NORTH I-25 EIS
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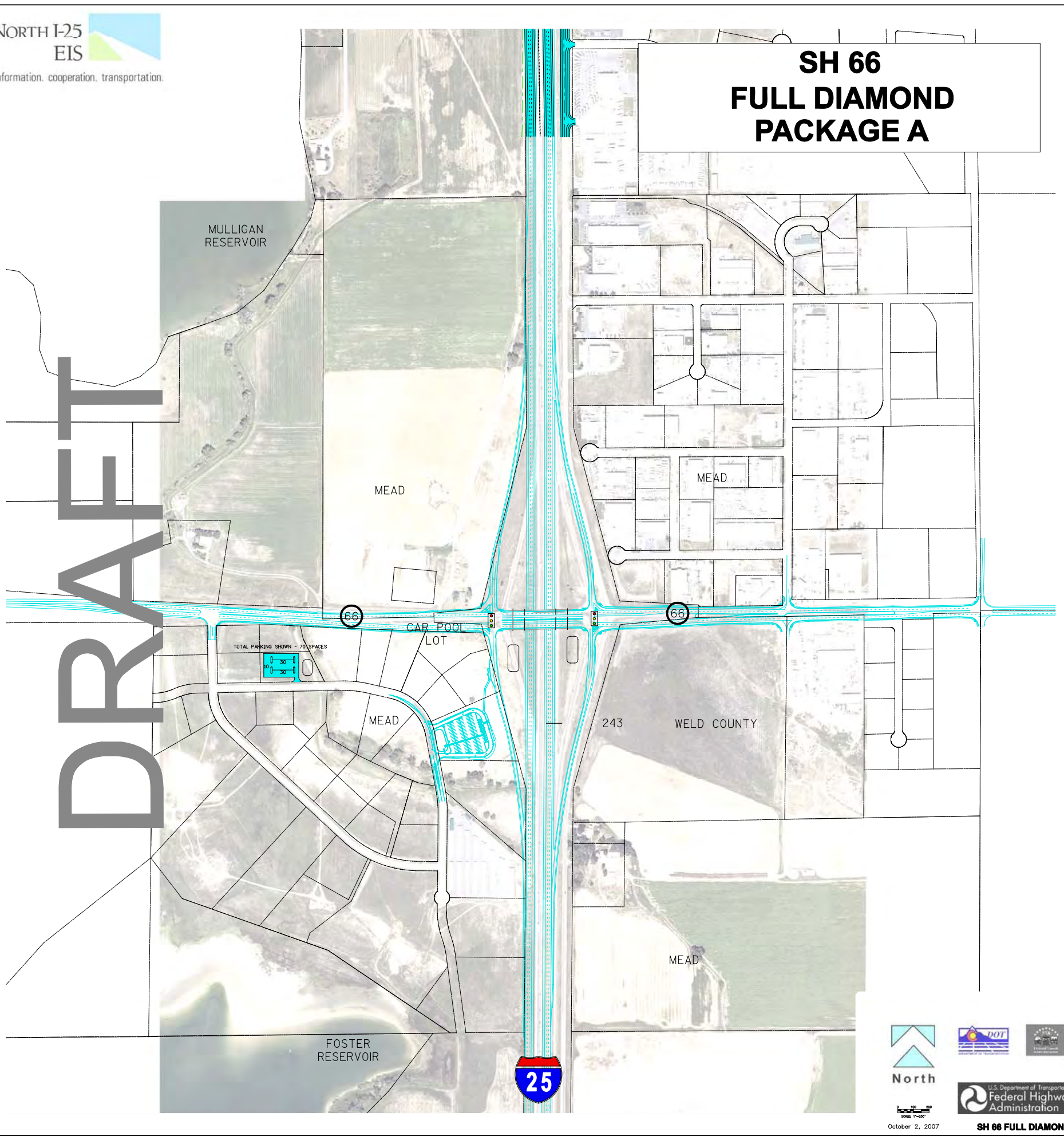
SH 66
FULL DIAMOND
PACKAGE A



DRAFT

North

0 100 200
SCALE: 1"=200'

October 2, 2007

U.S. Department of Transportation Federal Highway Administration

SH 66 FULL DIAMOND

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SH 66
FULL DIAMOND
PACKAGE B

DRAFT

MULLIGAN RESERVOIR
MEAD
MEAD
MEAD
66
66
CAR POOL LOT
TOTAL PARKING SHOWN - 70 SPACES
243
WELD COUNTY
MEAD
FOSTER RESERVOIR
25

North

SCALE 1"=200'

October 2, 2007

SH 66 FULL DIAMOND

U.S. Department of Transportation Federal Highway Administration

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10/3/2007

SH 66 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 SH 66 interchange was constructed in 1958; this interchange is going to receive a major upgrade within the next year. It is a diamond configuration and is similar to several other diamond interchanges (i.e. SH 392, Crossroads) in the corridor. The north and southbound off ramps are dual-lane approaches; a left turn lane and a shared through-right lane. There is one lane on the north and southbound on ramps. Figure 1 shows the location of SH 66 along I-25.

The interchange area includes the following roadways:

SH 66. SH 66 is an east-west two lane arterial roadway that connects I-25 to the rural areas north of Longmont to US 36 to the west and US 85 to the east. The land along SH 66 is primarily open fields both east and west of the interstate; with a small industrial park on the northeast corner of the interchange. The speed limit is 50 mph in the vicinity of the interchange, and there are no turn lanes on SH 66 at the ramp terminals. Both ramp intersections are signalized. There is an access to a carpool lot on the south side of SH 66 approximately 350 feet west of the southbound ramps.

Frontage Roads. A frontage road is located on the east side of the interchange but not on the west side. This frontage road is less than 100 feet east of the northbound ramps. There is currently a proposal to relocate this frontage road when the new interchange is constructed.

Figure 2 summarizes the traffic counts collected in August 2004 at this interchange. As shown, average daily traffic on SH 66 is around 17,100 vehicles per day (vpd) west of the interchange and 13,200 vpd east of the interchange. The frontage road has daily traffic volumes of ranging from 2,100 north of SH 66 to 2,600 south of SH 66. Daily ramp volumes range between 3,400 and 5,700 vehicles per day, with total volumes generally greater to and from the south direction. At the interchange, turn movements to/from the ramps range from 50 to 220 vehicles per hour during the peak periods, with the eastbound to southbound movement representing the highest traffic volumes in the morning and in the afternoon.

Figure 1. Vicinity Map

Traffic Operations

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. 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

As shown on Figure 2, the intersections in the vicinity of the SH 66 interchange operate at LOS C or better during the peak hours.

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 66 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 east frontage road intersection have not been included in the table because they would not impede traffic flow on SH 66. As shown in the table, the 95th percentile queue lengths for all movements were not greater than the distance between intersections or did not exceed the current storage length provided on the ramps.

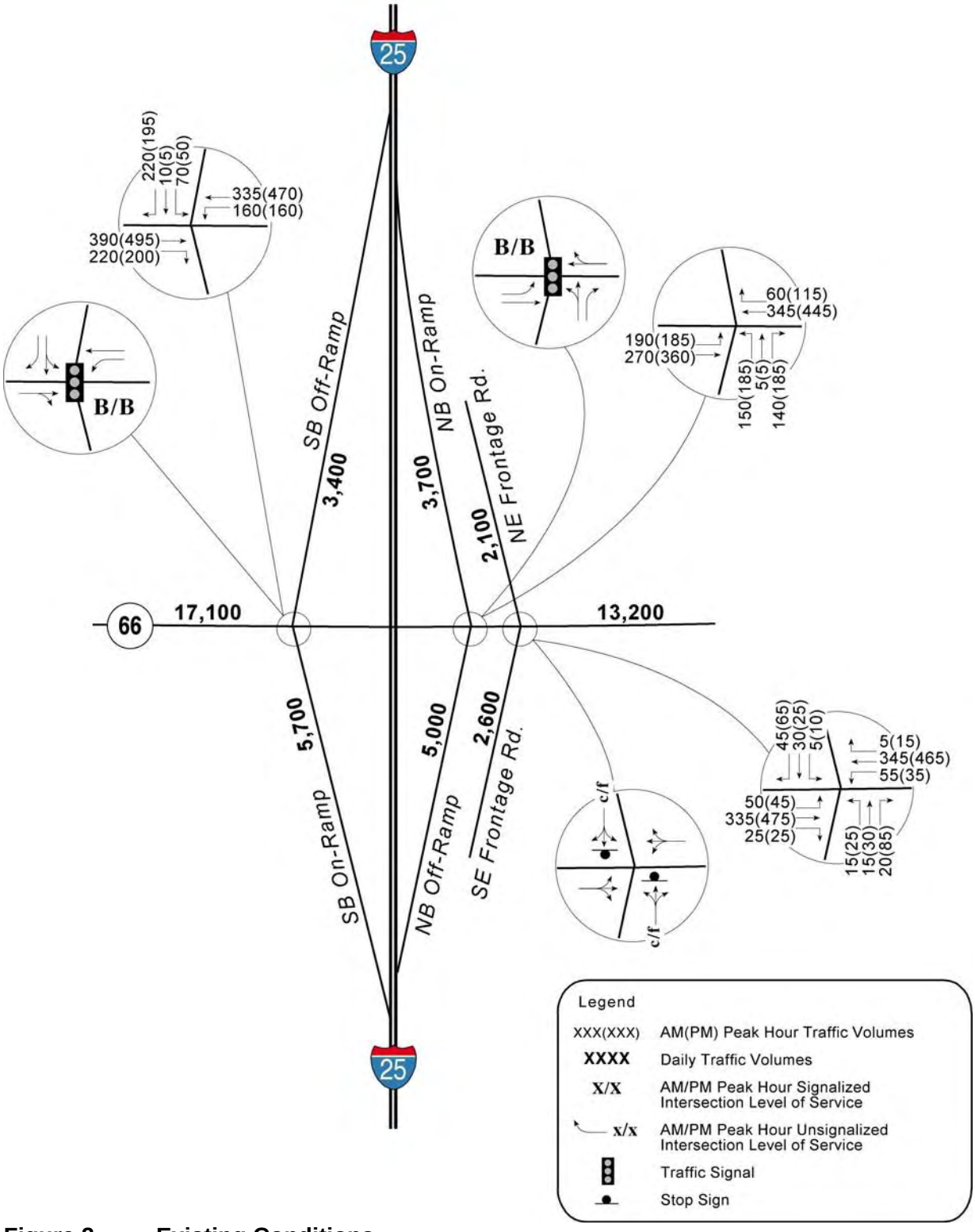

Figure 2. Existing Conditions

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	
Southbound Ramp Terminal					
WB Approach	A	A	110'	120'	Distance to Adjacent Intersection – 560'
SB Approach	D	D	130'	100'	Ramp Length – 1,150'
Northbound Ramp Terminal					
EB Approach	A	A	150'	140'	Distance to Adjacent Intersection –560'
NB Approach	D	D	210'	230'	Ramp Length – 1,120'
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 (H1)

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

1) No-Action Alternative
2) Package A: GPL + CR + CB 85
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.

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Figure 3. No Action Alternative

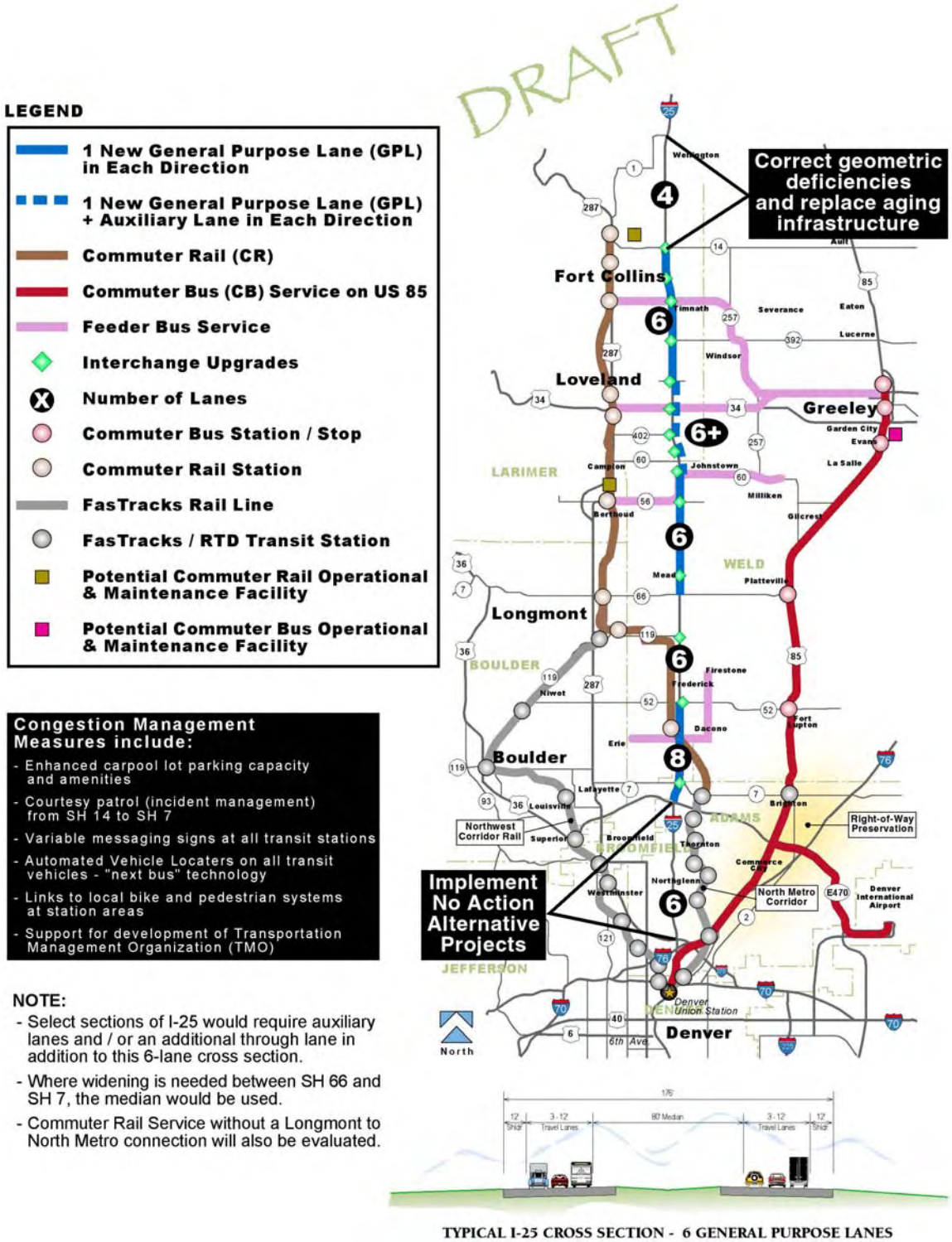

Figure 4. Package A

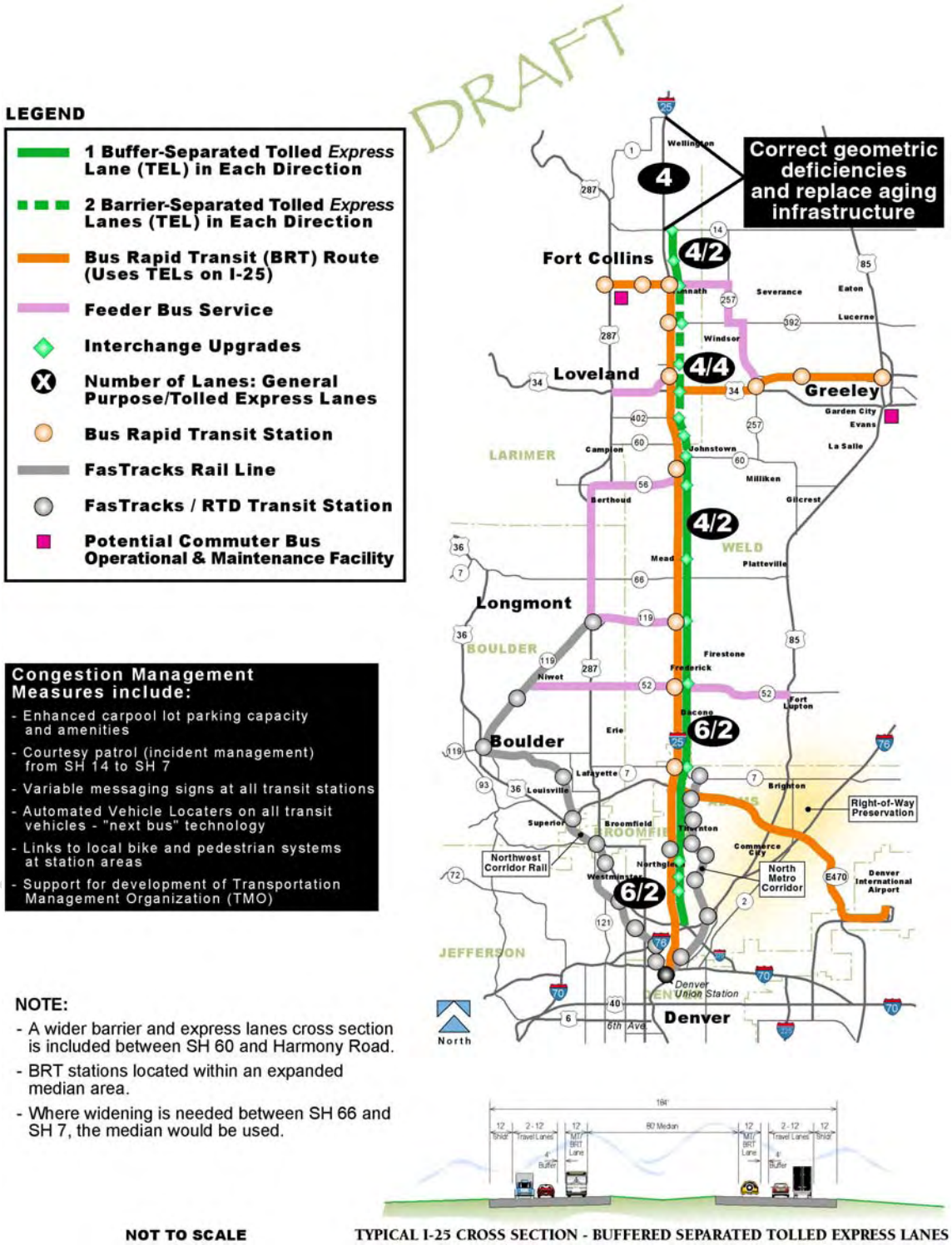

Figure 5. Package B

2030 No Action Traffic Volumes

Figure 6 depicts 2030 daily and peak hour No Action traffic projections for the SH 66 interchange and adjacent intersections. As shown, daily volume projections on SH 66 range from 25,400 vpd east of the interchange to 22,500 vpd west of the interchange, and ramp volumes range from 4,800 to 9,300 vehicles per day. These volumes show a pattern shift of traffic growing more to and from the east than the west. The patterns on the ramp volumes remain consistent with existing conditions; the majority to and from the south. The analysis for the No Action alternative used the improved design.

2030 Package A Traffic Volumes

Figure 7 depicts 2030 daily and peak hour Package A traffic projections for the SH 66 interchange and adjacent intersections. The volumes in the figure are generally similar to those in the No Action Alternative, but are slightly higher west of the interchange. Daily volume projections on SH 66 range from 25,100 vpd east of the interchange to 24,200 vpd west of the interchange, and ramp volumes range from 3,400 to 10,400 vehicles per day. The volumes patterns show slightly higher flow to and from the west as compared to No Action conditions.

2030 Package B Volumes

Figure 8 depicts 2030 daily and peak hour Package B traffic projections for the SH 66 interchange and adjacent intersections. The volumes in the figure are generally similar to those presented in the No Action Alternative. Daily volume projections on SH 66 range from 25,300 vpd east of the interchange to 22,900 vpd west of the interchange, and ramp volumes range from 5,500 to 9,500 vehicles per day.

2030 No Action Traffic Operations

Interchange Configuration

The existing SH 66 interchange will be reconstructed with the planned addition of new general purpose lanes on I-25. The existing bridge will be replaced with an eight lane bridge that would include two left turn lanes in each direction and two through lanes in each direction. In addition, the east frontage road would be relocated to provide approximately 600 feet of spacing from the northbound ramp intersection. Figure 6 shows the proposed configuration.

Interchange Operations

Figure 6 also shows the projected levels of service at the frontage road and ramp intersections on SH 66 under the No Action Alternative. As the figure indicates, all intersections in the interchange area would operate at LOS C or better in the peak periods. Table 3 shows the projected queuing for key movements at the interchange and validates that the planned re-design of the interchange will be adequate to service 2030 traffic demands.

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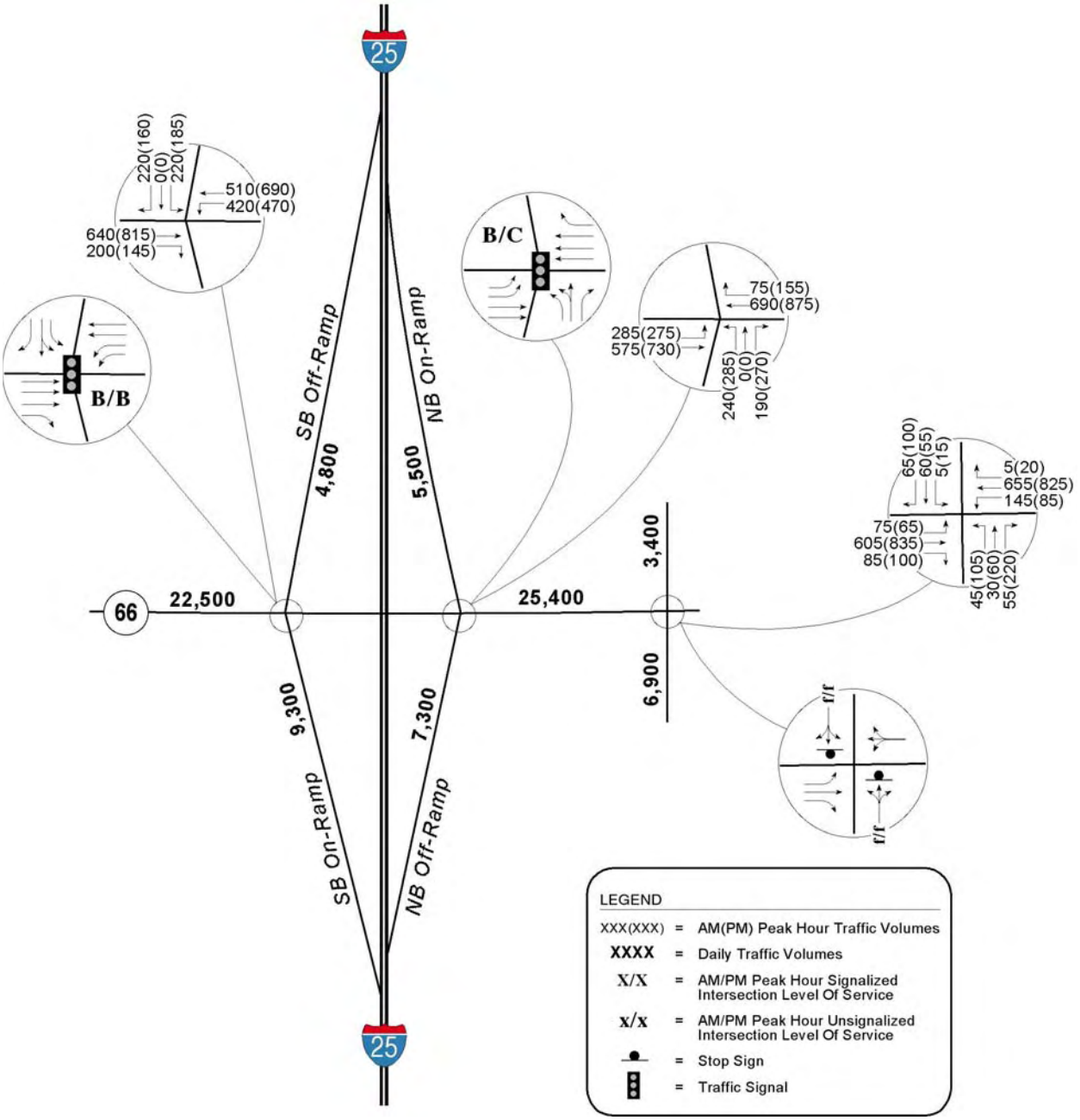

Figure 6. No Action Forecasts and Levels of Service

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

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[1]		Distance Between Intersections and Storage Length Provisions
	AM	PM	AM	PM	
Southbound Ramp Terminal					
EB Right	A	A	100’	80’	Storage Provided in Design – 200’
WB Left	B	B	330’	390’	Storage Provided in Design – 1,400’
WB Thru	A	A	90’	90’	Distance to Adjacent Intersection – 560’
SB Left	E	E	260’	250’	Storage Provided in Design – 800’
SB Right	D	D	50’	50’	Storage Provided in Design – 400’
Northbound Ramp Terminal					
EB Left	B	B	210’	250’	Storage Provided in Design – 1,300’
EB Thru	A	B	140’	150’	Distance to Adjacent Intersection – 560’
WB Thru	B	C	190’	240’	Distance to Adjacent Intersection – 650’
WB Right	B	B	50’	50’	Storage Provided in Design – 200’
NB Left	C	C	260’	270’	Storage Provided in Design – 800’
NB Right	C	C	50’	50’	Storage Provided in Design – 300’

[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

Package A traffic volumes were assigned to the planned improved interchange (Figure 7).

A 70-space carpool lot is proposed to the south of SH 66 and west of the southbound ramps. The carpool lot would be accessed from a local road off of SH 66.

Interchange Operations

Figure 7 also shows the levels of service for the ramps and frontage road intersections, along with recommendations for laneage at each location. As shown, all the 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.

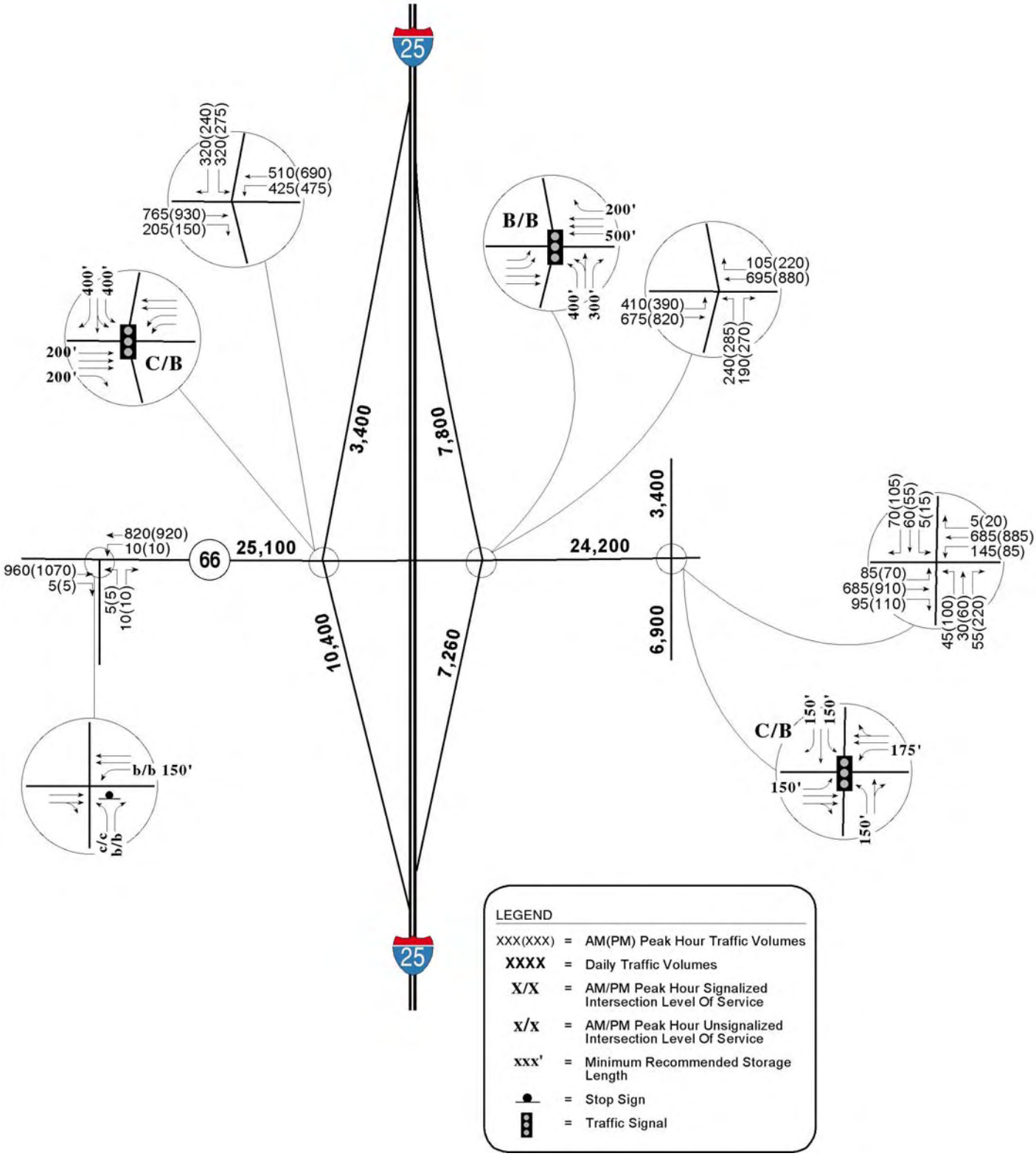

Figure 7. Package A Forecasts and Levels of Service

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[1]		Distance Between Intersections and Storage Length Provisions
	AM	PM	AM	PM	
Carpool Lot Access					
WB Left	B	B	50’	50’	Storage Provided in Design – 150’
Southbound Ramp Terminal					
EB Right	B	B	150’	150’	Storage Provided in Design – 200’
WB Left	C	B	530’	580’	Storage Provided in Design – 1,400’
WB Thru	A	A	80’	80’	Distance to Adjacent Intersection – 560’
SB Left	D	D	290’	300’	Storage Provided in Design – 800’
SB Right	D	D	50’	50’	Storage Provided in Design – 400’
Northbound Ramp Terminal					
EB Left	C	B	640’	570’	Storage Provided in Design – 1,300’
EB Thru	A	A	90’	140’	Distance to Adjacent Intersection – 560’
WB Thru	A	B	140’	170’	Distance to Adjacent Intersection – 650’
WB Right	A	A	50’	50’	Storage Provided in Design – 200’
NB Left	D	D	240’	290’	Storage Provided in Design – 800’
NB Right	D	D	50’	70’	Storage Provided in Design – 300’
East Frontage Road Intersection					
EB Left	C	A	90’	100’	Storage Provided in Design – 150’
EB Thru	C	A	280’	340’	Distance to Adjacent Intersection – 650’

[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 B Traffic Operations

Interchange Configuration

The proposed configuration for SH 66 in Package B is the same as in Package A (Figure 7). Likewise, the carpool lot location and size in Package B is the same as 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 would also operate acceptably in this package.

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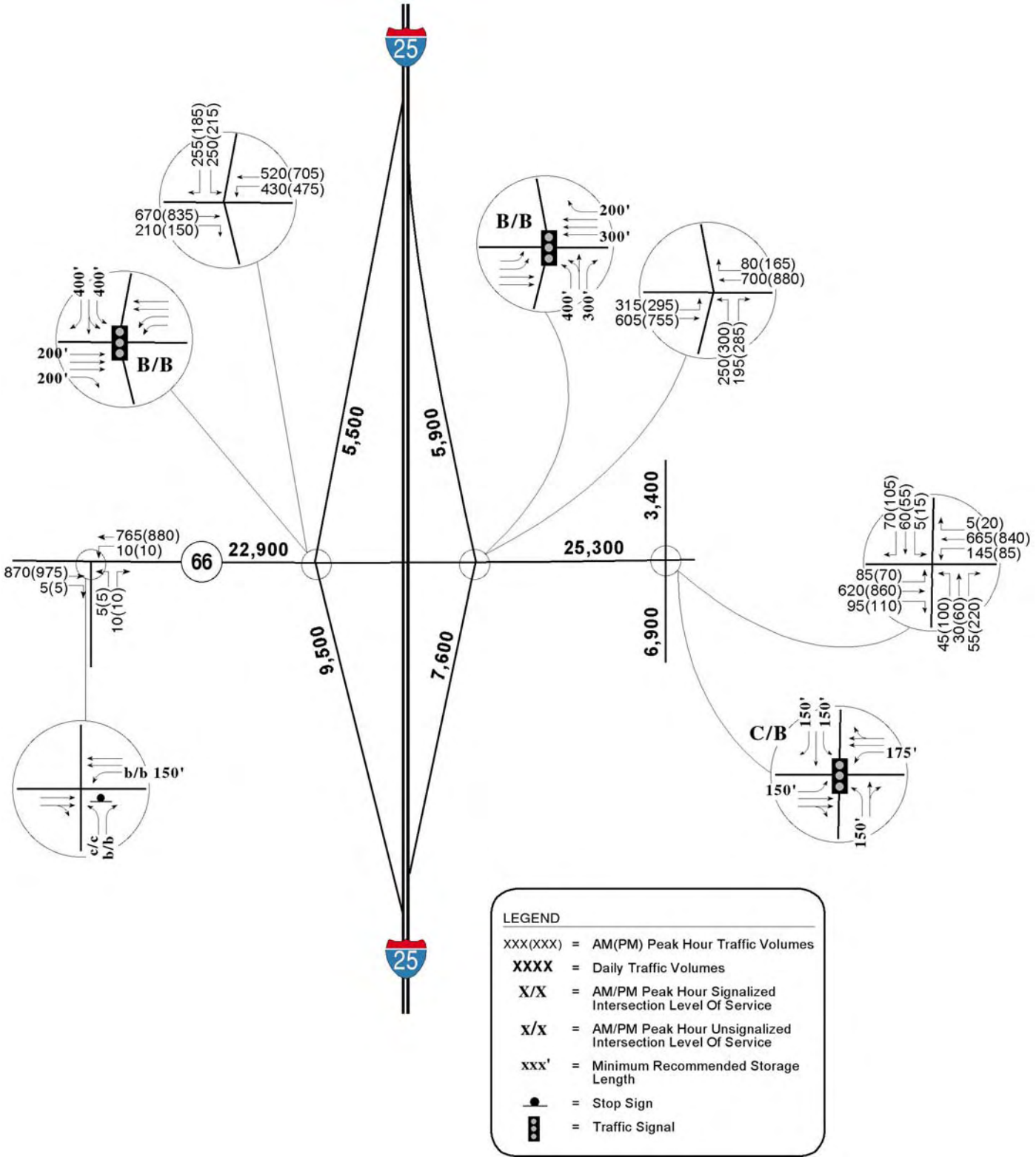

Figure 8. Package B Forecasts and Levels of Service

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

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[1]		Distance Between Intersections and Storage Length Provisions
	AM	PM	AM	PM	
Carpool Lot Access					
WB Left	B	B	50'	50'	Storage Provided in Design – 150'
Southbound Ramp Terminal					
EB Right	B	B	120'	130'	Storage Provided in Design – 200'
WB Left	C	B	520'	630'	Storage Provided in Design – 1,400'
WB Thru	A	A	70'	60'	Distance to Adjacent Intersection – 560'
SB Left	D	D	240'	230'	Storage Provided in Design – 800'
SB Right	D	D	50'	50'	Storage Provided in Design – 400'
Northbound Ramp Terminal					
EB Left	C	B	460'	410'	Storage Provided in Design – 1,300'
EB Thru	A	A	110'	160'	Distance to Adjacent Intersection – 560'
WB Thru	A	A	200'	180'	Distance to Adjacent Intersection – 650'
WB Right	A	A	50'	50'	Storage Provided in Design – 200'
NB Left	D	D	260'	310'	Storage Provided in Design – 800'
NB Right	D	D	50'	70'	Storage Provided in Design – 300'
East Frontage Road Intersection					
EB Left	C	A	120'	90'	Storage Provided in Design – 150'
EB Thru	C	A	260'	380'	Distance to Adjacent Intersection – 650'

[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.

Alternatives Evaluation Comparison

Traffic Operational Analysis

Table 6 compares the levels of service and delay at the SH 66 interchange for the three packages. As the table indicates, with the improvements already planned for this interchange, both ramps would operate at LOS C or better during both peak periods. The levels of service and delays at each intersection are virtually the same for both Package A and B, so it would appear that either package would result in adequate operations at this interchange.

Table 6. Intersection Level of Service and Delay

Intersection	No Action		Package A		Package B	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Southbound Ramps	LOS B (16 sec.)	LOS B (14 sec.)	LOS C (21 sec.)	LOS B (17 sec.)	LOS B (19 sec.)	LOS B (16 sec.)
Northbound Ramps	LOS B (18 sec.)	LOS C (20 sec.)	LOS B (16 sec.)	LOS B (16 sec.)	LOS B (16 sec.)	LOS B (17 sec.)
East Intersection	LOS C (20 sec.)	LOS B (15 sec.)	LOS C (22 sec.)	LOS B (15 sec.)	LOS C (21 sec.)	LOS B (15 sec.)

LOS X – Level of service
- Average delay in seconds per vehicle

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