Highway 50B (US 50B) to support the evaluation of design and operational alternatives for the I-25 New Pueblo Freeway project.

The purpose of this assessment was to determine intersection traffic operations using forecasted 2025 peak-hour volumes and to determine the percent increase in these volumes that would result in failure of one of the US 50B intersections.

The intersections that were analyzed along US 50B included the southbound ramp terminal intersection, northbound ramp terminal intersection, Dillon Drive, potential Erie Avenue, and Bonforte Boulevard. The Dillon Drive and Erie Avenue intersections do not currently exist. However, it is proposed that Dillon Drive will be extended as a result of the I-25 New Pueblo Freeway Project. Currently, the City of Pueblo plans to extend Erie Avenue sometime in the future. Although, the extension of Erie is not proposed as part of the I-25 New Pueblo Freeway project, Erie was included in the analysis to ensure that all intersections along US 50B would operate at an acceptable level of service (LOS) with the proposed build alternative configuration.

1. Channelization and Traffic Volumes

Figure 1 provides sketches of the intersection geometries used in the analysis. Note that these geometries may be more conservative than the actual design, where additional turn bays may be included.

Figure 2 shows the 2025 AM and PM peak-hour traffic volumes for the analysis intersections along US 50B. The PM peak-hour volumes were developed with an extensive travel demand forecasting analysis, using the regional model (built using the TransCAD software package). The AM peak-hour volumes were determined by "flipping" the PM peak-hour volumes. The "flipping" technique assumes that movements to/from an intersection for the PM peak-hour would be the result of the reverse movement for the AM peak-hour. For example, the northbound left-turn movement at the intersection of US 50B and Erie for the

PM peak would be used ("flipped") as the eastbound right-turn movement for the AM peak. The flips at the I-25 ramp terminal intersections are more complex – the values shown in Figure 2 reflect a composite adjustment of the two intersections and all movements within the interchange.

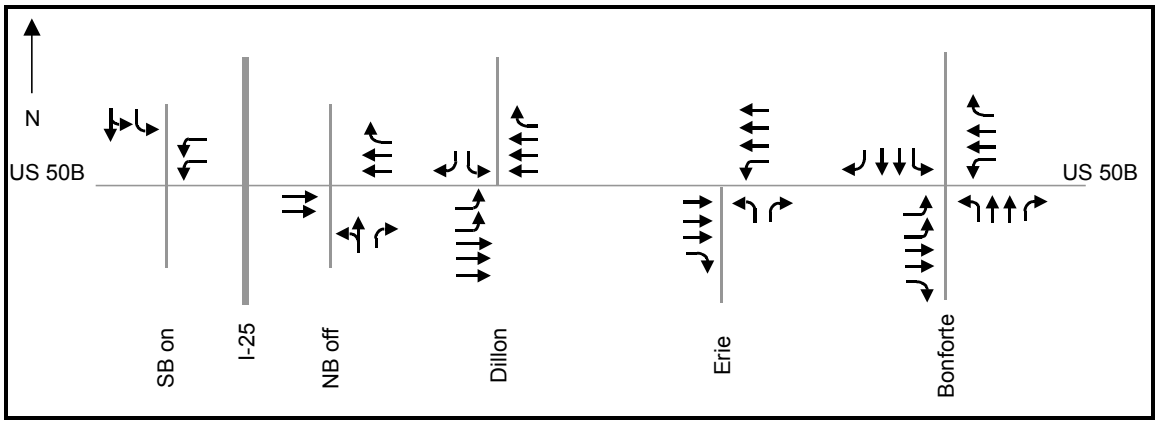

FIGURE 1. Intersection Lane Configurations along US 50B

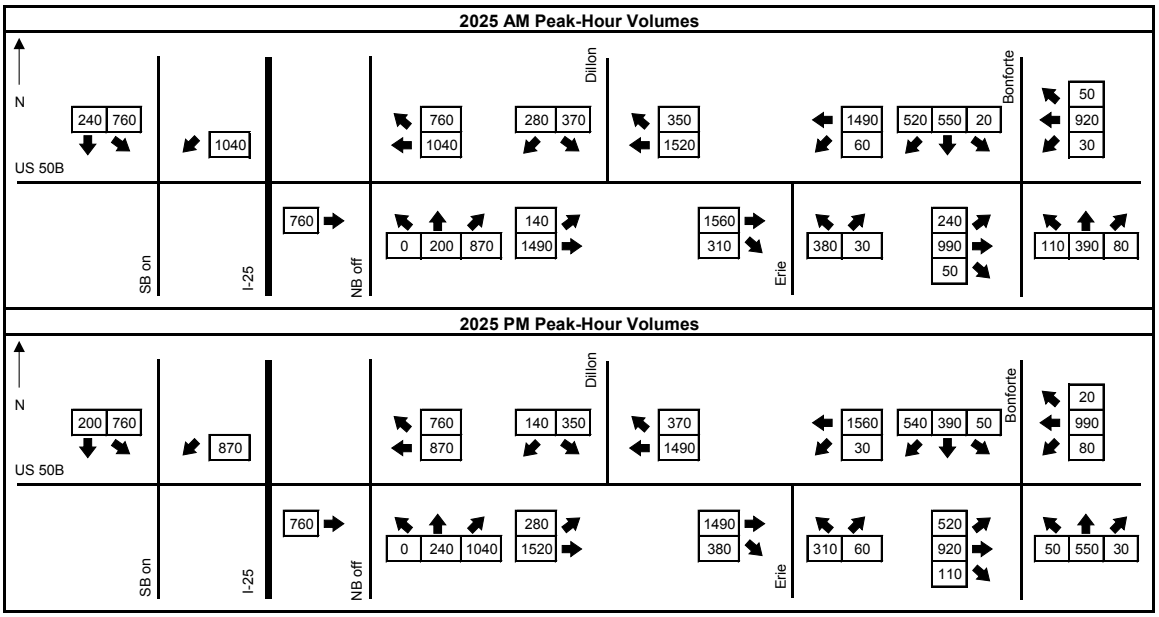

FIGURE 2. 2025 Forecasted AM and PM Peak-Hour Volumes along US 50B

2. LOS Analysis

The intersections were analyzed using the procedures in the 2000 *Highway Capacity Manual* (HCM) using the Synchro traffic analysis software, which reports LOS for both turning movements and the entire intersection based on delay. Synchro's optimization features were used to determine the appropriate phase splits and cycle length for each signal. Cycle lengths between 60 and 110 seconds were used for the optimization routine; a cycle length of 110 seconds was selected for best operations.

The base volumes, presented in Figure 2, were used for the initial analysis. However, to determine the breakdown point for this system of intersections, a sensitivity analysis was conducted. The following scenarios were evaluated as part of the sensitivity analysis:

- Scenario 1 - 20% increase in volumes
- Scenario 2 - 40% increase in volumes
- Scenario 3 - Increase through movements at ramp terminal intersections by 500 vehicles and then apply a 20% increase to the volumes
- Scenario 4 - Increase through movements at ramp terminal intersection by 500 vehicles, increase critical turning movements between the northbound ramp terminal intersection and Dillon Drive by 150 to 200 vehicles and then apply 20% increase to the volumes

These sensitivity adjustments were applied to recognize the uncertainty in the future forecasts. While the travel demand forecasts were developed using state-of-the-art procedures and best practices, there is always uncertainty in future land use, as well as limitations to the available data and technologies. The percentage demand increases reflect conservative adjustments to the forecasts; the specific additions of vehicle at the ramp terminal intersections were designed to test the capacity buffer available at those critical locations.

Table 1 (AM peak) and 2 (PM peak) provide a summary of the LOS calculated for the intersections for both the standard HCM calculation and the Synchro calculation for the base volumes and the sensitivity analysis scenarios.

TABLE 1.
2025 AM Peak-Hour LOS Results

Scenario	Intersection along US 50B				
	SB Ramp Terminal	NB Ramp Terminal	Dillon	Erie	Bonforte
Base Forecast	B/A	A/A	B/B	B/B	C/C
Scenario 1	C/B	B/A	B/B	C/B	D/C
Scenario 2	D/D	B/B	C/B	C/C	E/E
Scenario 3	E/E	D/D	B/B	C/C	D/C
Scenario 4	F/E	D/D	C/B	C/C	D/C

Key - X/Y: X = HCM Calculated LOS; Y = Synchro Calculated LOS

TABLE 2.
2025 PM Peak-Hour LOS Results

Scenario	Intersection along US 50B				
	SB Ramp Terminal	NB Ramp Terminal	Dillon	Erie	Bonforte
Base Forecast	B/B	B/A	B/B	C/B	C/C
Scenario 1	B/B	B/A	C/B	B/B	D/D
Scenario 2	C/C	D/B	C/C	C/C	E/E
Scenario 3	D/C	E/D	C/B	C/B	D/D
Scenario 4	D/C	F/E	C/C	C/B	D/D

Key - X/Y: X = HCM Calculated LOS; Y = Synchro Calculated LOS

Figures 1 to 10 display the results graphically. Additionally, the value of the critical turning movements are displayed on each figure.

Comments on the specific results are as follows:

- The 2025 Base Forecasts and Scenario 1 analyses predict acceptable operations for the AM and PM peak-hours (LOS D or better)
- Intersection failure (LOS F) does not occur until scenario 4:
  - Southbound ramp terminal intersection for AM peak with an increase of 500 through vehicles at the ramp terminal intersections and an increase of 150 vehicles from southbound Dillon Dr to southbound I-25 plus 20% growth
  - Northbound ramp terminal intersection for AM peak with an increase of 500 through vehicles at the ramp terminal intersections and an increase of 200 vehicles from northbound I-25 to northbound Dillon Dr plus 20% growth

Note that none of the scenarios include any improvements (e.g., additional turn lanes) to the geometry of the intersections. It is likely that an acceptable LOS service could be maintained beyond the volumes in the Scenario 4 sensitivity with some cost-effective geometric improvements to these intersections.

3. Conclusion

The operational analysis shows that the intersections along US50B would operate at LOS C or better. The sensitivity analysis showed that the intersections along US 50B would operate at LOS D or better conditions even if the forecasts are off by as much as 20 percent. Additionally, a large capacity buffer exists between the base forecasts and intersection failure (under scenario 4), supporting the conclusion that the LOS of the intersections along US 50B will operate at an acceptable LOS for Year 2025.

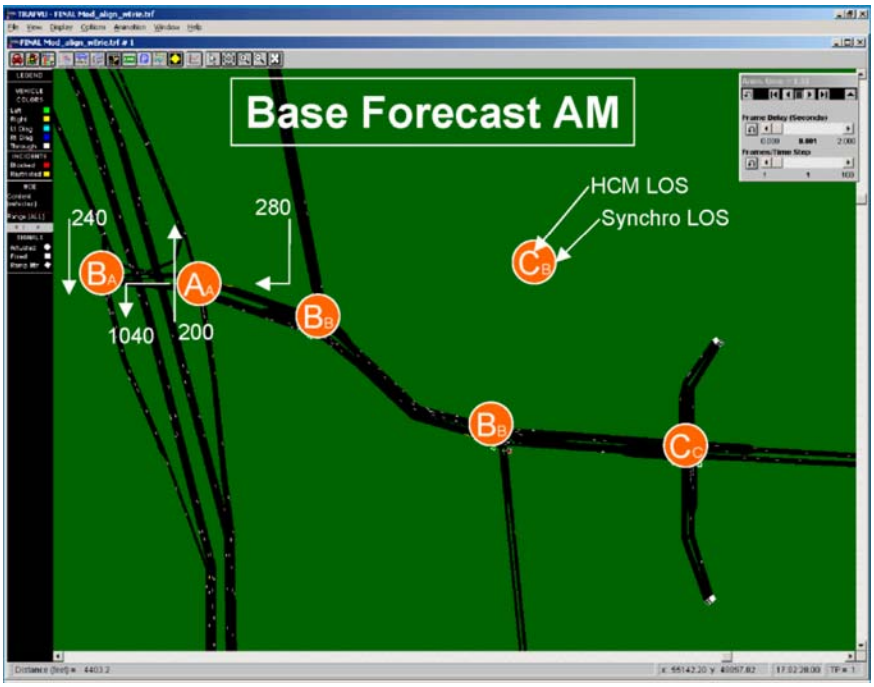

FIGURE 1. Base Forecast AM Peak-Hour

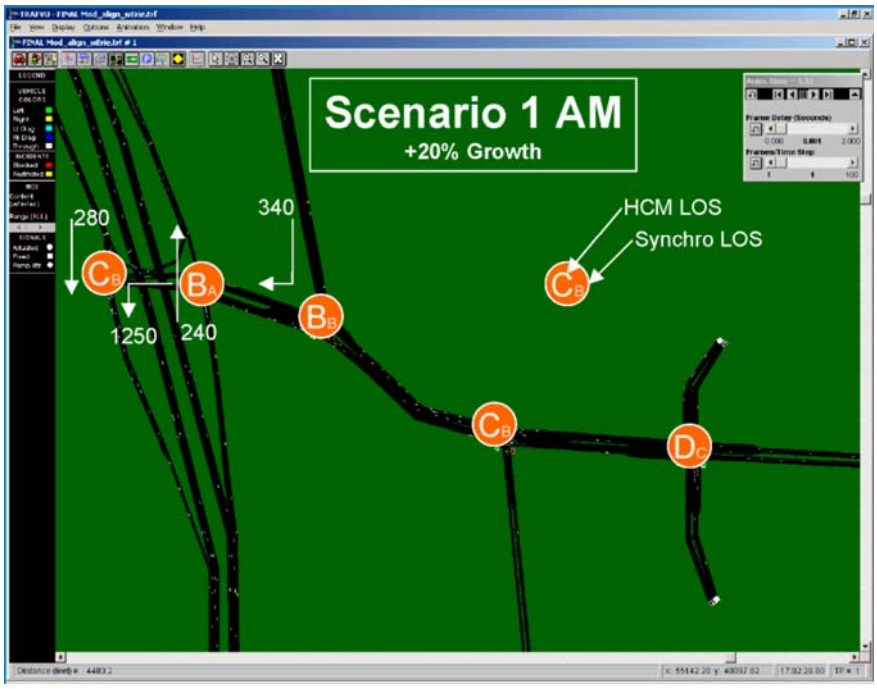

FIGURE 2. Scenario 1 AM Peak-Hour

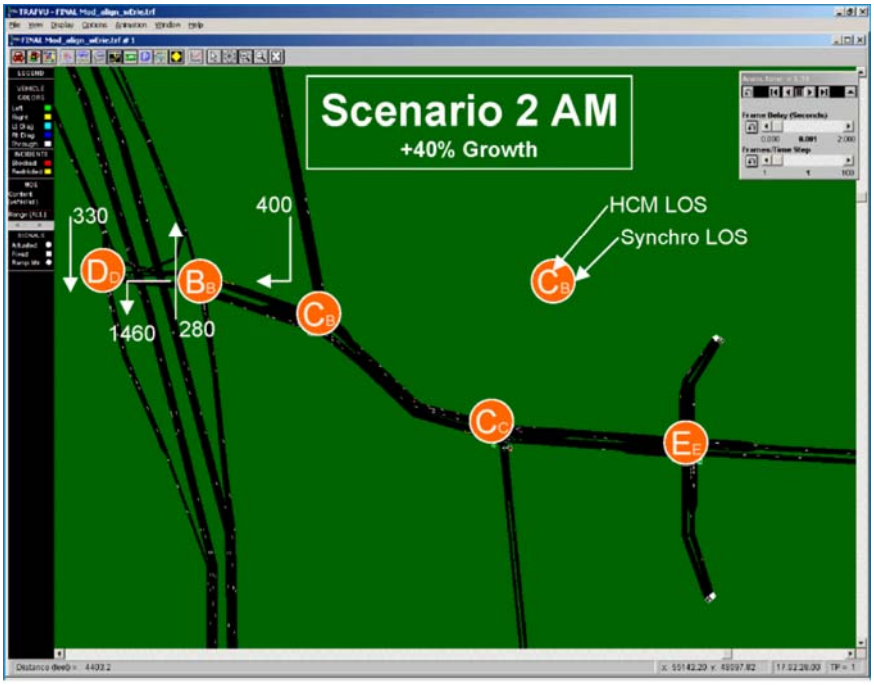

FIGURE 3. Scenario 2 AM Peak-Hour

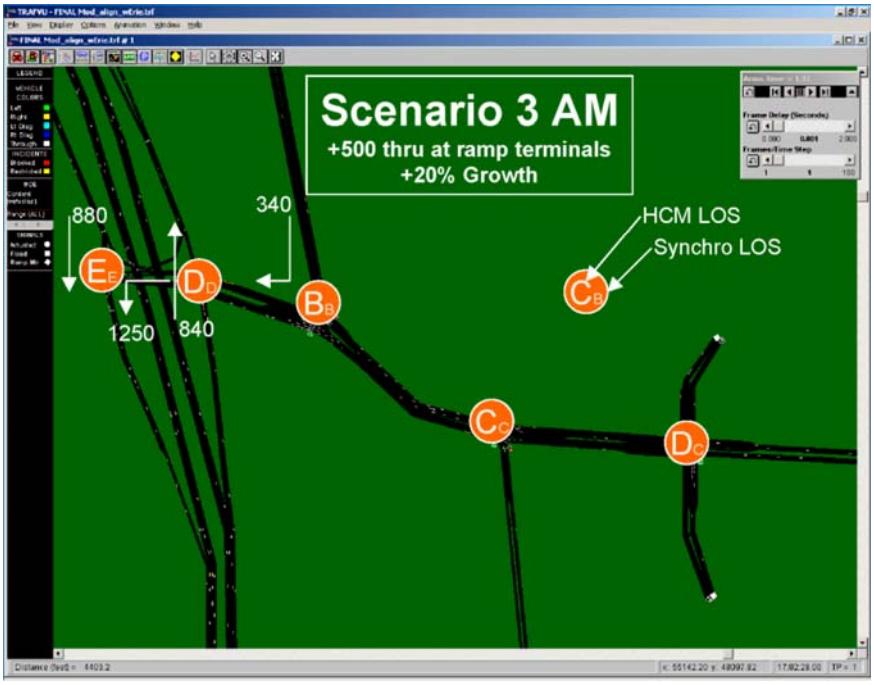

FIGURE 4. Scenario 3 AM Peak-Hour

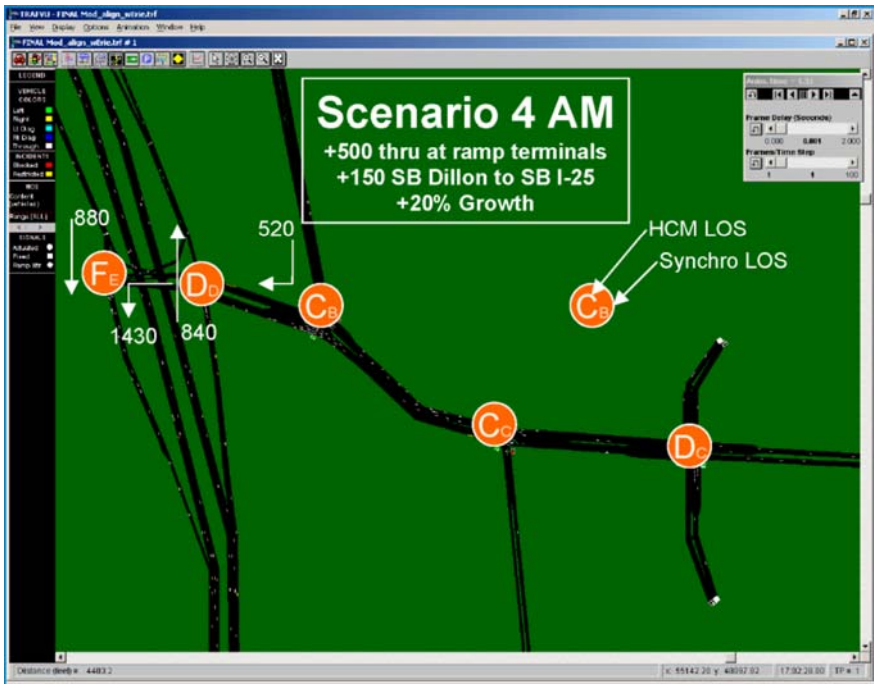

FIGURE 5. Scenario 4 AM Peak-Hour

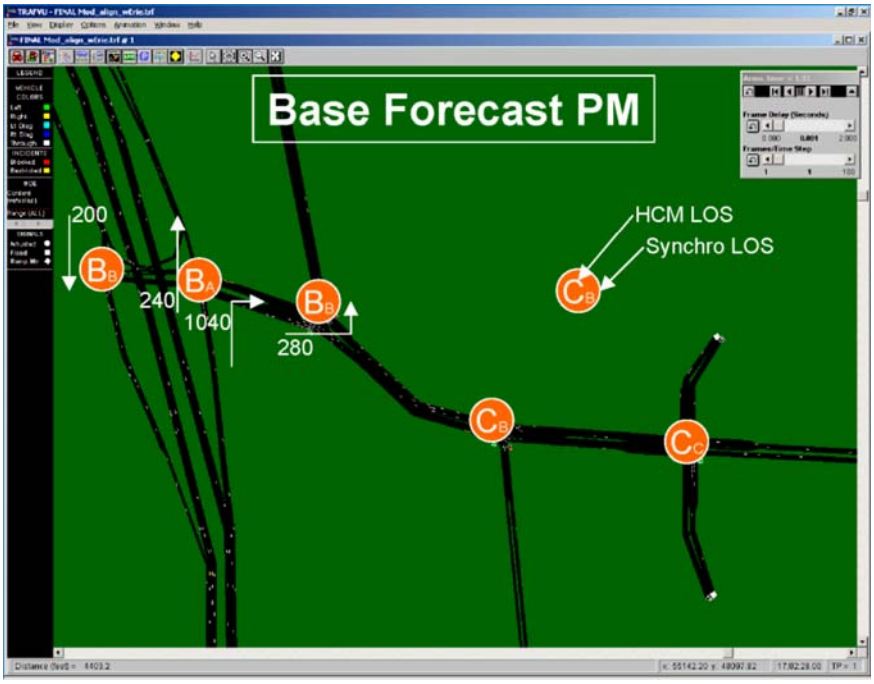

FIGURE 6. Base Forecast PM Peak-Hour

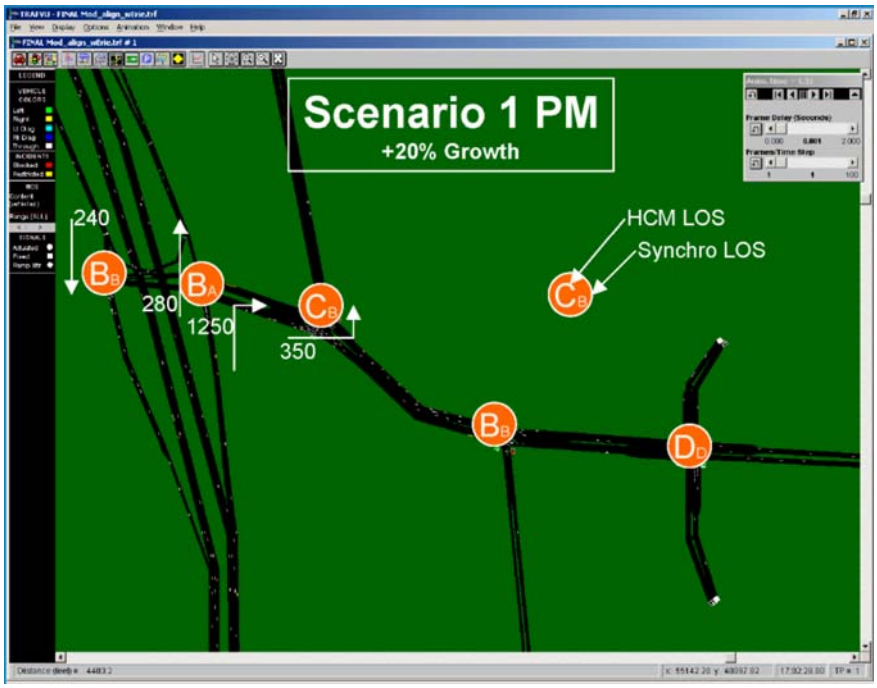

FIGURE 7. Scenario 1 PM Peak-Hour

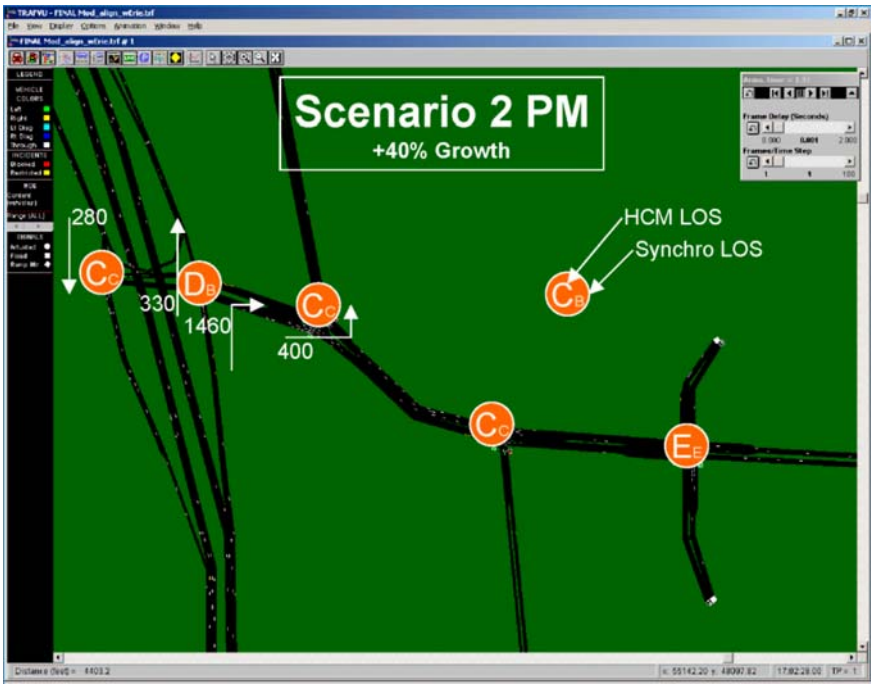

FIGURE 8. Scenario 2 PM Peak-Hour

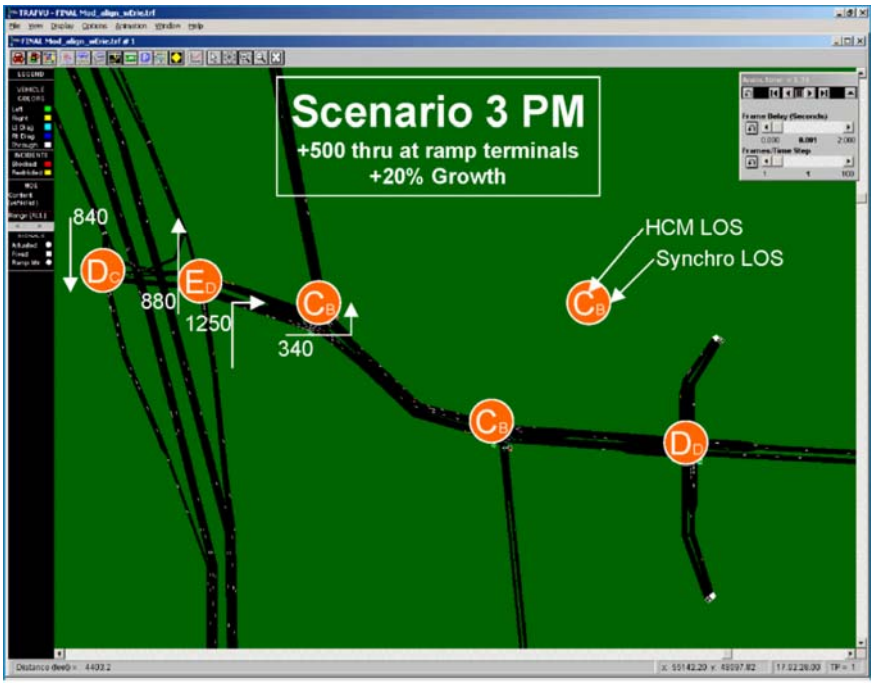

FIGURE 9. Scenario 3 PM Peak-Hour

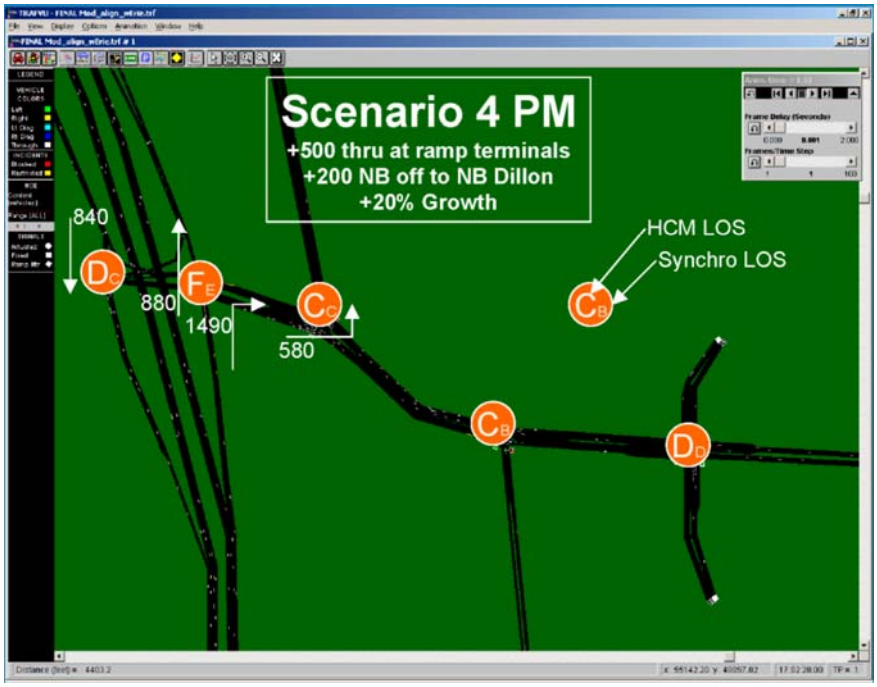

FIGURE 10. Scenario 4 PM Peak-Hour

Appendix F

Lane Configuration Modifications

Response Codes:

A: Recommended lane configuration change incorporated into design

O: Outside project construction limits

R: Reject or engineering issues

Number	Alt	Location	Improvement	Response	Requested by/Reason
1	EA	Indiana and Evans	Exclusive EBL added	A	City added - need some left turns
2	EA		Exclusive WBL added	A	City added - need some left turns
3	EA	I-25 SB and Indiana Ramp Terminal	Additional SBL added	A	City wants to provide additional capacity should steel mill operations increase
4	EA	I-25 NB and Indiana Ramp Terminal	Additional NBL added	R	City added - symmetry based on above improvement
5	EA	Indiana SB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry
6	EA	Indiana NB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry
7	EA	Abriendo and Central	Added NBL	E	City added - presumably for volume thresholds
8	EA	Northern SB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry
9	EA	I-25 SB and Northern Ramp Terminal	Exclusive EBR added	A	Traffic team added based on City-provided volume thresholds
10	EA		Exclusive SBR added	A	City added based on City-provided volume thresholds
11	EA	I-25 NB and Northern Ramp Terminal	Exclusive NBR added	A	City added based on City-provided volume thresholds

Number	Alt	Location	Improvement	Response	Requested by/Reason
12	EA		Exclusive WBR added	A	City added - reason may be for symmetry with I-25 SB/Northern intersection
13	EA	I-25 SB and Abriendo Ramp Terminal	Exclusive EBR added	A	Traffic team added based on City-provided volume thresholds
14	EA		Exclusive SBR added	A	City added based on City-provided volume thresholds
15	EA		Additional SBL added	A	City added based on City-provided volume thresholds
16	EA	I-25 NB and Abriendo Ramp Terminal	Exclusive NBL added	A	City added - reason may be for symmetry with I-25 SB/Abriendo intersection
17	EA		Exclusive NBR added	A	City added - reason may be for symmetry with I-25 SB/Abriendo intersection
18	EA		Exclusive WBR added	A	Traffic team added based on City-provided volume thresholds
19	EA	Santa Fe Dr (50C) and Abriendo	Additional EBL added	A	City added, does not meet volume thresholds
20	EA	Abriendo NB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry
21	EA	Abriendo SB off-ramp	Suggest option lane on off-ramp (2 lane off-ramp)	A	City added, does not meet volume thresholds
22	MA/EA	I-25 SB and Pueblo Ramp Terminal	EBR to SB on-ramp free right-turn	A	City added
23	MA/EA		Exclusive WBT added	A	City added, does not meet volume thresholds
24	MA/EA		1 WBT west of SBR movement	A	Traffic team added based on capacity and operations needs
25	MA/EA		Added additional SBR (total of 2 SBRs)	A	Traffic team added based on capacity and operations needs
26	MA/EA	Pueblo NB loop on-ramp	Loop ramp to be two lane on-ramp	A	City added to provide two lane loop on-ramp at freeway

Number	Alt	Location	Improvement	Response	Requested by/Reason
27	MA/EA	I-25 NB and Pueblo Ramp Terminal	Exclusive EBR added	A	Traffic team added to add capacity to single lane loop ramp
28	MA/EA	Pueblo NB loop on-ramp	Widened to 2 lanes from cross street (merge into 1 lane before freeway)	A	Traffic team added to add capacity to single lane loop ramp
29	MA/EA	I-25 NB and Pueblo Ramp Terminal	WBT/R to be re-channelized as WBT only	A	City added based on City-provided volume thresholds
30	MA/EA		Exclusive WBR added	A	City added based on City-provided volume thresholds
31	MA	Indiana and Evans	Exclusive EBL added	A	City added - need some left turns
32	MA		Exclusive WBL added	A	City added - need some left turns
33	MA	Indiana SPUI	Additional SBL added	A	City requested to provide additional capacity should steel mill operations increase
34	MA		Additional NBL added	R	City requested - symmetry based on above improvement
35	MA		Double left for EB to NB movement	R	City requested - consistent with design for interchange in EA
36	MA		Suggests outside merge for dropping lane on the NB on-ramp	A	City added - geometry
37	MA	Abriendo and Central	Exclusive WBR added	A	City added, does not meet volume thresholds
38	MA	Santa Fe Ave. and Central	Exclusive EBR added	R	City added, does not meet volume thresholds
39	MA		Exclusive SBR added	A	City added based on City-provided volume thresholds
40	MA		Exclusive NBL added	A	City added, does not meet volume thresholds
41	MA	Northern SB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry

Number	Alt	Location	Improvement	Response	Requested by/Reason
42	MA	I-25 SB and Northern Ramp Terminal	Exclusive EBR added	A	Traffic team added based on City-provided volume thresholds
43	MA		Exclusive SBR added	A	City added based on City-provided volume thresholds
44	MA	I-25 NB and Northern Ramp Terminal	Exclusive NBR added	A	City added based on City-provided volume thresholds
45	MA		Exclusive WBR added	A	City added - reason may be for symmetry with I-25 SB/Northern intersection
46	MA	Berwind and Northern	Exclusive EBL shown	E	City added, does not meet volume thresholds
47	MA	SB Frontage Rd and Mesa	If signalized, suggest exclusive SB right-turn lane	R	City added
48	MA	NB Frontage Rd and Mesa	If signalized, suggest exclusive NB right-turn lane	R	City added
49	MA	Santa Fe Ave. and Abriendo	Exclusive EBR added	A	City added based on City-provided volume thresholds
50	MA		Exclusive SBR added	A	City added based on City-provided volume thresholds
51	MA		Exclusive NBL added	A	City added - reason may be for symmetry
52	MA		Exclusive SBL added	A	City added based on City-provided volume thresholds
53	MA		Exclusive NBR added	A	City added, does not meet volume thresholds
54	MA		Exclusive WBR added	A	City added based on City-provided volume thresholds
55	MA	I-25 SB and Abriendo Ramp Terminal	Exclusive EBR added	A	City added, does not meet volume thresholds
56	MA		Exclusive SBR added	A	City added based on City-provided volume thresholds
57	MA		Exclusive SBL added	A	City added based on City-provided volume thresholds

Number	Alt	Location	Improvement	Response	Requested by/Reason
58	MA	I-25 NB and Abriendo Ramp Terminal	Exclusive NBL added	A	City added, does not meet volume thresholds
59	MA		Exclusive NBR added	A	City added, does not meet volume thresholds
60	MA		Two through lanes on north side of intersection	A	Traffic team added to model, but it was already part of the design
61	MA		Exclusive WBR added	A	Traffic team added based on City-provided volume thresholds
62	MA	Stanton and 50C	Exclusive WBR added	R	City request if roadway does not separate parking areas
63	MA	Stanton north of 50C	Change to 3-lane cross-section	R	City asked to consider 3-lane cross-section (NB/SB/TWLTL)
64	MA	Santa Fe Ave. and D Street	Exclusive NBL added	A	City added based on City-provided volume thresholds
65	MA		Exclusive SBL added	A	City added for symmetry
66	MA	Santa Fe Ave. and D Street	Exclusive NBR added	A	Traffic team added to provide for lane add on east leg
67	MA	Stanton north of Locust	Change to 3-lane cross-section	R	City asked to consider 3-lane cross-section (NB/SB/TWLTL)
68	MA	Santa Fe Ave. and D Street	Add dedicated left turn lane to east leg	A	Traffic team changed geometry for symmetry with west leg
69	MA/EA	1st Street SB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry
70a	EA	SB Frontage Rd and 1st	Exclusive EBR added	A	Traffic team added based on City-provided volume thresholds
70b	MA		Exclusive EBR added	A	City added based on City-provided volume thresholds
71	MA/EA		Exclusive SBR added	A	Traffic team added based on capacity and operations needs
72	MA/EA	NB Frontage Rd and 1st	Exclusive NBL added	A	City added, does not meet volume thresholds

Number	Alt	Location	Improvement	Response	Requested by/Reason
73	MA/EA		Exclusive NBR added	A	City added, would need to have two lanes east of frontage road
74a	EA	SB Frontage Rd and 4th	Exclusive EBR added	A	Traffic team added based on City-provided volume thresholds
74b	MA		Exclusive EBR added	A	City added based on City-provided volume thresholds
75	MA/EA		Exclusive SBR added	A	Traffic team added based on City-provided volume thresholds
76	MA/EA		Additional WBL added	A	Traffic team added based on capacity and operations needs
77	MA/EA		Exclusive SBL added	A	City added, does not meet volume thresholds
78	MA/EA	NB Frontage Rd and 4th	NB lane channelization = L, L/T, R	A	City added based on City-provided volume thresholds (for NB RT)
79	MA/EA		Exclusive EBR added	A	City added, does not meet volume thresholds
80	MA/EA	SB Frontage Rd and 6th	Exclusive SBR added	A	City added, does not meet volume thresholds
81	MA/EA	SB Frontage Rd and 7th	Exclusive SBR added	A	City added, does not meet volume thresholds
82a	EA	SB Frontage Rd and 8th	Exclusive EBR added	A	Traffic team added based on City-provided volume thresholds
82b	MA		Exclusive EBR added	A	City added based on City-provided volume thresholds
83a	EA		Exclusive SBR added	A	City added, does not meet volume thresholds
83b	MA		Exclusive SBR added	A	City added based on City-provided volume thresholds
84	MA/EA	SB Frontage Rd and 8th	Additional SBL added	A	City added, does not meet volume thresholds

Number	Alt	Location	Improvement	Response	Requested by/Reason
85	MA/EA	NB Frontage Rd and 8th	Exclusive NBL added	A	City added based on City-provided volume thresholds
86	MA/EA		Exclusive NBR added	A	Traffic team added based on City-provided volume thresholds
87	MA/EA		Exclusive WBR added	A	Traffic team added based on City-provided volume thresholds
88	MA/EA	SB Frontage Rd and 9th	Exclusive SBR added	A	City added, does not meet volume thresholds
89	MA/EA	SB Frontage Rd and 11th	Exclusive SBR added	A	City added, does not meet volume thresholds
90	MA/EA	I-25 SB and 13th Ramp Terminal	Added additional WBT	A	City added, does not meet volume thresholds
91	MA/EA	13th NB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry
92	MA/EA	US 50 B SB on-ramp	Suggests outside merge for dropping lane on the on-ramp	A	City added - geometry
93	MA/EA	I-25 NB and US 50 B Ramp Terminal	NB lane channelization = L/T, T/R, R	A	City added, does not meet volume thresholds
94	MA/EA	Dillon and US 50B	Added additional SBL	A	City added based on City-provided volume thresholds
95	MA/EA		Exclusive WBR added	A	Traffic team added based on City-provided volume thresholds
96	MA/EA		Exclusive WBR added	A	City added, but appears to be the same as #95
97	MA/EA		Remove "add" lane NB north of intersection	R	Traffic team added temporarily to avoid modeling arterial drop lane in CORSIM, but not a real change
98	MA/EA	SB Frontage Rd and 29th St	Exclusive EBR added	A	City added based on City-provided volume thresholds

Number	Alt	Location	Improvement	Response	Requested by/Reason
99	MA/EA		Added additional WBL	A	City added, does not meet volume thresholds
100	MA/EA	NB Frontage Rd and 29th St	Remove 3rd EB through lane	A	Traffic team added because the 3rd lane was not needed
101	MA/EA		3rd EB through lane already exists	A	City added because lane exists
102	MA/EA	Elizabeth and 29th	Additional SBL added	E	Traffic team added based on City-provided volume thresholds
103	MA/EA	Pueblo and Lake	Additional WBL added	E	Traffic team added based on capacity and operations needs
104	MA	Indiana SPUI	Restripe EB as L,L/T	A	Number 35 rejected and replaced with Number 104
105	MA/EA	NB Frontage Rd and 8th	Added additional EBL	A	Traffic team added based on City-provided volume thresholds

Appendix G

HCM Signal Reports for the No Action Alternative

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0		3.0	3.0						3.0	
Lane Util. Factor		0.95		1.00	1.00						1.00	
Frt		0.97		1.00	1.00						1.00	
Flt Protected		1.00		0.95	1.00						0.95	
Satd. Flow (prot)		3366		1736	1827						1736	
Flt Permitted		1.00		0.06	1.00						0.95	
Satd. Flow (perm)		3366		117	1827						1736	
Volume (vph)	0	1200	305	10	329	0	0	0	0	66	0	0
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	1333	339	11	366	0	0	0	0	73	0	0
Lane Group Flow (vph)	0	1672	0	11	366	0	0	0	0	0	73	0
Turn Type				pm+pt						Perm		
Protected Phases		4		3	8						6	
Permitted Phases				8						6		
Actuated Green, G (s)		66.7		76.2	76.2						24.8	
Effective Green, g (s)		68.2		77.7	77.7						26.3	
Actuated g/C Ratio		0.62		0.71	0.71						0.24	
Clearance Time (s)		4.5		4.5	4.5						4.5	
Lane Grp Cap (vph)		2087		178	1291						415	
v/s Ratio Prot		c0.50		0.00	c0.20							
v/s Ratio Perm				0.04							c0.04	
v/c Ratio		0.80		0.06	0.28						0.18	
Uniform Delay, d1		15.8		12.4	5.9						33.2	
Progression Factor		1.00		1.29	1.82						1.00	
Incremental Delay, d2		3.3		0.6	0.5						0.9	
Delay (s)		19.1		16.5	11.3						34.2	
Level of Service		B		B	B						C	
Approach Delay (s)		19.1			11.4			0.0			34.2	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0	3.0		3.0				
Lane Util. Factor	0.95	0.95			1.00	1.00		1.00				
Frt	1.00	1.00			1.00	0.85		1.00				
Flt Protected	0.95	0.96			1.00	1.00		0.95				
Satd. Flow (prot)	1649	1668			1827	1553		1734				
Flt Permitted	0.44	0.45			1.00	1.00		0.95				
Satd. Flow (perm)	769	777			1827	1553		1734				
Volume (vph)	1132	133	0	0	146	115	192	0	7	0	0	0
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)	1258	148	0	0	162	128	213	0	8	0	0	0
Lane Group Flow (vph)	629	777	0	0	162	128	0	221	0	0	0	0
Turn Type	pm+pt					Perm	Perm					
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2					
Actuated Green, G (s)	79.0	79.0			22.0	22.0		22.0				
Effective Green, g (s)	80.5	80.5			23.5	23.5		23.5				
Actuated g/C Ratio	0.73	0.73			0.21	0.21		0.21				
Clearance Time (s)	4.5	4.5			4.5	4.5		4.5				
Lane Grp Cap (vph)	995	1006			390	332		370				
v/s Ratio Prot	0.31	c0.38			0.09							
v/s Ratio Perm	0.15	c0.19				0.08		c0.13				
v/c Ratio	0.63	0.77			0.42	0.39		0.60				
Uniform Delay, d1	7.1	9.1			37.3	37.1		39.0				
Progression Factor	0.06	0.07			1.00	1.00		1.00				
Incremental Delay, d2	1.9	3.7			3.2	3.4		6.9				
Delay (s)	2.4	4.3			40.6	40.4		45.9				
Level of Service	A	A			D	D		D				
Approach Delay (s)		3.5			40.5			45.9			0.0	
Approach LOS		A			D			D			A	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	1.00	1.00	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1736	3471		1736	3471	1553		3471	1553	1736	3124	
Flt Permitted	0.10	1.00		0.10	1.00	1.00		1.00	1.00	0.76	1.00	
Satd. Flow (perm)	187	3471		174	3471	1553		3471	1553	1383	3124	
Volume (vph)	123	1311	0	213	1389	79	0	1	17	177	68	137
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)	137	1457	0	237	1543	88	0	1	19	197	76	152
Lane Group Flow (vph)	137	1457	0	237	1543	88	0	1	19	197	228	0
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt		
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	41.5	37.5		49.5	41.5	45.5		22.5	30.5	26.5	22.5	
Effective Green, g (s)	44.5	39.0		51.5	43.0	48.5		24.0	33.5	29.5	24.0	
Actuated g/C Ratio	0.49	0.43		0.57	0.48	0.54		0.27	0.37	0.33	0.27	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	187	1504		264	1658	889		926	630	475	833	
v/s Ratio Prot	0.04	0.42		c0.09	c0.44	0.01		0.00	0.00	c0.03	0.07	
v/s Ratio Perm	0.32			0.42		0.05			0.01	c0.11		
v/c Ratio	0.73	0.97		0.90	0.93	0.10		0.00	0.03	0.41	0.27	
Uniform Delay, d1	18.9	24.9		24.3	22.1	10.1		24.2	17.9	23.0	26.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	22.3	16.9		34.3	10.8	0.2		0.0	0.1	2.7	0.8	
Delay (s)	41.2	41.8		58.6	32.9	10.3		24.2	18.0	25.7	26.9	
Level of Service	D	D		E	C	B		C	B	C	C	
Approach Delay (s)		41.7			35.1			18.3			26.3	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	36.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0							3.0
Lane Util. Factor		1.00	1.00		1.00							1.00
Frt		1.00	0.85		1.00							0.85
Flt Protected		1.00	1.00		1.00							1.00
Satd. Flow (prot)		1827	1553		1827							1553
Flt Permitted		1.00	1.00		1.00							1.00
Satd. Flow (perm)		1827	1553		1827							1553
Volume (vph)	0	608	353	0	197	0	0	0	0	0	0	615
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	676	392	0	219	0	0	0	0	0	0	683
Lane Group Flow (vph)	0	676	392	0	219	0	0	0	0	0	0	683
Turn Type			Perm	Perm						Perm		Perm
Protected Phases		4			8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		57.7	57.7		57.7							43.3
Effective Green, g (s)		59.2	59.2		59.2							44.8
Actuated g/C Ratio		0.54	0.54		0.54							0.41
Clearance Time (s)		4.5	4.5		4.5							4.5
Lane Grp Cap (vph)		983	836		983							632
v/s Ratio Prot		c0.37			0.12							
v/s Ratio Perm			0.25									c0.44
v/c Ratio		0.69	0.47		0.22							1.08
Uniform Delay, d1		18.6	15.7		13.3							32.6
Progression Factor		1.00	1.00		1.26							1.00
Incremental Delay, d2		3.9	1.9		0.5							59.6
Delay (s)		22.5	17.6		17.3							92.2
Level of Service		C	B		B							F
Approach Delay (s)		20.7			17.3			0.0			92.2	
Approach LOS		C			B			A			F	

Intersection Summary			
HCM Average Control Delay	45.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0		
Lane Util. Factor	1.00			1.00		
Frt	1.00			1.00		
Flt Protected	0.95			0.95		
Satd. Flow (prot)	1736			1736		
Flt Permitted	0.95			0.95		
Satd. Flow (perm)	1736			1736		
Volume (vph)	608	0	197	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	676	0	219	0	0	0
Lane Group Flow (vph)	676	0	0	219	0	0
Turn Type			Perm			
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	68.6			32.4		
Effective Green, g (s)	70.1			33.9		
Actuated g/C Ratio	0.64			0.31		
Clearance Time (s)	4.5			4.5		
Lane Grp Cap (vph)	1106			535		
v/s Ratio Prot	c0.39					
v/s Ratio Perm				c0.13		
v/c Ratio	0.61			0.41		
Uniform Delay, d1	11.9			30.1		
Progression Factor	0.08			1.00		
Incremental Delay, d2	1.8			2.3		
Delay (s)	2.8			32.4		
Level of Service	A			C		
Approach Delay (s)	2.8			32.4	0.0	
Approach LOS	A			C	A	

Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	56.2%	ICU Level of Service	A

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	NBR2	SBL	SBT	SWL	SWR
Lane Configurations									
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			3.0			3.0	3.0	3.0	3.0
Lane Util. Factor			0.95			1.00	0.95	1.00	1.00
Frt			0.99			1.00	1.00	1.00	0.85
Flt Protected			1.00			0.95	1.00	0.95	1.00
Satd. Flow (prot)			3423			1736	3471	1736	1553
Flt Permitted			1.00			0.10	1.00	0.95	1.00
Satd. Flow (perm)			3423			183	3471	1736	1553
Volume (vph)	0	0	824	0	84	233	661	607	37
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	916	0	93	259	734	674	41
Lane Group Flow (vph)	0	0	1009	0	0	259	734	674	41
Turn Type						pm+pt			Perm
Protected Phases			2			1	6	8	
Permitted Phases						6			8
Actuated Green, G (s)			35.5			54.5	54.5	46.5	46.5
Effective Green, g (s)			37.0			56.0	56.0	48.0	48.0
Actuated g/C Ratio			0.34			0.51	0.51	0.44	0.44
Clearance Time (s)			4.5			4.5	4.5	4.5	4.5
Lane Grp Cap (vph)			1151			319	1767	758	678
v/s Ratio Prot			c0.29			c0.12	0.21	c0.39	
v/s Ratio Perm						0.30			0.03
v/c Ratio			0.88			0.81	0.42	0.89	0.06
Uniform Delay, d1			34.4			28.6	16.8	28.6	17.9
Progression Factor			1.00			0.65	0.24	1.00	1.00
Incremental Delay, d2			9.5			18.1	0.7	14.7	0.2
Delay (s)			43.8			36.7	4.7	43.3	18.1
Level of Service			D			D	A	D	B
Approach Delay (s)	0.0		43.8				13.0	41.8	
Approach LOS	A		D				B	D	

Intersection Summary			
HCM Average Control Delay	32.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	D

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1736	1553	3471	1553	1736	3471
Flt Permitted	0.95	1.00	1.00	1.00	0.31	1.00
Satd. Flow (perm)	1736	1553	3471	1553	570	3471
Volume (vph)	5	66	531	330	35	889
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	6	73	590	367	39	988
Lane Group Flow (vph)	6	73	590	367	39	988
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	35.0	35.0	44.4	44.4	66.0	66.0
Effective Green, g (s)	36.5	36.5	45.9	45.9	67.5	67.5
Actuated g/C Ratio	0.33	0.33	0.42	0.42	0.61	0.61
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	576	515	1448	648	547	2130
v/s Ratio Prot	0.00		0.17		0.01	c0.28
v/s Ratio Perm		c0.05		c0.24	0.03	
v/c Ratio	0.01	0.14	0.41	0.57	0.07	0.46
Uniform Delay, d1	24.6	25.8	22.5	24.5	9.3	11.5
Progression Factor	1.00	1.00	0.10	0.01	0.91	1.11
Incremental Delay, d2	0.0	0.6	0.4	1.9	0.2	0.7
Delay (s)	24.7	26.3	2.6	2.0	8.7	13.4
Level of Service	C	C	A	A	A	B
Approach Delay (s)	26.2		2.4			13.2
Approach LOS	C		A			B

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	37.3%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	14	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	0.95			0.95			1.00				
Frt	1.00	1.00			0.99			1.00				
Flt Protected	0.95	1.00			1.00			0.95				
Satd. Flow (prot)	1736	3471			3442			1851				
Flt Permitted	0.40	1.00			1.00			0.95				
Satd. Flow (perm)	730	3471			3442			1851				
Volume (vph)	447	51	0	0	287	17	129	0	0	0	0	0
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)	497	57	0	0	319	19	143	0	0	0	0	0
Lane Group Flow (vph)	497	57	0	0	338	0	0	143	0	0	0	0
Turn Type	pm+pt						Perm					
Protected Phases	7	4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	72.7	72.7			28.0			28.3				
Effective Green, g (s)	74.2	74.2			29.5			29.8				
Actuated g/C Ratio	0.67	0.67			0.27			0.27				
Clearance Time (s)	4.5	4.5			4.5			4.5				
Lane Grp Cap (vph)	874	2341			923			501				
v/s Ratio Prot	c0.22	0.02			0.10							
v/s Ratio Perm	c0.17							c0.08				
v/c Ratio	0.57	0.02			0.37			0.29				
Uniform Delay, d1	8.9	5.9			32.7			31.7				
Progression Factor	0.63	0.45			1.00			1.00				
Incremental Delay, d2	2.4	0.0			1.1			1.4				
Delay (s)	8.0	2.7			33.8			33.1				
Level of Service	A	A			C			C				
Approach Delay (s)		7.4			33.8			33.1			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	1.00		1.00	0.95			0.87			1.00	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.96	
Satd. Flow (prot)	1736	3469		1736	3314			1583			1747	
Flt Permitted	0.14	1.00		0.14	1.00			1.00			0.96	
Satd. Flow (perm)	252	3469		263	3314			1583			1747	
Volume (vph)	121	613	3	289	678	294	2	3	362	31	3	0
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)	134	681	3	321	753	327	2	3	402	34	3	0
Lane Group Flow (vph)	134	684	0	321	1080	0	0	407	0	0	37	0
Turn Type	pm+pt			pm+pt			Split			Split		
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases	2			6								
Actuated Green, G (s)	35.0	27.5		51.5	39.5			23.0			22.0	
Effective Green, g (s)	38.0	29.0		53.0	41.0			24.5			23.5	
Actuated g/C Ratio	0.35	0.26		0.48	0.37			0.22			0.21	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	208	915		408	1235			353			373	
v/s Ratio Prot	0.05	0.20		c0.15	c0.33			c0.26			c0.02	
v/s Ratio Perm	0.17			0.23								
v/c Ratio	0.64	0.75		0.79	0.87			1.15			0.10	
Uniform Delay, d1	27.2	37.1		25.1	32.1			42.8			34.7	
Progression Factor	0.61	0.91		1.57	0.98			0.96			1.00	
Incremental Delay, d2	11.9	4.6		11.4	7.1			96.3			0.5	
Delay (s)	28.5	38.5		50.7	38.4			137.3			35.3	
Level of Service	C	D		D	D			F			D	
Approach Delay (s)		36.9			41.2			137.3			35.3	
Approach LOS		D			D			F			D	

Intersection Summary			
HCM Average Control Delay	54.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.74		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0						3.0	
Lane Util. Factor		1.00	1.00		0.95						1.00	
Frt		1.00	0.85		1.00						0.86	
Flt Protected		1.00	1.00		1.00						1.00	
Satd. Flow (prot)		1827	1553		3471						1580	
Flt Permitted		1.00	1.00		1.00						1.00	
Satd. Flow (perm)		1827	1553		3471						1580	
Volume (vph)	0	498	573	0	426	0	0	0	0	0	0	343
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	553	637	0	473	0	0	0	0	0	0	381
Lane Group Flow (vph)	0	553	637	0	473	0	0	0	0	0	381	0
Turn Type			Perm	Perm						Perm		
Protected Phases		4			8						6	
Permitted Phases			4	8						6		
Actuated Green, G (s)		60.0	60.0		60.0						41.0	
Effective Green, g (s)		61.5	61.5		61.5						42.5	
Actuated g/C Ratio		0.56	0.56		0.56						0.39	
Clearance Time (s)		4.5	4.5		4.5						4.5	
Lane Grp Cap (vph)		1021	868		1941						610	
v/s Ratio Prot		0.30			0.14						c0.24	
v/s Ratio Perm			c0.41									
v/c Ratio		0.54	0.73		0.24						0.62	
Uniform Delay, d1		15.3	18.1		12.4						27.3	
Progression Factor		1.09	3.02		1.43						1.00	
Incremental Delay, d2		1.7	4.5		0.2						4.8	
Delay (s)		18.4	59.2		17.9						32.1	
Level of Service		B	E		B						C	
Approach Delay (s)		40.2			17.9			0.0			32.1	
Approach LOS		D			B			A			C	

Intersection Summary			
HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	86.1%	ICU Level of Service	D

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0		
Lane Util. Factor	1.00			1.00		
Frt	1.00			1.00		
Flt Protected	0.95			0.95		
Satd. Flow (prot)	1736			1736		
Flt Permitted	0.95			0.95		
Satd. Flow (perm)	1736			1736		
Volume (vph)	498	0	426	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	553	0	473	0	0	0
Lane Group Flow (vph)	553	0	0	473	0	0
Turn Type			Perm			
Protected Phases	4			2		
Permitted Phases			2			
Actuated Green, G (s)	54.2			46.8		
Effective Green, g (s)	55.7			48.3		
Actuated g/C Ratio	0.51			0.44		
Clearance Time (s)	4.5			4.5		
Lane Grp Cap (vph)	879			762		
v/s Ratio Prot	c0.32					
v/s Ratio Perm				c0.27		
v/c Ratio	0.63			0.62		
Uniform Delay, d1	19.7			23.8		
Progression Factor	0.29			1.00		
Incremental Delay, d2	2.9			3.8		
Delay (s)	8.7			27.6		
Level of Service	A			C		
Approach Delay (s)	8.7			27.6	0.0	
Approach LOS	A			C	A	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0							3.0
Lane Util. Factor		1.00	1.00	1.00	0.95							1.00
Frt		1.00	0.85	1.00	1.00							0.85
Flt Protected		1.00	1.00	0.95	1.00							1.00
Satd. Flow (prot)		1827	1553	1736	3471							1553
Flt Permitted		1.00	1.00	0.53	1.00							1.00
Satd. Flow (perm)		1827	1553	971	3471							1553
Volume (vph)	0	136	575	176	623	0	0	0	0	0	0	673
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	151	639	196	692	0	0	0	0	0	0	748
Lane Group Flow (vph)	0	151	639	196	692	0	0	0	0	0	0	748
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		31.5	31.5	40.5	40.5							60.5
Effective Green, g (s)		33.0	33.0	42.0	42.0							62.0
Actuated g/C Ratio		0.30	0.30	0.38	0.38							0.56
Clearance Time (s)		4.5	4.5	4.5	4.5							4.5
Lane Grp Cap (vph)		548	466	412	1325							875
v/s Ratio Prot		0.08		0.03	c0.20							
v/s Ratio Perm			c0.41	0.16								c0.48
v/c Ratio		0.28	1.37	0.48	0.52							0.85
Uniform Delay, d1		29.4	38.5	25.7	26.3							20.2
Progression Factor		0.39	3.62	0.41	0.40							1.00
Incremental Delay, d2		0.8	175.4	3.4	1.3							10.4
Delay (s)		12.3	314.6	14.0	11.8							30.7
Level of Service		B	F	B	B							C
Approach Delay (s)		256.8			12.3			0.0			30.7	
Approach LOS		F			B			A			C	

Intersection Summary			
HCM Average Control Delay	97.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.01		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0						3.0	3.0				3.0
Lane Util. Factor	1.00						0.97	1.00				1.00
Frt	1.00						1.00	1.00				0.85
Flt Protected	0.95						0.95	1.00				1.00
Satd. Flow (prot)	1736						3367	1827				1553
Flt Permitted	0.68						0.95	1.00				1.00
Satd. Flow (perm)	1243						3367	1827				1553
Volume (vph)	136	0	0	0	0	0	434	176	0	0	0	365
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)	151	0	0	0	0	0	482	196	0	0	0	406
Lane Group Flow (vph)	151	0	0	0	0	0	482	196	0	0	0	406
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6
Actuated Green, G (s)	42.5						27.0	27.0				27.0
Effective Green, g (s)	44.0						28.5	28.5				28.5
Actuated g/C Ratio	0.40						0.26	0.26				0.26
Clearance Time (s)	4.5						4.5	4.5				4.5
Lane Grp Cap (vph)	562						872	473				402
v/s Ratio Prot	c0.04						c0.14	0.11				
v/s Ratio Perm	c0.07											c0.26
v/c Ratio	0.27						0.55	0.41				1.01
Uniform Delay, d1	21.7						35.2	33.8				40.8
Progression Factor	1.92						1.00	1.00				1.00
Incremental Delay, d2	1.1						2.5	2.7				47.4
Delay (s)	42.8						37.8	36.5				88.2
Level of Service	D						D	D				F
Approach Delay (s)		42.8			0.0			37.4			88.2	
Approach LOS		D			A			D			F	

Intersection Summary			
HCM Average Control Delay	54.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.56		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	45.5%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBL	WBT	SBL	SEL	SET	NWL	NWT	NEL
Lane Configurations										
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0		3.0		3.0		
Lane Util. Factor	0.97	0.91	0.97	0.91		0.97		0.97		
Frt	1.00	1.00	1.00	1.00		1.00		1.00		
Flt Protected	0.95	1.00	0.95	1.00		0.95		0.95		
Satd. Flow (prot)	3367	4988	3367	4988		3367		3367		
Flt Permitted	0.95	1.00	0.95	1.00		0.95		0.95		
Satd. Flow (perm)	3367	4988	3367	4988		3367		3367		
Volume (vph)	592	1700	134	2293	0	27	0	609	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	658	1889	149	2548	0	30	0	677	0	0
Lane Group Flow (vph)	658	1889	149	2548	0	30	0	677	0	0
Turn Type	Prot		Prot			custom		custom		
Protected Phases	7	4	3	8		6		2		
Permitted Phases						6		2		
Actuated Green, G (s)	19.9	66.4	8.1	54.6		22.0		22.0		
Effective Green, g (s)	21.4	67.9	9.6	56.1		23.5		23.5		
Actuated g/C Ratio	0.19	0.62	0.09	0.51		0.21		0.21		
Clearance Time (s)	4.5	4.5	4.5	4.5		4.5		4.5		
Lane Grp Cap (vph)	655	3079	294	2544		719		719		
v/s Ratio Prot	c0.20	0.38	0.04	c0.51		0.01		c0.20		
v/s Ratio Perm										
v/c Ratio	1.00	0.61	0.51	1.00		0.04		0.94		
Uniform Delay, d1	44.3	13.0	47.9	26.9		34.3		42.6		
Progression Factor	1.24	0.34	1.32	0.11		1.00		1.00		
Incremental Delay, d2	25.3	0.4	0.6	5.7		0.1		22.0		
Delay (s)	80.3	4.8	63.8	8.6		34.4		64.6		
Level of Service	F	A	E	A		C		E		
Approach Delay (s)		24.3		11.6	0.0		34.4		64.6	0.0
Approach LOS		C		B	A		C		E	A

Intersection Summary			
HCM Average Control Delay	23.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.99		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	97.3%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	10	10	12	10	10	12
Total Lost time (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95		1.00	0.95	
Frt	1.00	1.00		1.00	0.96			1.00		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00			1.00		0.95	1.00	
Satd. Flow (prot)	1458	2916		1458	2805			2916		1458	2711	
Flt Permitted	0.18	1.00		0.46	1.00			1.00		0.39	1.00	
Satd. Flow (perm)	282	2916		711	2805			2916		597	2711	
Volume (vph)	246	461	0	20	416	141	0	283	0	275	369	325
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)	273	512	0	22	462	157	0	314	0	306	410	361
Lane Group Flow (vph)	273	512	0	22	619	0	0	314	0	306	771	0
Parking (#/hr)												15
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	3	8		7	4		5	2	7	1	6	
Permitted Phases	8			4			2		2	6		
Actuated Green, G (s)	53.5	45.0		31.5	27.5			23.5		47.5	39.0	
Effective Green, g (s)	55.0	46.5		34.5	29.0			25.0		49.0	40.5	
Actuated g/C Ratio	0.50	0.42		0.31	0.26			0.23		0.45	0.37	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5		4.5	4.5	
Lane Grp Cap (vph)	387	1233		260	740			663		430	998	
v/s Ratio Prot	c0.15	0.18		0.00	c0.22			0.11		c0.14	c0.28	
v/s Ratio Perm	0.21			0.02						0.18		
v/c Ratio	0.71	0.42		0.08	0.84			0.47		0.71	0.77	
Uniform Delay, d1	19.5	22.2		26.3	38.3			36.8		21.9	30.7	
Progression Factor	1.00	1.00		0.98	1.04			0.74		0.56	0.52	
Incremental Delay, d2	10.3	1.0		0.6	10.8			2.3		7.2	4.3	
Delay (s)	29.8	23.3		26.4	50.5			29.6		19.5	20.2	
Level of Service	C	C		C	D			C		B	C	
Approach Delay (s)		25.5			49.6			29.6			20.0	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM Average Control Delay	29.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	D

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	12	12	10	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.97		1.00	1.00		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1562	3034		1562	3121		1458	2916	1398	1562	2878	
Flt Permitted	0.49	1.00		0.17	1.00		0.23	1.00	1.00	0.40	1.00	
Satd. Flow (perm)	809	3034		285	3121		354	2916	1398	664	2878	
Volume (vph)	193	485	116	263	402	3	68	386	216	3	547	52
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)	214	539	129	292	447	3	76	429	240	3	608	58
Lane Group Flow (vph)	214	668	0	292	450	0	76	429	240	3	666	0
Parking (#/hr)												15
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	42.5	29.5		57.5	40.0		39.5	35.0	58.5	38.5	34.5	
Effective Green, g (s)	45.5	31.0		59.0	41.5		42.5	36.5	61.5	41.5	36.0	
Actuated g/C Ratio	0.41	0.28		0.54	0.38		0.39	0.33	0.56	0.38	0.33	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	434	855		443	1177		197	968	820	295	942	
v/s Ratio Prot	0.07	c0.22		c0.15	0.14		c0.02	0.15	0.07	0.00	c0.23	
v/s Ratio Perm	0.14			0.20			0.13		0.11	0.00		
v/c Ratio	0.49	0.78		0.66	0.38		0.39	0.44	0.29	0.01	0.71	
Uniform Delay, d1	21.9	36.4		18.0	24.9		23.1	28.8	12.8	21.6	32.4	
Progression Factor	1.00	1.00		0.62	1.02		0.77	0.82	3.35	0.23	0.21	
Incremental Delay, d2	4.0	7.0		3.9	0.5		4.4	1.1	0.7	0.1	4.2	
Delay (s)	25.9	43.4		15.0	25.8		22.1	24.6	43.5	5.0	11.1	
Level of Service	C	D		B	C		C	C	D	A	B	
Approach Delay (s)		39.1			21.6			30.5			11.0	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0						3.0			3.0	
Lane Util. Factor		0.91						0.95			0.95	
Frt		1.00						1.00			1.00	
Flt Protected		0.97						1.00			1.00	
Satd. Flow (prot)		4860						3471			3471	
Flt Permitted		0.97						1.00			1.00	
Satd. Flow (perm)		4860						3471			3471	
Volume (vph)	106	96	0	0	0	0	0	582	0	0	704	0
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)	118	107	0	0	0	0	0	647	0	0	782	0
Lane Group Flow (vph)	0	225	0	0	0	0	0	647	0	0	782	0
Turn Type	Perm									pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4									6		
Actuated Green, G (s)		37.0						40.5			64.0	
Effective Green, g (s)		38.5						42.0			65.5	
Actuated g/C Ratio		0.35						0.38			0.60	
Clearance Time (s)		4.5						4.5			4.5	
Lane Grp Cap (vph)		1701						1325			2067	
v/s Ratio Prot								c0.19			c0.23	
v/s Ratio Perm		c0.05										
v/c Ratio		0.13						0.49			0.38	
Uniform Delay, d1		24.4						25.8			11.6	
Progression Factor		1.00						0.73			0.53	
Incremental Delay, d2		0.2						1.2			0.5	
Delay (s)		24.5						20.1			6.6	
Level of Service		C						C			A	
Approach Delay (s)		24.5			0.0			20.1			6.6	
Approach LOS		C			A			C			A	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.33		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	34.8%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	10	12	10	10
Total Lost time (s)					3.0		3.0	3.0			3.0	
Lane Util. Factor					0.91		1.00	0.95			0.95	
Frt					1.00		1.00	1.00			1.00	
Flt Protected					0.96		0.95	1.00			1.00	
Satd. Flow (prot)					4324		1458	2650			2916	
Flt Permitted					0.96		0.27	1.00			1.00	
Satd. Flow (perm)					4324		419	2650			2916	
Volume (vph)	0	0	0	138	49	2	135	572	0	0	561	0
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	153	54	2	150	636	0	0	623	0
Lane Group Flow (vph)	0	0	0	0	209	0	150	636	0	0	623	0
Bus Blockages (#/hr)	0	0	0	0	0	0	0	2	0	0	0	0
Parking (#/hr)				15		15		15				15
Turn Type				Perm			pm+pt					
Protected Phases					4		5	2			6	
Permitted Phases				4			2					
Actuated Green, G (s)					34.0		67.0	67.0			40.0	
Effective Green, g (s)					35.5		68.5	68.5			41.5	
Actuated g/C Ratio					0.32		0.62	0.62			0.38	
Clearance Time (s)					4.5		4.5	4.5			4.5	
Lane Grp Cap (vph)					1395		488	1650			1100	
v/s Ratio Prot							0.07	c0.24			c0.21	
v/s Ratio Perm					c0.05		0.12					
v/c Ratio					0.15		0.31	0.39			0.57	
Uniform Delay, d1					26.5		10.1	10.3			27.1	
Progression Factor					1.00		1.25	0.49			0.63	
Incremental Delay, d2					0.2		1.5	0.6			1.9	
Delay (s)					26.7		14.2	5.7			18.9	
Level of Service					C		B	A			B	
Approach Delay (s)		0.0			26.7			7.3			18.9	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.38		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	A
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.96		1.00	0.97		1.00	0.86		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1736	3341		1736	3374		1736	2987		1736	3367	
Flt Permitted	0.53	1.00		0.23	1.00		0.74	1.00		0.19	1.00	
Satd. Flow (perm)	962	3341		423	3374		1359	2987		352	3367	
Volume (vph)	58	332	111	321	278	64	69	35	469	132	14	4
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)	64	369	123	357	309	71	77	39	521	147	16	4
Lane Group Flow (vph)	64	492	0	357	380	0	77	560	0	147	20	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	29.8	23.5		58.0	47.2		30.7	24.6		43.0	32.4	
Effective Green, g (s)	32.8	25.0		59.5	48.7		33.7	26.1		44.5	33.9	
Actuated g/C Ratio	0.30	0.23		0.54	0.44		0.31	0.24		0.40	0.31	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	342	759		605	1494		442	709		336	1038	
v/s Ratio Prot	0.01	0.15		c0.17	0.11		0.01	c0.19		c0.06	0.01	
v/s Ratio Perm	0.04			c0.15			0.04			0.12		
v/c Ratio	0.19	0.65		0.59	0.25		0.17	0.79		0.44	0.02	
Uniform Delay, d1	28.1	38.5		16.2	19.2		27.7	39.4		22.8	26.5	
Progression Factor	1.00	1.00		1.04	1.09		0.31	1.95		0.14	0.05	
Incremental Delay, d2	1.2	4.3		3.8	0.4		0.8	8.2		4.1	0.0	
Delay (s)	29.3	42.8		20.6	21.3		9.5	84.9		7.2	1.4	
Level of Service	C	D		C	C		A	F		A	A	
Approach Delay (s)		41.2			21.0			75.8			6.5	
Approach LOS		D			C			E			A	

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.62		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0							3.0			3.0	
Lane Util. Factor	1.00							0.95			0.95	
Frt	1.00							1.00			0.95	
Flt Protected	0.95							1.00			1.00	
Satd. Flow (prot)	1736							3471			3297	
Flt Permitted	0.76							1.00			1.00	
Satd. Flow (perm)	1383							3471			3297	
Volume (vph)	50	0	0	0	0	0	0	157	0	0	150	76
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)	56	0	0	0	0	0	0	174	0	0	167	84
Lane Group Flow (vph)	56	0	0	0	0	0	0	174	0	0	251	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	38.0							38.5			38.5	
Effective Green, g (s)	39.5							40.0			40.0	
Actuated g/C Ratio	0.36							0.36			0.36	
Clearance Time (s)	4.5							4.5			4.5	
Lane Grp Cap (vph)	497							1262			1199	
v/s Ratio Prot								0.05			c0.08	
v/s Ratio Perm	c0.04											
v/c Ratio	0.11							0.14			0.21	
Uniform Delay, d1	23.5							23.4			24.1	
Progression Factor	1.00							1.24			0.03	
Incremental Delay, d2	0.5							0.2			0.4	
Delay (s)	24.0							29.4			1.2	
Level of Service	C							C			A	
Approach Delay (s)		24.0			0.0			29.4			1.2	
Approach LOS		C			A			C			A	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.16		
Cycle Length (s)	110.0	Sum of lost time (s)	30.5
Intersection Capacity Utilization	17.3%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0							3.0			3.0	
Lane Util. Factor	1.00							0.95			0.95	
Frt	1.00							1.00			0.97	
Flt Protected	0.95							1.00			1.00	
Satd. Flow (prot)	1736							3471			3380	
Flt Permitted	0.76							1.00			1.00	
Satd. Flow (perm)	1383							3471			3380	
Volume (vph)	103	0	0	0	0	0	0	273	0	0	259	55
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)	114	0	0	0	0	0	0	303	0	0	288	61
Lane Group Flow (vph)	114	0	0	0	0	0	0	303	0	0	349	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	38.0							38.5			38.5	
Effective Green, g (s)	39.5							40.0			40.0	
Actuated g/C Ratio	0.36							0.36			0.36	
Clearance Time (s)	4.5							4.5			4.5	
Lane Grp Cap (vph)	497							1262			1229	
v/s Ratio Prot								0.09			c0.10	
v/s Ratio Perm	c0.08											
v/c Ratio	0.23							0.24			0.28	
Uniform Delay, d1	24.6							24.4			24.8	
Progression Factor	1.00							0.67			0.62	
Incremental Delay, d2	1.1							0.4			0.5	
Delay (s)	25.7							16.8			15.9	
Level of Service	C							B			B	
Approach Delay (s)		25.7			0.0			16.8			15.9	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.26		
Cycle Length (s)	110.0	Sum of lost time (s)	30.5
Intersection Capacity Utilization	22.9%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	10	10	12	10	10	12
Total Lost time (s)		3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Util. Factor		0.95		1.00	0.95			0.95	1.00	1.00	0.95	
Frt		1.00		1.00	0.88			1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3238		1620	2849			3240	1553	1620	3240	
Flt Permitted		1.00		0.43	1.00			1.00	1.00	0.62	1.00	
Satd. Flow (perm)		3238		735	2849			3240	1553	1058	3240	
Volume (vph)	0	234	1	184	115	470	0	80	289	549	111	0
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	260	1	204	128	522	0	89	321	610	123	0
Lane Group Flow (vph)	0	261	0	204	650	0	0	89	321	610	123	0
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	3	8		7	4		1	6	7	5	2	
Permitted Phases	8			4			6		6	2		
Actuated Green, G (s)		22.0		37.0	28.5			23.0	33.5	64.0	55.5	
Effective Green, g (s)		23.5		38.5	30.0			24.5	36.5	65.5	57.0	
Actuated g/C Ratio		0.21		0.35	0.27			0.22	0.33	0.60	0.52	
Clearance Time (s)		4.5		4.5	4.5			4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)		692		354	777			722	558	824	1679	
v/s Ratio Prot		0.08		c0.06	c0.23			0.03	c0.06	c0.26	0.04	
v/s Ratio Perm				0.14					0.14	c0.19		
v/c Ratio		0.38		0.58	0.84			0.12	0.58	0.74	0.07	
Uniform Delay, d1		37.0		26.9	37.7			34.2	30.3	14.5	13.3	
Progression Factor		1.00		0.68	0.08			0.44	0.93	1.00	1.00	
Incremental Delay, d2		1.6		6.4	10.0			0.3	4.2	5.9	0.1	
Delay (s)		38.6		24.8	13.0			15.4	32.4	20.4	13.4	
Level of Service		D		C	B			B	C	C	B	
Approach Delay (s)		38.6			15.8			28.7			19.3	
Approach LOS		D			B			C			B	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Cycle Length (s)	110.0	Sum of lost time (s)	3.0
Intersection Capacity Utilization	79.5%	ICU Level of Service	C
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.86	1.00	0.97	0.91		0.97	0.91	0.91	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.90	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	6285	1553	3367	4988		3367	2991	1413	3367	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	6285	1553	3367	4988		3367	2991	1413	3367	3471	1553
Volume (vph)	14	2150	209	585	2607	0	326	186	753	16	90	6
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)	16	2389	232	650	2897	0	362	207	837	18	100	7
Lane Group Flow (vph)	16	2389	232	650	2897	0	362	625	419	18	100	7
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	42.0	51.5	18.5	56.5		9.5	28.0	46.5	3.5	22.0	26.0
Effective Green, g (s)	5.5	43.5	54.5	20.0	58.0		11.0	29.5	49.5	5.0	23.5	29.0
Actuated g/C Ratio	0.05	0.40	0.50	0.18	0.53		0.10	0.27	0.45	0.05	0.21	0.26
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	168	2485	812	612	2630		337	802	674	153	742	452
v/s Ratio Prot	0.00	0.38	0.03	c0.19	c0.58		c0.11	c0.21	0.11	0.01	0.03	0.00
v/s Ratio Perm			0.12						0.18			0.00
v/c Ratio	0.10	0.96	0.29	1.06	1.10		1.07	0.78	0.62	0.12	0.13	0.02
Uniform Delay, d1	49.9	32.4	16.3	45.0	26.0		49.5	37.2	23.1	50.4	35.0	29.9
Progression Factor	1.00	1.00	1.00	0.89	1.19		1.54	0.58	0.31	1.00	1.00	1.00
Incremental Delay, d2	1.1	11.0	0.9	41.9	48.6		53.6	3.2	1.8	1.6	0.4	0.1
Delay (s)	51.0	43.5	17.2	82.0	79.6		129.7	24.8	9.0	51.9	35.4	30.0
Level of Service	D	D	B	F	E		F	C	A	D	D	C
Approach Delay (s)		41.2			80.1			47.1			37.5	
Approach LOS		D			F			D			D	

Intersection Summary			
HCM Average Control Delay	60.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	D

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	4988	1553	3367	4988	1553	3367	3471	1553	3367	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	4988	1553	3367	4988	1553	3367	3471	1553	3367	3471	1553
Volume (vph)	17	1718	91	146	2339	545	133	83	202	889	56	3
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)	19	1909	101	162	2599	606	148	92	224	988	62	3
Lane Group Flow (vph)	19	1909	101	162	2599	606	148	92	224	988	62	3
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	43.7	51.8	4.8	44.5	66.0	8.1	22.0	26.8	21.5	35.4	39.4
Effective Green, g (s)	5.5	45.2	54.8	6.3	46.0	69.0	9.6	23.5	29.8	23.0	36.9	42.4
Actuated g/C Ratio	0.05	0.41	0.50	0.06	0.42	0.63	0.09	0.21	0.27	0.21	0.34	0.39
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	168	2050	816	193	2086	1017	294	742	463	704	1164	641
v/s Ratio Prot	0.01	0.38	0.01	c0.05	c0.52	0.12	0.04	0.03	c0.03	c0.29	0.02	0.00
v/s Ratio Perm			0.05			0.27			0.12			0.00
v/c Ratio	0.11	0.93	0.12	0.84	1.25	0.60	0.50	0.12	0.48	1.40	0.05	0.00
Uniform Delay, d1	49.9	30.9	14.8	51.3	32.0	12.2	47.9	34.9	33.6	43.5	24.7	20.8
Progression Factor	1.25	0.55	0.72	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	7.8	0.3	33.4	114.9	2.6	6.0	0.3	3.6	190.0	0.1	0.0
Delay (s)	63.7	25.0	10.8	84.7	146.9	14.8	54.0	35.3	37.2	233.5	24.8	20.8
Level of Service	E	C	B	F	F	B	D	D	D	F	C	C
Approach Delay (s)		24.6			120.1			42.2			220.6	
Approach LOS		C			F			D			F	

Intersection Summary			
HCM Average Control Delay	102.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.05		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	98.4%	ICU Level of Service	E

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0		
Lane Util. Factor	0.95			0.95		
Frt	1.00			1.00		
Flt Protected	1.00			1.00		
Satd. Flow (prot)	3471			3471		
Flt Permitted	1.00			1.00		
Satd. Flow (perm)	3471			3471		
Volume (vph)	991	0	0	1234	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1101	0	0	1371	0	0
Lane Group Flow (vph)	1101	0	0	1371	0	0
Turn Type			Perm			Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Actuated Green, G (s)	66.7			66.7		
Effective Green, g (s)	68.2			68.2		
Actuated g/C Ratio	0.62			0.62		
Clearance Time (s)	4.5			4.5		
Lane Grp Cap (vph)	2152			2152		
v/s Ratio Prot	0.32			c0.39		
v/s Ratio Perm						
v/c Ratio	0.51			0.64		
Uniform Delay, d1	11.6			13.1		
Progression Factor	0.33			0.88		
Incremental Delay, d2	0.6			1.1		
Delay (s)	4.5			12.7		
Level of Service	A			B		
Approach Delay (s)	4.5			12.7	0.0	
Approach LOS	A			B	A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.64		
Cycle Length (s)	110.0	Sum of lost time (s)	41.8
Intersection Capacity Utilization	41.2%	ICU Level of Service	A

c Critical Lane Group

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1736	1553	3471	1553	1736	1827
Flt Permitted	0.95	1.00	1.00	1.00	0.37	1.00
Satd. Flow (perm)	1736	1553	3471	1553	683	1827
Volume (vph)	57	347	407	129	309	363
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	63	386	452	143	343	403
Lane Group Flow (vph)	63	386	452	143	343	403
Turn Type		Perm		custom	custom	
Protected Phases	2			2	3	
Permitted Phases		2	4	4	8	8
Actuated Green, G (s)	22.0	22.0	22.0	44.0	34.0	34.0
Effective Green, g (s)	23.5	23.5	23.5	47.0	35.5	35.5
Actuated g/C Ratio	0.36	0.36	0.36	0.72	0.55	0.55
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	628	561	1255	1195	519	998
v/s Ratio Prot	0.04			0.04	c0.09	
v/s Ratio Perm		c0.25	0.13	0.05	c0.27	0.22
v/c Ratio	0.10	0.69	0.36	0.12	0.66	0.40
Uniform Delay, d1	13.7	17.6	15.2	2.7	8.8	8.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	6.8	0.8	0.2	6.5	1.2
Delay (s)	14.1	24.4	16.0	2.9	15.3	9.8
Level of Service	B	C	B	A	B	A
Approach Delay (s)	22.9		12.9			12.3
Approach LOS	C		B			B

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Cycle Length (s)	65.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		3471	3471			
Flt Permitted		1.00	1.00			
Satd. Flow (perm)		3471	3471			
Volume (vph)	0	991	1234	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1101	1371	0	0	0
Lane Group Flow (vph)	0	1101	1371	0	0	0
Turn Type	Perm				custom	
Protected Phases		4	8			
Permitted Phases	4				6	6
Actuated Green, G (s)		66.7	66.7			
Effective Green, g (s)		68.2	68.2			
Actuated g/C Ratio		0.62	0.62			
Clearance Time (s)		4.5	4.5			
Lane Grp Cap (vph)		2152	2152			
v/s Ratio Prot		0.32	c0.39			
v/s Ratio Perm						
v/c Ratio		0.51	0.64			
Uniform Delay, d1		11.6	13.1			
Progression Factor		0.01	1.00			
Incremental Delay, d2		0.8	1.5			
Delay (s)		0.8	14.6			
Level of Service		A	B			
Approach Delay (s)		0.8	14.6		0.0	
Approach LOS		A	B		A	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.64		
Cycle Length (s)	110.0	Sum of lost time (s)	41.8
Intersection Capacity Utilization	41.2%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	3471	1553	1736	3471	1553	1736	3471	1553	1736	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.35	1.00	1.00	0.33	1.00	1.00
Satd. Flow (perm)	3367	3471	1553	1736	3471	1553	642	3471	1553	605	3471	1553
Volume (vph)	624	704	218	98	816	31	199	453	110	49	429	577
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)	693	782	242	109	907	34	221	503	122	54	477	641
Lane Group Flow (vph)	693	782	242	109	907	34	221	503	122	54	477	641
Turn Type	Prot		Perm	Prot		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8	2		2	6		6
Actuated Green, G (s)	18.0	31.0	31.0	10.0	23.0	23.0	29.0	25.0	25.0	29.0	25.0	25.0
Effective Green, g (s)	20.0	33.0	33.0	12.0	25.0	25.0	33.0	27.0	27.0	33.0	27.0	27.0
Actuated g/C Ratio	0.22	0.37	0.37	0.13	0.28	0.28	0.37	0.30	0.30	0.37	0.30	0.30
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	748	1273	569	231	964	431	308	1041	466	297	1041	466
v/s Ratio Prot	c0.21	0.23		0.06	c0.26		c0.05	0.14		0.01	0.14	
v/s Ratio Perm			0.16			0.02	0.22		0.08	0.05		c0.41
v/c Ratio	0.93	0.61	0.43	0.47	0.94	0.08	0.72	0.48	0.26	0.18	0.46	1.38
Uniform Delay, d1	34.3	23.3	21.4	36.1	31.8	24.0	23.0	25.8	23.9	19.0	25.6	31.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.2	2.2	2.3	6.8	17.8	0.4	13.4	1.6	1.4	1.3	1.5	182.1
Delay (s)	53.5	25.5	23.7	42.8	49.6	24.4	36.5	27.4	25.3	20.3	27.0	213.6
Level of Service	D	C	C	D	D	C	D	C	C	C	C	F
Approach Delay (s)		36.5			48.1			29.5			128.8	
Approach LOS		D			D			C			F	

Intersection Summary			
HCM Average Control Delay	60.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	D

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0							
Lane Util. Factor		0.95			0.95							
Frt		1.00			1.00							
Flt Protected		1.00			1.00							
Satd. Flow (prot)		3471			3471							
Flt Permitted		1.00			1.00							
Satd. Flow (perm)		3471			3471							
Volume (vph)	0	889	0	0	650	0	0	0	0	0	0	0
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	988	0	0	722	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	988	0	0	722	0	0	0	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		23.0			23.0							
Effective Green, g (s)		24.5			24.5							
Actuated g/C Ratio		0.45			0.45							
Clearance Time (s)		4.5			4.5							
Lane Grp Cap (vph)		1546			1546							
v/s Ratio Prot		c0.28			0.21							
v/s Ratio Perm												
v/c Ratio		0.64			0.47							
Uniform Delay, d1		11.8			10.7							
Progression Factor		0.85			1.00							
Incremental Delay, d2		1.7			1.0							
Delay (s)		11.8			11.7							
Level of Service		B			B							
Approach Delay (s)		11.8			11.7			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Cycle Length (s)	55.0	Sum of lost time (s)	30.5
Intersection Capacity Utilization	30.6%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	3471	1553	1736	3471	1553	3367	3471	1553	1736	3471	1553
Flt Permitted	0.17	1.00	1.00	0.19	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	311	3471	1553	355	3471	1553	3367	3471	1553	1736	3471	1553
Volume (vph)	386	481	60	410	667	126	119	774	75	316	425	219
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)	429	534	67	456	741	140	132	860	83	351	472	243
Lane Group Flow (vph)	429	534	67	456	741	140	132	860	83	351	472	243
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	43.5	22.0	29.2	45.5	23.0	43.6	7.2	26.9	49.4	20.6	40.3	61.8
Effective Green, g (s)	46.5	23.5	32.2	48.5	24.5	46.6	8.7	28.4	52.4	22.1	41.8	64.8
Actuated g/C Ratio	0.42	0.21	0.29	0.44	0.22	0.42	0.08	0.26	0.48	0.20	0.38	0.59
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	429	742	497	458	773	700	266	896	782	349	1319	957
v/s Ratio Prot	0.21	0.15	0.01	c0.22	0.21	0.04	0.04	c0.25	0.02	c0.20	0.14	0.05
v/s Ratio Perm	0.21		0.03	c0.22		0.05			0.03			0.10
v/c Ratio	1.00	0.72	0.13	1.00	0.96	0.20	0.50	0.96	0.11	1.01	0.36	0.25
Uniform Delay, d1	31.6	40.2	28.6	29.3	42.2	20.0	48.5	40.2	15.9	44.0	24.5	10.9
Progression Factor	1.00	1.00	1.00	0.98	1.05	1.24	1.00	1.00	1.00	0.49	0.55	0.95
Incremental Delay, d2	43.5	5.9	0.6	34.9	19.3	0.5	6.5	21.8	0.3	41.3	0.5	0.4
Delay (s)	75.0	46.1	29.2	63.6	63.7	25.2	55.0	62.0	16.2	63.0	13.9	10.8
Level of Service	E	D	C	E	E	C	E	E	B	E	B	B
Approach Delay (s)		57.1			59.6			57.6			29.3	
Approach LOS		E			E			E			C	

Intersection Summary			
HCM Average Control Delay	51.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.8%	ICU Level of Service	F

c Critical Lane Group

Appendix H

HCM Signal Reports for the Existing Alignment Alternative

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		3.0	3.0	3.0	3.0
Lane Util. Factor	0.95		1.00	0.95	0.97	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3337		1736	3471	3367	1553
Flt Permitted	1.00		0.15	1.00	0.95	1.00
Satd. Flow (perm)	3337		283	3471	3367	1553
Volume (vph)	475	166	382	221	65	431
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	528	184	424	246	72	479
Lane Group Flow (vph)	712	0	424	246	72	479
Turn Type			pm+pt			Perm
Protected Phases	4		3	8	2	
Permitted Phases			8			2
Actuated Green, G (s)	30.2		68.3	68.3	32.7	32.7
Effective Green, g (s)	31.7		69.8	69.8	34.2	34.2
Actuated g/C Ratio	0.29		0.63	0.63	0.31	0.31
Clearance Time (s)	4.5		4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	962		643	2203	1047	483
v/s Ratio Prot	c0.21		c0.21	0.07	0.02	
v/s Ratio Perm			0.21			c0.31
v/c Ratio	0.74		0.66	0.11	0.07	0.99
Uniform Delay, d1	35.4		19.5	7.9	26.7	37.8
Progression Factor	0.41		1.00	1.00	0.51	2.37
Incremental Delay, d2	4.9		5.2	0.1	0.1	38.7
Delay (s)	19.3		24.7	8.0	13.7	128.1
Level of Service	B		C	A	B	F
Approach Delay (s)	19.3			18.6	113.1	
Approach LOS	B			B	F	

Intersection Summary			
HCM Average Control Delay	45.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.80		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	A

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0	3.0	3.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3471			3471	1736	1553
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	3471			3471	1736	1553
Volume (vph)	136	0	0	262	71	4
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	151	0	0	291	79	4
Lane Group Flow (vph)	151	0	0	291	79	4
Turn Type						Perm
Protected Phases	4			8	2	
Permitted Phases						2
Actuated Green, G (s)	23.0			23.0	23.0	23.0
Effective Green, g (s)	24.5			24.5	24.5	24.5
Actuated g/C Ratio	0.45			0.45	0.45	0.45
Clearance Time (s)	4.5			4.5	4.5	4.5
Lane Grp Cap (vph)	1546			1546	773	692
v/s Ratio Prot	0.04			c0.08	c0.05	
v/s Ratio Perm						0.00
v/c Ratio	0.10			0.19	0.10	0.01
Uniform Delay, d1	8.8			9.2	8.9	8.5
Progression Factor	0.93			1.00	1.00	1.00
Incremental Delay, d2	0.1			0.3	0.3	0.0
Delay (s)	8.2			9.5	9.1	8.5
Level of Service	A			A	A	A
Approach Delay (s)	8.2			9.5	9.1	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.15		
Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	19.1%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NET	SWT
Lane Configurations										
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0		3.0			
Lane Util. Factor	0.97	1.00	1.00	1.00	0.97		1.00			
Frt	1.00	1.00	1.00	1.00	1.00		1.00			
Flt Protected	0.95	1.00	0.95	1.00	0.95		0.95			
Satd. Flow (prot)	3367	1827	1736	1827	3367		1736			
Flt Permitted	0.95	1.00	0.95	1.00	0.95		0.95			
Satd. Flow (perm)	3367	1827	1736	1827	3367		1736			
Volume (vph)	520	12	29	35	23	0	19	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	578	13	32	39	26	0	21	0	0	0
Lane Group Flow (vph)	578	13	32	39	26	0	21	0	0	0
Turn Type	Prot		Prot		custom		custom			
Protected Phases	7	4	3	8	1		5			
Permitted Phases					1		5			
Actuated Green, G (s)	40.6	57.6	19.8	36.8	19.1		19.1			
Effective Green, g (s)	42.1	59.1	21.3	38.3	20.6		20.6			
Actuated g/C Ratio	0.38	0.54	0.19	0.35	0.19		0.19			
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5		4.5			
Lane Grp Cap (vph)	1289	982	336	636	631		325			
v/s Ratio Prot	c0.17	0.01	0.02	c0.02	0.01		c0.01			
v/s Ratio Perm										
v/c Ratio	0.45	0.01	0.10	0.06	0.04		0.06			
Uniform Delay, d1	25.3	11.9	36.4	23.9	36.6		36.8			
Progression Factor	0.75	0.74	1.00	1.00	1.00		1.00			
Incremental Delay, d2	1.1	0.0	0.6	0.2	0.1		0.4			
Delay (s)	20.0	8.8	37.0	24.1	36.7		37.2			
Level of Service	B	A	D	C	D		D			
Approach Delay (s)		19.7		29.9		36.7		37.2	0.0	0.0
Approach LOS		B		C		D		D	A	A

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.22		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	33.1%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Lane Util. Factor		0.95	1.00	1.00	0.95					0.97	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	1.00	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3471	1553	1736	3471					3367	1827	
Flt Permitted		1.00	1.00	0.36	1.00					0.95	1.00	
Satd. Flow (perm)		3471	1553	654	3471					3367	1827	
Volume (vph)	0	422	78	21	575	0	0	0	0	178	84	0
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	469	87	23	639	0	0	0	0	198	93	0
Lane Group Flow (vph)	0	469	87	23	639	0	0	0	0	198	93	0
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		38.5	38.5	63.0	63.0					38.0	38.0	
Effective Green, g (s)		40.0	40.0	64.5	64.5					39.5	39.5	
Actuated g/C Ratio		0.36	0.36	0.59	0.59					0.36	0.36	
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	
Lane Grp Cap (vph)		1262	565	595	2035					1209	656	
v/s Ratio Prot		c0.14		0.01	c0.18						0.05	
v/s Ratio Perm			0.06	0.02						c0.06		
v/c Ratio		0.37	0.15	0.04	0.31					0.16	0.14	
Uniform Delay, d1		25.8	23.6	10.1	11.5					24.0	23.8	
Progression Factor		0.56	0.86	1.18	1.28					0.99	0.99	
Incremental Delay, d2		0.7	0.5	0.1	0.4					0.3	0.5	
Delay (s)		15.2	20.8	12.1	15.1					24.1	24.1	
Level of Service		B	C	B	B					C	C	
Approach Delay (s)		16.0			15.0			0.0			24.1	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.28		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	30.0%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Util. Factor		0.91	1.00	1.00	0.95					0.91	0.91	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (prot)		4988	1553	1736	3471					1579	3286	1553
Flt Permitted		1.00	1.00	0.24	1.00					0.95	0.99	1.00
Satd. Flow (perm)		4988	1553	445	3471					1579	3286	1553
Volume (vph)	0	638	99	59	254	0	0	0	0	315	335	399
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	709	110	66	282	0	0	0	0	350	372	443
Lane Group Flow (vph)	0	709	110	66	282	0	0	0	0	233	489	443
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		32.8	32.8	54.8	54.8					46.2	46.2	46.2
Effective Green, g (s)		34.3	34.3	56.3	56.3					47.7	47.7	47.7
Actuated g/C Ratio		0.31	0.31	0.51	0.51					0.43	0.43	0.43
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Grp Cap (vph)		1555	484	451	1777					685	1425	673
v/s Ratio Prot		c0.14		0.03	c0.08							
v/s Ratio Perm			0.07	0.05						0.15	0.15	c0.29
v/c Ratio		0.46	0.23	0.15	0.16					0.34	0.34	0.66
Uniform Delay, d1		30.4	28.0	14.4	14.3					20.7	20.7	24.7
Progression Factor		0.44	0.08	0.98	0.69					1.00	1.00	1.00
Incremental Delay, d2		0.9	1.0	0.7	0.2					1.3	0.7	5.0
Delay (s)		14.1	3.4	14.8	10.0					22.0	21.4	29.7
Level of Service		B	A	B	A					C	C	C
Approach Delay (s)		12.6			10.9			0.0			24.7	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	41.9%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0	3.0	3.0	3.0				
Lane Util. Factor	1.00	0.95			0.91	1.00	1.00	0.95				
Frt	1.00	1.00			1.00	0.85	1.00	1.00				
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00				
Satd. Flow (prot)	1736	3471			4988	1553	1736	3471				
Flt Permitted	0.49	1.00			1.00	1.00	0.95	1.00				
Satd. Flow (perm)	888	3471			4988	1553	1736	3471				
Volume (vph)	457	496	0	0	266	283	47	359	0	0	0	0
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)	508	551	0	0	296	314	52	399	0	0	0	0
Lane Group Flow (vph)	508	551	0	0	296	314	52	399	0	0	0	0
Turn Type	pm+pt					Perm	Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2		2			
Actuated Green, G (s)	74.3	74.3			31.4	31.4	26.7	26.7				
Effective Green, g (s)	75.8	75.8			32.9	32.9	28.2	28.2				
Actuated g/C Ratio	0.69	0.69			0.30	0.30	0.26	0.26				
Clearance Time (s)	4.5	4.5			4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)	920	2392			1492	464	445	890				
v/s Ratio Prot	c0.20	0.16			0.06			c0.11				
v/s Ratio Perm	0.18					c0.20	0.03					
v/c Ratio	0.55	0.23			0.20	0.68	0.12	0.45				
Uniform Delay, d1	7.7	6.3			28.7	33.9	31.4	34.4				
Progression Factor	2.77	0.95			0.52	1.29	1.09	1.14				
Incremental Delay, d2	2.2	0.2			0.2	5.7	0.5	1.4				
Delay (s)	23.6	6.2			15.0	49.4	34.5	40.6				
Level of Service	C	A			B	D	C	D				
Approach Delay (s)		14.5			32.7			39.9			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	68.6%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	0.91	0.91	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (prot)	3367	3471			3471	1553	1579	3245	1553			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (perm)	3367	3471			3471	1553	1579	3245	1553			
Volume (vph)	13	586	0	0	361	223	234	120	244	0	0	0
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)	14	651	0	0	401	248	260	133	271	0	0	0
Lane Group Flow (vph)	14	651	0	0	401	248	130	263	271	0	0	0
Turn Type	Prot					Perm	Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases						8	2		2			
Actuated Green, G (s)	18.1	60.6			38.0	38.0	40.4	40.4	40.4			
Effective Green, g (s)	19.6	62.1			39.5	39.5	41.9	41.9	41.9			
Actuated g/C Ratio	0.18	0.56			0.36	0.36	0.38	0.38	0.38			
Clearance Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lane Grp Cap (vph)	600	1960			1246	558	601	1236	592			
v/s Ratio Prot	0.00	c0.19			0.12							
v/s Ratio Perm						c0.16	0.08	0.08	c0.17			
v/c Ratio	0.02	0.33			0.32	0.44	0.22	0.21	0.46			
Uniform Delay, d1	37.3	12.8			25.5	26.9	23.0	22.9	25.5			
Progression Factor	0.74	0.41			0.90	0.80	1.00	1.00	0.98			
Incremental Delay, d2	0.1	0.4			0.3	1.1	0.8	0.4	2.5			
Delay (s)	27.6	5.7			23.3	22.5	23.7	23.3	27.7			
Level of Service	C	A			C	C	C	C	C			
Approach Delay (s)		6.2			23.0			25.2			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	41.5%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.91	0.86	0.91
Frt		1.00	0.85	1.00	1.00					1.00	0.94	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3471	1553	1736	3471					1579	2942	1413
Flt Permitted		1.00	1.00	0.63	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3471	1553	1150	3471					1579	2942	1413
Volume (vph)	0	91	85	7	28	0	0	0	0	18	472	831
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	101	94	8	31	0	0	0	0	20	524	923
Lane Group Flow (vph)	0	101	94	8	31	0	0	0	0	20	910	537
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		30.5	30.5	48.0	48.0					53.0	53.0	53.0
Effective Green, g (s)		32.0	32.0	49.5	49.5					54.5	54.5	54.5
Actuated g/C Ratio		0.29	0.29	0.45	0.45					0.50	0.50	0.50
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Grp Cap (vph)		1010	452	595	1562					782	1458	700
v/s Ratio Prot		0.03		0.00	c0.01						0.31	
v/s Ratio Perm			c0.06	0.00						0.01		c0.38
v/c Ratio		0.10	0.21	0.01	0.02					0.03	0.62	0.77
Uniform Delay, d1		28.5	29.4	16.8	16.8					14.2	20.3	22.6
Progression Factor		1.15	2.65	1.49	1.47					0.24	0.11	0.47
Incremental Delay, d2		0.2	1.0	0.0	0.0					0.0	1.3	5.3
Delay (s)		33.0	79.1	25.0	24.6					3.4	3.6	16.0
Level of Service		C	E	C	C					A	A	B
Approach Delay (s)		55.2			24.7			0.0			8.1	
Approach LOS		E			C			A			A	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91	1.00			
Frt	1.00	1.00			0.91		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (prot)	1736	3471			3165		1579	3325	1553			
Flt Permitted	0.67	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (perm)	1224	3471			3165		1579	3325	1553			
Volume (vph)	83	26	0	0	19	27	16	84	7	0	0	0
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)	92	29	0	0	21	30	18	93	8	0	0	0
Lane Group Flow (vph)	92	29	0	0	51	0	18	93	8	0	0	0
Turn Type	pm+pt						Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases	4						2		2			
Actuated Green, G (s)	63.0	63.0			37.2		38.0	38.0	38.0			
Effective Green, g (s)	64.5	64.5			38.7		39.5	39.5	39.5			
Actuated g/C Ratio	0.59	0.59			0.35		0.36	0.36	0.36			
Clearance Time (s)	4.5	4.5			4.5		4.5	4.5	4.5			
Lane Grp Cap (vph)	824	2035			1114		567	1194	558			
v/s Ratio Prot	c0.02	0.01			0.02			c0.03				
v/s Ratio Perm	c0.04						0.01		0.01			
v/c Ratio	0.11	0.01			0.05		0.03	0.08	0.01			
Uniform Delay, d1	10.0	9.5			23.5		22.9	23.2	22.7			
Progression Factor	0.46	0.35			1.00		1.00	1.00	1.00			
Incremental Delay, d2	0.3	0.0			0.1		0.1	0.1	0.0			
Delay (s)	4.9	3.3			23.4		23.0	23.4	22.8			
Level of Service	A	A			C		C	C	C			
Approach Delay (s)		4.5			23.4			23.3			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.10		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	21.8%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.91	0.86	0.91
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3471	1553	3367	3471					1579	3142	1413
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3471	1553	3367	3471					1579	3142	1413
Volume (vph)	0	916	95	749	456	0	0	0	0	61	477	134
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	1018	106	832	507	0	0	0	0	68	530	149
Lane Group Flow (vph)	0	1018	106	832	507	0	0	0	0	68	530	149
Turn Type			Perm	Prot						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4							6		6
Actuated Green, G (s)		40.5	40.5	32.5	77.5					23.5	23.5	23.5
Effective Green, g (s)		42.0	42.0	34.0	79.0					25.0	25.0	25.0
Actuated g/C Ratio		0.38	0.38	0.31	0.72					0.23	0.23	0.23
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Grp Cap (vph)		1325	593	1041	2493					359	714	321
v/s Ratio Prot		c0.29		c0.25	0.15						c0.17	
v/s Ratio Perm			0.07							0.04		0.11
v/c Ratio		0.77	0.18	0.80	0.20					0.19	0.74	0.46
Uniform Delay, d1		29.7	22.6	34.9	5.1					34.3	39.5	36.7
Progression Factor		0.82	0.66	0.80	2.47					1.02	1.03	1.21
Incremental Delay, d2		3.6	0.6	4.5	0.1					1.2	6.9	4.8
Delay (s)		28.0	15.4	32.5	12.8					36.2	47.5	49.0
Level of Service		C	B	C	B					D	D	D
Approach Delay (s)		26.8			25.0			0.0			46.8	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0	3.0	3.0	3.0	3.0			
Lane Util. Factor		0.95			0.95	1.00	0.95	0.95	1.00			
Frt		1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected		1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)		3471			3471	1553	1649	1736	1553			
Flt Permitted		1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)		3471			3471	1553	1649	1736	1553			
Volume (vph)	0	977	0	0	1201	32	4	30	161	0	0	0
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	1086	0	0	1334	36	4	33	179	0	0	0
Lane Group Flow (vph)	0	1086	0	0	1334	36	4	33	179	0	0	0
Turn Type	Prot					Perm	Split		Perm			
Protected Phases	5	2			6		4	4				
Permitted Phases						6			4			
Actuated Green, G (s)		72.0			57.5	57.5	29.0	29.0	29.0			
Effective Green, g (s)		73.5			59.0	59.0	30.5	30.5	30.5			
Actuated g/C Ratio		0.67			0.54	0.54	0.28	0.28	0.28			
Clearance Time (s)		4.5			4.5	4.5	4.5	4.5	4.5			
Lane Grp Cap (vph)		2319			1862	833	457	481	431			
v/s Ratio Prot		c0.31			c0.38		0.00	0.02				
v/s Ratio Perm						0.02			c0.12			
v/c Ratio		0.47			0.72	0.04	0.01	0.07	0.42			
Uniform Delay, d1		8.8			19.2	12.1	28.8	29.3	32.5			
Progression Factor		0.01			0.30	0.09	0.52	0.54	0.31			
Incremental Delay, d2		0.5			1.8	0.1	0.0	0.3	2.9			
Delay (s)		0.6			7.4	1.2	15.1	16.1	13.1			
Level of Service		A			A	A	B	B	B			
Approach Delay (s)		0.6			7.3			13.6			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	47.8%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0						3.0	3.0
Lane Util. Factor		0.95			0.95						0.91	0.91
Frt		1.00			1.00						0.86	0.85
Flt Protected		1.00			1.00						1.00	1.00
Satd. Flow (prot)		3471			3471						2854	1413
Flt Permitted		1.00			1.00						1.00	1.00
Satd. Flow (perm)		3471			3471						2854	1413
Volume (vph)	0	1143	0	0	207	0	0	0	0	0	17	578
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	1270	0	0	230	0	0	0	0	0	19	642
Lane Group Flow (vph)	0	1270	0	0	230	0	0	0	0	0	340	321
Turn Type			Perm	Perm						Perm		Free
Protected Phases		4			8						6	
Permitted Phases			4	8						6		Free
Actuated Green, G (s)		24.0			24.0						22.0	55.0
Effective Green, g (s)		25.5			25.5						23.5	55.0
Actuated g/C Ratio		0.46			0.46						0.43	1.00
Clearance Time (s)		4.5			4.5						4.5	
Lane Grp Cap (vph)		1609			1609						1219	1413
v/s Ratio Prot		c0.37			0.07						c0.12	
v/s Ratio Perm												0.23
v/c Ratio		0.79			0.14						0.28	0.23
Uniform Delay, d1		12.5			8.5						10.2	0.0
Progression Factor		1.07			0.90						1.00	1.00
Incremental Delay, d2		3.2			0.2						0.6	0.4
Delay (s)		16.6			7.8						10.8	0.4
Level of Service		B			A						B	A
Approach Delay (s)		16.6			7.8			0.0			5.7	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		3.0	3.0		
Lane Util. Factor	0.97		0.91	0.91		
Frt	1.00		1.00	1.00		
Flt Protected	0.95		0.95	0.98		
Satd. Flow (prot)	3367		1579	3263		
Flt Permitted	0.95		0.95	0.98		
Satd. Flow (perm)	3367		1579	3263		
Volume (vph)	1143	0	207	149	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1270	0	230	166	0	0
Lane Group Flow (vph)	1270	0	127	269	0	0
Turn Type			Perm			
Protected Phases	7			2		
Permitted Phases			2			
Actuated Green, G (s)	65.0		36.0	36.0		
Effective Green, g (s)	66.5		37.5	37.5		
Actuated g/C Ratio	0.60		0.34	0.34		
Clearance Time (s)	4.5		4.5	4.5		
Lane Grp Cap (vph)	2036		538	1112		
v/s Ratio Prot	c0.38					
v/s Ratio Perm			0.08	c0.08		
v/c Ratio	0.62		0.24	0.24		
Uniform Delay, d1	13.8		26.0	26.0		
Progression Factor	0.66		0.80	0.81		
Incremental Delay, d2	1.3		1.0	0.5		
Delay (s)	10.3		21.7	21.5		
Level of Service	B		C	C		
Approach Delay (s)	10.3			21.5	0.0	
Approach LOS	B			C	A	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	50.4%	ICU Level of Service	A

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0				3.0	3.0
Lane Util. Factor	0.97				0.95	0.95
Frt	1.00				1.00	1.00
Flt Protected	0.95				0.95	0.97
Satd. Flow (prot)	3367				1649	1683
Flt Permitted	0.95				0.95	0.97
Satd. Flow (perm)	3367				1649	1683
Volume (vph)	935	0	0	0	711	169
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1039	0	0	0	790	188
Lane Group Flow (vph)	1039	0	0	0	476	502
Turn Type					Perm	
Protected Phases	8					6
Permitted Phases					6	
Actuated Green, G (s)	48.4				52.6	52.6
Effective Green, g (s)	49.9				54.1	54.1
Actuated g/C Ratio	0.45				0.49	0.49
Clearance Time (s)	4.5				4.5	4.5
Lane Grp Cap (vph)	1527				811	828
v/s Ratio Prot	c0.31					
v/s Ratio Perm					0.29	c0.30
v/c Ratio	0.68				0.59	0.61
Uniform Delay, d1	23.7				20.0	20.2
Progression Factor	0.22				0.51	0.52
Incremental Delay, d2	2.2				2.8	3.0
Delay (s)	7.4				13.1	13.5
Level of Service	A				B	B
Approach Delay (s)	7.4		0.0			13.3
Approach LOS	A		A			B

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0	3.0		3.0	3.0			
Lane Util. Factor		0.95			0.95	1.00		0.91	0.91			
Frt		1.00			1.00	0.85		0.90	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3471			3471	1553		2985	1413			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3471			3471	1553		2985	1413			
Volume (vph)	0	711	0	0	930	763	5	185	1135	0	0	0
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	790	0	0	1033	848	6	206	1261	0	0	0
Lane Group Flow (vph)	0	790	0	0	1033	848	0	661	812	0	0	0
Turn Type						Perm	Perm		Free			
Protected Phases		4			8			2				
Permitted Phases						8	2		Free			
Actuated Green, G (s)		69.5			69.5	69.5		31.5	110.0			
Effective Green, g (s)		71.0			71.0	71.0		33.0	110.0			
Actuated g/C Ratio		0.65			0.65	0.65		0.30	1.00			
Clearance Time (s)		4.5			4.5	4.5		4.5				
Lane Grp Cap (vph)		2240			2240	1002		896	1413			
v/s Ratio Prot		0.23			0.30							
v/s Ratio Perm						c0.55		c0.22	0.57			
v/c Ratio		0.35			0.46	0.85		0.74	0.57			
Uniform Delay, d1		9.0			9.8	15.2		34.6	0.0			
Progression Factor		0.91			0.06	0.37		1.00	1.00			
Incremental Delay, d2		0.4			0.4	5.0		5.4	1.7			
Delay (s)		8.5			0.9	10.6		40.0	1.7			
Level of Service		A			A	B		D	A			
Approach Delay (s)		8.5			5.3			18.9			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0				3.0		3.0					3.0
Lane Util. Factor	1.00				0.95		0.97					1.00
Frt	1.00				1.00		1.00					0.85
Flt Protected	0.95				1.00		0.95					1.00
Satd. Flow (prot)	1736				3471		3367					1553
Flt Permitted	0.68				1.00		0.95					1.00
Satd. Flow (perm)	1244				3471		3367					1553
Volume (vph)	152	0	0	0	2	0	639	0	0	0	0	217
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)	169	0	0	0	2	0	710	0	0	0	0	241
Lane Group Flow (vph)	169	0	0	0	2	0	710	0	0	0	0	241
Turn Type	pm+pt						Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4								2	6		6
Actuated Green, G (s)	39.8				25.5		32.7					24.0
Effective Green, g (s)	41.3				27.0		34.2					25.5
Actuated g/C Ratio	0.38				0.25		0.31					0.23
Clearance Time (s)	4.5				4.5		4.5					4.5
Lane Grp Cap (vph)	518				852		1047					360
v/s Ratio Prot	c0.03				0.00		c0.21					
v/s Ratio Perm	c0.09											c0.16
v/c Ratio	0.33				0.00		0.68					0.67
Uniform Delay, d1	23.8				31.3		33.1					38.4
Progression Factor	0.66				1.00		1.14					1.00
Incremental Delay, d2	1.2				0.0		2.5					9.5
Delay (s)	16.8				31.3		40.1					47.9
Level of Service	B				C		D					D
Approach Delay (s)		16.8			31.3			40.1			47.9	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM Average Control Delay	38.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.53		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	48.5%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBL	WBT	SBL	SEL	SET	NWL	NWT	NEL
Lane Configurations										
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0		3.0		3.0		
Lane Util. Factor	0.97	0.91	0.97	0.91		0.97		0.97		
Frt	1.00	1.00	1.00	1.00		1.00		1.00		
Flt Protected	0.95	1.00	0.95	1.00		0.95		0.95		
Satd. Flow (prot)	3367	4988	3367	4988		3367		3367		
Flt Permitted	0.95	1.00	0.95	1.00		0.95		0.95		
Satd. Flow (perm)	3367	4988	3367	4988		3367		3367		
Volume (vph)	509	1730	183	2407	0	39	0	494	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	566	1922	203	2674	0	43	0	549	0	0
Lane Group Flow (vph)	566	1922	203	2674	0	43	0	549	0	0
Turn Type	Prot		Prot			custom		custom		
Protected Phases	7	4	3	8		6		2		
Permitted Phases						6		2		
Actuated Green, G (s)	17.5	64.3	10.2	57.0		22.0		22.0		
Effective Green, g (s)	19.0	65.8	11.7	58.5		23.5		23.5		
Actuated g/C Ratio	0.17	0.60	0.11	0.53		0.21		0.21		
Clearance Time (s)	4.5	4.5	4.5	4.5		4.5		4.5		
Lane Grp Cap (vph)	582	2984	358	2653		719		719		
v/s Ratio Prot	c0.17	0.39	0.06	c0.54		0.01		c0.16		
v/s Ratio Perm										
v/c Ratio	0.97	0.64	0.57	1.01		0.06		0.76		
Uniform Delay, d1	45.2	14.4	46.7	25.8		34.5		40.6		
Progression Factor	1.09	0.47	1.45	0.34		1.00		1.00		
Incremental Delay, d2	19.2	0.5	0.6	7.3		0.2		7.5		
Delay (s)	68.5	7.3	68.2	16.1		34.6		48.2		
Level of Service	E	A	E	B		C		D		
Approach Delay (s)		21.3		19.8	0.0		34.6		48.2	0.0
Approach LOS		C		B	A		C		D	A

Intersection Summary			
HCM Average Control Delay	23.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	10	10	12	10	10	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1458	2903		1458	2910		1458	2916	1398	1458	2811	
Flt Permitted	0.13	1.00		0.66	1.00		0.22	1.00	1.00	0.54	1.00	
Satd. Flow (perm)	199	2903		1018	2910		344	2916	1398	832	2811	
Volume (vph)	405	122	4	148	695	10	3	198	11	30	359	113
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)	450	136	4	164	772	11	3	220	12	33	399	126
Lane Group Flow (vph)	450	140	0	164	783	0	3	220	12	33	525	0
Parking (#/hr)												15
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	3	8		7	4		5	2	7	1	6	
Permitted Phases	8			4			2		2	6		
Actuated Green, G (s)	69.5	56.1		40.4	31.5		27.0	23.0	31.9	27.0	23.0	
Effective Green, g (s)	71.0	57.6		43.4	33.0		30.0	24.5	34.9	30.0	24.5	
Actuated g/C Ratio	0.65	0.52		0.39	0.30		0.27	0.22	0.32	0.27	0.22	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	529	1520		443	873		150	649	482	258	626	
v/s Ratio Prot	c0.27	0.05		0.03	0.27		0.00	0.08	0.00	c0.01	c0.19	
v/s Ratio Perm	c0.28			0.11			0.00		0.01	0.03		
v/c Ratio	0.85	0.09		0.37	0.90		0.02	0.34	0.02	0.13	0.84	
Uniform Delay, d1	26.1	13.1		22.7	36.9		29.9	35.9	25.8	29.8	40.9	
Progression Factor	1.00	1.00		0.94	0.56		0.63	0.71	0.89	0.60	0.57	
Incremental Delay, d2	15.7	0.1		2.0	12.1		0.2	1.4	0.1	0.8	10.6	
Delay (s)	41.8	13.2		23.5	32.8		19.1	26.8	23.0	18.7	33.9	
Level of Service	D	B		C	C		B	C	C	B	C	
Approach Delay (s)		35.0			31.2			26.5			33.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	32.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	12	12	10	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1562	3073		1562	3124		1458	2916	1398	1562	2845	
Flt Permitted	0.45	1.00		0.19	1.00		0.29	1.00	1.00	0.43	1.00	
Satd. Flow (perm)	732	3073		307	3124		451	2916	1398	709	2845	
Volume (vph)	53	660	80	61	498	0	44	331	277	36	363	70
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)	59	733	89	68	553	0	49	368	308	40	403	78
Lane Group Flow (vph)	59	822	0	68	553	0	49	368	308	40	481	0
Parking (#/hr)												15
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	5	2		1	6		7	4	1	3	8	
Permitted Phases	2			6			4		4	8		
Actuated Green, G (s)	47.9	41.9		62.1	51.6		35.6	28.4	44.1	33.2	27.2	
Effective Green, g (s)	50.9	43.4		63.6	53.1		38.6	29.9	47.1	36.2	28.7	
Actuated g/C Ratio	0.46	0.39		0.58	0.48		0.35	0.27	0.43	0.33	0.26	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	395	1212		374	1508		238	793	637	291	742	
v/s Ratio Prot	0.01	c0.27		0.03	0.18		c0.02	0.13	c0.08	0.01	c0.17	
v/s Ratio Perm	0.06			0.08			0.06		0.14	0.04		
v/c Ratio	0.15	0.68		0.18	0.37		0.21	0.46	0.48	0.14	0.65	
Uniform Delay, d1	16.5	27.5		12.5	17.9		24.6	33.4	22.7	25.5	36.2	
Progression Factor	1.00	1.00		0.56	0.40		1.04	1.13	1.81	0.52	0.45	
Incremental Delay, d2	0.8	3.1		1.0	0.7		1.5	1.5	2.0	1.0	4.3	
Delay (s)	17.3	30.6		8.0	7.9		27.0	39.1	43.1	14.2	20.7	
Level of Service	B	C		A	A		C	D	D	B	C	
Approach Delay (s)		29.7			7.9			40.0			20.2	
Approach LOS		C			A			D			C	

Intersection Summary			
HCM Average Control Delay	25.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.2%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0				3.0			3.0	
Lane Util. Factor	1.00	1.00		1.00				0.95			0.95	
Frt	1.00	1.00		1.00				0.98			1.00	
Flt Protected	0.95	1.00		0.95				1.00			1.00	
Satd. Flow (prot)	1736	1827		1736				3400			3471	
Flt Permitted	0.95	1.00		0.76				1.00			1.00	
Satd. Flow (perm)	1736	1827		1381				3400			3471	
Volume (vph)	169	3	0	78	0	0	0	332	52	0	449	0
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)	188	3	0	87	0	0	0	369	58	0	499	0
Lane Group Flow (vph)	188	3	0	87	0	0	0	427	0	0	499	0
Turn Type	Perm			custom		custom				pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4			8		8				6		
Actuated Green, G (s)	38.0	38.0		38.0				38.5			63.0	
Effective Green, g (s)	39.5	39.5		39.5				40.0			64.5	
Actuated g/C Ratio	0.36	0.36		0.36				0.36			0.59	
Clearance Time (s)	4.5	4.5		4.5				4.5			4.5	
Lane Grp Cap (vph)	623	656		496				1236			2035	
v/s Ratio Prot		0.00						c0.13			c0.14	
v/s Ratio Perm	c0.11			0.06								
v/c Ratio	0.30	0.00		0.18				0.35			0.25	
Uniform Delay, d1	25.3	22.6		24.1				25.5			11.0	
Progression Factor	1.00	1.00		1.00				0.11			0.00	
Incremental Delay, d2	1.2	0.0		0.8				0.7			0.2	
Delay (s)	26.6	22.6		24.9				3.6			0.2	
Level of Service	C	C		C				A			A	
Approach Delay (s)		26.5			24.9			3.6			0.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.31		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	31.9%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	10	12	10	10
Total Lost time (s)							3.0	3.0			3.0	
Lane Util. Factor							1.00	0.95			0.95	
Frt							1.00	1.00			1.00	
Flt Protected							0.95	1.00			1.00	
Satd. Flow (prot)							1458	2650			2916	
Flt Permitted							0.30	1.00			1.00	
Satd. Flow (perm)							461	2650			2916	
Volume (vph)	0	0	0	0	0	0	58	583	0	0	528	0
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	0	0	0	64	648	0	0	587	0
Lane Group Flow (vph)	0	0	0	0	0	0	64	648	0	0	587	0
Bus Blockages (#/hr)	0	0	0	0	0	0	0	2	0	0	0	0
Parking (#/hr)				15		15		15				15
Turn Type				Perm			pm+pt					
Protected Phases					4		5	2			6	
Permitted Phases				4			2					
Actuated Green, G (s)							64.0	64.0			41.4	
Effective Green, g (s)							65.5	65.5			42.9	
Actuated g/C Ratio							0.60	0.60			0.39	
Clearance Time (s)							4.5	4.5			4.5	
Lane Grp Cap (vph)							452	1578			1137	
v/s Ratio Prot							0.03	c0.24			c0.20	
v/s Ratio Perm							0.06					
v/c Ratio							0.14	0.41			0.52	
Uniform Delay, d1							10.4	11.9			25.6	
Progression Factor							0.96	0.88			0.75	
Incremental Delay, d2							0.6	0.8			1.6	
Delay (s)							10.6	11.3			20.8	
Level of Service							B	B			C	
Approach Delay (s)		0.0			0.0			11.2			20.8	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Cycle Length (s)	110.0	Sum of lost time (s)	47.5
Intersection Capacity Utilization	28.7%	ICU Level of Service	A
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	0.97		1.00	0.94		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1736	3365		1736	3352		1736	3273		1736	3389	
Flt Permitted	0.26	1.00		0.33	1.00		0.51	1.00		0.19	1.00	
Satd. Flow (perm)	467	3365		606	3352		933	3273		349	3389	
Volume (vph)	56	286	73	148	330	98	32	341	210	22	196	37
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)	62	318	81	164	367	109	36	379	233	24	218	41
Lane Group Flow (vph)	62	399	0	164	476	0	36	612	0	24	259	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	44.0	22.0		44.0	22.0		48.0	26.0		48.0	26.0	
Effective Green, g (s)	47.0	23.5		47.0	23.5		51.0	27.5		51.0	27.5	
Actuated g/C Ratio	0.43	0.21		0.43	0.21		0.46	0.25		0.46	0.25	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	471	719		500	716		604	818		458	847	
v/s Ratio Prot	0.03	0.12		c0.07	c0.14		c0.01	c0.19		0.01	0.08	
v/s Ratio Perm	0.03			0.07			0.01			0.01		
v/c Ratio	0.13	0.55		0.33	0.66		0.06	0.75		0.05	0.31	
Uniform Delay, d1	19.3	38.6		20.3	39.6		16.2	38.1		17.1	33.5	
Progression Factor	1.00	1.00		0.06	0.55		0.93	0.80		0.77	0.48	
Incremental Delay, d2	0.6	3.1		1.7	4.7		0.2	5.8		0.2	0.9	
Delay (s)	19.9	41.7		3.0	26.5		15.3	36.0		13.3	16.8	
Level of Service	B	D		A	C		B	D		B	B	
Approach Delay (s)		38.7			20.5			34.9			16.5	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM Average Control Delay	28.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.46		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0					3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00					1.00	0.95		1.00	0.95	
Frt	1.00	0.94					1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00					0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1736	1725					1736	3471		1736	3394	
Flt Permitted	0.76	1.00					0.54	1.00		0.30	1.00	
Satd. Flow (perm)	1383	1725					989	3471		551	3394	
Volume (vph)	78	55	32	0	0	0	79	475	0	190	269	47
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)	87	61	36	0	0	0	88	528	0	211	299	52
Lane Group Flow (vph)	87	97	0	0	0	0	88	528	0	211	351	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	34.0	34.0					52.5	35.1		67.0	45.1	
Effective Green, g (s)	35.5	35.5					55.5	36.6		68.5	46.6	
Actuated g/C Ratio	0.32	0.32					0.50	0.33		0.62	0.42	
Clearance Time (s)	4.5	4.5					4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	446	557					627	1155		654	1438	
v/s Ratio Prot		0.06					0.02	c0.15		c0.08	0.10	
v/s Ratio Perm	c0.06						0.05			0.12		
v/c Ratio	0.20	0.17					0.14	0.46		0.32	0.24	
Uniform Delay, d1	26.9	26.7					14.2	28.9		10.0	20.4	
Progression Factor	1.00	1.00					0.63	0.67		2.16	0.23	
Incremental Delay, d2	1.0	0.7					0.4	1.1		1.2	0.4	
Delay (s)	27.9	27.4					9.3	20.4		22.9	5.1	
Level of Service	C	C					A	C		C	A	
Approach Delay (s)		27.6			0.0			18.8			11.7	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	17.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.33		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	41.7%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0					3.0	3.0			3.0	
Lane Util. Factor	1.00	1.00					1.00	0.95			0.95	
Frt	1.00	0.85					1.00	1.00			0.99	
Flt Protected	0.95	1.00					0.95	1.00			1.00	
Satd. Flow (prot)	1736	1553					1736	3471			3440	
Flt Permitted	0.76	1.00					0.35	1.00			1.00	
Satd. Flow (perm)	1383	1553					635	3471			3440	
Volume (vph)	55	0	74	0	0	0	45	509	0	0	431	27
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)	61	0	82	0	0	0	50	566	0	0	479	30
Lane Group Flow (vph)	61	82	0	0	0	0	50	566	0	0	509	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	38.0	38.0					59.2	38.5			37.8	
Effective Green, g (s)	39.5	39.5					62.2	40.0			39.3	
Actuated g/C Ratio	0.36	0.36					0.57	0.36			0.36	
Clearance Time (s)	4.5	4.5					4.5	4.5			4.5	
Lane Grp Cap (vph)	497	558					581	1262			1229	
v/s Ratio Prot		c0.05					c0.02	c0.16			0.15	
v/s Ratio Perm	0.04						0.03					
v/c Ratio	0.12	0.15					0.09	0.45			0.41	
Uniform Delay, d1	23.6	23.9					11.2	26.6			26.7	
Progression Factor	1.00	1.00					1.38	0.94			0.70	
Incremental Delay, d2	0.5	0.6					0.3	1.1			1.0	
Delay (s)	24.1	24.4					15.7	26.1			19.8	
Level of Service	C	C					B	C			B	
Approach Delay (s)		24.3			0.0			25.3			19.8	
Approach LOS		C			A			C			B	

Intersection Summary			
HCM Average Control Delay	23.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.25		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	27.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	10	10	12	10	12	12	12	12	12
Total Lost time (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor		0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt		1.00		1.00	0.91		1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3240		1620	2951		1620	3471	1553	1736	3471	
Flt Permitted		1.00		0.27	1.00		0.57	1.00	1.00	0.62	1.00	
Satd. Flow (perm)		3240		452	2951		980	3471	1553	1128	3471	
Volume (vph)	0	388	0	198	239	349	1	50	512	242	260	0
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	431	0	220	266	388	1	56	569	269	289	0
Lane Group Flow (vph)	0	431	0	220	654	0	1	56	569	269	289	0
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	3	8		7	4		5	2	7	1	6	
Permitted Phases	8			4			2		2	6		
Actuated Green, G (s)		22.0		54.8	46.3		25.3	25.3	53.6	37.7	37.7	
Effective Green, g (s)		23.5		56.3	47.8		26.8	26.8	56.6	39.2	39.2	
Actuated g/C Ratio		0.21		0.51	0.43		0.24	0.24	0.51	0.36	0.36	
Clearance Time (s)		4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)		692		548	1282		271	846	841	501	1237	
v/s Ratio Prot		c0.13		0.11	0.22		0.00	0.02	c0.18	c0.09	0.08	
v/s Ratio Perm				0.10			0.00		0.18	0.10		
v/c Ratio		0.62		0.40	0.51		0.00	0.07	0.68	0.54	0.23	
Uniform Delay, d1		39.2		16.1	22.6		31.5	32.0	19.9	27.0	24.9	
Progression Factor		1.00		0.71	0.31		1.05	1.06	0.33	1.00	1.00	
Incremental Delay, d2		4.2		2.1	1.4		0.0	0.1	4.0	4.1	0.4	
Delay (s)		43.4		13.7	8.3		33.2	34.0	10.6	31.1	25.3	
Level of Service		D		B	A		C	C	B	C	C	
Approach Delay (s)		43.4			9.7			12.7			28.1	
Approach LOS		D			A			B			C	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	C
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.86	1.00	0.97	0.91	1.00	0.97	0.91	0.91	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	6285	1553	3367	4988	1553	3367	3001	1413	3367	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	6285	1553	3367	4988	1553	3367	3001	1413	3367	3471	1553
Volume (vph)	14	2073	270	727	2613	4	335	182	698	14	140	7
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)	16	2303	300	808	2903	4	372	202	776	16	156	8
Lane Group Flow (vph)	16	2303	300	808	2903	4	372	578	400	16	156	8
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.5	39.0	51.5	24.5	58.0	62.0	12.5	24.5	49.0	4.0	16.0	21.5
Effective Green, g (s)	7.0	40.5	54.5	26.0	59.5	65.0	14.0	26.0	52.0	5.5	17.5	24.5
Actuated g/C Ratio	0.06	0.37	0.50	0.24	0.54	0.59	0.13	0.24	0.47	0.05	0.16	0.22
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	214	2314	812	796	2698	960	429	709	707	168	552	388
v/s Ratio Prot	0.00	0.37	0.05	c0.24	c0.58	0.00	c0.11	c0.19	0.13	0.00	0.04	0.00
v/s Ratio Perm			0.15			0.00			0.15			0.00
v/c Ratio	0.07	1.00	0.37	1.02	1.08	0.00	0.87	0.82	0.57	0.10	0.28	0.02
Uniform Delay, d1	48.5	34.7	17.1	42.0	25.2	9.2	47.1	39.7	20.9	49.9	40.7	33.4
Progression Factor	1.00	1.00	1.00	1.11	1.04	1.44	1.26	0.34	0.19	1.00	1.00	1.00
Incremental Delay, d2	0.7	17.6	1.3	26.7	38.5	0.0	11.2	5.1	1.6	1.1	1.3	0.1
Delay (s)	49.1	52.3	18.4	73.5	64.8	13.3	70.4	18.6	5.5	51.0	42.0	33.5
Level of Service	D	D	B	E	E	B	E	B	A	D	D	C
Approach Delay (s)		48.4			66.7			29.0			42.4	
Approach LOS		D			E			C			D	

Intersection Summary			
HCM Average Control Delay	53.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	4988	1553	3367	4988	1553	3367	3471	1553	3367	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	4988	1553	3367	4988	1553	3367	3471	1553	3367	3471	1553
Volume (vph)	32	1560	199	249	2258	535	352	106	380	833	137	29
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)	36	1733	221	277	2509	594	391	118	422	926	152	32
Lane Group Flow (vph)	36	1733	221	277	2509	594	391	118	422	926	152	32
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.5	43.5	61.0	11.5	50.5	77.0	17.5	10.5	22.0	26.5	19.5	24.0
Effective Green, g (s)	6.0	45.0	64.0	13.0	52.0	80.0	19.0	12.0	25.0	28.0	21.0	27.0
Actuated g/C Ratio	0.05	0.41	0.58	0.12	0.47	0.73	0.17	0.11	0.23	0.25	0.19	0.25
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	184	2041	946	398	2358	1172	582	379	395	857	663	424
v/s Ratio Prot	0.01	0.35	0.04	0.08	c0.50	0.13	0.12	0.03	c0.13	c0.28	0.04	0.00
v/s Ratio Perm			0.10			0.25			0.15			0.02
v/c Ratio	0.20	0.85	0.23	0.70	1.06	0.51	0.67	0.31	1.07	1.08	0.23	0.08
Uniform Delay, d1	49.7	29.4	11.1	46.6	29.0	6.5	42.6	45.2	42.5	41.0	37.7	31.9
Progression Factor	1.08	0.32	1.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	3.7	0.5	9.7	38.3	1.6	6.1	2.1	64.6	54.9	0.8	0.3
Delay (s)	55.4	13.2	21.7	56.3	67.3	8.0	48.7	47.3	107.1	95.9	38.5	32.3
Level of Service	E	B	C	E	E	A	D	D	F	F	D	C
Approach Delay (s)		14.9			56.0			75.0			86.2	
Approach LOS		B			E			E			F	

Intersection Summary			
HCM Average Control Delay	51.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	3.0	
Lane Util. Factor				0.95	0.95	
Frt				1.00	1.00	
Flt Protected				1.00	1.00	
Satd. Flow (prot)				3471	3469	
Flt Permitted				1.00	1.00	
Satd. Flow (perm)				3471	3469	
Volume (vph)	0	0	0	648	507	2
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	720	563	2
Lane Group Flow (vph)	0	0	0	720	565	0
Turn Type		custom	pm+pt			
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)				33.0	23.5	
Effective Green, g (s)				34.5	25.0	
Actuated g/C Ratio				0.53	0.38	
Clearance Time (s)				4.5	4.5	
Lane Grp Cap (vph)				1842	1334	
v/s Ratio Prot				c0.21	0.16	
v/s Ratio Perm						
v/c Ratio				0.39	0.42	
Uniform Delay, d1				9.0	14.7	
Progression Factor				1.00	1.00	
Incremental Delay, d2				0.6	1.0	
Delay (s)				9.7	15.7	
Level of Service				A	B	
Approach Delay (s)	0.0			9.7	15.7	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Cycle Length (s)	65.0	Sum of lost time (s)	30.5
Intersection Capacity Utilization	23.2%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.91	0.95	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3367	4988	3471	1553	3367	1553
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3367	4988	3471	1553	3367	1553
Volume (vph)	266	1580	1569	382	383	124
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	296	1756	1743	424	426	138
Lane Group Flow (vph)	296	1756	1743	424	426	138
Turn Type	Prot			pm+ov		Free
Protected Phases	7		8	6	6	
Permitted Phases		4		8		Free
Actuated Green, G (s)	11.5	77.5	61.5	85.0	23.5	110.0
Effective Green, g (s)	13.0	79.0	63.0	88.0	25.0	110.0
Actuated g/C Ratio	0.12	0.72	0.57	0.80	0.23	1.00
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	398	3582	1988	1285	765	1553
v/s Ratio Prot	c0.09		c0.50	0.08	c0.13	
v/s Ratio Perm		0.35		0.20		0.09
v/c Ratio	0.74	0.49	0.88	0.33	0.56	0.09
Uniform Delay, d1	46.9	6.7	20.2	3.0	37.6	0.0
Progression Factor	1.10	0.40	0.58	0.84	1.00	1.00
Incremental Delay, d2	10.6	0.4	1.9	0.2	2.9	0.1
Delay (s)	61.9	3.1	13.5	2.7	40.5	0.1
Level of Service	E	A	B	A	D	A
Approach Delay (s)		11.6	11.4		30.6	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Util. Factor		0.86	1.00	0.97	0.95						0.95	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						1.00	1.00
Satd. Flow (prot)		6285	1553	3367	3471						3471	1553
Flt Permitted		1.00	1.00	0.95	1.00						1.00	1.00
Satd. Flow (perm)		6285	1553	3367	3471						3471	1553
Volume (vph)	0	1116	106	278	981	0	0	0	0	0	158	335
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	1240	118	309	1090	0	0	0	0	0	176	372
Lane Group Flow (vph)	0	1240	118	309	1090	0	0	0	0	0	176	372
Turn Type			Perm	Prot						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4							6		6
Actuated Green, G (s)		50.3	50.3	17.7	46.5						28.5	28.5
Effective Green, g (s)		51.8	51.8	19.2	48.0						30.0	30.0
Actuated g/C Ratio		0.47	0.47	0.17	0.44						0.27	0.27
Clearance Time (s)		4.5	4.5	4.5	4.5						4.5	4.5
Lane Grp Cap (vph)		2960	731	588	1515						947	424
v/s Ratio Prot		c0.20		c0.09	c0.31						0.05	
v/s Ratio Perm			0.08									c0.24
v/c Ratio		0.42	0.16	0.53	0.72						0.19	0.88
Uniform Delay, d1		19.2	16.7	41.3	25.5						30.6	38.2
Progression Factor		1.00	1.00	1.66	0.24						0.57	0.78
Incremental Delay, d2		0.4	0.5	3.0	2.6						0.4	21.5
Delay (s)		19.6	17.1	71.3	8.7						17.8	51.4
Level of Service		B	B	E	A						B	D
Approach Delay (s)		19.4			22.5			0.0			40.6	
Approach LOS		B			C			A			D	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0			3.0	3.0			
Lane Util. Factor	0.97	0.95			0.86			0.95	1.00			
Frt	1.00	1.00			1.00			1.00	0.85			
Flt Protected	0.95	1.00			1.00			0.99	1.00			
Satd. Flow (prot)	3367	3471			6285			3420	1553			
Flt Permitted	0.95	1.00			1.00			0.99	1.00			
Satd. Flow (perm)	3367	3471			6285			3420	1553			
Volume (vph)	359	757	0	0	1238	0	20	47	358	0	0	0
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)	399	841	0	0	1376	0	22	52	398	0	0	0
Lane Group Flow (vph)	399	841	0	0	1376	0	0	74	398	0	0	0
Turn Type	Prot					Perm	Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases						8	2		2			
Actuated Green, G (s)	21.5	50.3			46.5			28.5	28.5			
Effective Green, g (s)	23.0	51.8			48.0			30.0	30.0			
Actuated g/C Ratio	0.21	0.47			0.44			0.27	0.27			
Clearance Time (s)	4.5	4.5			4.5			4.5	4.5			
Lane Grp Cap (vph)	704	1635			2743			933	424			
v/s Ratio Prot	c0.12	c0.24			0.22							
v/s Ratio Perm								0.02	c0.26			
v/c Ratio	0.57	0.51			0.50			0.08	0.94			
Uniform Delay, d1	39.0	20.3			22.4			29.7	39.1			
Progression Factor	1.89	0.17			1.00			1.00	1.00			
Incremental Delay, d2	3.0	1.1			0.7			0.2	30.7			
Delay (s)	76.7	4.5			23.0			29.9	69.8			
Level of Service	E	A			C			C	E			
Approach Delay (s)		27.7			23.0			63.6			0.0	
Approach LOS		C			C			E			A	

Intersection Summary			
HCM Average Control Delay	31.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.97			0.87			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.96	
Satd. Flow (prot)	1736	1827		1736	1775			1591			1726	
Flt Permitted	0.31	1.00		0.40	1.00			1.00			0.77	
Satd. Flow (perm)	573	1827		734	1775			1591			1374	
Volume (vph)	3	423	0	66	439	102	0	1	21	118	12	20
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)	3	470	0	73	488	113	0	1	23	131	13	22
Lane Group Flow (vph)	3	470	0	73	601	0	0	24	0	0	166	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	65.0	65.0		65.0	65.0			36.0			36.0	
Effective Green, g (s)	66.5	66.5		66.5	66.5			37.5			37.5	
Actuated g/C Ratio	0.60	0.60		0.60	0.60			0.34			0.34	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	346	1105		444	1073			542			468	
v/s Ratio Prot		0.26			c0.34			0.02				
v/s Ratio Perm	0.01			0.10							c0.12	
v/c Ratio	0.01	0.43		0.16	0.56			0.04			0.35	
Uniform Delay, d1	8.6	11.6		9.6	13.0			24.3			27.2	
Progression Factor	1.00	1.00		0.99	1.00			1.00			1.00	
Incremental Delay, d2	0.0	1.2		0.8	2.1			0.2			2.1	
Delay (s)	8.7	12.8		10.3	15.1			24.4			29.3	
Level of Service	A	B		B	B			C			C	
Approach Delay (s)		12.8			14.6			24.4			29.3	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	1.00	1.00	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1736	3471		1736	3471	1553		3471	1553	1736	3124	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.76	1.00	
Satd. Flow (perm)	1736	3471		1736	3471	1553		3471	1553	1383	3124	
Volume (vph)	123	1311	0	213	1389	79	0	1	17	177	68	137
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)	137	1457	0	237	1543	88	0	1	19	197	76	152
Lane Group Flow (vph)	137	1457	0	237	1543	88	0	1	19	197	228	0
Turn Type	Prot		pm+ov	Prot		pm+ov	pm+pt		pm+ov	pm+pt		
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)	10.7	48.5		16.5	54.3	58.3		23.0	39.5	27.0	23.0	
Effective Green, g (s)	12.2	50.0		18.0	55.8	61.3		24.5	42.5	30.0	24.5	
Actuated g/C Ratio	0.11	0.45		0.16	0.51	0.56		0.22	0.39	0.27	0.22	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	193	1578		284	1761	908		773	642	395	696	
v/s Ratio Prot	0.08	c0.42		c0.14	0.44	0.00		0.00	0.00	c0.02	0.07	
v/s Ratio Perm						0.05			0.01	c0.11		
v/c Ratio	0.71	0.92		0.83	0.88	0.10		0.00	0.03	0.50	0.33	
Uniform Delay, d1	47.2	28.2		44.6	24.0	11.4		33.2	20.9	33.1	35.8	
Progression Factor	1.00	1.00		0.98	0.91	1.13		1.00	1.00	1.00	1.00	
Incremental Delay, d2	19.8	10.5		14.3	3.6	0.1		0.0	0.1	4.4	1.3	
Delay (s)	67.0	38.7		58.0	25.6	13.0		33.2	21.0	37.5	37.1	
Level of Service	E	D		E	C	B		C	C	D	D	
Approach Delay (s)		41.2			29.1			21.6			37.3	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM Average Control Delay	34.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0	3.0	3.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3462			3465	1736	1553
Flt Permitted	1.00			0.85	0.95	1.00
Satd. Flow (perm)	3462			2944	1736	1553
Volume (vph)	1102	21	41	1184	23	13
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1224	23	46	1316	26	14
Lane Group Flow (vph)	1247	0	0	1362	26	14
Turn Type			Perm			Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Actuated Green, G (s)	71.1			71.1	29.9	29.9
Effective Green, g (s)	72.6			72.6	31.4	31.4
Actuated g/C Ratio	0.66			0.66	0.29	0.29
Clearance Time (s)	4.5			4.5	4.5	4.5
Lane Grp Cap (vph)	2285			1943	496	443
v/s Ratio Prot	0.36				c0.01	
v/s Ratio Perm				c0.46		0.01
v/c Ratio	0.55			0.70	0.05	0.03
Uniform Delay, d1	9.9			11.8	28.5	28.3
Progression Factor	0.18			0.65	0.52	0.35
Incremental Delay, d2	0.9			1.6	0.2	0.1
Delay (s)	2.6			9.3	14.9	10.0
Level of Service	A			A	B	A
Approach Delay (s)	2.6			9.3	13.2	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	6.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	68.6%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0			3.0				
Lane Util. Factor		0.95			0.95			1.00				
Frt		0.97			1.00			0.94				
Flt Protected		1.00			0.97			0.98				
Satd. Flow (prot)		3355			3378			1684				
Flt Permitted		0.90			0.51			0.85				
Satd. Flow (perm)		3033			1786			1463				
Volume (vph)	26	628	177	445	357	0	228	52	201	0	0	0
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)	29	698	197	494	397	0	253	58	223	0	0	0
Lane Group Flow (vph)	0	924	0	0	891	0	0	534	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		58.5			58.5			42.5				
Effective Green, g (s)		60.0			60.0			44.0				
Actuated g/C Ratio		0.55			0.55			0.40				
Clearance Time (s)		4.5			4.5			4.5				
Lane Grp Cap (vph)		1654			974			585				
v/s Ratio Prot												
v/s Ratio Perm		0.30			c0.50			c0.37				
v/c Ratio		0.56			2.17dl			0.91				
Uniform Delay, d1		16.3			22.7			31.2				
Progression Factor		0.80			1.00			1.08				
Incremental Delay, d2		1.3			14.4			15.1				
Delay (s)		14.4			37.1			49.0				
Level of Service		B			D			D				
Approach Delay (s)		14.4			37.1			49.0			0.0	
Approach LOS		B			D			D			A	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	94.5%	ICU Level of Service	E

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

Movement	WBL	WBR	SEL	SER	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0		3.0	3.0
Lane Util. Factor	1.00	0.88	0.97		0.97	1.00
Frt	1.00	0.85	1.00		1.00	0.85
Flt Protected	0.95	1.00	0.95		0.95	1.00
Satd. Flow (prot)	1736	2733	3367		3367	1553
Flt Permitted	0.95	1.00	0.95		0.95	1.00
Satd. Flow (perm)	1736	2733	3367		3367	1553
Volume (vph)	53	234	578	0	273	63
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	59	260	642	0	303	70
Lane Group Flow (vph)	59	260	642	0	303	70
Turn Type		Perm			Prot	
Protected Phases	8!		4!		6	
Permitted Phases		8				4
Actuated Green, G (s)	54.2	54.2	54.2		46.8	54.2
Effective Green, g (s)	55.7	55.7	55.7		48.3	55.7
Actuated g/C Ratio	0.51	0.51	0.51		0.44	0.51
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Lane Grp Cap (vph)	879	1384	1705		1478	786
v/s Ratio Prot	0.03		c0.19		c0.09	
v/s Ratio Perm		0.10				0.05
v/c Ratio	0.07	0.19	0.38		0.21	0.09
Uniform Delay, d1	13.9	14.8	16.6		19.0	14.0
Progression Factor	0.95	1.93	0.67		1.00	1.00
Incremental Delay, d2	0.1	0.3	0.6		0.3	0.2
Delay (s)	13.3	28.8	11.7		19.3	14.3
Level of Service	B	C	B		B	B
Approach Delay (s)	26.0		11.7		18.4	
Approach LOS	C		B		B	

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	40.3%	ICU Level of Service	A

! Phase conflict between lane groups.
c Critical Lane Group

Movement	NBL	NBT	SBT	SBR	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1736	1827	3471	1553	1736	1553
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1736	1827	3471	1553	1736	1553
Volume (vph)	241	377	455	155	82	276
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	268	419	506	172	91	307
Lane Group Flow (vph)	268	419	506	172	91	307
Turn Type	Prot			custom		custom
Protected Phases	5	2	6	6	8	8
Permitted Phases		2	6	8	8	8
Actuated Green, G (s)	34.8	68.8	29.5	61.7	32.2	32.2
Effective Green, g (s)	36.3	70.3	31.0	64.7	33.7	33.7
Actuated g/C Ratio	0.33	0.64	0.28	0.59	0.31	0.31
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	573	1168	978	956	532	476
v/s Ratio Prot	c0.15	0.23	c0.15	0.05	0.05	c0.20
v/s Ratio Perm				0.06		
v/c Ratio	0.47	0.36	0.52	0.18	0.17	0.64
Uniform Delay, d1	29.2	9.3	33.2	10.4	27.9	33.0
Progression Factor	0.73	0.83	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.6	0.8	2.0	0.4	0.7	6.6
Delay (s)	23.9	8.5	35.2	10.8	28.6	39.6
Level of Service	C	A	D	B	C	D
Approach Delay (s)		14.5	29.0		37.1	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frt		1.00	0.97		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3430	3350		1736	1553
Flt Permitted		0.54	1.00		0.95	1.00
Satd. Flow (perm)		1867	3350		1736	1553
Volume (vph)	266	848	753	228	170	472
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	296	942	837	253	189	524
Lane Group Flow (vph)	0	1238	1090	0	189	524
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)		73.5	73.5		27.5	27.5
Effective Green, g (s)		75.0	75.0		29.0	29.0
Actuated g/C Ratio		0.68	0.68		0.26	0.26
Clearance Time (s)		4.5	4.5		4.5	4.5
Lane Grp Cap (vph)		1273	2284		458	409
v/s Ratio Prot			0.33		0.11	
v/s Ratio Perm		c0.66				c0.34
v/c Ratio		1.10dl	0.48		0.41	1.28
Uniform Delay, d1		16.5	8.3		33.5	40.5
Progression Factor		0.70	1.00		0.37	0.73
Incremental Delay, d2		17.6	0.7		1.6	137.5
Delay (s)		29.2	9.0		13.9	167.2
Level of Service		C	A		B	F
Approach Delay (s)		29.2	9.0		126.6	
Approach LOS		C	A		F	

Intersection Summary			
HCM Average Control Delay	44.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	D

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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	3471	1553	1736	3471	1553	1736	3471	1553	1736	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.32	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)	3367	3471	1553	1736	3471	1553	587	3471	1553	698	3471	1553
Volume (vph)	585	990	388	98	1095	16	298	482	89	48	347	557
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)	650	1100	431	109	1217	18	331	536	99	53	386	619
Lane Group Flow (vph)	650	1100	431	109	1217	18	331	536	99	53	386	619
Turn Type	Prot		pm+ov	Prot		pm+ov	pm+pt		pm+ov	pm+pt		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8	2		2	6		6
Actuated Green, G (s)	20.5	44.5	56.0	12.0	36.0	40.0	39.0	30.5	42.5	27.0	23.0	43.5
Effective Green, g (s)	22.0	46.5	59.5	13.5	38.0	43.5	41.0	32.5	46.0	30.5	25.0	47.0
Actuated g/C Ratio	0.20	0.42	0.54	0.12	0.35	0.40	0.37	0.30	0.42	0.28	0.23	0.43
Clearance Time (s)	4.5	5.0	4.5	4.5	5.0	4.5	4.5	5.0	4.5	4.5	5.0	4.5
Lane Grp Cap (vph)	673	1467	882	213	1199	656	355	1026	692	245	789	706
v/s Ratio Prot	c0.19	0.32	0.06	0.06	c0.35	0.00	c0.11	0.15	0.02	0.01	0.11	c0.18
v/s Ratio Perm			0.22			0.01	c0.24		0.05	0.05		0.22
v/c Ratio	0.97	0.75	0.49	0.51	1.02	0.03	0.93	0.52	0.14	0.22	0.49	0.88
Uniform Delay, d1	43.6	26.8	15.8	45.2	36.0	20.3	29.9	32.3	19.8	29.7	36.9	28.8
Progression Factor	0.86	0.98	1.38	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.1	3.1	1.7	8.5	29.8	0.1	33.4	1.9	0.4	2.0	2.2	14.4
Delay (s)	62.6	29.5	23.4	53.7	65.8	20.4	63.2	34.2	20.2	31.7	39.1	43.2
Level of Service	E	C	C	D	E	C	E	C	C	C	D	D
Approach Delay (s)		38.2			64.2			42.7			41.2	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	45.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	100.3%	ICU Level of Service	F

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	3471	1553	1736	3471	1553	3367	3471	1553	1736	3471	1553
Flt Permitted	0.16	1.00	1.00	0.27	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	292	3471	1553	500	3471	1553	3367	3471	1553	1736	3471	1553
Volume (vph)	293	445	96	177	523	120	145	831	98	333	607	281
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)	326	494	107	197	581	133	161	923	109	370	674	312
Lane Group Flow (vph)	326	494	107	197	581	133	161	923	109	370	674	312
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	Prot		Perm	Prot		Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	40.0	23.5	32.0	37.0	22.0	45.5	8.5	30.0	30.0	23.5	45.0	45.0
Effective Green, g (s)	43.0	25.0	35.0	40.0	23.5	48.5	10.0	31.5	31.5	25.0	46.5	46.5
Actuated g/C Ratio	0.39	0.23	0.32	0.36	0.21	0.44	0.09	0.29	0.29	0.23	0.42	0.42
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	350	789	536	367	742	727	306	994	445	395	1467	656
v/s Ratio Prot	c0.15	0.14	0.02	0.08	0.17	0.04	0.05	c0.27		c0.21	0.19	
v/s Ratio Perm	c0.21		0.05	0.11		0.04			0.07			0.20
v/c Ratio	0.93	0.63	0.20	0.54	0.78	0.18	0.53	0.93	0.24	0.94	0.46	0.48
Uniform Delay, d1	29.0	38.3	27.3	25.7	40.8	18.7	47.7	38.2	30.1	41.7	22.7	22.9
Progression Factor	1.00	1.00	1.00	0.67	0.47	0.44	1.00	1.00	1.00	1.01	0.38	0.24
Incremental Delay, d2	33.5	3.7	0.8	4.6	6.7	0.5	6.3	15.8	1.3	24.8	0.7	1.7
Delay (s)	62.5	42.0	28.1	21.6	25.8	8.6	54.1	53.9	31.4	67.0	9.3	7.3
Level of Service	E	D	C	C	C	A	D	D	C	E	A	A
Approach Delay (s)		47.6			22.4			51.9			24.6	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	36.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	0.88
Frt		1.00	0.85	1.00	1.00						1.00	1.00
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3471	1553	1736	3471						1736	3215
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		3471	1553	1736	3471						1736	3215
Volume (vph)	0	1624	288	10	199	0	0	0	0	75	0	2063
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	1804	320	11	221	0	0	0	0	83	0	2292
Lane Group Flow (vph)	0	1804	320	11	221	0	0	0	0	0	83	2292
Turn Type			Prot	Split						custom		custom
Protected Phases		4	4	8	8					6	6	4 6
Permitted Phases										6		4 6
Actuated Green, G (s)		60.5	60.5	12.5	12.5						23.5	88.5
Effective Green, g (s)		62.0	62.0	14.0	14.0						25.0	90.0
Actuated g/C Ratio		0.56	0.56	0.13	0.13						0.23	0.82
Clearance Time (s)		4.5	4.5	4.5	4.5						4.5	
Lane Grp Cap (vph)		1956	875	221	442						395	2630
v/s Ratio Prot		c0.52	0.21	0.01	c0.06						0.05	c0.71
v/s Ratio Perm												
v/c Ratio		0.92	0.37	0.05	0.50						0.21	0.87
Uniform Delay, d1		21.8	13.2	42.2	44.7						34.5	6.3
Progression Factor		0.37	0.09	1.25	1.25						1.00	1.00
Incremental Delay, d2		6.6	0.9	0.4	4.0						1.2	4.3
Delay (s)		14.7	2.0	53.2	59.9						35.7	10.7
Level of Service		B	A	D	E						D	B
Approach Delay (s)		12.8			59.6			0.0			11.5	
Approach LOS		B			E			A			B	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	93.0%	ICU Level of Service	E

c Critical Lane Group

Appendix I

HCM Signal Reports for the Modified Alignment Alternative

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0			3.0		3.0		3.0
Lane Util. Factor	1.00	0.95			0.95			0.95		1.00		1.00
Frt	1.00	1.00			1.00			1.00		1.00		0.85
Flt Protected	0.95	1.00			1.00			1.00		0.95		1.00
Satd. Flow (prot)	1736	3471			3467			3471		1736		1553
Flt Permitted	0.34	1.00			1.00			1.00		0.76		1.00
Satd. Flow (perm)	624	3471			3467			3471		1383		1553
Volume (vph)	20	716	0	0	485	4	0	1	0	4	0	19
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	796	0	0	539	4	0	1	0	4	0	21
Lane Group Flow (vph)	22	796	0	0	543	0	0	1	0	4	0	21
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		pm+ov
Protected Phases	7	4		3	8		5	2	3	1	6	7
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	50.9	39.9			39.9			30.1		41.1		41.1
Effective Green, g (s)	53.9	41.4			41.4			31.6		44.1		44.1
Actuated g/C Ratio	0.49	0.38			0.38			0.29		0.40		0.40
Clearance Time (s)	4.5	4.5			4.5			4.5		4.5		4.5
Lane Grp Cap (vph)	432	1306			1305			997		595		665
v/s Ratio Prot	c0.01	c0.23			0.16			0.00		c0.00		c0.00
v/s Ratio Perm	0.02									0.00		0.01
v/c Ratio	0.05	0.61			0.42			0.00		0.01		0.03
Uniform Delay, d1	15.0	27.8			25.4			27.9		19.8		20.0
Progression Factor	0.25	0.36			1.00			1.00		1.00		1.00
Incremental Delay, d2	0.2	2.0			1.0			0.0		0.0		0.1
Delay (s)	3.9	12.0			26.3			27.9		19.8		20.1
Level of Service	A	B			C			C		B		C
Approach Delay (s)		11.8			26.3			27.9			20.0	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.28		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	32.0%	ICU Level of Service	A

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0	3.0	3.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3471			3471	1736	1553
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	3471			3471	1736	1553
Volume (vph)	136	0	0	262	75	4
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	151	0	0	291	83	4
Lane Group Flow (vph)	151	0	0	291	83	4
Turn Type						Perm
Protected Phases	4			8	2	
Permitted Phases						2
Actuated Green, G (s)	23.0			23.0	23.0	23.0
Effective Green, g (s)	24.5			24.5	24.5	24.5
Actuated g/C Ratio	0.45			0.45	0.45	0.45
Clearance Time (s)	4.5			4.5	4.5	4.5
Lane Grp Cap (vph)	1546			1546	773	692
v/s Ratio Prot	0.04			c0.08	c0.05	
v/s Ratio Perm						0.00
v/c Ratio	0.10			0.19	0.11	0.01
Uniform Delay, d1	8.8			9.2	8.9	8.5
Progression Factor	0.95			1.00	1.00	1.00
Incremental Delay, d2	0.0			0.3	0.3	0.0
Delay (s)	8.4			9.5	9.2	8.5
Level of Service	A			A	A	A
Approach Delay (s)	8.4			9.5	9.1	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.15		
Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	19.3%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NET	SWT
Lane Configurations										
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0		3.0			
Lane Util. Factor	0.91	0.91	1.00	1.00	0.97		1.00			
Frt	1.00	1.00	1.00	1.00	1.00		1.00			
Flt Protected	0.95	0.96	0.95	1.00	0.95		0.95			
Satd. Flow (prot)	1579	3180	1736	1827	3367		1736			
Flt Permitted	0.95	0.96	0.95	1.00	0.95		0.95			
Satd. Flow (perm)	1579	3180	1736	1827	3367		1736			
Volume (vph)	350	16	39	34	16	0	9	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	389	18	43	38	18	0	10	0	0	0
Lane Group Flow (vph)	195	212	43	38	18	0	10	0	0	0
Turn Type	Split		Split		custom		custom			
Protected Phases	4	4	8	8	1		5			
Permitted Phases					1		5			
Actuated Green, G (s)	38.5	38.5	38.0	38.0	20.0		20.0			
Effective Green, g (s)	40.0	40.0	39.5	39.5	21.5		21.5			
Actuated g/C Ratio	0.36	0.36	0.36	0.36	0.20		0.20			
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5		4.5			
Lane Grp Cap (vph)	574	1156	623	656	658		339			
v/s Ratio Prot	c0.12	0.07	c0.02	0.02	0.01		c0.01			
v/s Ratio Perm										
v/c Ratio	0.34	0.18	0.07	0.06	0.03		0.03			
Uniform Delay, d1	25.4	23.9	23.2	23.1	35.8		35.8			
Progression Factor	0.82	0.83	1.00	1.00	1.00		1.00			
Incremental Delay, d2	1.5	0.3	0.2	0.2	0.1		0.2			
Delay (s)	22.3	20.1	23.4	23.2	35.9		36.0			
Level of Service	C	C	C	C	D		D			
Approach Delay (s)		21.2		23.3		35.9		36.0	0.0	0.0
Approach LOS		C		C		D		D	A	A

Intersection Summary			
HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.17		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	27.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.97	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3471	1553	1736	3471					3367	1827	1553
Flt Permitted		1.00	1.00	0.14	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3471	1553	257	3471					3367	1827	1553
Volume (vph)	0	965	64	58	565	0	0	0	0	260	158	99
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	1072	71	64	628	0	0	0	0	289	176	110
Lane Group Flow (vph)	0	1072	71	64	628	0	0	0	0	289	176	110
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		51.0	51.0	70.0	70.0					31.0	31.0	31.0
Effective Green, g (s)		52.5	52.5	71.5	71.5					32.5	32.5	32.5
Actuated g/C Ratio		0.48	0.48	0.65	0.65					0.30	0.30	0.30
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Grp Cap (vph)		1657	741	382	2256					995	540	459
v/s Ratio Prot		c0.31		0.02	c0.18						c0.10	
v/s Ratio Perm			0.05	0.08						0.09		0.07
v/c Ratio		0.65	0.10	0.17	0.28					0.29	0.33	0.24
Uniform Delay, d1		21.7	15.7	10.6	8.2					29.9	30.2	29.4
Progression Factor		0.81	1.12	0.00	0.02					0.88	0.88	0.83
Incremental Delay, d2		1.5	0.2	0.9	0.3					0.7	1.6	1.2
Delay (s)		19.0	17.9	0.9	0.4					27.0	28.1	25.5
Level of Service		B	B	A	A					C	C	C
Approach Delay (s)		18.9			0.5			0.0			27.0	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	52.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Util. Factor	0.97	0.95	1.00		0.95	1.00	0.97	0.95		0.97	0.95	1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3367	3471	1553		3471	1553	3367	3471		3367	3471	1553
Flt Permitted	0.95	1.00	1.00		1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3367	3471	1553		3471	1553	3367	3471		3367	3471	1553
Volume (vph)	42	461	107	0	428	111	79	467	0	229	941	79
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)	47	512	119	0	476	123	88	519	0	254	1046	88
Lane Group Flow (vph)	47	512	119	0	476	123	88	519	0	254	1046	88
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	9.0	25.5	35.9		25.5	43.1	10.4	39.9		17.6	47.1	56.1
Effective Green, g (s)	10.5	27.0	38.9		27.0	46.1	11.9	41.4		19.1	48.6	59.1
Actuated g/C Ratio	0.10	0.25	0.35		0.25	0.42	0.11	0.38		0.17	0.44	0.54
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5	4.5	4.5		4.5	4.5	4.5
Lane Grp Cap (vph)	321	852	592		852	693	364	1306		585	1534	877
v/s Ratio Prot	c0.01	c0.15	0.02		0.14	0.03	0.03	0.15		c0.08	c0.30	0.01
v/s Ratio Perm			0.05			0.05						0.05
v/c Ratio	0.15	0.60	0.20		0.56	0.18	0.24	0.40		0.43	0.68	0.10
Uniform Delay, d1	45.6	36.7	24.7		36.3	20.1	44.9	25.2		40.6	24.5	12.4
Progression Factor	0.46	0.65	2.80		0.55	0.17	1.00	1.00		1.42	0.46	0.15
Incremental Delay, d2	0.9	2.8	0.7		2.6	0.5	1.6	0.9		1.7	1.8	0.2
Delay (s)	21.6	26.7	70.0		22.7	4.1	46.5	26.1		59.3	13.0	2.0
Level of Service	C	C	E		C	A	D	C		E	B	A
Approach Delay (s)		34.0			18.8			29.0			20.8	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0		3.0	3.0					3.0	3.0	3.0
Lane Util. Factor		0.95		0.97	0.95					1.00	0.95	1.00
Frt		1.00		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3471		3367	3471					1736	3471	1553
Flt Permitted		1.00		0.21	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3471		740	3471					1736	3471	1553
Volume (vph)	0	690	0	15	300	0	0	0	0	277	483	239
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	767	0	17	333	0	0	0	0	308	537	266
Lane Group Flow (vph)	0	767	0	17	333	0	0	0	0	308	537	266
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		41.5		61.0	61.0					40.0	40.0	40.0
Effective Green, g (s)		43.0		62.5	62.5					41.5	41.5	41.5
Actuated g/C Ratio		0.39		0.57	0.57					0.38	0.38	0.38
Clearance Time (s)		4.5		4.5	4.5					4.5	4.5	4.5
Lane Grp Cap (vph)		1357		815	1972					655	1310	586
v/s Ratio Prot		c0.22		0.00	c0.10						0.15	
v/s Ratio Perm				0.01						c0.18		0.17
v/c Ratio		0.57		0.02	0.17					0.47	0.41	0.45
Uniform Delay, d1		26.2		12.0	11.3					25.9	25.2	25.7
Progression Factor		0.18		1.77	2.02					1.00	1.00	1.00
Incremental Delay, d2		1.5		0.0	0.2					2.4	1.0	2.5
Delay (s)		6.0		21.3	23.1					28.3	26.2	28.3
Level of Service		A		C	C					C	C	C
Approach Delay (s)		6.0			23.0			0.0			27.3	
Approach LOS		A			C			A			C	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	44.9%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	1.00	0.95	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	3367	3471			3471	1553	1736	3471	1553			
Flt Permitted	0.45	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1602	3471			3471	1553	1736	3471	1553			
Volume (vph)	248	719	0	0	285	220	31	539	16	0	0	0
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)	276	799	0	0	317	244	34	599	18	0	0	0
Lane Group Flow (vph)	276	799	0	0	317	244	34	599	18	0	0	0
Turn Type	pm+pt					Perm	Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2		2			
Actuated Green, G (s)	61.5	61.5			34.7	34.7	39.5	39.5	39.5			
Effective Green, g (s)	63.0	63.0			36.2	36.2	41.0	41.0	41.0			
Actuated g/C Ratio	0.57	0.57			0.33	0.33	0.37	0.37	0.37			
Clearance Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lane Grp Cap (vph)	1299	1988			1142	511	647	1294	579			
v/s Ratio Prot	0.05	c0.23			0.09			c0.17				
v/s Ratio Perm	0.08					c0.16	0.02		0.01			
v/c Ratio	0.21	0.40			0.28	0.48	0.05	0.46	0.03			
Uniform Delay, d1	11.2	13.0			27.2	29.4	22.1	26.2	21.9			
Progression Factor	0.39	0.51			0.14	0.22	0.65	0.63	0.37			
Incremental Delay, d2	0.3	0.5			0.6	3.0	0.1	1.1	0.1			
Delay (s)	4.7	7.1			4.3	9.4	14.5	17.7	8.2			
Level of Service	A	A			A	A	B	B	A			
Approach Delay (s)		6.5			6.5			17.3			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	49.6%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Util. Factor	0.97	0.95			0.95	1.00	0.91	0.91	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (prot)	3367	3471			3471	1553	1579	3274	1553			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.98	1.00			
Satd. Flow (perm)	3367	3471			3471	1553	1579	3274	1553			
Volume (vph)	499	725	0	0	430	284	193	168	174	0	0	0
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)	554	806	0	0	478	316	214	187	193	0	0	0
Lane Group Flow (vph)	554	806	0	0	478	316	129	272	193	0	0	0
Turn Type	Prot					Perm	Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases						8	2		2			
Actuated Green, G (s)	33.4	71.0			33.1	33.1	30.0	30.0	30.0			
Effective Green, g (s)	34.9	72.5			34.6	34.6	31.5	31.5	31.5			
Actuated g/C Ratio	0.32	0.66			0.31	0.31	0.29	0.29	0.29			
Clearance Time (s)	4.5	4.5			4.5	4.5	4.5	4.5	4.5			
Lane Grp Cap (vph)	1068	2288			1092	488	452	938	445			
v/s Ratio Prot	c0.16	0.23			0.14							
v/s Ratio Perm						c0.20	0.08	0.08	c0.12			
v/c Ratio	0.52	0.35			0.44	0.65	0.29	0.29	0.43			
Uniform Delay, d1	30.7	8.3			30.0	32.5	30.5	30.5	32.0			
Progression Factor	0.51	1.70			0.92	0.88	0.97	0.97	0.90			
Incremental Delay, d2	1.5	0.4			0.3	1.8	1.6	0.8	3.1			
Delay (s)	17.2	14.5			27.8	30.2	31.2	30.4	32.0			
Level of Service	B	B			C	C	C	C	C			
Approach Delay (s)		15.6			28.8			31.1			0.0	
Approach LOS		B			C			C			A	

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.91	0.86	0.91
Frt		1.00	0.85	1.00	1.00					1.00	0.92	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3471	1553	1736	3471					1579	2900	1413
Flt Permitted		1.00	1.00	0.48	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3471	1553	868	3471					1579	2900	1413
Volume (vph)	0	239	65	6	35	0	0	0	0	22	445	986
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	266	72	7	39	0	0	0	0	24	494	1096
Lane Group Flow (vph)	0	266	72	7	39	0	0	0	0	24	1016	574
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		30.1	30.1	46.6	46.6					54.4	54.4	54.4
Effective Green, g (s)		31.6	31.6	48.1	48.1					55.9	55.9	55.9
Actuated g/C Ratio		0.29	0.29	0.44	0.44					0.51	0.51	0.51
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Grp Cap (vph)		997	446	486	1518					802	1474	718
v/s Ratio Prot		c0.08		0.00	c0.01						0.35	
v/s Ratio Perm			0.05	0.00						0.02		c0.41
v/c Ratio		0.27	0.16	0.01	0.03					0.03	0.69	0.80
Uniform Delay, d1		30.3	29.3	17.7	17.6					13.5	20.5	22.4
Progression Factor		0.90	1.25	1.28	1.25					0.33	0.09	0.26
Incremental Delay, d2		0.6	0.8	0.1	0.0					0.0	1.6	5.6
Delay (s)		28.0	37.5	22.7	22.1					4.5	3.5	11.4
Level of Service		C	D	C	C					A	A	B
Approach Delay (s)		30.0			22.2			0.0			6.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	55.2%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91	1.00			
Frt	1.00	1.00			0.91		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (prot)	1736	3471			3174		1579	3325	1553			
Flt Permitted	0.66	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (perm)	1211	3471			3174		1579	3325	1553			
Volume (vph)	228	33	0	0	22	29	19	59	6	0	0	0
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)	253	37	0	0	24	32	21	66	7	0	0	0
Lane Group Flow (vph)	253	37	0	0	56	0	21	66	7	0	0	0
Turn Type	pm+pt						Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases	4						2		2			
Actuated Green, G (s)	66.0	66.0			34.1		35.0	35.0	35.0			
Effective Green, g (s)	67.5	67.5			35.6		36.5	36.5	36.5			
Actuated g/C Ratio	0.61	0.61			0.32		0.33	0.33	0.33			
Clearance Time (s)	4.5	4.5			4.5		4.5	4.5	4.5			
Lane Grp Cap (vph)	881	2130			1027		524	1103	515			
v/s Ratio Prot	c0.08	0.01			0.02			c0.02				
v/s Ratio Perm	c0.10						0.01		0.00			
v/c Ratio	0.29	0.02			0.05		0.04	0.06	0.01			
Uniform Delay, d1	9.7	8.3			25.6		24.9	25.1	24.7			
Progression Factor	0.71	0.13			0.90		1.00	1.00	1.00			
Incremental Delay, d2	0.8	0.0			0.1		0.1	0.1	0.0			
Delay (s)	7.7	1.1			23.2		25.0	25.2	24.7			
Level of Service	A	A			C		C	C	C			
Approach Delay (s)		6.8			23.2			25.1			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.21		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	30.7%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Util. Factor		0.95	1.00	0.97	0.95					0.91	0.86	0.91
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3471	1553	3367	3471					1579	3142	1413
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3471	1553	3367	3471					1579	3142	1413
Volume (vph)	0	920	90	784	421	0	0	0	0	40	580	235
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	1022	100	871	468	0	0	0	0	44	644	261
Lane Group Flow (vph)	0	1022	100	871	468	0	0	0	0	44	644	261
Turn Type			Perm	Prot						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4							6		6
Actuated Green, G (s)		37.5	37.5	32.5	74.5					26.5	26.5	26.5
Effective Green, g (s)		39.0	39.0	34.0	76.0					28.0	28.0	28.0
Actuated g/C Ratio		0.35	0.35	0.31	0.69					0.25	0.25	0.25
Clearance Time (s)		4.5	4.5	4.5	4.5					4.5	4.5	4.5
Lane Grp Cap (vph)		1231	551	1041	2398					402	800	360
v/s Ratio Prot		c0.29		c0.26	0.13						c0.20	
v/s Ratio Perm			0.06							0.03		0.18
v/c Ratio		0.83	0.18	0.84	0.20					0.11	0.80	0.72
Uniform Delay, d1		32.5	24.5	35.4	6.1					31.4	38.4	37.5
Progression Factor		0.92	0.85	0.93	2.59					0.97	0.92	0.94
Incremental Delay, d2		5.5	0.6	5.5	0.1					0.5	8.5	12.0
Delay (s)		35.3	21.4	38.4	15.9					30.9	43.8	47.1
Level of Service		D	C	D	B					C	D	D
Approach Delay (s)		34.0			30.5			0.0			44.1	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	35.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0	3.0	3.0	3.0	3.0			
Lane Util. Factor		0.95			0.95	1.00	0.95	0.95	1.00			
Frt		1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected		1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)		3471			3471	1553	1649	1736	1553			
Flt Permitted		1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)		3471			3471	1553	1649	1736	1553			
Volume (vph)	0	959	0	0	1201	33	4	33	280	0	0	0
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	1066	0	0	1334	37	4	37	311	0	0	0
Lane Group Flow (vph)	0	1066	0	0	1334	37	4	37	311	0	0	0
Turn Type	Prot					Perm	Split		Perm			
Protected Phases	5	2			6		4	4				
Permitted Phases						6			4			
Actuated Green, G (s)		69.1			56.6	56.6	31.9	31.9	31.9			
Effective Green, g (s)		70.6			58.1	58.1	33.4	33.4	33.4			
Actuated g/C Ratio		0.64			0.53	0.53	0.30	0.30	0.30			
Clearance Time (s)		4.5			4.5	4.5	4.5	4.5	4.5			
Lane Grp Cap (vph)		2228			1833	820	501	527	472			
v/s Ratio Prot		c0.31			c0.38		0.00	0.02				
v/s Ratio Perm						0.02			c0.20			
v/c Ratio		0.48			0.73	0.05	0.01	0.07	0.66			
Uniform Delay, d1		10.2			19.9	12.5	26.7	27.3	33.3			
Progression Factor		0.01			0.39	0.25	0.29	0.29	0.25			
Incremental Delay, d2		0.4			1.9	0.1	0.0	0.3	7.0			
Delay (s)		0.6			9.6	3.3	7.7	8.2	15.2			
Level of Service		A			A	A	A	A	B			
Approach Delay (s)		0.6			9.4			14.4			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.68		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0						3.0	3.0
Lane Util. Factor		0.95	1.00		0.95						0.91	0.91
Frt		1.00	0.85		1.00						0.93	0.85
Flt Protected		1.00	1.00		1.00						1.00	1.00
Satd. Flow (prot)		3471	1553		3471						3092	1413
Flt Permitted		1.00	1.00		1.00						1.00	1.00
Satd. Flow (perm)		3471	1553		3471						3092	1413
Volume (vph)	0	585	237	0	288	0	0	0	0	0	187	330
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	650	263	0	320	0	0	0	0	0	208	367
Lane Group Flow (vph)	0	650	263	0	320	0	0	0	0	0	391	184
Turn Type			Perm	Perm						Perm		Perm
Protected Phases		4			8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		53.0	53.0		53.0						48.0	48.0
Effective Green, g (s)		54.5	54.5		54.5						49.5	49.5
Actuated g/C Ratio		0.50	0.50		0.50						0.45	0.45
Clearance Time (s)		4.5	4.5		4.5						4.5	4.5
Lane Grp Cap (vph)		1720	769		1720						1391	636
v/s Ratio Prot		c0.19			0.09						0.13	
v/s Ratio Perm			0.17									c0.13
v/c Ratio		0.38	0.34		0.19						0.28	0.29
Uniform Delay, d1		17.2	16.9		15.4						19.0	19.1
Progression Factor		0.53	1.45		0.67						1.00	1.00
Incremental Delay, d2		0.6	1.1		0.2						0.5	1.1
Delay (s)		9.7	25.6		10.5						19.6	20.3
Level of Service		A	C		B						B	C
Approach Delay (s)		14.3			10.5			0.0			19.8	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.34		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	44.8%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0		
Lane Util. Factor	0.97			0.95		
Frt	1.00			1.00		
Flt Protected	0.95			0.99		
Satd. Flow (prot)	3367			3419		
Flt Permitted	0.95			0.99		
Satd. Flow (perm)	3367			3419		
Volume (vph)	585	0	288	664	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	650	0	320	738	0	0
Lane Group Flow (vph)	650	0	0	1058	0	0
Turn Type			Perm			
Protected Phases	7			2		
Permitted Phases			2			
Actuated Green, G (s)	18.7			27.3		
Effective Green, g (s)	20.2			28.8		
Actuated g/C Ratio	0.37			0.52		
Clearance Time (s)	4.5			4.5		
Lane Grp Cap (vph)	1237			1790		
v/s Ratio Prot	c0.19					
v/s Ratio Perm				c0.31		
v/c Ratio	0.53			0.59		
Uniform Delay, d1	13.6			9.0		
Progression Factor	0.61			0.55		
Incremental Delay, d2	1.5			1.3		
Delay (s)	9.9			6.3		
Level of Service	A			A		
Approach Delay (s)	9.9			6.3	0.0	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0				3.0	3.0
Lane Util. Factor	0.97				0.95	0.95
Frt	1.00				1.00	1.00
Flt Protected	0.95				0.95	0.97
Satd. Flow (prot)	3367				1649	1685
Flt Permitted	0.95				0.95	0.97
Satd. Flow (perm)	3367				1649	1685
Volume (vph)	874	0	0	0	764	197
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	971	0	0	0	849	219
Lane Group Flow (vph)	971	0	0	0	520	548
Turn Type					Perm	
Protected Phases	8					6
Permitted Phases					6	
Actuated Green, G (s)	22.5				23.5	23.5
Effective Green, g (s)	24.0				25.0	25.0
Actuated g/C Ratio	0.44				0.45	0.45
Clearance Time (s)	4.5				4.5	4.5
Lane Grp Cap (vph)	1469				750	766
v/s Ratio Prot	c0.29					
v/s Ratio Perm					0.32	c0.33
v/c Ratio	0.66				0.69	0.72
Uniform Delay, d1	12.3				11.9	12.1
Progression Factor	1.01				0.80	0.80
Incremental Delay, d2	2.2				4.7	5.1
Delay (s)	14.6				14.3	14.9
Level of Service	B				B	B
Approach Delay (s)	14.6		0.0			14.6
Approach LOS	B		A			B

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	63.6%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0	3.0		3.0	3.0			
Lane Util. Factor		0.95			0.95	1.00		0.91	0.91			
Frt		1.00			1.00	0.85		0.92	0.85			
Flt Protected		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)		3471			3471	1553		3044	1413			
Flt Permitted		1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)		3471			3471	1553		3044	1413			
Volume (vph)	0	764	0	0	874	761	0	235	1040	0	0	0
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	849	0	0	971	846	0	261	1156	0	0	0
Lane Group Flow (vph)	0	849	0	0	971	846	0	599	818	0	0	0
Turn Type						Perm	Perm		Free			
Protected Phases		4			8			2				
Permitted Phases						8	2		Free			
Actuated Green, G (s)		73.5			73.5	73.5		27.5	110.0			
Effective Green, g (s)		75.0			75.0	75.0		29.0	110.0			
Actuated g/C Ratio		0.68			0.68	0.68		0.26	1.00			
Clearance Time (s)		4.5			4.5	4.5		4.5				
Lane Grp Cap (vph)		2367			2367	1059		803	1413			
v/s Ratio Prot		0.24			0.28			c0.20				
v/s Ratio Perm						c0.54			0.58			
v/c Ratio		0.36			0.41	0.80		0.75	0.58			
Uniform Delay, d1		7.4			7.7	12.2		37.1	0.0			
Progression Factor		1.31			0.07	0.39		1.00	1.00			
Incremental Delay, d2		0.3			0.3	3.9		6.2	1.7			
Delay (s)		10.0			0.9	8.7		43.4	1.7			
Level of Service		A			A	A		D	A			
Approach Delay (s)		10.0			4.5			19.3			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0				3.0		3.0					3.0
Lane Util. Factor	1.00				0.95		0.97					1.00
Frt	1.00				1.00		1.00					0.85
Flt Protected	0.95				1.00		0.95					1.00
Satd. Flow (prot)	1736				3471		3367					1553
Flt Permitted	0.67				1.00		0.95					1.00
Satd. Flow (perm)	1230				3471		3367					1553
Volume (vph)	144	0	0	0	3	0	707	0	0	0	0	203
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)	160	0	0	0	3	0	786	0	0	0	0	226
Lane Group Flow (vph)	160	0	0	0	3	0	786	0	0	0	0	226
Turn Type	pm+pt						Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4								2	6		6
Actuated Green, G (s)	36.9				23.0		35.6					24.0
Effective Green, g (s)	38.4				24.5		37.1					25.5
Actuated g/C Ratio	0.35				0.22		0.34					0.23
Clearance Time (s)	4.5				4.5		4.5					4.5
Lane Grp Cap (vph)	480				773		1136					360
v/s Ratio Prot	c0.03				0.00		c0.23					
v/s Ratio Perm	c0.08											c0.15
v/c Ratio	0.33				0.00		0.69					0.63
Uniform Delay, d1	25.7				33.3		31.5					38.0
Progression Factor	0.67				1.00		0.80					1.00
Incremental Delay, d2	1.3				0.0		2.4					8.0
Delay (s)	18.5				33.3		27.5					46.0
Level of Service	B				C		C					D
Approach Delay (s)		18.5			33.3			27.5			46.0	
Approach LOS		B			C			C			D	

Intersection Summary			
HCM Average Control Delay	29.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBL	WBT	SBL	SEL	SET	NWL	NWT	NEL
Lane Configurations										
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0		3.0		3.0		
Lane Util. Factor	0.97	0.91	0.97	0.91		0.97		0.97		
Frt	1.00	1.00	1.00	1.00		1.00		1.00		
Flt Protected	0.95	1.00	0.95	1.00		0.95		0.95		
Satd. Flow (prot)	3367	4988	3367	4988		3367		3367		
Flt Permitted	0.95	1.00	0.95	1.00		0.95		0.95		
Satd. Flow (perm)	3367	4988	3367	4988		3367		3367		
Volume (vph)	572	1700	185	2355	0	28	0	552	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	636	1889	206	2617	0	31	0	613	0	0
Lane Group Flow (vph)	636	1889	206	2617	0	31	0	613	0	0
Turn Type	Prot		Prot			custom		custom		
Protected Phases	7	4	3	8		6		2		
Permitted Phases						6		2		
Actuated Green, G (s)	19.2	64.2	10.3	55.3		22.0		22.0		
Effective Green, g (s)	20.7	65.7	11.8	56.8		23.5		23.5		
Actuated g/C Ratio	0.19	0.60	0.11	0.52		0.21		0.21		
Clearance Time (s)	4.5	4.5	4.5	4.5		4.5		4.5		
Lane Grp Cap (vph)	634	2979	361	2576		719		719		
v/s Ratio Prot	c0.19	0.38	0.06	c0.52		0.01		c0.18		
v/s Ratio Perm										
v/c Ratio	1.00	0.63	0.57	1.02		0.04		0.85		
Uniform Delay, d1	44.6	14.4	46.7	26.6		34.3		41.6		
Progression Factor	1.18	0.36	1.49	0.40		1.00		1.00		
Incremental Delay, d2	24.7	0.5	1.7	13.4		0.1		12.2		
Delay (s)	77.5	5.6	71.5	24.1		34.4		53.8		
Level of Service	E	A	E	C		C		D		
Approach Delay (s)		23.7		27.5	0.0		34.4		53.8	0.0
Approach LOS		C		C	A		C		D	A

Intersection Summary			
HCM Average Control Delay	28.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	10	10	12	10	10	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1458	2908		1458	2909		1458	2916	1398	1458	2819	
Flt Permitted	0.18	1.00		0.54	1.00		0.21	1.00	1.00	0.43	1.00	
Satd. Flow (perm)	273	2908		833	2909		316	2916	1398	656	2819	
Volume (vph)	381	203	4	392	615	9	4	304	72	19	415	118
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)	423	226	4	436	683	10	4	338	80	21	461	131
Lane Group Flow (vph)	423	230	0	436	693	0	4	338	80	21	592	0
Parking (#/hr)												15
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	3	8		7	4		5	2	7	1	6	
Permitted Phases	8			4			2		2	6		
Actuated Green, G (s)	61.4	28.9		62.6	29.5		30.0	26.0	59.1	30.0	26.0	
Effective Green, g (s)	64.4	30.4		65.6	31.0		33.0	27.5	62.1	33.0	27.5	
Actuated g/C Ratio	0.59	0.28		0.60	0.28		0.30	0.25	0.56	0.30	0.25	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	526	804		693	820		152	729	827	237	705	
v/s Ratio Prot	c0.25	0.08		c0.20	c0.24		0.00	0.12	0.03	c0.00	c0.21	
v/s Ratio Perm	0.22			0.18			0.01		0.03	0.02		
v/c Ratio	0.80	0.29		0.63	0.85		0.03	0.46	0.10	0.09	0.84	
Uniform Delay, d1	22.8	31.3		12.9	37.2		28.0	35.0	11.0	27.5	39.2	
Progression Factor	1.00	1.00		0.24	0.66		0.74	0.59	0.00	0.49	0.62	
Incremental Delay, d2	12.3	0.9		3.6	8.9		0.3	2.1	0.2	0.6	9.8	
Delay (s)	35.1	32.2		6.7	33.5		21.1	22.7	0.2	14.0	34.2	
Level of Service	D	C		A	C		C	C	A	B	C	
Approach Delay (s)		34.1			23.1			18.4			33.5	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM Average Control Delay	27.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	12	12	10	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1562	3075		1562	3124		1458	2916	1398	1562	2846	
Flt Permitted	0.35	1.00		0.18	1.00		0.31	1.00	1.00	0.31	1.00	
Satd. Flow (perm)	571	3075		292	3124		477	2916	1398	510	2846	
Volume (vph)	126	685	79	99	521	0	35	452	238	34	368	70
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)	140	761	88	110	579	0	39	502	264	38	409	78
Lane Group Flow (vph)	140	849	0	110	579	0	39	502	264	38	487	0
Parking (#/hr)												15
Turn Type	pm+pt			pm+pt			pm+pt		pm+ov	pm+pt		
Protected Phases	5	2		1	6		7	4	1	3	8	
Permitted Phases	2			6			4		4	8		
Actuated Green, G (s)	53.6	41.5		57.0	43.2		37.1	29.3	43.1	36.3	28.9	
Effective Green, g (s)	56.6	43.0		60.0	44.7		40.1	30.8	46.1	39.3	30.4	
Actuated g/C Ratio	0.51	0.39		0.55	0.41		0.36	0.28	0.42	0.36	0.28	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	416	1202		336	1269		257	816	624	267	787	
v/s Ratio Prot	0.04	c0.28		c0.05	0.19		c0.01	c0.17	c0.06	0.01	0.17	
v/s Ratio Perm	0.13			0.13			0.04		0.13	0.04		
v/c Ratio	0.34	0.71		0.33	0.46		0.15	0.62	0.42	0.14	0.62	
Uniform Delay, d1	14.7	28.2		14.7	23.8		23.4	34.4	22.6	23.8	34.7	
Progression Factor	1.00	1.00		1.08	0.40		0.72	0.91	2.31	0.38	0.28	
Incremental Delay, d2	2.2	3.5		2.5	1.1		1.0	2.7	1.6	1.1	3.6	
Delay (s)	16.8	31.7		18.4	10.6		17.8	33.9	53.9	10.1	13.2	
Level of Service	B	C		B	B		B	C	D	B	B	
Approach Delay (s)		29.6			11.9			39.7			12.9	
Approach LOS		C			B			D			B	

Intersection Summary			
HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0				3.0			3.0	
Lane Util. Factor	1.00	1.00		1.00				0.95			0.95	
Frt	1.00	1.00		1.00				0.99			1.00	
Flt Protected	0.95	1.00		0.95				1.00			1.00	
Satd. Flow (prot)	1736	1827		1736				3427			3471	
Flt Permitted	0.95	1.00		0.76				1.00			1.00	
Satd. Flow (perm)	1736	1827		1380				3427			3471	
Volume (vph)	169	4	0	66	0	0	0	529	49	0	463	0
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)	188	4	0	73	0	0	0	588	54	0	514	0
Lane Group Flow (vph)	188	4	0	73	0	0	0	642	0	0	514	0
Turn Type	Perm			custom		custom				pm+pt		
Protected Phases		4						2		1	6	
Permitted Phases	4			8		8				6		
Actuated Green, G (s)	37.0	37.0		37.0				40.5			64.0	
Effective Green, g (s)	38.5	38.5		38.5				42.0			65.5	
Actuated g/C Ratio	0.35	0.35		0.35				0.38			0.60	
Clearance Time (s)	4.5	4.5		4.5				4.5			4.5	
Lane Grp Cap (vph)	608	639		483				1308			2067	
v/s Ratio Prot		0.00						c0.19			c0.15	
v/s Ratio Perm	c0.11			0.05								
v/c Ratio	0.31	0.01		0.15				0.49			0.25	
Uniform Delay, d1	26.1	23.3		24.5				25.9			10.6	
Progression Factor	1.00	1.00		1.00				0.19			0.00	
Incremental Delay, d2	1.3	0.0		0.7				1.1			0.3	
Delay (s)	27.4	23.3		25.2				6.0			0.3	
Level of Service	C	C		C				A			A	
Approach Delay (s)		27.3			25.2			6.0			0.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.37		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	35.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	10	12	10	10
Total Lost time (s)							3.0	3.0			3.0	
Lane Util. Factor							1.00	0.95			0.95	
Frt							1.00	1.00			1.00	
Flt Protected							0.95	1.00			1.00	
Satd. Flow (prot)							1458	2650			2916	
Flt Permitted							0.31	1.00			1.00	
Satd. Flow (perm)							473	2650			2916	
Volume (vph)	0	0	0	0	0	0	82	754	0	0	538	0
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	0	0	0	91	838	0	0	598	0
Lane Group Flow (vph)	0	0	0	0	0	0	91	838	0	0	598	0
Bus Blockages (#/hr)	0	0	0	0	0	0	0	2	0	0	0	0
Parking (#/hr)				15		15		15				15
Turn Type				Perm			pm+pt					
Protected Phases					4		5	2			6	
Permitted Phases				4			2					
Actuated Green, G (s)							66.0	66.0			44.5	
Effective Green, g (s)							67.5	67.5			46.0	
Actuated g/C Ratio							0.61	0.61			0.42	
Clearance Time (s)							4.5	4.5			4.5	
Lane Grp Cap (vph)							456	1626			1219	
v/s Ratio Prot							0.03	c0.32			0.21	
v/s Ratio Perm							0.09					
v/c Ratio							0.20	0.52			0.49	
Uniform Delay, d1							9.7	12.0			23.4	
Progression Factor							0.88	0.79			0.85	
Incremental Delay, d2							0.9	1.1			1.3	
Delay (s)							9.5	10.6			21.2	
Level of Service							A	B			C	
Approach Delay (s)		0.0			0.0			10.5			21.2	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Cycle Length (s)	110.0	Sum of lost time (s)	42.5
Intersection Capacity Utilization	30.6%	ICU Level of Service	A
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	0.99		1.00	0.86		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1736	3378		1736	3430		1736	2991		1736	3433	
Flt Permitted	0.23	1.00		0.17	1.00		0.65	1.00		0.15	1.00	
Satd. Flow (perm)	424	3378		315	3430		1196	2991		266	3433	
Volume (vph)	1	420	92	225	415	36	64	54	637	1	114	9
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)	1	467	102	250	461	40	71	60	708	1	127	10
Lane Group Flow (vph)	1	569	0	250	501	0	71	768	0	1	137	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	44.0	22.0		44.0	22.0		48.0	26.0		48.0	26.0	
Effective Green, g (s)	47.0	23.5		47.0	23.5		51.0	27.5		51.0	27.5	
Actuated g/C Ratio	0.43	0.21		0.43	0.21		0.46	0.25		0.46	0.25	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	461	722		438	733		670	748		437	858	
v/s Ratio Prot	0.00	c0.17		c0.12	0.15		c0.02	c0.26		0.00	0.04	
v/s Ratio Perm	0.00			0.12			0.03			0.00		
v/c Ratio	0.00	0.79		0.57	0.68		0.11	1.03		0.00	0.16	
Uniform Delay, d1	18.7	40.9		22.4	39.8		16.5	41.2		17.8	32.2	
Progression Factor	1.00	1.00		0.60	0.65		0.50	2.59		0.74	0.56	
Incremental Delay, d2	0.0	8.5		5.2	5.0		0.3	37.7		0.0	0.4	
Delay (s)	18.7	49.4		18.7	31.0		8.6	144.6		13.2	18.4	
Level of Service	B	D		B	C		A	F		B	B	
Approach Delay (s)		49.4			26.9			133.0			18.3	
Approach LOS		D			C			F			B	

Intersection Summary			
HCM Average Control Delay	70.7	HCM Level of Service	E
HCM Volume to Capacity ratio	0.64		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0						3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00						1.00	0.95		1.00	0.95	
Frt	1.00						1.00	1.00		1.00	0.97	
Flt Protected	0.95						0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1736						1736	3471		1736	3354	
Flt Permitted	0.76						0.58	1.00		0.64	1.00	
Satd. Flow (perm)	1383						1054	3471		1168	3354	
Volume (vph)	79	0	0	0	0	0	1	143	0	48	164	48
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)	88	0	0	0	0	0	1	159	0	53	182	53
Lane Group Flow (vph)	88	0	0	0	0	0	1	159	0	53	235	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	38.0						58.2	38.2		58.8	38.5	
Effective Green, g (s)	39.5						61.2	39.7		61.8	40.0	
Actuated g/C Ratio	0.36						0.56	0.36		0.56	0.36	
Clearance Time (s)	4.5						4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	497						720	1253		769	1220	
v/s Ratio Prot							0.00	0.05		c0.01	c0.07	
v/s Ratio Perm	c0.06						0.00			0.03		
v/c Ratio	0.18						0.00	0.13		0.07	0.19	
Uniform Delay, d1	24.1						10.8	23.5		10.9	24.0	
Progression Factor	1.00						1.04	1.05		0.37	0.22	
Incremental Delay, d2	0.8						0.0	0.2		0.2	0.4	
Delay (s)	24.9						11.3	24.8		4.2	5.7	
Level of Service	C						B	C		A	A	
Approach Delay (s)		24.9			0.0			24.7			5.4	
Approach LOS		C			A			C			A	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.16		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	18.3%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0					3.0	3.0			3.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.85					1.00	0.97			1.00	
Flt Protected		1.00					0.95	1.00			1.00	
Satd. Flow (prot)		1553					1736	3368			3471	
Flt Permitted		1.00					0.61	1.00			1.00	
Satd. Flow (perm)		1553					1112	3368			3471	
Volume (vph)	0	0	56	0	0	0	32	178	44	0	176	0
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	62	0	0	0	36	198	49	0	196	0
Lane Group Flow (vph)	0	62	0	0	0	0	36	247	0	0	196	0
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		38.0					58.5	38.5			38.5	
Effective Green, g (s)		39.5					61.5	40.0			40.0	
Actuated g/C Ratio		0.36					0.56	0.36			0.36	
Clearance Time (s)		4.5					4.5	4.5			4.5	
Lane Grp Cap (vph)		558					744	1225			1262	
v/s Ratio Prot		c0.04					c0.01	c0.07			0.06	
v/s Ratio Perm							0.02					
v/c Ratio		0.11					0.05	0.20			0.16	
Uniform Delay, d1		23.5					10.9	24.0			23.6	
Progression Factor		1.00					0.78	0.73			0.45	
Incremental Delay, d2		0.4					0.1	0.4			0.3	
Delay (s)		23.9					8.7	18.0			10.8	
Level of Service		C					A	B			B	
Approach Delay (s)		23.9			0.0			16.8			10.8	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.13		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	17.5%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	10	10	12	10	12	12	12	12	12
Total Lost time (s)		3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Util. Factor		0.95		1.00	0.95			0.95	1.00	1.00	0.95	
Frt		1.00		1.00	0.89			1.00	0.85	1.00	0.98	
Flt Protected		1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3240		1620	2868			3471	1553	1736	3408	
Flt Permitted		1.00		0.95	1.00			1.00	1.00	0.64	1.00	
Satd. Flow (perm)		3240		1620	2868			3471	1553	1176	3408	
Volume (vph)	0	193	0	105	121	391	0	48	175	454	66	9
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	214	0	117	134	434	0	53	194	504	73	10
Lane Group Flow (vph)	0	214	0	117	568	0	0	53	194	504	83	0
Turn Type	Prot			Prot			pm+pt		Perm	pm+pt		
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases							2		2	6		
Actuated Green, G (s)		23.0		15.6	33.6			23.6	23.6	57.9	48.4	
Effective Green, g (s)		24.5		17.1	35.1			25.1	25.1	59.4	49.9	
Actuated g/C Ratio		0.22		0.16	0.32			0.23	0.23	0.54	0.45	
Clearance Time (s)		4.5		4.5	4.5			4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)		722		252	915			792	354	794	1546	
v/s Ratio Prot		c0.07		0.07	c0.20			0.02		c0.18	0.02	
v/s Ratio Perm									0.12	c0.16		
v/c Ratio		0.30		0.46	0.62			0.07	0.55	0.63	0.05	
Uniform Delay, d1		35.6		42.3	31.8			33.3	37.4	16.5	16.8	
Progression Factor		1.00		0.95	1.47			0.43	0.85	1.00	1.00	
Incremental Delay, d2		1.0		6.0	3.1			0.2	6.0	3.8	0.1	
Delay (s)		36.6		46.2	49.9			14.5	37.8	20.3	16.9	
Level of Service		D		D	D			B	D	C	B	
Approach Delay (s)		36.6			49.2			32.8			19.8	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM Average Control Delay	35.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.61		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	B
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.86	1.00	0.97	0.91		0.97	0.91	0.91	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.91	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	6285	1553	3367	4988		3367	3020	1413	3367	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	6285	1553	3367	4988		3367	3020	1413	3367	3471	1553
Volume (vph)	14	2137	269	729	2709	0	272	200	688	16	127	7
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)	16	2374	299	810	3010	0	302	222	764	18	141	8
Lane Group Flow (vph)	16	2374	299	810	3010	0	302	572	414	18	141	8
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.5	41.0	53.5	24.5	60.0		12.5	22.5	47.0	4.0	14.0	19.5
Effective Green, g (s)	7.0	42.5	56.5	26.0	61.5		14.0	24.0	50.0	5.5	15.5	22.5
Actuated g/C Ratio	0.06	0.39	0.51	0.24	0.56		0.13	0.22	0.45	0.05	0.14	0.20
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	214	2428	840	796	2789		429	659	681	168	489	360
v/s Ratio Prot	0.00	0.38	0.05	c0.24	c0.60		c0.09	c0.19	0.14	0.01	0.04	0.00
v/s Ratio Perm			0.15						0.15			0.00
v/c Ratio	0.07	0.98	0.36	1.02	1.08		0.70	0.87	0.61	0.11	0.29	0.02
Uniform Delay, d1	48.5	33.3	15.9	42.0	24.2		46.0	41.5	22.6	49.9	42.3	35.0
Progression Factor	1.00	1.00	1.00	1.00	1.12		1.46	0.69	0.28	1.00	1.00	1.00
Incremental Delay, d2	0.7	13.7	1.2	27.6	39.8		4.6	7.6	1.9	1.3	1.5	0.1
Delay (s)	49.1	47.0	17.1	69.4	67.0		71.7	36.4	8.2	51.2	43.8	35.1
Level of Service	D	D	B	E	E		E	D	A	D	D	D
Approach Delay (s)		43.7			67.5			35.6			44.2	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	53.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	4988	1553	3367	4988	1553	3367	3471	1553	3367	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	4988	1553	3367	4988	1553	3367	3471	1553	3367	3471	1553
Volume (vph)	27	1526	175	261	2235	528	341	109	387	830	121	30
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	1696	194	290	2483	587	379	121	430	922	134	33
Lane Group Flow (vph)	30	1696	194	290	2483	587	379	121	430	922	134	33
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.5	43.5	63.0	11.5	50.5	77.0	19.5	10.5	22.0	26.5	17.5	22.0
Effective Green, g (s)	6.0	45.0	66.0	13.0	52.0	80.0	21.0	12.0	25.0	28.0	19.0	25.0
Actuated g/C Ratio	0.05	0.41	0.60	0.12	0.47	0.73	0.19	0.11	0.23	0.25	0.17	0.23
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	184	2041	974	398	2358	1172	643	379	395	857	600	395
v/s Ratio Prot	0.01	0.34	0.04	0.09	c0.50	0.13	0.11	0.03	c0.13	c0.27	0.04	0.00
v/s Ratio Perm			0.09			0.25			0.15			0.02
v/c Ratio	0.16	0.83	0.20	0.73	1.05	0.50	0.59	0.32	1.09	1.08	0.22	0.08
Uniform Delay, d1	49.6	29.1	10.0	46.8	29.0	6.4	40.6	45.2	42.5	41.0	39.2	33.5
Progression Factor	1.14	0.27	1.53	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	3.2	0.4	11.1	34.4	1.5	3.9	2.2	71.2	53.2	0.9	0.4
Delay (s)	57.9	11.2	15.6	57.9	63.4	8.0	44.5	47.4	113.7	94.2	40.0	33.9
Level of Service	E	B	B	E	E	A	D	D	F	F	D	C
Approach Delay (s)		12.4			53.2			76.9			85.7	
Approach LOS		B			D			E			F	

Intersection Summary			
HCM Average Control Delay	50.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.7%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	3.0	
Lane Util. Factor				0.95	0.95	
Frt				1.00	1.00	
Flt Protected				1.00	1.00	
Satd. Flow (prot)				3471	3468	
Flt Permitted				1.00	1.00	
Satd. Flow (perm)				3471	3468	
Volume (vph)	0	0	0	652	490	3
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	724	544	3
Lane Group Flow (vph)	0	0	0	724	547	0
Turn Type		custom	pm+pt			
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)				33.0	23.5	
Effective Green, g (s)				34.5	25.0	
Actuated g/C Ratio				0.53	0.38	
Clearance Time (s)				4.5	4.5	
Lane Grp Cap (vph)				1842	1334	
v/s Ratio Prot				c0.21	0.16	
v/s Ratio Perm						
v/c Ratio				0.39	0.41	
Uniform Delay, d1				9.0	14.6	
Progression Factor				1.00	1.00	
Incremental Delay, d2				0.6	0.9	
Delay (s)				9.7	15.5	
Level of Service				A	B	
Approach Delay (s)	0.0			9.7	15.5	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Cycle Length (s)	65.0	Sum of lost time (s)	30.5
Intersection Capacity Utilization	23.4%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.91	0.95	1.00	0.97	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3367	4988	3471	1553	3367	1553
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3367	4988	3471	1553	3367	1553
Volume (vph)	283	1522	1492	370	346	144
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	314	1691	1658	411	384	160
Lane Group Flow (vph)	314	1691	1658	411	384	160
Turn Type	Prot			pm+ov		Free
Protected Phases	7		8	6	6	
Permitted Phases		4		8		Free
Actuated Green, G (s)	13.5	78.5	60.5	83.0	22.5	110.0
Effective Green, g (s)	15.0	80.0	62.0	86.0	24.0	110.0
Actuated g/C Ratio	0.14	0.73	0.56	0.78	0.22	1.00
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	459	3628	1956	1257	735	1553
v/s Ratio Prot	c0.09		c0.48	0.07	c0.11	
v/s Ratio Perm		0.34		0.19		0.10
v/c Ratio	0.68	0.47	0.85	0.33	0.52	0.10
Uniform Delay, d1	45.2	6.2	20.1	3.5	37.9	0.0
Progression Factor	1.03	0.61	0.59	0.84	1.00	1.00
Incremental Delay, d2	7.1	0.4	2.0	0.3	2.6	0.1
Delay (s)	53.9	4.2	13.8	3.2	40.6	0.1
Level of Service	D	A	B	A	D	A
Approach Delay (s)		12.0	11.7		28.7	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0	3.0	3.0
Lane Util. Factor	0.97			0.95	0.95	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	0.95			1.00	1.00	1.00
Satd. Flow (prot)	3367			3471	3471	1553
Flt Permitted	0.95			1.00	1.00	1.00
Satd. Flow (perm)	3367			3471	3471	1553
Volume (vph)	220	0	0	422	437	322
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	244	0	0	469	486	358
Lane Group Flow (vph)	244	0	0	469	486	358
Turn Type		Perm	pm+pt			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	23.0			33.0	23.5	23.5
Effective Green, g (s)	24.5			34.5	25.0	25.0
Actuated g/C Ratio	0.38			0.53	0.38	0.38
Clearance Time (s)	4.5			4.5	4.5	4.5
Lane Grp Cap (vph)	1269			1842	1335	597
v/s Ratio Prot	c0.07			c0.14	0.14	
v/s Ratio Perm						c0.23
v/c Ratio	0.19			0.25	0.36	0.60
Uniform Delay, d1	13.6			8.3	14.3	16.0
Progression Factor	1.00			1.00	1.00	1.00
Incremental Delay, d2	0.3			0.3	0.8	4.4
Delay (s)	13.9			8.6	15.1	20.4
Level of Service	B			A	B	C
Approach Delay (s)	13.9			8.6	17.3	
Approach LOS	B			A	B	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.38		
Cycle Length (s)	65.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	27.1%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Util. Factor		0.95	1.00	1.00	0.95						0.91	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						1.00	1.00
Satd. Flow (prot)		3471	1553	1736	3471						3325	1553
Flt Permitted		1.00	1.00	0.08	1.00						1.00	1.00
Satd. Flow (perm)		3471	1553	141	3471						3325	1553
Volume (vph)	0	1314	203	258	1246	0	0	0	0	0	27	309
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	1460	226	287	1384	0	0	0	0	0	30	343
Lane Group Flow (vph)	0	1460	226	287	1384	0	0	0	0	0	30	343
Turn Type			Perm	pm+pt						Perm		Perm
Protected Phases		4		3	8						6	
Permitted Phases			4	8						6		6
Actuated Green, G (s)		57.1	57.1	70.4	53.0						22.0	22.0
Effective Green, g (s)		58.6	58.6	73.4	54.5						23.5	23.5
Actuated g/C Ratio		0.53	0.53	0.67	0.50						0.21	0.21
Clearance Time (s)		4.5	4.5	4.5	4.5						4.5	4.5
Lane Grp Cap (vph)		1849	827	368	1720						710	332
v/s Ratio Prot		c0.42		c0.13	0.40						0.01	
v/s Ratio Perm			0.15	0.39								c0.22
v/c Ratio		0.79	0.27	0.78	0.80						0.04	1.03
Uniform Delay, d1		20.7	14.1	29.7	23.3						34.3	43.2
Progression Factor		1.00	1.00	1.65	0.23						0.57	0.43
Incremental Delay, d2		3.5	0.8	7.3	1.9						0.1	57.2
Delay (s)		24.3	14.9	56.1	7.4						19.8	75.7
Level of Service		C	B	E	A						B	E
Approach Delay (s)		23.0			15.7			0.0			71.2	
Approach LOS		C			B			A			E	

Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Util. Factor	1.00	0.95			0.95		0.91	0.91	1.00			
Frt	1.00	1.00			1.00		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.97	1.00			
Satd. Flow (prot)	1736	3471			3471		1579	3223	1553			
Flt Permitted	0.07	1.00			1.00		0.95	0.97	1.00			
Satd. Flow (perm)	127	3471			3471		1579	3223	1553			
Volume (vph)	324	989	0	0	1418	0	85	24	240	0	0	0
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)	360	1099	0	0	1576	0	94	27	267	0	0	0
Lane Group Flow (vph)	360	1099	0	0	1576	0	47	74	267	0	0	0
Turn Type	pm+pt					Perm	Perm		Perm			
Protected Phases	7	4			8			2				
Permitted Phases	4					8	2		2			
Actuated Green, G (s)	78.6	57.1			53.0		22.0	22.0	22.0			
Effective Green, g (s)	80.5	58.6			54.5		23.5	23.5	23.5			
Actuated g/C Ratio	0.73	0.53			0.50		0.21	0.21	0.21			
Clearance Time (s)	4.5	4.5			4.5		4.5	4.5	4.5			
Lane Grp Cap (vph)	429	1849			1720		337	689	332			
v/s Ratio Prot	c0.18	0.32			c0.45							
v/s Ratio Perm	0.44						0.03	0.02	c0.17			
v/c Ratio	0.84	0.59			0.92		0.14	0.11	0.80			
Uniform Delay, d1	33.3	17.6			25.6		35.1	34.8	41.1			
Progression Factor	1.97	0.11			1.00		1.00	1.00	1.00			
Incremental Delay, d2	11.1	0.8			9.2		0.9	0.3	18.4			
Delay (s)	76.9	2.7			34.8		35.9	35.1	59.5			
Level of Service	E	A			C		D	D	E			
Approach Delay (s)		21.0			34.8			52.0			0.0	
Approach LOS		C			C			D			A	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	C

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0		3.0	3.0		3.0	3.0			3.0	
Lane Util. Factor		0.95		1.00	0.95		1.00	1.00			1.00	
Frt		0.96		1.00	1.00		1.00	0.89			1.00	
Flt Protected		1.00		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		3337		1736	3471		1736	1634			1827	
Flt Permitted		1.00		0.54	1.00		0.73	1.00			1.00	
Satd. Flow (perm)		3337		992	3471		1332	1634			1827	
Volume (vph)	0	146	50	96	160	0	48	22	51	0	39	0
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	162	56	107	178	0	53	24	57	0	43	0
Lane Group Flow (vph)	0	218	0	107	178	0	53	81	0	0	43	0
Turn Type	pm+pt			pm+pt			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		37.0		63.0	40.5		37.0	37.0			37.0	
Effective Green, g (s)		38.5		65.5	42.0		38.5	38.5			38.5	
Actuated g/C Ratio		0.35		0.60	0.38		0.35	0.35			0.35	
Clearance Time (s)		4.5		4.5	4.5		4.5	4.5			4.5	
Lane Grp Cap (vph)		1168		753	1325		466	572			639	
v/s Ratio Prot		c0.07		c0.03	0.05			c0.05			0.02	
v/s Ratio Perm				0.05			0.04					
v/c Ratio		0.19		0.14	0.13		0.11	0.14			0.07	
Uniform Delay, d1		24.9		9.7	22.2		24.2	24.4			23.8	
Progression Factor		1.00		1.00	1.00		1.02	1.04			1.00	
Incremental Delay, d2		0.4		0.4	0.2		0.5	0.5			0.2	
Delay (s)		25.2		10.1	22.4		25.2	25.9			24.0	
Level of Service		C		B	C		C	C			C	
Approach Delay (s)		25.2			17.8			25.6			24.0	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.16		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	26.9%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.95			0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00			0.98	
Satd. Flow (prot)	1736	1827		1736	1827	1553		1733			1732	
Flt Permitted	0.54	1.00		0.49	1.00	1.00		1.00			0.85	
Satd. Flow (perm)	982	1827		894	1827	1553		1733			1511	
Volume (vph)	18	283	0	22	241	80	0	23	14	93	53	38
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	314	0	24	268	89	0	26	16	103	59	42
Lane Group Flow (vph)	20	314	0	24	268	89	0	42	0	0	204	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	23.0	23.0		23.0	23.0	23.0		23.0			23.0	
Effective Green, g (s)	24.5	24.5		24.5	24.5	24.5		24.5			24.5	
Actuated g/C Ratio	0.45	0.45		0.45	0.45	0.45		0.45			0.45	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Lane Grp Cap (vph)	437	814		398	814	692		772			673	
v/s Ratio Prot		c0.17			0.15			0.02				
v/s Ratio Perm	0.02			0.03		0.06					c0.14	
v/c Ratio	0.05	0.39		0.06	0.33	0.13		0.05			0.30	
Uniform Delay, d1	8.6	10.2		8.7	9.9	9.0		8.7			9.8	
Progression Factor	1.00	1.00		0.94	0.94	0.83		1.00			0.83	
Incremental Delay, d2	0.2	1.4		0.3	1.1	0.4		0.1			1.2	
Delay (s)	8.8	11.6		8.4	10.4	7.9		8.8			9.3	
Level of Service	A	B		A	B	A		A			A	
Approach Delay (s)		11.4			9.7			8.8			9.3	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	10.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.34		
Cycle Length (s)	55.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	41.3%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	1.00	1.00	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1736	3471		1736	3471	1553		3471	1553	1736	3124	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.76	1.00	
Satd. Flow (perm)	1736	3471		1736	3471	1553		3471	1553	1383	3124	
Volume (vph)	123	1311	0	213	1389	79	0	1	17	177	68	137
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)	137	1457	0	237	1543	88	0	1	19	197	76	152
Lane Group Flow (vph)	137	1457	0	237	1543	88	0	1	19	197	228	0
Turn Type	Prot		pm+ov	Prot		pm+ov	pm+pt		pm+ov	pm+pt		
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)	10.7	48.5		16.5	54.3	58.3		23.0	39.5	27.0	23.0	
Effective Green, g (s)	12.2	50.0		18.0	55.8	61.3		24.5	42.5	30.0	24.5	
Actuated g/C Ratio	0.11	0.45		0.16	0.51	0.56		0.22	0.39	0.27	0.22	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	193	1578		284	1761	908		773	642	395	696	
v/s Ratio Prot	0.08	c0.42		c0.14	0.44	0.00		0.00	0.00	c0.02	0.07	
v/s Ratio Perm						0.05			0.01	c0.11		
v/c Ratio	0.71	0.92		0.83	0.88	0.10		0.00	0.03	0.50	0.33	
Uniform Delay, d1	47.2	28.2		44.6	24.0	11.4		33.2	20.9	33.1	35.8	
Progression Factor	1.00	1.00		0.98	0.97	1.30		1.00	1.00	1.00	1.00	
Incremental Delay, d2	19.8	10.5		12.1	3.0	0.1		0.0	0.1	4.4	1.3	
Delay (s)	67.0	38.7		55.7	26.3	15.0		33.2	21.0	37.5	37.1	
Level of Service	E	D		E	C	B		C	C	D	D	
Approach Delay (s)		41.2			29.5			21.6			37.3	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM Average Control Delay	35.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0			3.0	3.0	3.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3462			3466	1736	1553
Flt Permitted	1.00			0.84	0.95	1.00
Satd. Flow (perm)	3462			2920	1736	1553
Volume (vph)	1203	21	40	1187	21	12
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1337	23	44	1319	23	13
Lane Group Flow (vph)	1360	0	0	1363	23	13
Turn Type			Perm			Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Actuated Green, G (s)	71.7			71.7	29.3	29.3
Effective Green, g (s)	73.2			73.2	30.8	30.8
Actuated g/C Ratio	0.67			0.67	0.28	0.28
Clearance Time (s)	4.5			4.5	4.5	4.5
Lane Grp Cap (vph)	2304			1943	486	435
v/s Ratio Prot	0.39				c0.01	
v/s Ratio Perm				c0.47		0.01
v/c Ratio	0.59			0.70	0.05	0.03
Uniform Delay, d1	10.1			11.5	28.9	28.8
Progression Factor	0.16			0.69	0.41	0.17
Incremental Delay, d2	1.0			1.7	0.2	0.1
Delay (s)	2.6			9.7	12.2	5.1
Level of Service	A			A	B	A
Approach Delay (s)	2.6			9.7	9.6	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	6.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0			3.0				
Lane Util. Factor		0.95			0.95			1.00				
Frt		0.95			1.00			0.94				
Flt Protected		1.00			0.98			0.98				
Satd. Flow (prot)		3287			3395			1672				
Flt Permitted		0.94			0.51			0.85				
Satd. Flow (perm)		3100			1775			1462				
Volume (vph)	10	575	314	373	459	0	254	42	266	0	0	0
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)	11	639	349	414	510	0	282	47	296	0	0	0
Lane Group Flow (vph)	0	999	0	0	924	0	0	625	0	0	0	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		56.5			56.5			44.5				
Effective Green, g (s)		58.0			58.0			46.0				
Actuated g/C Ratio		0.53			0.53			0.42				
Clearance Time (s)		4.5			4.5			4.5				
Lane Grp Cap (vph)		1635			936			611				
v/s Ratio Prot												
v/s Ratio Perm		0.32			c0.52			c0.43				
v/c Ratio		0.61			2.19dl			1.02				
Uniform Delay, d1		18.1			25.6			32.0				
Progression Factor		0.22			1.00			0.62				
Incremental Delay, d2		1.6			26.5			33.8				
Delay (s)		5.7			52.1			53.7				
Level of Service		A			D			D				
Approach Delay (s)		5.7			52.1			53.7			0.0	
Approach LOS		A			D			D			A	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	1.00		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	101.5%	ICU Level of Service	F

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
c Critical Lane Group

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1736	1553	3471	1553	1736	1827
Flt Permitted	0.95	1.00	1.00	1.00	0.27	1.00
Satd. Flow (perm)	1736	1553	3471	1553	487	1827
Volume (vph)	73	70	520	101	111	440
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	81	78	578	112	123	489
Lane Group Flow (vph)	81	78	578	112	123	489
Turn Type		custom		custom	pm+pt	
Protected Phases	8	8	6	6	5	2
Permitted Phases	8	8	6	8	2	2
Actuated Green, G (s)	31.0	31.0	34.5	65.5	70.0	70.0
Effective Green, g (s)	32.5	32.5	36.0	68.5	71.5	71.5
Actuated g/C Ratio	0.30	0.30	0.33	0.62	0.65	0.65
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	513	459	1136	1009	686	1188
v/s Ratio Prot	0.05	c0.05	c0.17	0.04	0.05	c0.27
v/s Ratio Perm				0.04	0.06	
v/c Ratio	0.16	0.17	0.51	0.11	0.18	0.41
Uniform Delay, d1	28.6	28.7	29.9	8.4	8.5	9.2
Progression Factor	1.00	1.00	1.00	1.00	0.45	0.80
Incremental Delay, d2	0.7	0.8	1.6	0.2	0.5	1.0
Delay (s)	29.3	29.5	31.5	8.6	4.3	8.3
Level of Service	C	C	C	A	A	A
Approach Delay (s)	29.4		27.8			7.5
Approach LOS	C		C			A

Intersection Summary			
HCM Average Control Delay	19.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	37.3%	ICU Level of Service	A

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		3.0				3.0	3.0			3.0	
Lane Util. Factor	1.00		1.00				1.00	0.95			0.95	
Frt	1.00		0.85				1.00	1.00			1.00	
Flt Protected	0.95		1.00				0.95	1.00			1.00	
Satd. Flow (prot)	1736		1553				1736	3471			3471	
Flt Permitted	0.76		1.00				0.13	1.00			1.00	
Satd. Flow (perm)	1383		1553				242	3471			3471	
Volume (vph)	1	0	449	0	0	0	274	376	0	0	804	0
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)	1	0	499	0	0	0	304	418	0	0	893	0
Lane Group Flow (vph)	1	0	499	0	0	0	304	418	0	0	893	0
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Actuated Green, G (s)	34.8		34.8				66.2	57.7			38.1	
Effective Green, g (s)	36.3		36.3				67.7	59.2			39.6	
Actuated g/C Ratio	0.33		0.33				0.62	0.54			0.36	
Clearance Time (s)	4.5		4.5				4.5	4.5			4.5	
Lane Grp Cap (vph)	456		512				490	1868			1250	
v/s Ratio Prot							c0.14	0.12			c0.26	
v/s Ratio Perm	0.00		c0.32				0.24					
v/c Ratio	0.00		0.97				0.62	0.22			0.71	
Uniform Delay, d1	24.7		36.4				19.5	13.3			30.3	
Progression Factor	1.00		1.00				0.33	0.33			0.76	
Incremental Delay, d2	0.0		34.0				5.6	0.3			2.4	
Delay (s)	24.7		70.4				12.0	4.7			25.5	
Level of Service	C		E				B	A			C	
Approach Delay (s)		70.3			0.0			7.8			25.5	
Approach LOS		E			A			A			C	

Intersection Summary			
HCM Average Control Delay	30.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frt		1.00	0.96		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3426	3349		1736	1553
Flt Permitted		0.52	1.00		0.95	1.00
Satd. Flow (perm)		1802	3349		1736	1553
Volume (vph)	324	892	829	254	308	397
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	360	991	921	282	342	441
Lane Group Flow (vph)	0	1351	1203	0	342	441
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Actuated Green, G (s)		78.5	78.5		22.5	22.5
Effective Green, g (s)		80.0	80.0		24.0	24.0
Actuated g/C Ratio		0.73	0.73		0.22	0.22
Clearance Time (s)		4.5	4.5		4.5	4.5
Lane Grp Cap (vph)		1311	2436		379	339
v/s Ratio Prot			0.36		0.20	
v/s Ratio Perm		c0.75				c0.28
v/c Ratio		1.39dl	0.49		0.90	1.30
Uniform Delay, d1		15.0	6.4		41.9	43.0
Progression Factor		0.87	1.00		0.72	1.06
Incremental Delay, d2		30.7	0.7		18.4	147.9
Delay (s)		43.7	7.1		48.6	193.6
Level of Service		D	A		D	F
Approach Delay (s)		43.7	7.1		130.3	
Approach LOS		D	A		F	

Intersection Summary			
HCM Average Control Delay	50.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	101.3%	ICU Level of Service	F

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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	3471	1553	1736	3471	1553	1736	3471	1553	1736	3471	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.28	1.00	1.00	0.33	1.00	1.00
Satd. Flow (perm)	3367	3471	1553	1736	3471	1553	519	3471	1553	596	3471	1553
Volume (vph)	523	952	394	102	1049	17	276	547	93	49	385	537
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)	581	1058	438	113	1166	19	307	608	103	54	428	597
Lane Group Flow (vph)	581	1058	438	113	1166	19	307	608	103	54	428	597
Turn Type	Prot		pm+ov	Prot		pm+ov	pm+pt		pm+ov	pm+pt		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8	2		2	6		6
Actuated Green, G (s)	18.0	44.0	56.0	11.0	37.0	41.0	40.0	31.0	42.0	27.0	23.0	41.0
Effective Green, g (s)	20.0	46.0	60.0	13.0	39.0	45.0	42.0	33.0	46.0	31.0	25.0	45.0
Actuated g/C Ratio	0.18	0.42	0.55	0.12	0.35	0.41	0.38	0.30	0.42	0.28	0.23	0.41
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	612	1452	889	205	1231	678	353	1041	692	230	789	678
v/s Ratio Prot	c0.17	0.30	0.06	0.07	c0.34	0.00	c0.11	0.18	0.02	0.01	0.12	c0.16
v/s Ratio Perm			0.22			0.01	c0.22		0.05	0.05		0.22
v/c Ratio	0.95	0.73	0.49	0.55	0.95	0.03	0.87	0.58	0.15	0.23	0.54	0.88
Uniform Delay, d1	44.5	26.8	15.5	45.7	34.5	19.4	27.0	32.7	19.9	29.4	37.5	30.0
Progression Factor	0.88	1.09	1.38	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	24.0	2.9	1.7	10.3	15.8	0.1	24.1	2.4	0.5	2.4	2.7	15.2
Delay (s)	63.1	32.1	23.2	56.0	50.3	19.5	51.1	35.1	20.3	31.8	40.1	45.3
Level of Service	E	C	C	E	D	B	D	D	C	C	D	D
Approach Delay (s)		38.9			50.3			38.4			42.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	42.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Cycle Length (s)	110.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	3471	1553	1736	3471	1553	3367	3471	1553	1736	3471	1553
Flt Permitted	0.15	1.00	1.00	0.30	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	276	3471	1553	554	3471	1553	3367	3471	1553	1736	3471	1553
Volume (vph)	338	472	77	174	566	126	124	723	100	382	544	281
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)	376	524	86	193	629	140	138	803	111	424	604	312
Lane Group Flow (vph)	376	524	86	193	629	140	138	803	111	424	604	312
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	44.5	26.0	33.4	36.5	22.0	47.5	7.4	26.0	40.5	25.5	44.1	62.6
Effective Green, g (s)	46.5	27.5	36.4	39.5	23.5	50.5	8.9	27.5	43.5	27.0	45.6	65.6
Actuated g/C Ratio	0.42	0.25	0.33	0.36	0.21	0.46	0.08	0.25	0.40	0.25	0.41	0.60
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lane Grp Cap (vph)	382	868	556	371	742	755	272	868	656	426	1439	969
v/s Ratio Prot	c0.18	0.15	0.01	0.08	0.18	0.05	0.04	c0.23	0.02	c0.24	0.17	0.06
v/s Ratio Perm	c0.24		0.04	0.11		0.04			0.05			0.14
v/c Ratio	0.98	0.60	0.15	0.52	0.85	0.19	0.51	0.93	0.17	1.00	0.42	0.32
Uniform Delay, d1	31.2	36.4	26.0	25.8	41.5	17.6	48.4	40.2	21.5	41.4	22.8	11.1
Progression Factor	1.00	1.00	1.00	1.04	0.39	0.26	1.00	1.00	1.00	0.65	0.44	0.63
Incremental Delay, d2	42.3	3.1	0.6	4.1	9.5	0.4	6.6	17.0	0.6	34.8	0.6	0.6
Delay (s)	73.5	39.5	26.5	30.9	25.9	5.0	55.1	57.3	22.1	61.7	10.7	7.6
Level of Service	E	D	C	C	C	A	E	E	C	E	B	A
Approach Delay (s)		51.4			23.8			53.3			26.1	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	97.2%	ICU Level of Service	E

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	0.88
Frt		1.00	0.85	1.00	1.00						1.00	1.00
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3471	1553	1736	3471						1736	3215
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		3471	1553	1736	3471						1736	3215
Volume (vph)	0	1720	249	10	205	0	0	0	0	73	0	2201
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	1911	277	11	228	0	0	0	0	81	0	2446
Lane Group Flow (vph)	0	1911	277	11	228	0	0	0	0	0	81	2446
Turn Type			Prot	Split						custom		custom
Protected Phases		4	4	8	8					6	6	4 6
Permitted Phases										6		4 6
Actuated Green, G (s)		60.5	60.5	12.5	12.5						23.5	88.5
Effective Green, g (s)		62.0	62.0	14.0	14.0						25.0	90.0
Actuated g/C Ratio		0.56	0.56	0.13	0.13						0.23	0.82
Clearance Time (s)		4.5	4.5	4.5	4.5						4.5	
Lane Grp Cap (vph)		1956	875	221	442						395	2630
v/s Ratio Prot		c0.55	0.18	0.01	c0.07						0.05	c0.76
v/s Ratio Perm												
v/c Ratio		0.98	0.32	0.05	0.52						0.21	0.93
Uniform Delay, d1		23.3	12.7	42.2	44.8						34.4	7.6
Progression Factor		0.35	0.05	1.24	1.25						1.00	1.00
Incremental Delay, d2		12.9	0.7	0.4	4.2						1.2	7.4
Delay (s)		21.1	1.3	52.7	60.3						35.6	15.0
Level of Service		C	A	D	E						D	B
Approach Delay (s)		18.6			59.9			0.0			15.6	
Approach LOS		B			E			A			B	

Intersection Summary			
HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Cycle Length (s)	110.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	E

c Critical Lane Group

traffic "hotspots" that could be operations issues if traffic volumes are much higher than forecasted. While these are projected to operate at a satisfactory LOS, more detailed assessment in the preliminary design stage may be appropriate. If deficiencies are identified, appropriate mitigation measures (design improvements) may be needed.