

LCR 16 (Johnson Corner) at I-25 DEIS Interchange Evaluation

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 LCR 16 interchange at I-25 was constructed in 1962. The interchange is unique in the corridor in that it consists of only off-ramps. The southbound off-ramp terminates at LCR 16 but the northbound off-ramp is a hook style off-ramp that terminates into the east side frontage road. Both interchange ramps are one-lane with no dedicated turn lanes at the ramp terminals. On the east side of I-25 existing commercial development includes the Johnsons Corner truck stop, a hotel, a RV retailer and other minor commercial uses. On the west side of the interchange land is open fields.

The interchange area includes the following roadways:

LCR 16. LCR 16 is an east-west two lane rural roadway that extend about 3.5 miles to the east and about 3 miles to the west and does not connect a town or a city to I-25. The land along LCR 16 is primarily open fields both east and west of the interstate. The speed limit is 35 mph in the vicinity of the interchange and the southbound off-ramp terminal has no turn lanes and has stop sign-control.

East Frontage Road. The east side frontage road connects the LCR 16 interchange to full movement interchanges at SH 60 and SH 402. This roadway is two-lanes and has some turn lanes at newer access points. The frontage road intersection with LCR 16 has stop sign control and only has a left-turn lane on the east approach.

West Frontage Road. The west side frontage road is continuous between LCR 16 and SH 60. It has two lanes and provides access to residential and commercial uses located adjacent to I-25. The intersection with LCR 16 is located approximately 125 feet west of the southbound ramp intersection and has stop sign-control.

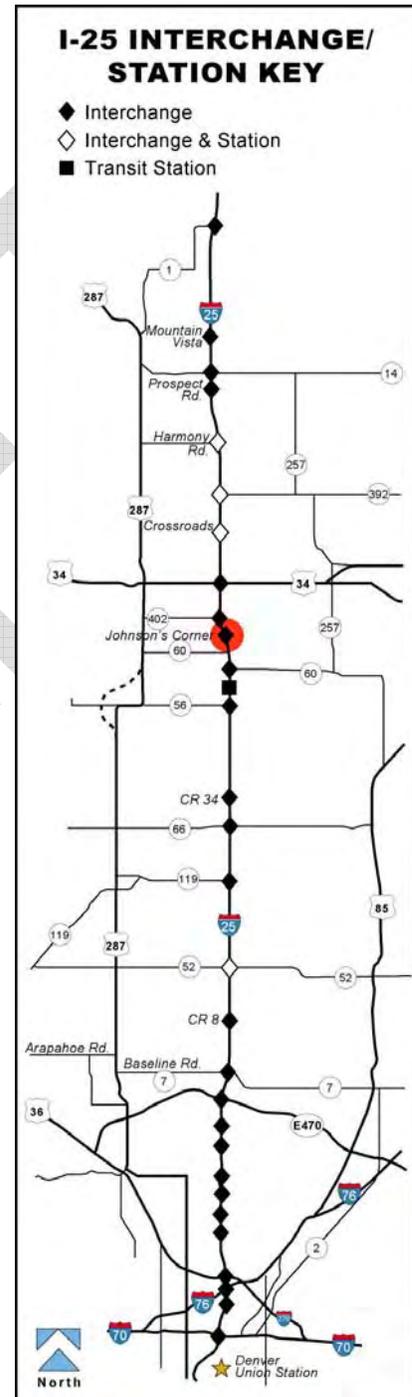


Figure 1. Vicinity Map

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Figure 2 summarizes the traffic counts collected in August 2004 at this interchange. As shown, average daily traffic on LCR 16 is between 500 and 800 vehicles per day. The east side frontage road has daily traffic volumes of about 3,500 vehicles per day north and south of LCR 16. The daily ramps volumes are 1,100 vehicles per day for the northbound off-ramp and 1,300 vehicles per day for the southbound off-ramp. Existing traffic volumes at this interchange represent the lowest traffic volumes observed on ramps and on cross-streets in the I-25 corridor. However, due to the Johnson Corner truck stop the percent of trucks using the frontage roads and LCR 16 are the highest in the corridor ranging from 15 to 25 percent on the east frontage road and LCR 16.

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

Figure 2 illustrates existing peak period levels of service at the ramp terminals and at frontage road intersections with LCR 16. As shown, turn movements at all intersections operate at LOS A or B 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 LCR 16 can queue into adjacent intersections and impede traffic flow at those locations,

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while vehicles on the ramps could queue back onto the interstate. North-south movements at the east and west frontage road intersections have not been included in the table because they would not impede traffic flow on LCR 16. As shown in the table, the 95th percentile queue lengths for all movements are less than the distance between intersections and do not exceed the current storage length provided on the ramps.

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

Intersection / Movement	Level of Service		Estimated 95 th Percentile Queue ¹		Intersection Spacing and Storage Length Provisions
	AM	PM	AM	PM	
West Frontage Road					
WB Approach	A	A	10'	10'	Distance to Adjacent Intersection – 120'
Southbound Off-Ramp					
EB Approach	A	A	N/A	N/A	Distance to Adjacent Intersection – 120'
SB Approach	A	A	80'	60'	Ramp Length – 1,000'
East Frontage Road					
EB Approach	B	A	40'	40'	Distance to Adjacent Intersection – 420'
NB Approach	A	A	10'	10'	Distance to Next Intersection – 490'
Northbound Off-Ramp					
EB Approach	A	B	60'	60'	Ramp Length – 380'
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 the southbound off-ramp on the eastbound approach traffic does not stop or turn so no queue will form.					

2030 Conditions

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

- 1) No-Action Alternative
- 2) Package A: GP + 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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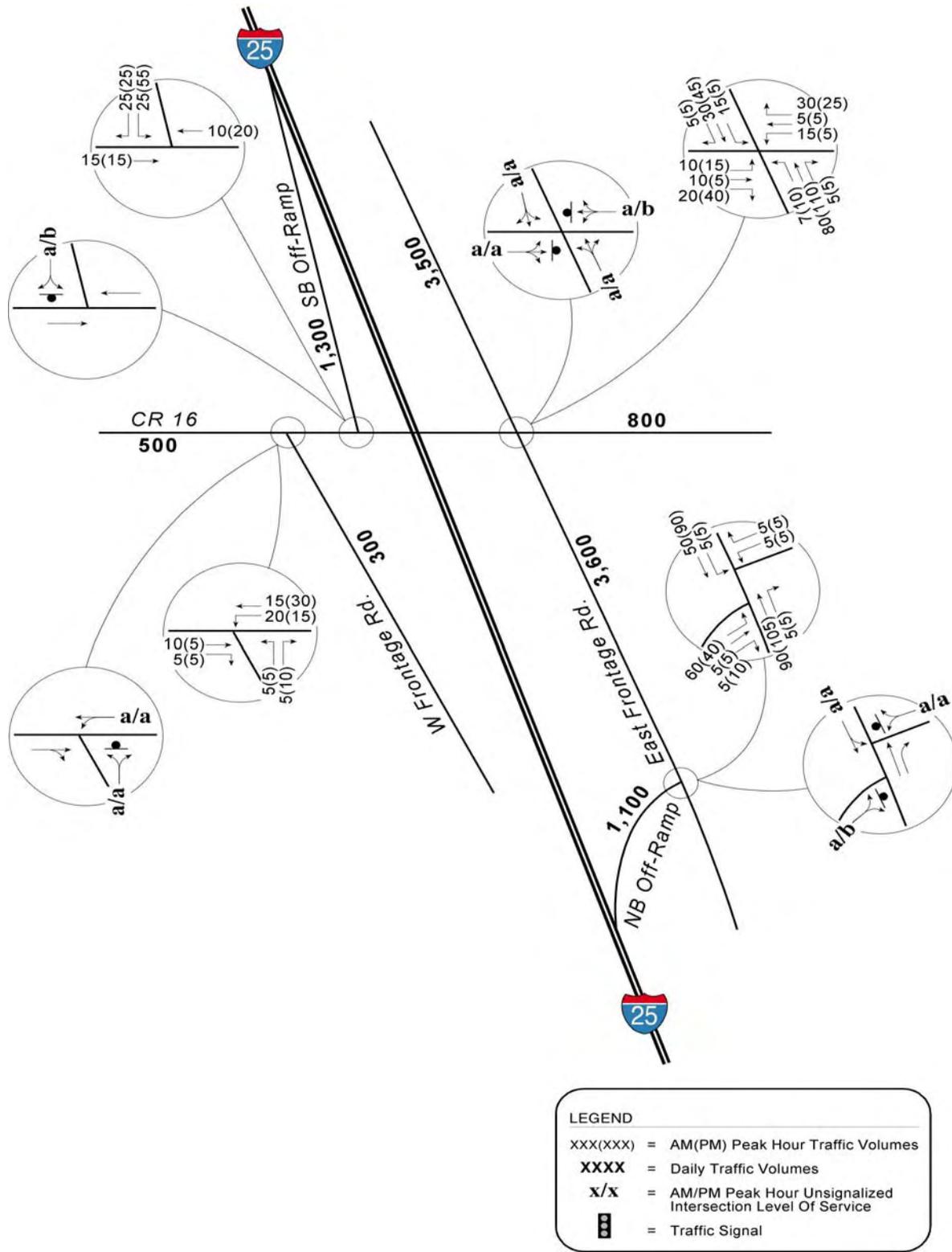


Figure 2. Existing Conditions

LEGEND

- ★ Major Structure Rehab by 2030
- Minor Structure Rehab by 2030
- Replace / Rehab Pavement by 2030
- Minor Safety Modifications by 2030
- FasTracks Rail Line

DRAFT



Figure 3. No Action Alternative

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LEGEND

- █ 1 New General Purpose Lane (GPL) in Each Direction
- ▒ 1 New General Purpose Lane (GPL) + Auxiliary Lane in Each Direction
- █ Commuter Rail (CR)
- █ Commuter Bus (CB) Service on US 85
- █ Feeder Bus Service
- ◆ Interchange Upgrades
- X Number of Lanes
- Commuter Bus Station / Stop
- Commuter Rail Station
- █ FasTracks Rail Line
- FasTracks / RTD Transit Station
- Potential Commuter Rail Operational & Maintenance Facility
- Potential Commuter Bus Operational & Maintenance Facility

Congestion Management Measures include:

- Enhanced carpool lot parking capacity and amenities
- Courtesy patrol (incident management) from SH 14 to SH 7
- Variable messaging signs at all transit stations
- Automated Vehicle Locaters on all transit vehicles - "next bus" technology
- Links to local bike and pedestrian systems at station areas
- Support for development of Transportation Management Organization (TMO)

NOTE:

- Select sections of I-25 would require auxiliary lanes and / or an additional through lane in addition to this 6-lane cross section.
- Where widening is needed between SH 66 and SH 7, the median would be used.
- Commuter Rail Service without a Longmont to North Metro connection will also be evaluated.



TYPICAL I-25 CROSS SECTION - 6 GENERAL PURPOSE LANES

Figure 4. Package A: GPL + CR + CB 85

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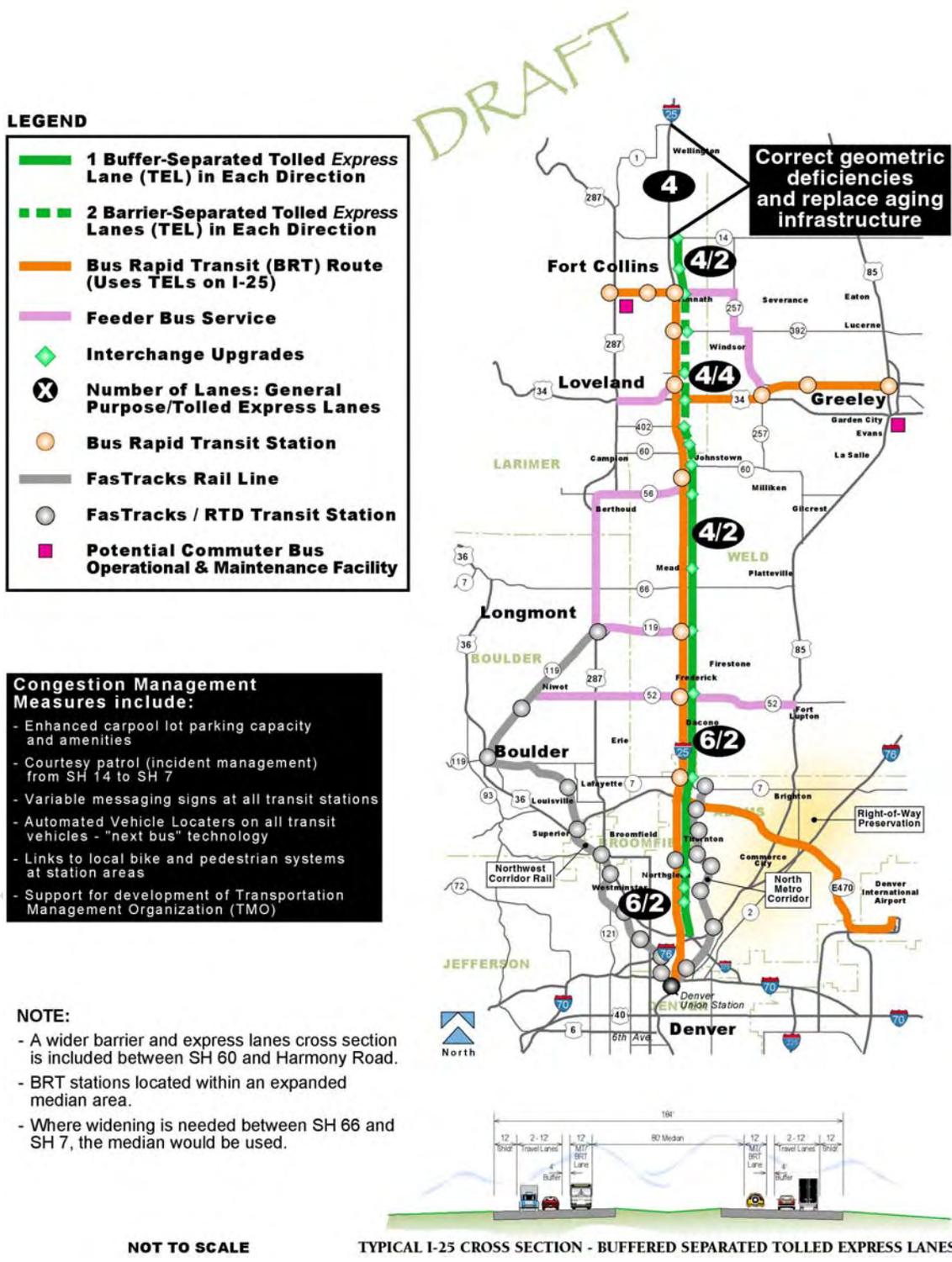


Figure 5. Package B: TEL + BRT

2030 No Action Traffic Volumes

Figure 6 depicts 2030 daily and peak hour No Action traffic projections for the LCR 16 interchange and adjacent intersections. As shown, daily volume projections on LCR 16 range from 2,000 vpd west of the interchange to 2,100 vpd east of the interchange, and off-ramp volumes range from 2,500 to 3,500 vehicles per day.

2030 Package A Traffic Volumes

Figure 7 depicts 2030 daily and peak hour Package A traffic projections for the LCR 16 interchange and adjacent intersections. The volumes in the figure differ from those of the No Action scenario, because Package A includes the addition of northbound and southbound on ramps at the interchange and the relocation of the northbound off-ramp to intersect LCR 16 instead of the east frontage road. As a result, daily volume projections on LCR 16 increase to 3,400 vpd west of the interchange and to 5,700 vpd east of the interchange. Ramp volumes also increase from the No Action scenario, with off-ramp volumes ranging from 3,400 to 5,400 vpd and on-ramp volumes ranging from 800 to 4,500 vpd.

2030 Package B Volumes

Figure 8 depicts 2030 daily and peak hour Package B traffic projections for the LCR 16 interchange and adjacent intersections. The volumes in the figure generally follow a similar pattern to Package A volumes but are slightly lower. Daily volume projections on LCR 16 range from 3,000 to 4,400 vehicles per day, off-ramp volumes range between 2,300 and 4,400 vpd and on-ramp volumes range between 900 and 4,500 vpd.

2030 No Action Traffic Operations

Figure 6 shows the projected levels of service at the frontage road and ramp intersections on LCR 16 under the No Action scenario. As the figure indicates, all turning movements at the off-ramp terminals and at the LCR 16 frontage road intersections would operate at LOS D or better during the peak hours. Table 3 shows the projected queuing for key movements at the interchange. The table further shows that even in the No Action condition the existing interchange configuration would function acceptably during the peak hours.

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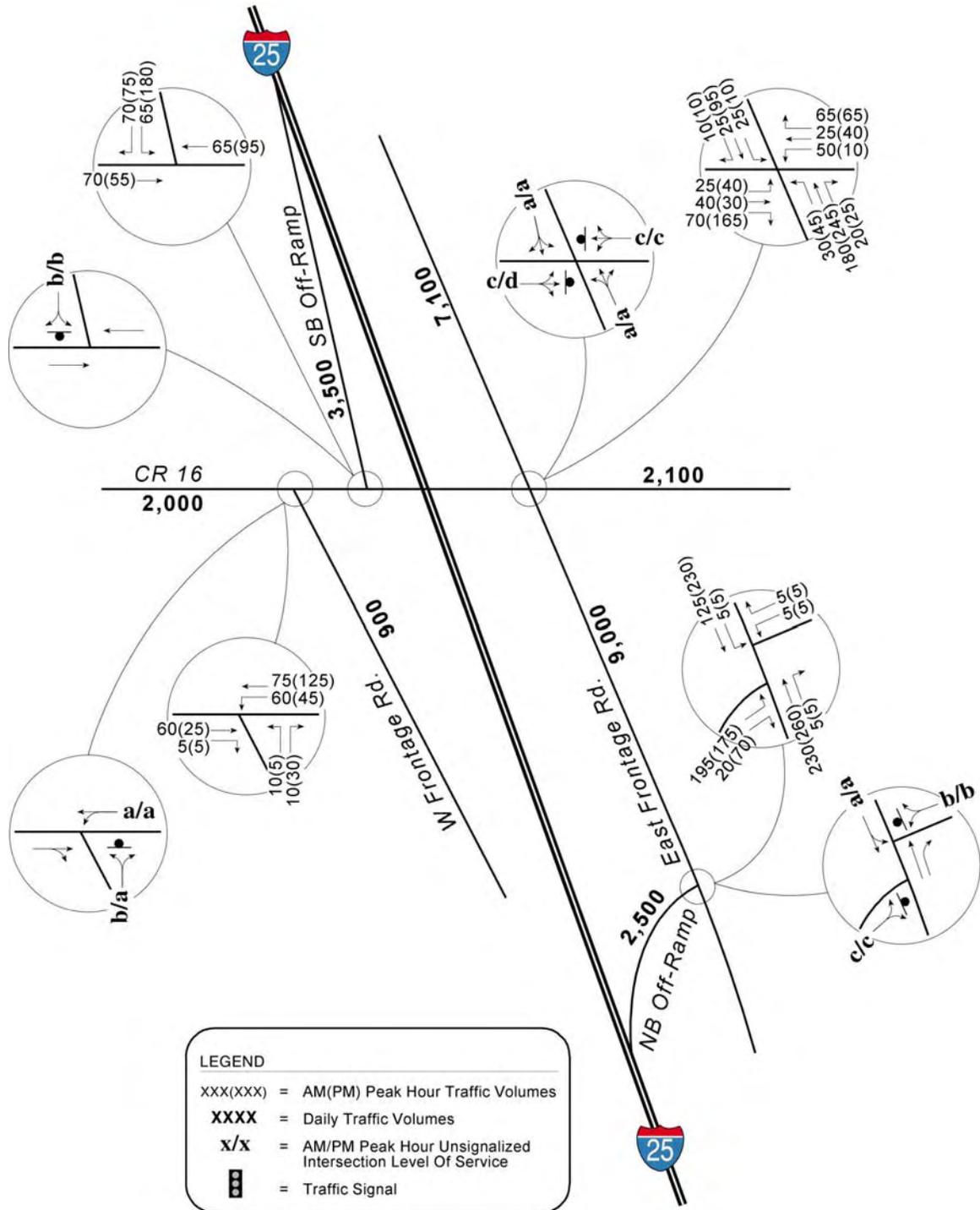


Figure 6. No Action Forecasts and Levels of Service

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

Intersection / Movement	Level of Service		Estimated 95 th Percentile Queue ¹		Intersection Spacing and Storage Length Provisions
	AM	PM	AM	PM	
West Frontage Road					
WB Approach	A	A	30'	20'	Distance to Adjacent Intersection – 120'
Southbound Off-Ramp					
EB Approach	A	A	N/A	N/A	Distance to Adjacent Intersection – 120'
SB Approach	B	B	70'	90'	Ramp Length – 1,000'
East Frontage Road					
EB Approach	C	D	60'	80'	Distance to Adjacent Intersection – 420'
NB Approach	A	A	20'	40'	Distance to Next Intersection – 490'
Northbound Off-Ramp					
EB Approach	C	C	100'	130'	Ramp Length – 380'
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 the southbound off-ramp on the eastbound approach traffic does not stop or turn so no queue will form.					

2030 Package A Traffic Operations

Interchange Configuration

The LCR 16 interchange, even in the No Action scenario will have low volumes and as a result the operational analysis discussed above shows acceptable levels of service and minimal queues with the current interchange configuration. Even though the current configuration gives acceptable levels of service, the LCR 16 is proposed to be reconfigured into a diamond interchange. This reconfiguration replaces the substandard northbound “hook” off-ramp, increases accessibility to areas around LCR 16 and is consistent with FHWA’s preference for full movement interchanges.

Specifically, the reconfigured LCR 16 interchange would add on-ramps to I-25, shift the northbound off-ramp terminal to LCR 16 and shift the east frontage road east of Johnson Corner to a new intersection that is about 1,000 feet from the northbound ramp terminal. Also, the vertical alignment of LCR 16 changes so that it would go over I-25. The new bridge over I-25 would have sufficient width to allow at least one through lane in each direction and back-to-back left-turn lanes at the ramp terminals. The northbound and southbound off ramps would be constructed with exclusive left and right turn lanes. Both ramp terminals and the east frontage road intersection with LCR 16 would be signalized while the west frontage road intersection would remain unsignalized.

Interchange Operations

Figure 7 also shows the levels of service for the ramp terminals and frontage road intersections, along with recommendations for laneage and storage at each location. As shown, all three signalized intersections are anticipated to operate at LOS B with the forecasted traffic volumes and the enhancements identified. Turn movements at the unsignalized west frontage road intersection would operate at LOS C or better during the peak hours.

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. So, the new interchange configuration appears to provide good operations at both ramp terminals and at the frontage road intersections.

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 most cases the estimated 95th percentile queues would be contained within the turn bays or within the space between adjacent intersections. For both the northbound and southbound off-ramps, the queues are accommodated within the storage length and would not extend into the I-25 main lanes.

2030 Package B Traffic Operations

Interchange Configuration

The proposed configuration for LCR 16 in Package B is the same as in Package A (Figure 8).

Interchange Operations

Figure 8 also shows the levels of service for the ramp terminals and frontage road intersections, along with recommendations for laneage and storage at each location. As shown, all three signalized intersections are anticipated to operate at LOS B with the forecasted traffic volumes and the enhancements identified. Turn movements at the unsignalized west frontage road intersection would operate at LOS C or better during the peak hours.

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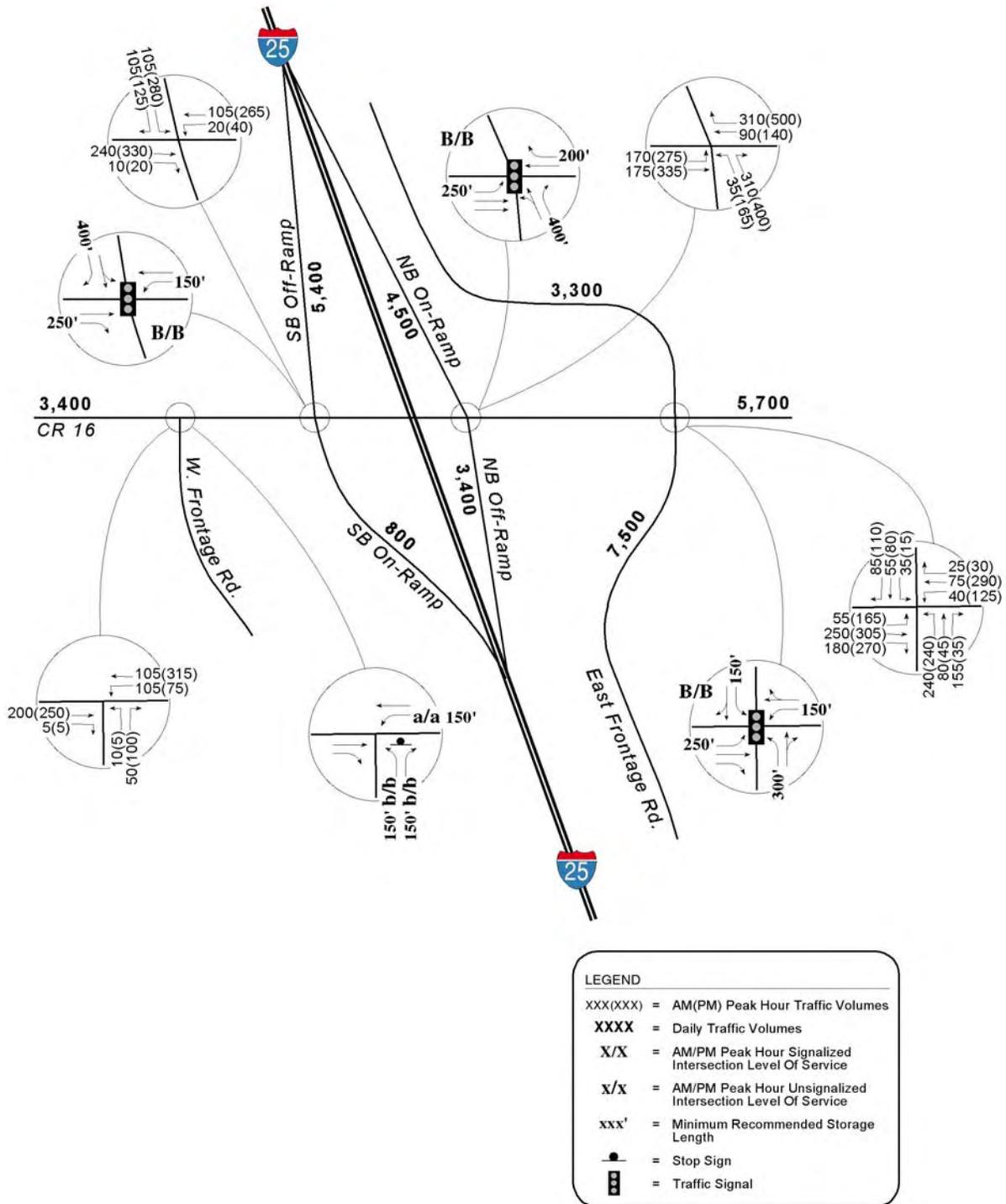


Figure 7. Package A Forecasts and Levels of Service

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

Intersection / Movement	Level of Service		Estimated 95 th Percentile Queue ¹		Distance Between Intersections and Storage Length Provisions
	AM	PM	AM	PM	
West Frontage Road Intersection					
WB Left	A	A	50'	40'	Storage Provided in Design – 150'
Southbound Ramp Terminal					
EB Thru	A	B	80'	210'	Distance to Adjacent Intersection – 580'
EB Right	A	B	20'	20'	Storage Provided in Design – 250'
WB Left	A	B	40'	50'	Storage Provided in Design – 150'
WB Thru	A	A	70'	140'	Distance to Adjacent Intersection – 580'
SB Left	D	D	90'	260'	Storage Provided in Design – 400'
SB Right	C	C	60'	60'	Storage Provided in Design – 400'
Northbound Ramp Terminal					
EB Left	A	A	110'	250'	Storage Provided in Design – 250'
EB Thru	A	A	80'	90'	Distance to Adjacent Intersection – 580'
WB Thru	A	A	70'	110'	Distance to Adjacent Intersection – 580'
WB Right	A	C	80'	190'	Storage Provided in Design – 200'
NB Left	C	C	70'	160'	Storage Provided in Design – 400'
NB Right	C	C	90'	160'	Storage Provided in Design – 400'
East Frontage Road Intersection					
EB Left	A	B	80'	170'	Storage Provided in Design – 250'
EB Thru	A	A	150'	220'	Distance to Adjacent Intersection – 1,100'
EB Right	A	A	70'	90'	Distance to Adjacent Intersection – 1,100'
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 multiple thru movements the queue length is the longest queue observed in any through lane. For a single turn lane (i.e. right turn), the queue is just the queue for that lane.					

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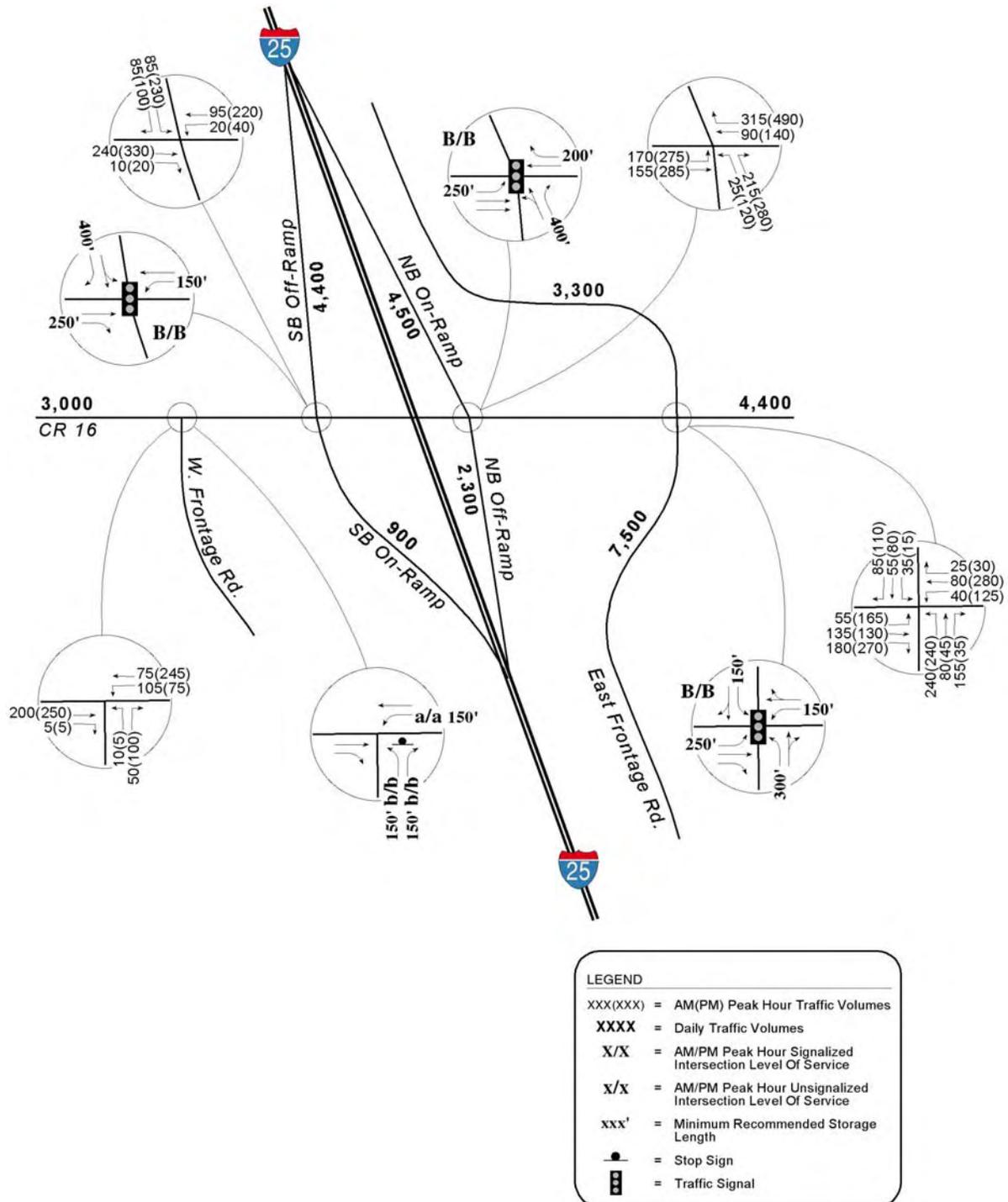


Figure 8. Package B Forecasts and Levels of Service

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Table 5 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. So, the new interchange configuration appears to provide good operations at both ramp terminals and at the frontage road intersections.

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

Intersection / Movement	Level of Service		Estimated 95 th Percentile Queue ¹		Distance Between Intersections and Storage Length Provisions
	AM	PM	AM	PM	
West Frontage Road Intersection					
WB Left	A	A	50'	50'	Storage Provided in Design – 150'
WB Thru	(free)	(free)	NA	NA	Unsignalized – Movement is free
Southbound Ramp Terminal					
EB Thru	A	B	70'	180'	Distance to Adjacent Intersection – 580'
EB Right	A	A	10'	30'	Storage Provided in Design – 250'
WB Left	A	A	30'	60'	Storage Provided in Design – 150'
WB Thru	A	A	40'	100'	Distance to Adjacent Intersection – 580'
SB Left	D	D	100'	220'	Storage Provided in Design – 400'
SB Right	C	C	50'	60'	Storage Provided in Design – 400'
Northbound Ramp Terminal					
EB Left	A	A	100'	180'	Storage Provided in Design – 250'
EB Thru	A	A	30'	70'	Distance to Adjacent Intersection – 580'
WB Thru	A	A	50'	100'	Distance to Adjacent Intersection – 580'
WB Right	A	C	60'	170'	Storage Provided in Design – 200'
NB Left	C	C	70'	140'	Storage Provided in Design – 400'
NB Right	C	C	80'	100'	Storage Provided in Design – 400'
East Frontage Road Intersection					
EB Left	B	B	70'	140'	Storage Provided in Design – 250'
EB Thru	B	A	110'	100'	Distance to Adjacent Intersection – 1,100'
EB Right	B	A	70'	100'	Distance to Adjacent Intersection – 1,100'
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 multiple thru movements the queue length is the longest queue observed in any through lane. For a single turn lane (i.e. right turn), the queue is just the queue for that lane.					

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Alternatives Evaluation Comparison

Traffic Operational Analysis

Table 6 compares the levels of service and delay at the LCR 16 interchange for Package A and Package B. As the table indicates the level of service and delays at each intersection are virtually the same for both alternatives, so it would appear that either package would result in adequate operations at this interchange.

Table 6. Intersection Level of Service and Delay

Intersection	Package A		Package B	
	AM Peak	PM Peak	AM Peak	PM Peak
Southbound Ramps	LOS B (15 sec.)	LOS B (19 sec.)	LOS B (14 sec.)	LOS B (18 sec.)
Northbound Ramps	LOS B (14 sec.)	LOS B (18 sec.)	LOS B (10 sec.)	LOS B (16 sec.)
East Frontage Road	LOS B (16 sec.)	LOS B (17 sec.)	LOS B (19 sec.)	LOS B (16 sec.)

- Average delay in seconds per vehicle