NORTH I-25 EIS

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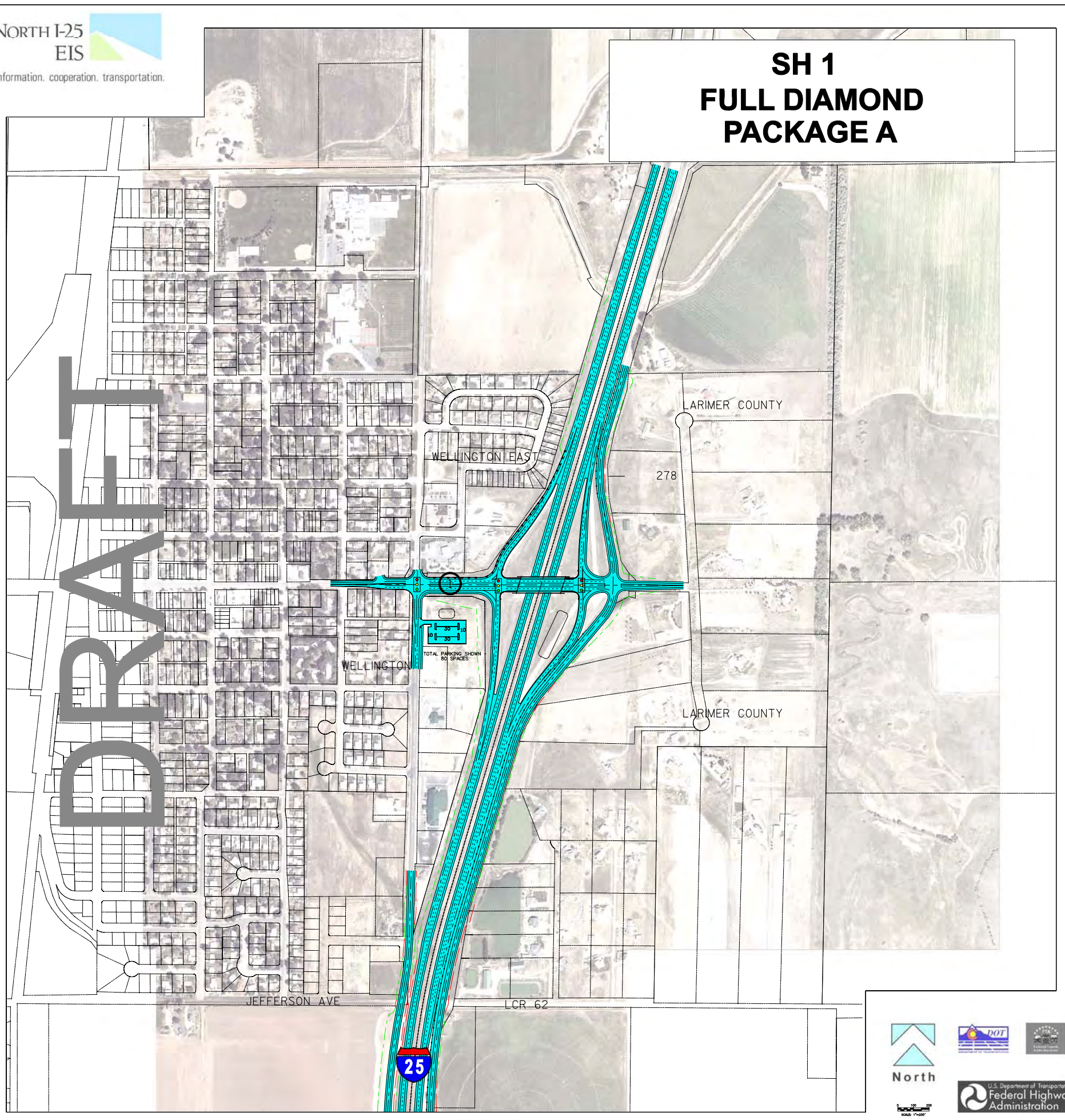
SH 1
FULL DIAMOND
PACKAGE A



North

SCALE: 1"=200'

October 1, 2007

U.S. Department of Transportation Federal Highway Administration

SH 1 FULL DIAMOND

10/2/2007 L:\05071\CAD\Supplemental\Interchange_Displays\Package A\SH 1 LINE SHT - Pkg A.dgn

NORTH I-25 EIS

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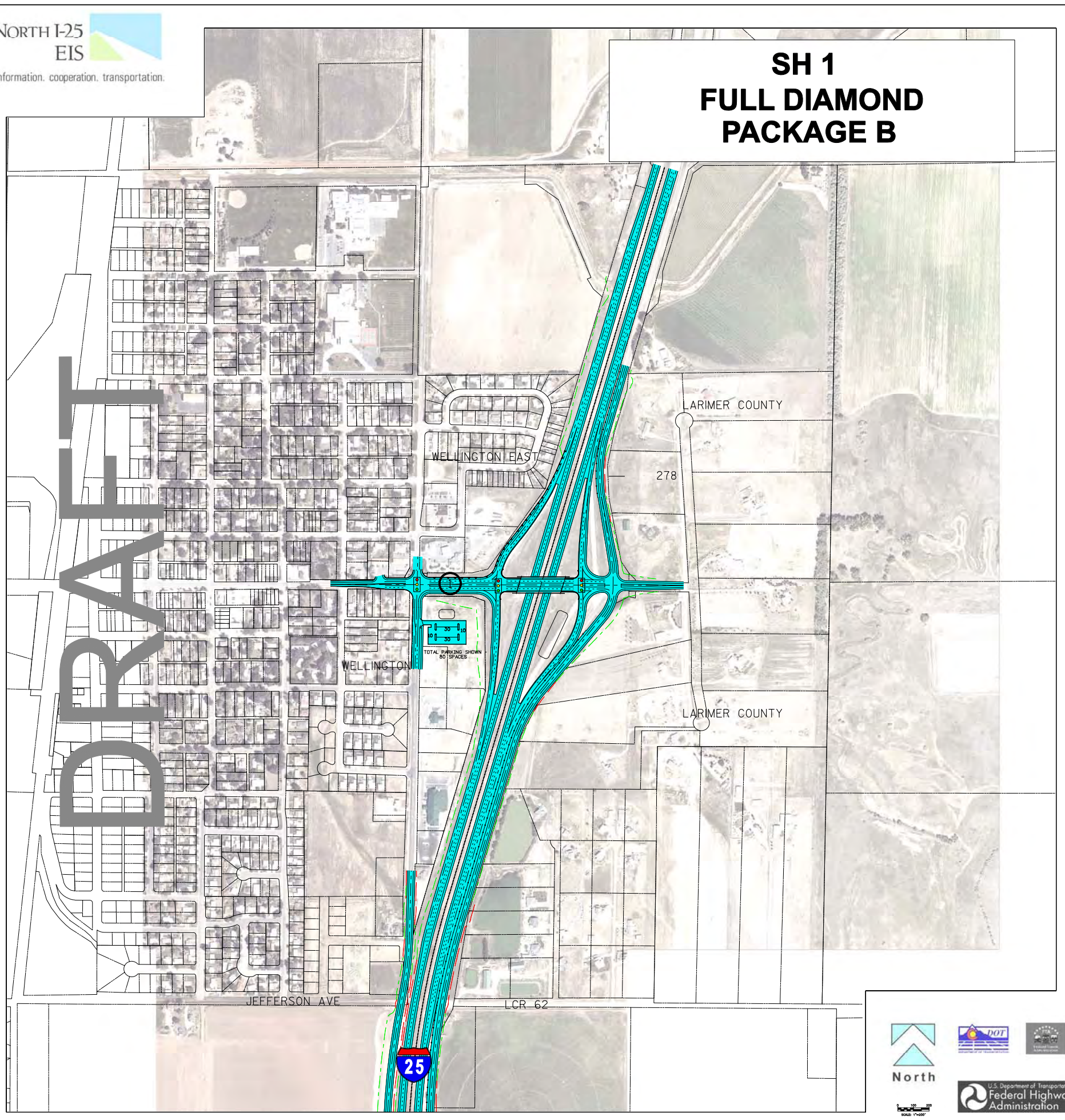
SH 1
FULL DIAMOND
PACKAGE B



DRAFT

North

October 1, 2007

SH 1 FULL DIAMOND

U.S. Department of Transportation Federal Highway Administration

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SH 1 at I-25
DEIS Interchange Evaluation

NORTH I-25 EIS
information. cooperation. transportation.

August 20, 2007

Introduction

This report describes the existing traffic volumes at this interchange and the adjacent intersections, as well as future traffic conditions with an improved interchange.

Existing Conditions

The interchange has a diamond configuration and is similar to several older diamond interchanges (i.e. SH 392, Crossroads) in the corridor. This interchange was constructed in 1966.

The interchange area includes the following roadways:

SH 1. SH 1 is an east-west two lane arterial roadway that connects I-25 to the town of Wellington to the west and small local neighborhoods to the east. The land along SH 1 is primarily open residential properties to the east of the interstate and the residential areas of Wellington to the west. The speed limit is 30 mph in the vicinity of the interchange, and there are no dedicated turn lanes at the ramp terminals, but the curb radii at both ramp terminals allow for a right turning vehicle to maneuver around up to three vehicles waiting to turn left onto SH 1. Both ramp intersections are stop sign-controlled.

Frontage Roads. There is a frontage road on the east side of the interchange and Sixth Street is on the west side of the interchange. The speed limit on the frontage road in the vicinity of the interchange is 30 mph.

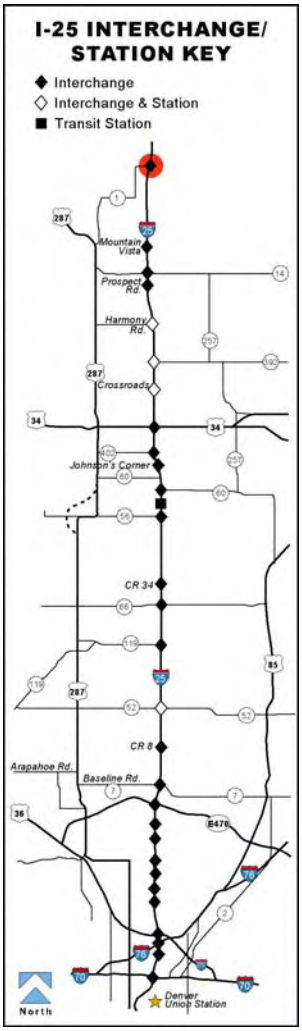

Figure 1. Vicinity Map

Figure 2 summarizes the traffic counts collected in August 2004 at this interchange. As shown, average daily traffic on SH 1 is around 9,900 vehicles per day (vpd) west of the interchange and 200 vpd east of the interchange. The east side frontage road has daily traffic volumes ranging from 1,900 north of SH 1 to 1,100 south of SH 1. The west side frontage road (Sixth Street) has daily volumes ranging from 1,600 VPD south of SH 1 and 5,700 north of SH 1. Daily ramp volumes range between 700 and 3,900 vehicles per day, with volumes significantly greater to and from the south. At the interchange, turn movements to/from the ramps are less than 100 vehicles per hour during the peak periods, except for northbound left-turn and eastbound right-turn movements during the peak hours. The eastbound to southbound movement represents the highest traffic volumes in the morning and the northbound to westbound movement representing the highest volumes in the afternoon.

Traffic Operations Evaluation

An operational analysis of the interchange was conducted based on methodology developed in the Highway Capacity Manual (Transportation Research Board, 2000). The result of such analysis is a level of service (LOS) rating. Level of service is a qualitative assessment of the traffic flow based on the average stopped delay per vehicles at controlled intersections (i.e. traffic signal, stop-sign).

Levels of service are described by a letter designation ranging from "A" to "F", with LOS A representing essentially uninterrupted flow, and LOS F representing a breakdown of traffic flow with excessive congestion and delay. Signalized intersection analyses result in a level of service rating for each movement and for the entire intersection but typically only the level of service for the entire intersection is reported. For unsignalized intersections a level of service rating is determined for each turn movement that must yield to another turn movement but an overall level of service rating is not determined for the entire intersection. At ramp merge and diverge locations the level of service rating is based on density and represents operations where ramps merge to or diverge from the I-25 main lanes. The following table shows how average stopped delay at controlled intersections equates to levels of service.

Table 1. Equivalent Level of Service to Average Stopped Delay and Density

Level of Service	Average Delay at Signalized Intersections in (sec./veh.)	Average Delay at Stop-Controlled intersections in (sec./veh.)
A	0 to <=10	0 to <=10
B	> 10 to <= 20	> 10 to <= 15
C	> 20 to <= 35	> 15 to <= 25
D	> 35 to <= 55	> 25 to <= 35
E	> 55 to <= 80	> 35 to <= 50
F	> 80	> 50

Figure 2 illustrates existing peak period levels of service at the ramp terminals, adjacent intersections and ramp junctions with I-25. Currently, all turning movements in the vicinity of the interchange operate at LOS B or better during both the AM and PM peak periods with the exception of the northbound left-turn from onto SH 1 from the northbound off ramp, which operates at LOS E in the afternoon peak.

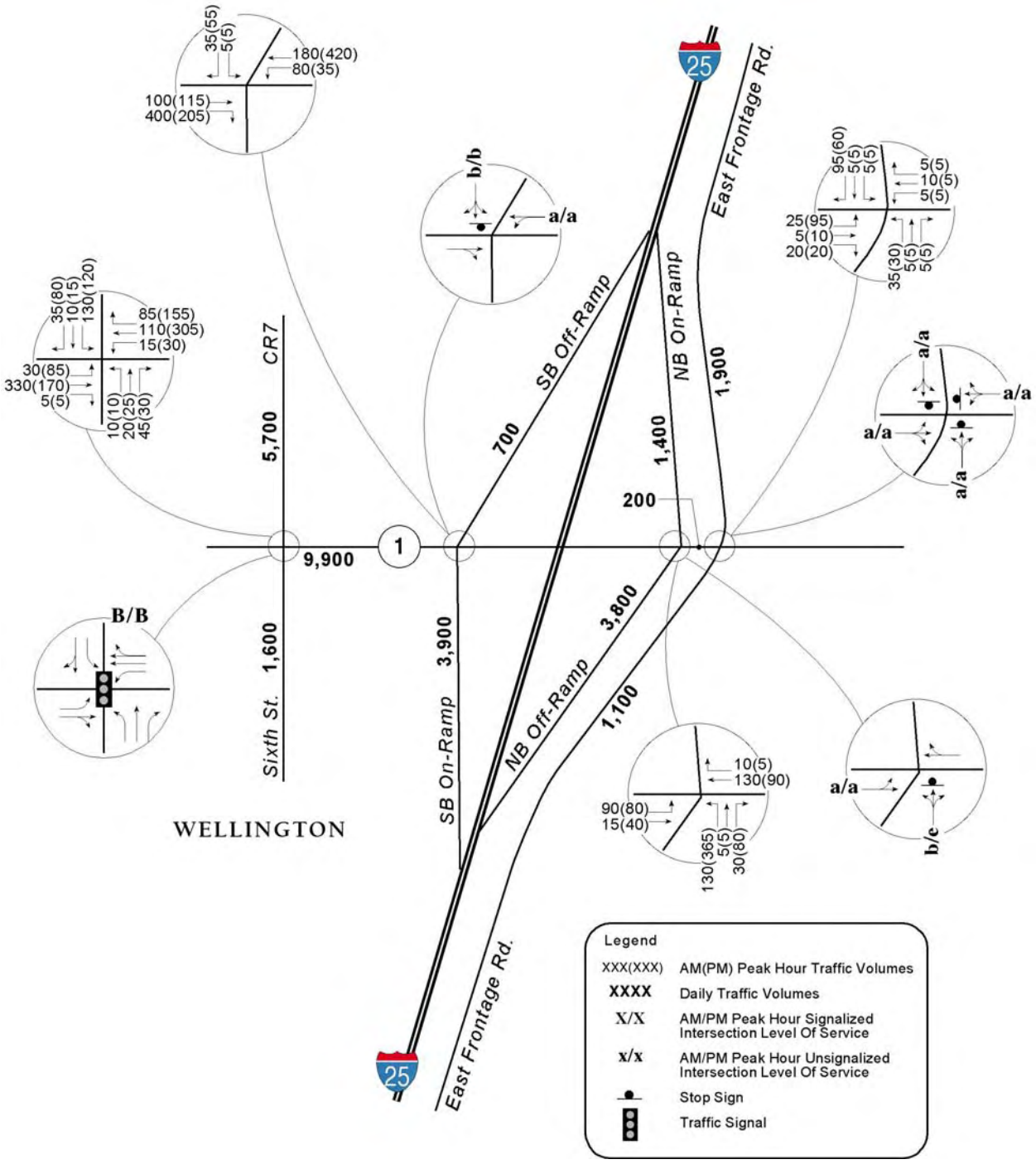

Figure 2. Existing Conditions

In addition to the intersection level of service shown in the figure, Table 2 provides additional information for key movements at each intersection to provide further insight into existing operations at the interchange. Key movements are those movements that could have an impact on adjacent intersections or an impact to I-25. For example, east-west movements along SH 1 can queue into adjacent intersections and impede traffic flow at those locations, while vehicles on the ramps could queue back onto the interstate. North-south movements at the west and east frontage road intersections have not been included in the table because they would not impede traffic flow on SH 1. As shown in the table, most of the turn movements currently operate at a LOS B or better. Only the northbound left-turn movement at the northbound ramp terminal had a level of service worse than LOS D. In all cases, the 95th percentile queue lengths were less than the distance between intersections or did not exceed the current storage length provided at the interchange.

Table 2. Existing Level of Service and Queue Lengths for Key Movements

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[1]		Intersection Spacing and Storage Length Provisions
	AM	PM	AM	PM	
Sixth Street					
WB Left	A	A	30'	40'	Storage Provided – 250'
WB Thru/Right	A	A	40'	70'	Distance to Adjacent Intersection – 445'
Southbound Ramp Terminal					
WB Approach	A	A	90'	70'	Distance to Adjacent Intersection – 585'
SB Approach	B	B	40'	40'	Ramp Length – 850'
Northbound Ramp Terminal					
EB Approach	A	A	30'	20'	Distance to Adjacent Intersection – 585'
NB Approach	B	E	60'	140'	Ramp Length – 1,000'
East Frontage Road Intersection					
EB Approach	A	A	50'	50'	Distance to Adjacent Intersection – 100'

[1] The queue lengths given in this table primarily come from SimTraffic with some engineering judgment. SimTraffic gives a queue length for each lane. For example, with dual left-turn lanes SimTraffic estimates a queue for each lane. In the table, for thru movements the queue length is the longest queue observed in any through lane. For multiple turn lanes (i.e. dual lefts), the queue length is the sum of the queues in each lane. For a single turn lane (i.e. right turn), the queue is just the queue for that lane.

2030 Conditions

2030 traffic projections were developed for the three alternatives being considered:

1) No-Action Alternative
2) Package A: GP + CR + CB85
3) Package B: TEL + BRT.

These three packages are illustrated in Figures 3 through 5. In developing peak hour turning movements at the ramp terminals and the nearest adjacent intersections, model results were calibrated against existing traffic counts to derive an adjusted model forecast. These adjusted forecasts along with existing turning movement data were used in the NCHRP 255 balancing procedure to develop 2030 peak hour turning movement forecasts. These forecasts were further adjusted, as necessary, to balance between intersections and for reasonableness.

Figure 3. No Action Alternative

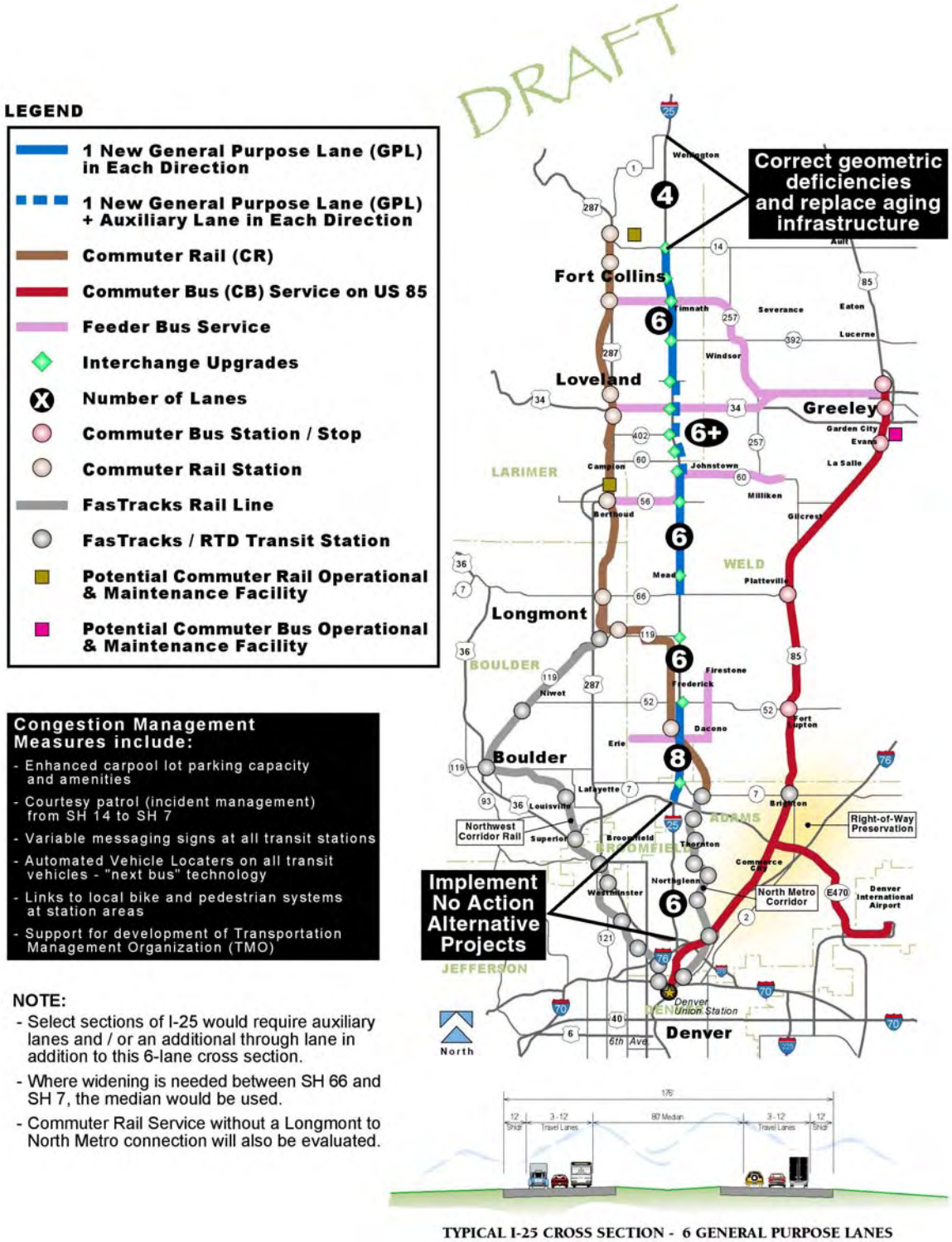

Figure 4. Package A: GPL + CR + CB85

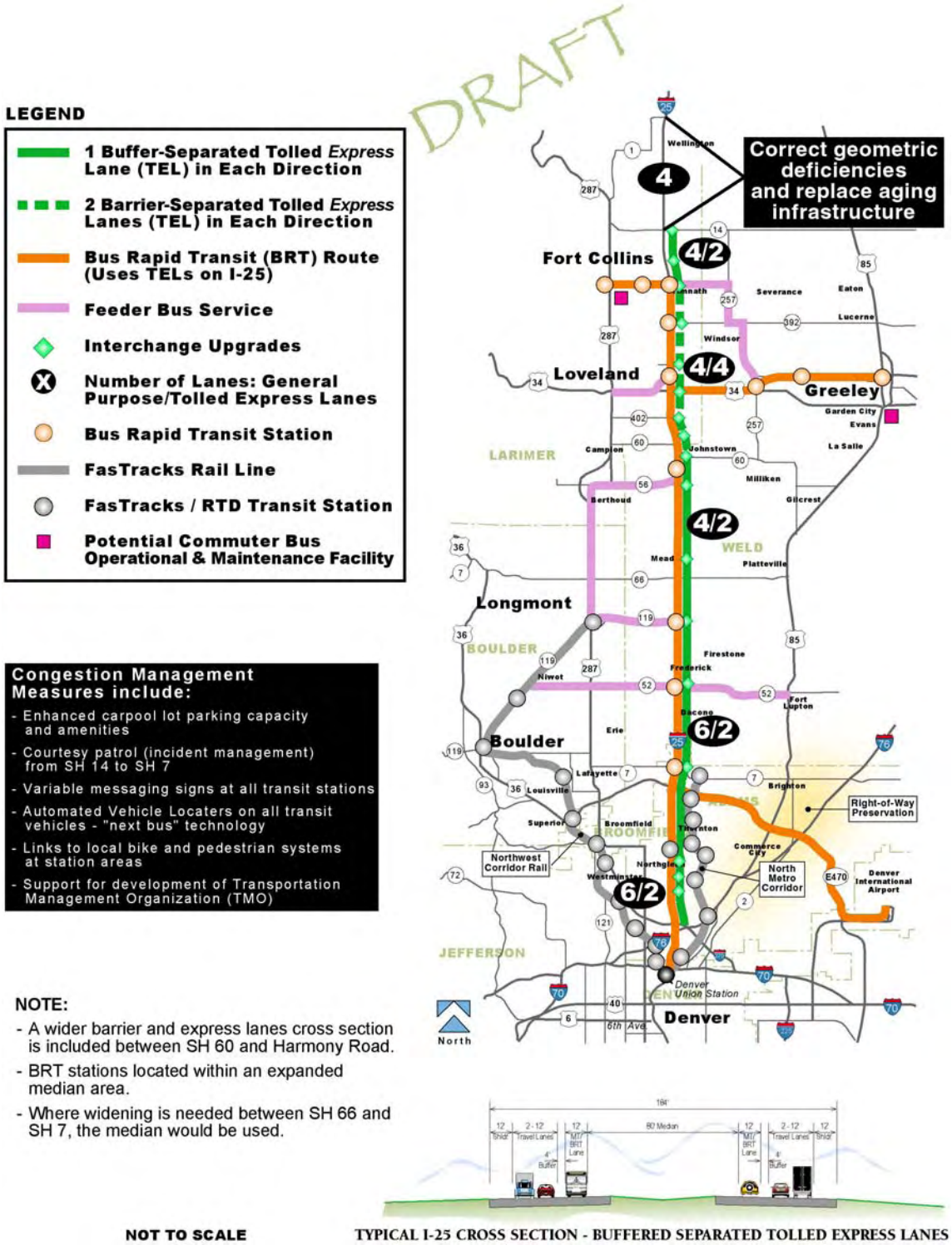

Figure 5. Package B: TEL + BRT

2030 No Action Traffic Volumes

Figure 6 depicts 2030 daily and peak hour No Action traffic projections for the SH 1 interchange and adjacent intersections. As shown, daily volume projections on SH 1 range from 3,900 vpd east of the interchange to 24,000 vpd west of the interchange, and ramp volumes range from 1,400 to 7,600 vehicles per day. These volumes show the same patterns as existing counts; the highest traffic flows are to and from the west on SH 1 and to and from the south on the ramps.

2030 Package A Traffic Volumes

Figure 7 depicts 2030 daily and peak hour Package A traffic projections for the SH 1 interchange and adjacent intersections. The volumes in the figure are generally similar to those presented in the No Action Alternative. Daily volume projections range from 4,200 vpd east of the interchange to 24,200 vpd west of the interchange, and ramp volumes range from 1,400 to 7,600 vehicles per day, the same as in the No Action.

2030 Package B Volumes

Figure 8 depicts 2030 daily and peak hour Package B traffic projections for the SH 1 interchange and adjacent intersections. The volumes in the figure are generally similar to those presented in the No Action. Daily volume projections on SH 1 range from 4,200 vpd east of the interchange to 25,800 vpd west of the interchange, and ramp volumes range from 1,400 to 8,300 vehicles per day.

2030 No Action Traffic Operations

Figure 6 shows the projected levels of service at the frontage road and ramp intersections on SH 1 under the No Action Alternative. As the figure indicates, off ramp movements would operate at LOS F in both of the peak periods. Table 3 shows the projected queuing for key movements at the interchange and further underscores that the existing interchange would be significantly over capacity with the projected traffic volumes.

It should be noted that signalizing the two ramp terminal intersections without any widening improvements would improve the operations at the ramp terminals in both peak periods, but would still result in LOS F operations at the northbound off ramp.

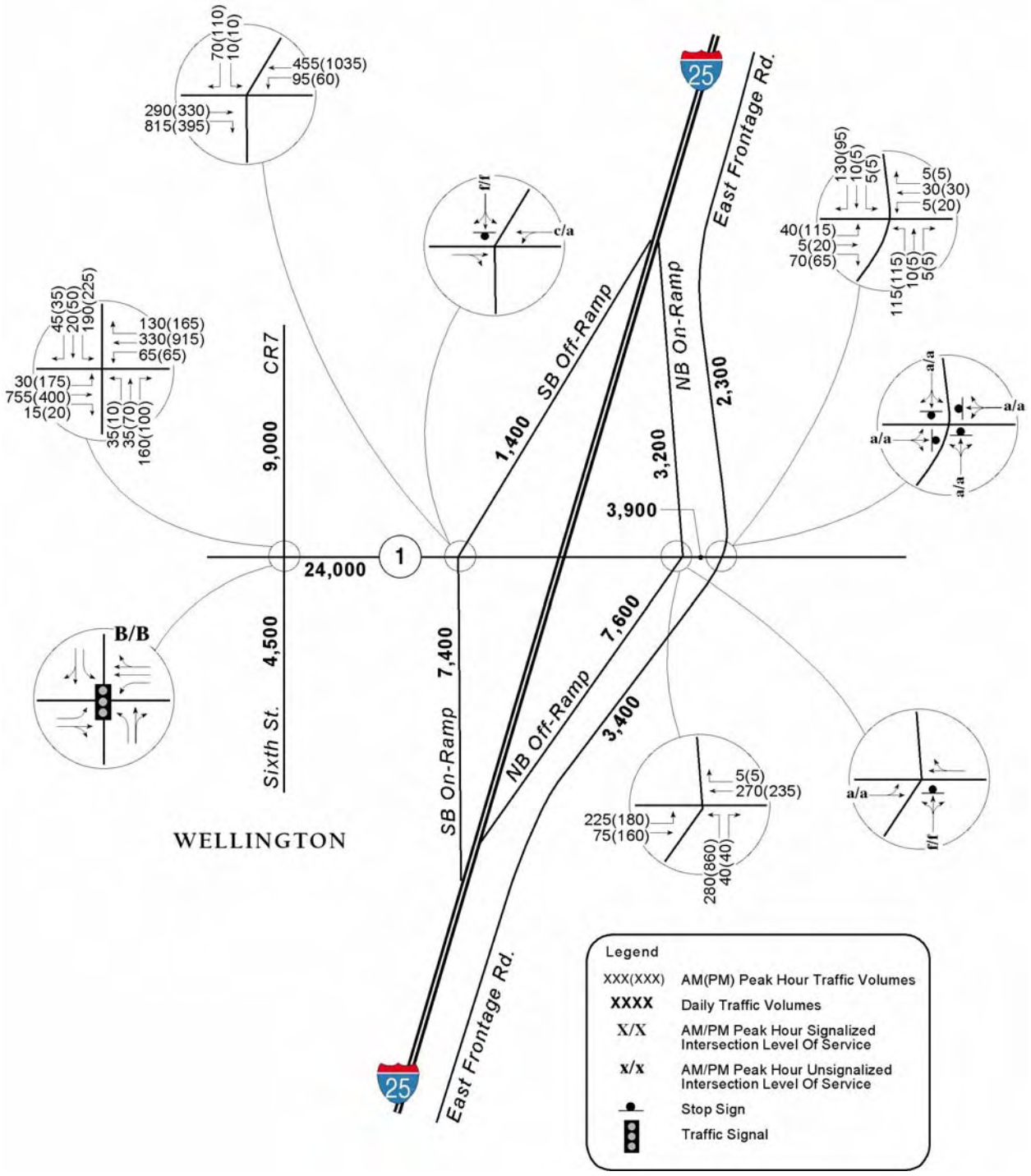

Figure 6. No Action Forecasts and Levels of Service

Table 3. 2030 No Action Level of Service and Queue Lengths for Key Movements

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[1]		Intersection Spacing and Storage Length Provisions
	AM	PM	AM	PM	
Sixth Street					
WB Left	A	A	80'	50'	Storage Provided – 250'
WB Thru/Right	A	A	110'	130'	Distance to Adjacent Intersection – 445'
Southbound Ramp Terminal					
WB Approach	C	A	750'	300'	Distance to Adjacent Intersection – 585'
SB Approach	F	F	470'	90'	Ramp Length – 850'
Northbound Ramp Terminal					
EB Approach	A	A	100'	60'	Distance to Adjacent Intersection – 585'
NB Approach	F	F	720'	570'	Ramp Length – 1,000'
East Frontage Road Intersection					
EB Approach	A	A	50'	60'	Distance to Adjacent Intersection – 100'

[1] The queue lengths given in this table primarily come from SimTraffic with some engineering judgment. SimTraffic gives a queue length for each lane. For example, with dual left-turn lanes SimTraffic estimates a queue for each lane. In the table, for thru movements the queue length is the longest queue observed in any through lane. For multiple turn lanes (i.e. dual lefts), the queue length is the sum of the queues in each lane. For a single turn lane (i.e. right turn), the queue is just the queue for that lane.

2030 Package A Traffic Operations

Interchange Configuration

The proposed configuration for the SH 1 DEIS interchange evaluation is a diamond configuration (Figure 7). The bridge would be widened to accommodate six lanes, two through lanes in each direction with side-by-side left turn lanes. The northbound off ramp would be constructed with a three lane cross-section; a left, a shared left-through, and a right turn lane. The southbound off ramp would be constructed as a two lane cross-section; a shared left-through, and a right turn lane. The east frontage road would remain unsignalized.

An 80-space carpool lot is proposed to the south of SH 1 and east of Sixth Street. The carpool lot would have access from Sixth Street. Traffic generated by this lot is included in the Package A volumes shown.

Interchange Operations

Figure 7 also shows the levels of service for the ramps and frontage road intersections, along with recommendations for laneage and storage at each location. As shown, all four intersections in the vicinity of the ramp are anticipated to operate at LOS C or better with the forecasted traffic volumes and the enhancements identified.

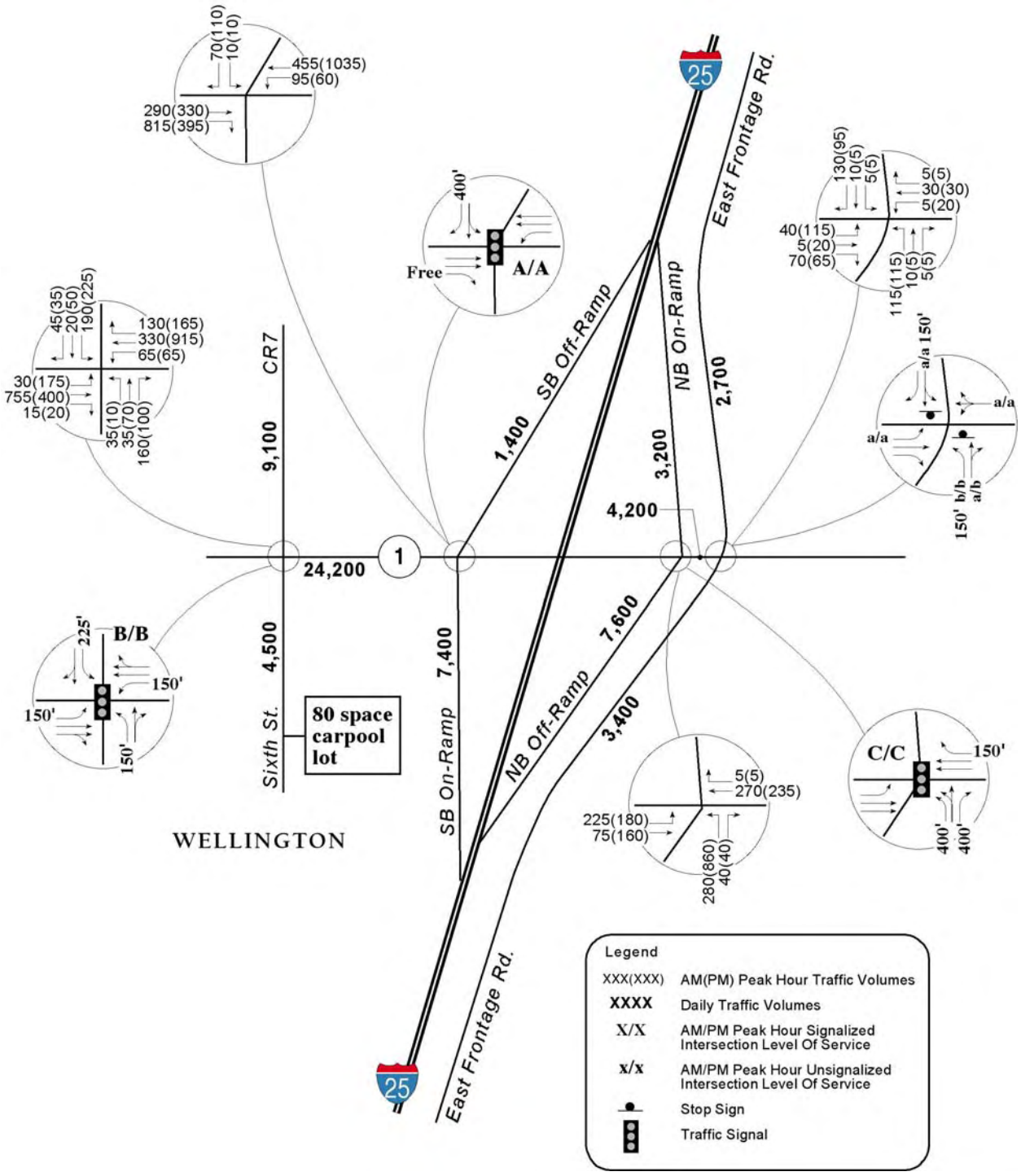

Figure 7. Package A Forecasts and Levels of Service

Table 4 summarizes the levels of service, queue lengths, intersection spacing and designed storage lengths for key movements at the interchange. As shown in the table, specific movement levels of service at this interchange range from LOS A to LOS D. No single movement operates with a substandard level of service; thus, the improvements identified at this interchange appear to provide good operations at both ramp terminals and at the frontage road intersection.

Table 4 also compares SimTraffic estimates of the 95th percentile queue length for key movements to the storage distance available for each. For turning movements, the distance listed is the planned turn lane storage length, while for through movements the length listed is the distance between intersections. The queuing analysis shows that in all cases the estimated 95th percentile queues would be contained within the turn bays or within the space between adjacent intersections. On both the northbound and southbound ramp terminals, the left and right turn queues would be accommodated well within the storage length and would not extend into the I-25 main lanes.

Table 4. 2030 Package A Level of Service and Queue Lengths for Key Movements

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[2]		Distance Between Intersections and Storage Length Provisions
	AM	PM	AM	PM	
Sixth Street					
WB Left	A	A	110’	70’	Storage Provided in Design – 250’
WB Thru	A	A	180’	270’	Distance to Adjacent Intersection – 445’
Southbound Ramp Terminal					
EB Right	Free	Free	N/A[1]	N/A[1]	N/A[1]
WB Left	A	A	50’	40’	Storage Provided in Design – 585’
WB Thru	A	A	10’	20’	Distance to Adjacent Intersection – 585’
SB Left	D	D	30’	30’	Storage Provided in Design – 400’
SB Right	D	D	50’	70’	Storage Provided in Design – 400’
Northbound Ramp Terminal					
EB Left	A	B	120’	160’	Storage Provided in Design – 585’
EB Thru	A	A	40’	110’	Distance to Adjacent Intersection – 585’
WB Thru	A	B	90’	90’	Distance to Adjacent Intersection – 150’
WB Right	A	B	10’	10’	Storage Provided in Design – 150’
NB Left	D	D	320’	680’	Storage Provided in Design – 800’
NB Right	D	B	40’	40’	Storage Provided in Design – 400’
East Frontage Road Intersection					
EB Left	A	A	10’	20’	Distance to Adjacent Intersection – 150’

[1] Continuous accel. / decel. lane is provided between southbound ramps and Sixth Street.
[2] The queue lengths given in this table primarily come from SimTraffic with some engineering judgment. SimTraffic gives a queue length for each lane. For example, with dual left-turn lanes SimTraffic estimates a queue for each lane. In the table, for thru movements the queue length is the longest queue observed in any through lane. For multiple turn lanes (i.e. dual lefts), the queue length is the sum of the queues in each lane. For a single turn lane (i.e. right turn), the queue is just the queue for that lane.

2030 Package B Traffic Operations

Interchange Configuration

The proposed configuration for SH 1 in Package B is the same as in Package A (Figure 8). Likewise, the carpool lot location and size in Package B is the same as in option in Package A.

Interchange Operations

Figure 8 also shows the levels of service for the ramps and frontage road intersections, along with recommendations for laneage at each location. As shown, all four intersections would operate at LOS C or better with the forecasted traffic volumes and the enhancements identified.

Table 5 summarizes levels of service for key individual turning movements and compares SimTraffic estimates of the 95th percentile queue length for those key movements to the storage distance available for each. The queuing analysis shows that the estimated 95th percentile queues would be contained well within the turn bays or within the space between adjacent intersections during both peak periods. On both the northbound and southbound ramp terminals, left and right turn queues would be accommodated well within the storage length and would not extend into the I-25 main lanes. The carpool lot access also operates acceptably in this package.

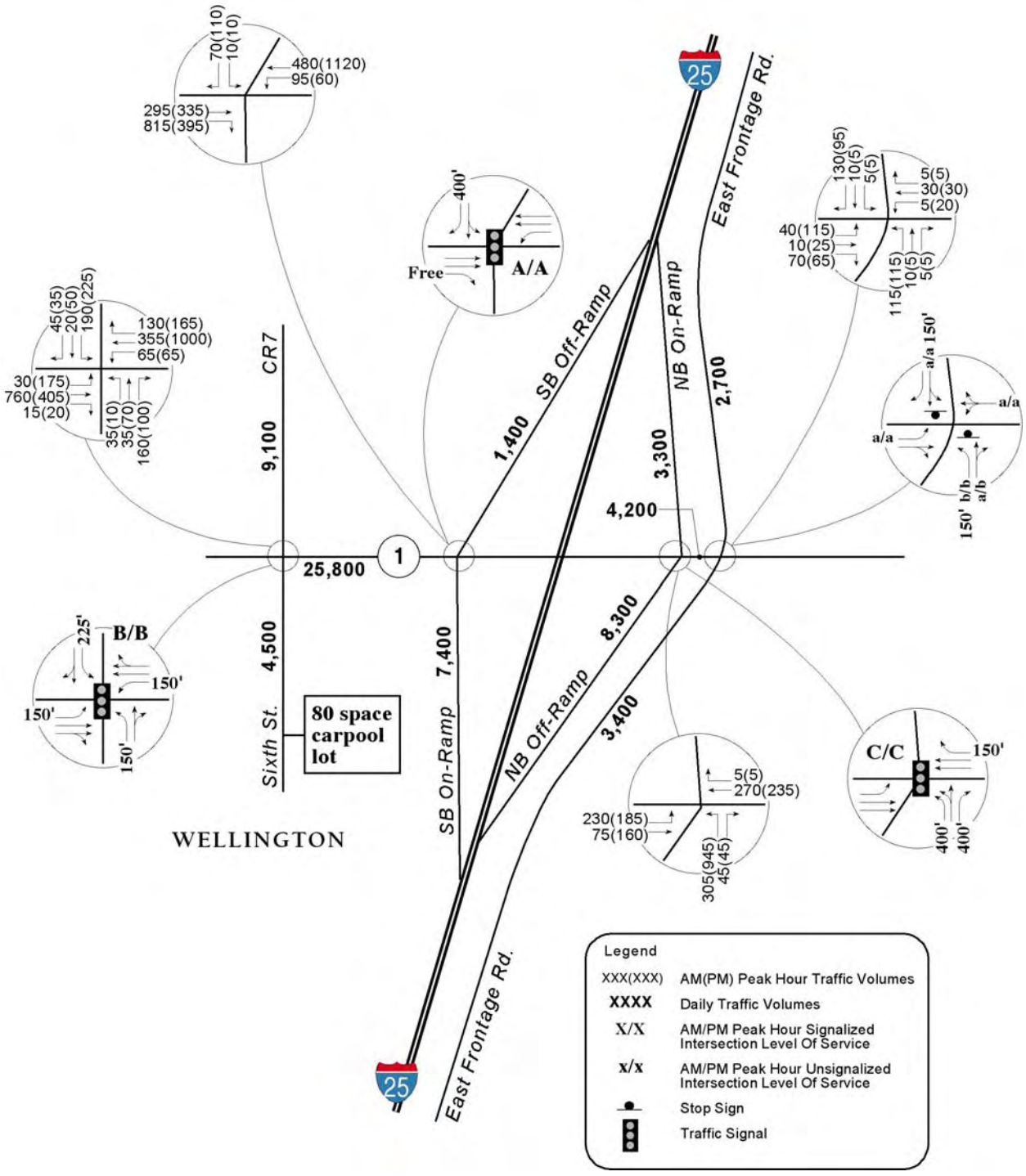

Figure 8. Package B Forecasts and Levels of Service

Table 5. 2030 Package B Level of Service and Queue Lengths for Key Movements

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[2]		Distance Between Intersections and Storage Length Provisions
	AM	PM	AM	PM	
Sixth Street					
WB Left	A	A	80’	90’	Storage Provided in Design – 250’
WB Thru	A	A	150’	300’	Distance to Adjacent Intersection – 445’
Southbound Ramp Terminal					
EB Right	Free	Free	N/A[1]	N/A[1]	N/A[1]
WB Left	A	A	40’	40’	Storage Provided in Design – 585’
WB Thru	A	A	10’	20’	Distance to Adjacent Intersection – 585’
SB Left	D	D	30’	30’	Storage Provided in Design – 400’
SB Right	D	D	50’	70’	Storage Provided in Design – 400’
Northbound Ramp Terminal					
EB Left	A	A	120’	160’	Storage Provided in Design – 585’
EB Thru	A	A	40’	110’	Distance to Adjacent Intersection – 585’
WB Thru	A	B	100’	80’	Distance to Adjacent Intersection – 150’
WB Right	A	B	10’	10’	Storage Provided in Design – 150’
NB Left	D	D	330’	650’	Storage Provided in Design – 800’
NB Right	D	B	50’	40’	Storage Provided in Design – 400’
East Frontage Road Intersection					
EB Left	A	A	20’	20’	Distance to Adjacent Intersection – 150’

[1] Continuous accel. / decel. lane is provided between southbound ramps and Sixth Street.
[2] The queue lengths given in this table primarily come from SimTraffic with some engineering judgment. SimTraffic gives a queue length for each lane. For example, with dual left-turn lanes SimTraffic estimates a queue for each lane. In the table, for thru movements the queue length is the longest queue observed in any through lane. For multiple turn lanes (i.e. dual lefts), the queue length is the sum of the queues in each lane. For a single turn lane (i.e. right turn), the queue is just the queue for that lane.

Alternatives Evaluation Comparison

Traffic Operational Analysis

Table 6 compares the levels of service and delay at the SH 1 interchange for the three packages. As the table indicates, without improvements at this location, the northbound ramp terminal would operate at LOS F during the PM peak hour, but with the improvements outlined above the interchange would operate adequately. The levels of service and delays at each intersection are virtually the same for both alternatives, indicating that either package would result in adequate operations at this interchange.

Table 6. Intersection Level of Service and Delay

Intersection	No Action[1]		Package A		Package B	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
West Frontage Road	LOS B (17 sec.)	LOS B (18 sec.)	LOS B (18 sec.)	LOS B (16 sec.)	LOS B (18 sec.)	LOS B (18 sec.)
Southbound Ramps	LOS F (>50 sec.)	LOS F (>50 sec.)	LOS A (3 sec.)	LOS A (4 sec.)	LOS A (3 sec.)	LOS A (6 sec.)
Northbound Ramps	LOS F (>50sec.)	LOS F (>50 sec.)	LOS C (20 sec.)	LOS C (27 sec.)	LOS C (21 sec.)	LOS C (26 sec.)

1. Assumes traffic signals only at each intersection (no turn lane revisions)
LOS X – Level of service
XX - Average delay in seconds per vehicle