NORTH I-25 EIS

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PROSPECT ROAD FULL DIAMOND PACKAGE A

DRAFT

CACHE LA POUDRE RESERVOIR INLET

FORT COLLINS

TOTAL PARKING SHOWN - 140 SPACES

30
30
20
30
30

PROSPECT RD

PROSPECT RD

FORT COLLINS

FORT COLLINS

FORT COLLINS

CANAL

LAKE

268

25

North

SCALE: 1"=200'

October 1, 2007

U.S. Department of Transportation
Federal Highway Administration

PROSPECT ROAD

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NORTH I-25 EIS

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PROSPECT ROAD FULL DIAMOND PACKAGE B

DRAFT

CACHE LA POUDRE RESERVOIR INLET

FORT COLLINS

TOTAL PARKING SHOWN - 140 SPACES

PROSPECT RD

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PROSPECT ROAD

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Prospect Road 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 of Prospect Road with I-25 (milepost 268) was built in 1966 and connects I-25 with Fort Collins to the west and rural Larimer County to the east. Prospect Road to the west is a two lane road that serves as one of the three access routes to Fort Collins, but because Harmony Road to the south and SH 14 to the north are four lane roads that also provide connections into town, Prospect carries somewhat less traffic than those other two arterials. East of the interchange, Prospect Road becomes LCR 44 and provides access to rural areas of Larimer County.

The interchange area includes the following roadways:

Prospect Road (LCR 44). To the west along Prospect Road the land use transitions from relatively undeveloped near the interchange to primarily residential as the road progresses toward Fort Collins. Prospect widens to four lanes at Sharp Point Drive as it nears the city. The land east of the interchange along LCR 44 remains primarily undeveloped. Both I-25 interchange terminals had stop-sign control at the time of data collection for the North I-25 EIS but in November 2006 CDOT signalized both ramp terminals.

West Frontage Road. Just west of the interchange is an existing intersection that provides access to the west frontage road. As with the ramp terminals, this intersection had stop-sign control at the time of data collection but was recently signalized by CDOT in November 2006. The land use along the frontage road both north and south of Prospect is currently agricultural.

East Frontage Road. An existing intersection east of the interchange provides access to the east frontage road. This intersection still has stop-sign control. Like the west frontage road, the east frontage road currently serves agricultural lands north and south of Prospect.

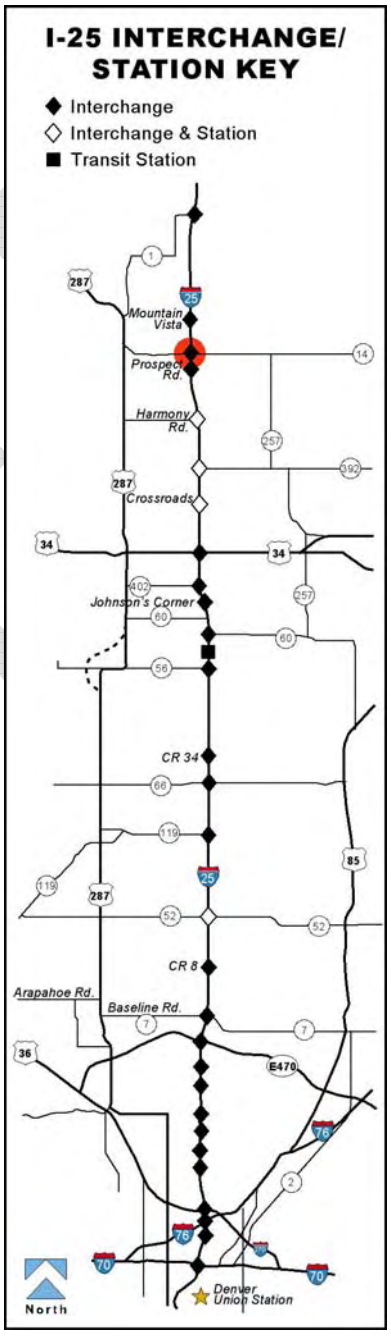

Figure 1. Vicinity Map

Figure 2 summarizes the traffic counts collected in August 2004 at the interchange. The figure shows that a majority of the traffic in the area is oriented to and from the west and south. For example, average daily traffic is around 19,200 vehicles per day (vpd) west of the interchange but is only about 4,100 vpd east of the interchange, and the ramps to and from the south range from 3,600 to 6,800 vpd while the ramps to and from the north average 2,400 vpd. At the interchange, the highest peak hour volumes occur for the northbound to westbound left-turn movement, with 650 vehicles in the AM peak and 430 vehicles in the PM peak. Both these volumes represent a significant amount of traffic for a left turn movement.

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 vehicle 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 adjacent intersections. As previously mentioned, CDOT recently signalized the ramp terminals and the west frontage road intersection; however, since counts were collected when these intersections operated with STOP-sign control the existing conditions analysis assumes a STOP-sign condition at all intersections. As shown in the figure, the northbound left turn movement operates at LOS F during both peak hours due to the high traffic volume. At the west frontage road intersection, the side street movements operate at LOS F during the afternoon peak due to the volume of through traffic on Prospect Road.

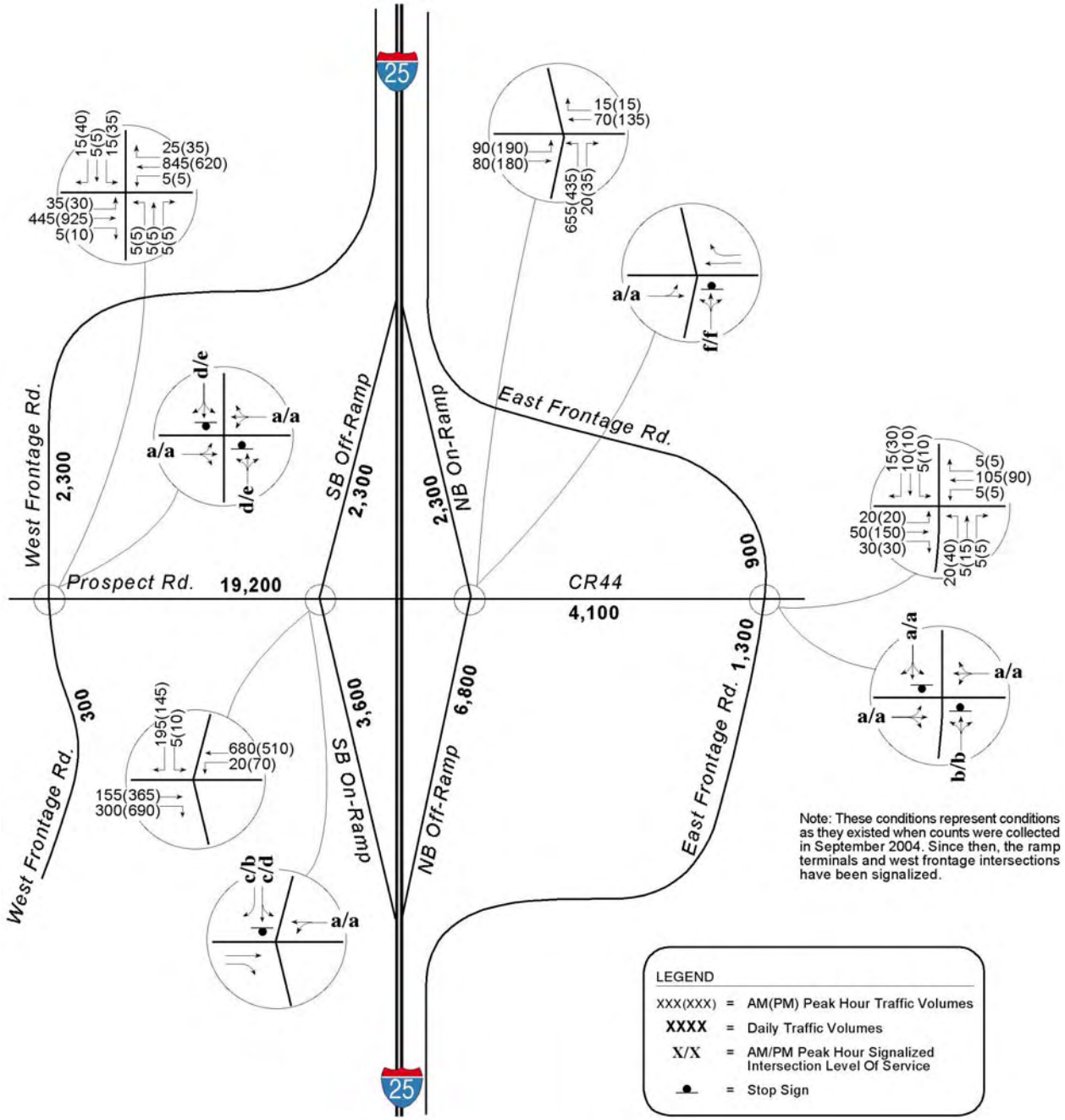

Figure 2. Existing Conditions

In addition to the intersection level of service shown in Figure 2, 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 Prospect Road 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 Prospect Road.

Table 2 also shows peak hour levels of service for key movements at the ramp terminals and at adjacent intersections. As noted above, only the northbound left turn at the off-ramp currently operates at a LOS F, but for that movement, as well as for all other key movements, the SimTraffic 95th percentile queue lengths were not greater than the current storage length provided.

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

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[3]		Intersection Spacing and Storage Length Provisions
	AM	PM	AM	PM	
Southbound Ramp Terminal					
WB LT/TH	A	A	40’	100’	Distance to Adjacent Intersection – 450’
SB Left	C	C	110’	30’	Current Storage Provided – 990’
SB Right[1]	C	C	140’	50’	Current Storage Provided – 185’
Northbound Ramp Terminal					
EB LT/TH/RT	A	A	40’	70’	Distance to Adjacent Intersection – 450’
NB LT/RT[2]	F	F	250’	400’	Current Storage Provided – 1,100’
West Frontage Road					
WB LT/TH/RT	A	A	40’	30’	Distance to Adjacent Intersection – 990’
East Frontage Road					
EB LT/TH/RT	A	A	10’	10’	Distance to Adjacent Intersection – 1000’

1. The southbound right turn flare provides 185 feet of storage; the ramp length is 990 feet from through/left turn stop line to gore.
2. The northbound ramp is 1,100 feet from the left/through/right turn stop line to gore; the right turn flare does not provide any appreciable storage.
3. The queue lengths given in this table primarily come from SimTraffic.

2030 Conditions

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

1) No-Action Alternative
2) Package A: GLP + 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.

2030 No Action Traffic Volumes

The No Action Alternative daily and peak hour projections for the Prospect Road interchange are shown in Figure 6. As shown, daily volume projections on Prospect Road range from 26,000 vpd east of the interchange to 60,000 vpd west of the interchange, and ramp volumes range from 10,000 to 15,000 vehicles per day. These volumes show similar patterns as existing counts; the highest traffic flows are westerly to and from Fort Collins and southerly on the ramps.

2030 Package A Traffic Volumes

The Package A daily and peak hour projections for the Prospect Road interchange are shown in Figure 7. The volumes in the figure are generally similar to those presented in the No Action Alternative, differing slightly due to the change in capacity on I-25. Daily volume projections on Prospect Road range from 26,000 vpd east of the interchange to 63,900 vpd west of the interchange, and ramp volumes range from 11,000 to 17,000 vehicles per day. The volumes patterns are generally the same patterns as existing conditions and No Action conditions; the highest traffic flow is westerly to and from Fort Collins and southerly on the ramps.

2030 Package B Traffic Volumes

Figure 8 depicts 2030 daily and peak hour Package B traffic projections for the Prospect Road interchange and adjacent intersections. The volumes in the figure are generally similar to those volumes in the No Action Alternative and in Package A, differing slightly due to the change in capacity on I-25. Daily volume projections on Prospect Road range from 26,100 vpd east of the interchange to 60,300 vpd west of the interchange, and ramp volumes range from 11,400 to 16,300 vehicles per day. While the traffic patterns in Package B are generally similar to both No Action and Package A (the highest flows are to and from the west and south), the flow to and from the north is higher than in either of the other alternatives.

Figure 3. No Action Alternative

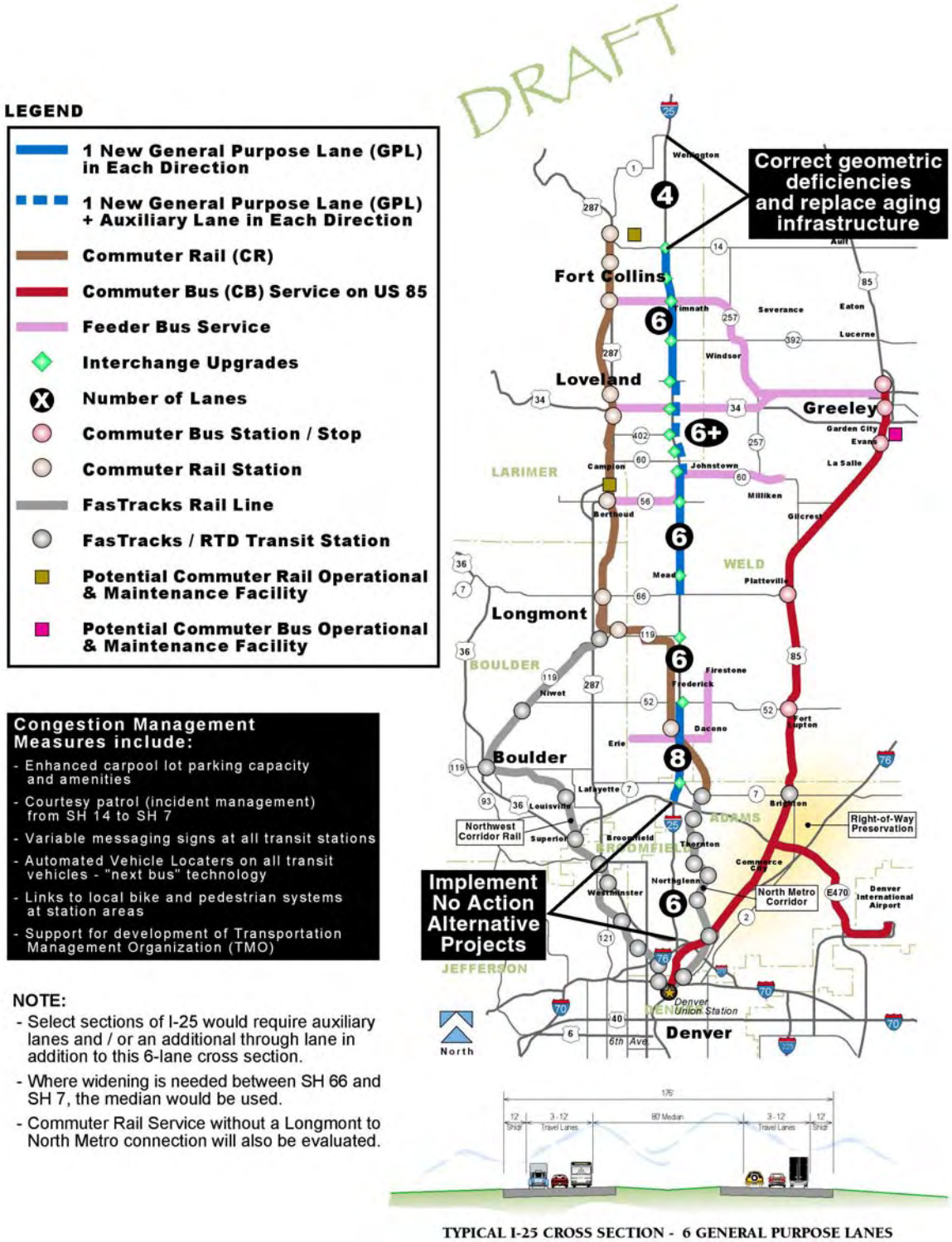

Figure 4. Package A

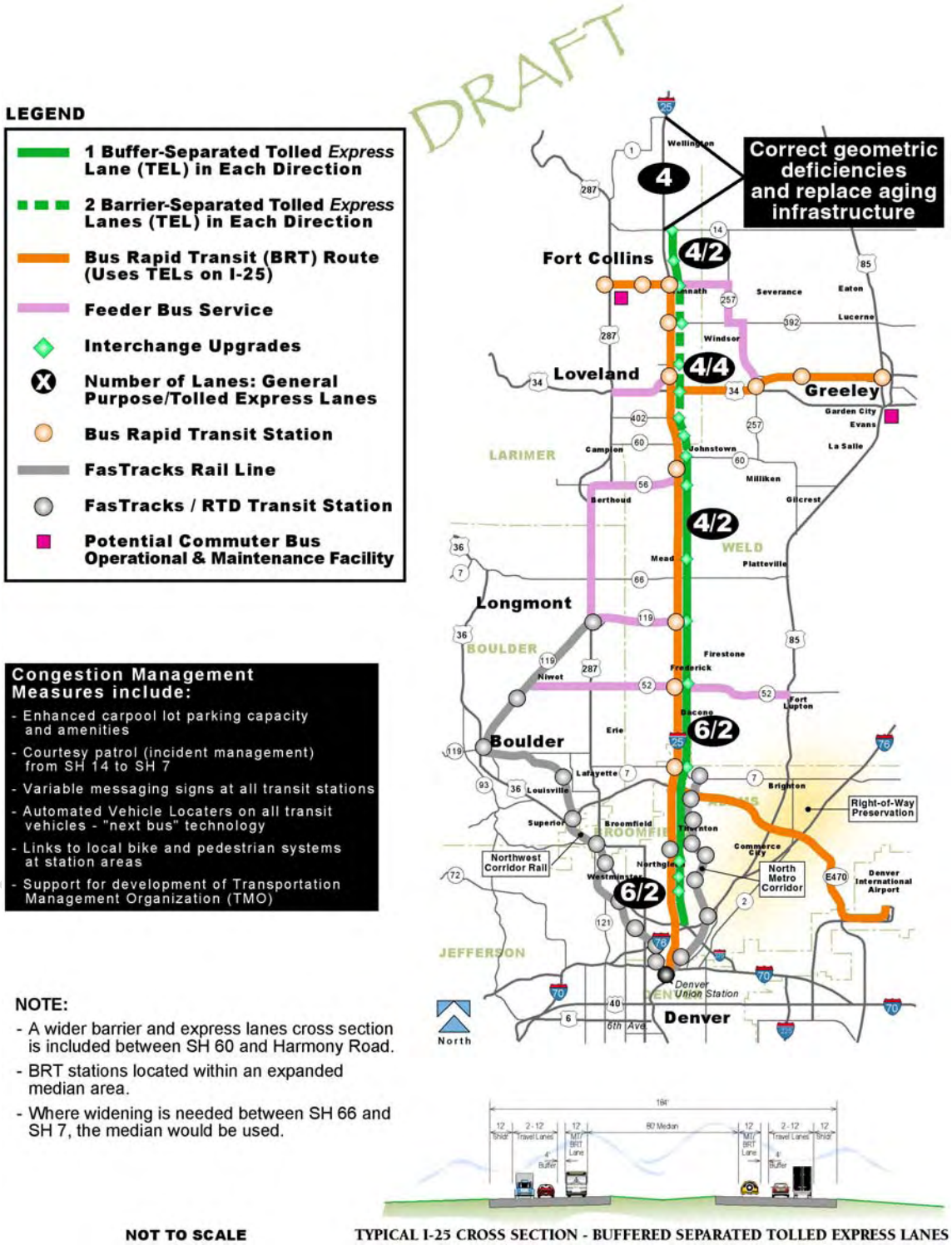

Figure 5. Package B

The traffic forecasts for Prospect Road west of the interchange are significantly higher than the generally accepted capacity of a four lane major arterial (32,000 vpd) under both Package A and Package B, but have been used in the analysis here to present a conservative analysis, ensuring that the turn lane designs at the interchange would accommodate higher traffic volumes. This was done because there are enough examples of other arterial roadways in Colorado carrying significantly more traffic than their generally accepted capacity (Table 3) to suggest it would be prudent to design for the higher forecasts.

Table 3. Arterial Roadways where Current Actual Traffic Volumes Significantly Exceed the Generally Accepted Roadway Capacity

Facility	Location	Roadway Type	Capacity	Actual Volume
Colorado	at I-25	6-lane Major	48,000 vpd	70,000 vpd
Wadsworth	n/o I-70	6-lane Major	48,000 vpd	62,500 vpd
Federal	s/o 6th Avenue	5-lane Major	40,000 vpd	51,200 vpd
Hampden	w/o I-25	4-lane Major	32,000 vpd	53,400 vpd
US 287	at US 36	4-lane Major	32,000 vpd	51,300 vpd
Sheridan	s/o 6th Avenue	4-lane Major	32,000 vpd	45,100 vpd

2030 No Action Traffic Operations

Figure 6 shows the projected levels of service at the frontage road and ramp intersections on Prospect under the No Action Alternative. While the traffic model assumed Prospect would have four lanes, for the purpose of this analysis it was assumed that Prospect would remain a two lane road, since (1) that geometry is more representative of true no action conditions in the area, and (2) the Package A section identifies the improvements necessary to accommodate Package A traffic forecasts, which are similar to the No Action projections. As the figure indicates all intersections were assumed to be signalized, and as expected given traffic projections west of I-25 nearly all intersections would operate at LOS F with only minor enhancements (i.e. exclusive right and left turn lanes) to the roadway configuration. In addition, the left turn movements from Prospect onto the I-25 ramps would block traffic on the arterial due to the lack of available gaps in the oncoming traffic stream, indicative of a roadway with traffic volumes that far exceed capacity. Table 4 shows the projected queuing for key movements at the interchange and further underscores that the existing interchange would be in need of capacity improvements with the projected traffic volumes.

Table 4. 2030 No Action Level of Service and Queue Lengths for Key Movements

Intersection / Movement	Level of Service		Estimated 95th Percentile Queue[3]		Intersection Spacing and Storage Length Provisions
	AM	PM	AM	PM	
Southbound Ramp Terminal					
WB LT/TH	F	F	> 500'	> 500'	Distance to Adjacent Intersection – 450'
SB Left	C	C	> 1000'	> 1000'	Current Storage Provided – 990'
SB Right[1]	A	A	270'	300'	Current Storage Provided – 185'
Northbound Ramp Terminal					
EB LT/TH	F	F	> 620'	> 500'	Distance to Adjacent Intersection – 450'
NB LT/RT[2]	F	F	>1100'	>1100'	Current Storage Provided – 1,100'
West Frontage Road					
WB Thru	F	F	970'	430'	Distance to Adjacent Intersection – 990'
East Frontage Road					
EB Thru	A	B	100'	50'	Distance to Adjacent Intersection – 1,000'

1. The southbound right turn flare provides 185 feet of storage; the ramp length is 990 feet from through/left turn stop line to gore.
2. The northbound ramp is 1,100 feet from the left/through/right turn stop line to gore; the right turn flare does not provide any appreciable storage.
3. The queue lengths given in this table primarily come from SimTraffic.

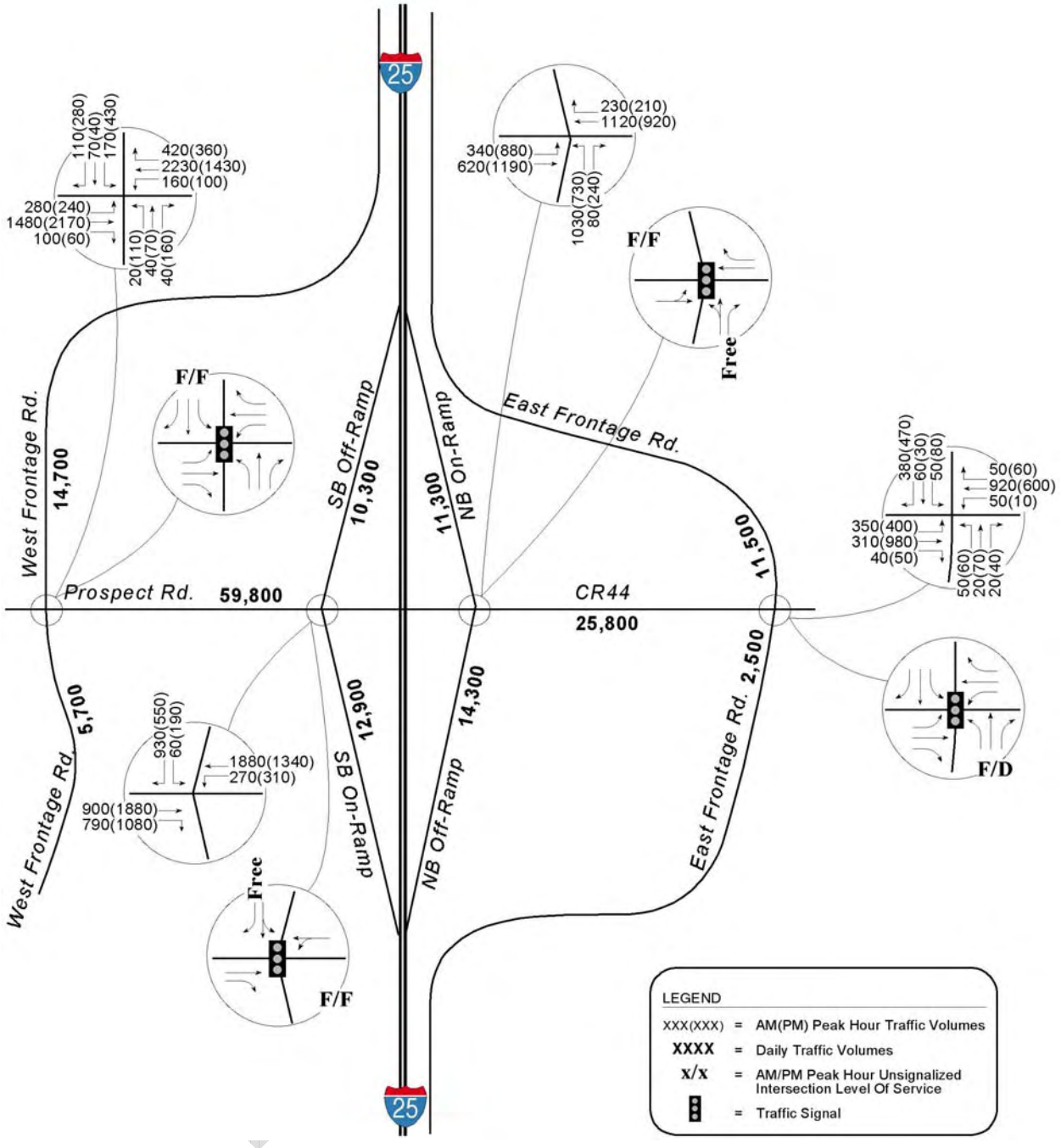

Figure 6. No Action Forecasts and Levels of Service

2030 Package A Traffic Operations

Interchange Configuration

The proposed configuration for the Prospect Road DEIS interchange evaluation is a diamond configuration. This diamond configuration maintains the current terminal spacing but has several lane enhancements over the existing interchange. Specifically, the design includes a new bridge with seven lanes to accommodate dual left-turn lanes and two through lanes in the eastbound and westbound directions, and both the northbound and southbound off-ramps have been widened to accommodate dual-left turn lanes and an exclusive right turn lane.

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, the ramp terminals and the frontage road intersections are anticipated to operate at LOS D or better with the forecasted traffic volumes and the enhancements identified.

Table 5 summarizes the levels of service for key individual turning movements at each intersection. As shown in the table, specific movement levels of service at this interchange range from LOS A to LOS E , but the only movement levels of service of less than LOS D are the left turn movement from the southbound off ramp in the AM peak and the left turn movement from the northbound off ramp in the PM peak. Both these movements operate at LOS E, indicating they operate near capacity but do not exceed the capacity.

Table 5 compares SimTraffic estimates of the 95th percentile queue length for those key movements to the storage distance available for each. For turning movements, the distance listed is the turn lane storage length provided in the design, 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, left-turn queues would be accommodated well within the storage length and would not extend into the I-25 main lanes. Likewise, the right turn from the northbound and southbound off-ramps have free right conditions, so projected queue lengths are well within the available storage length on the ramp.

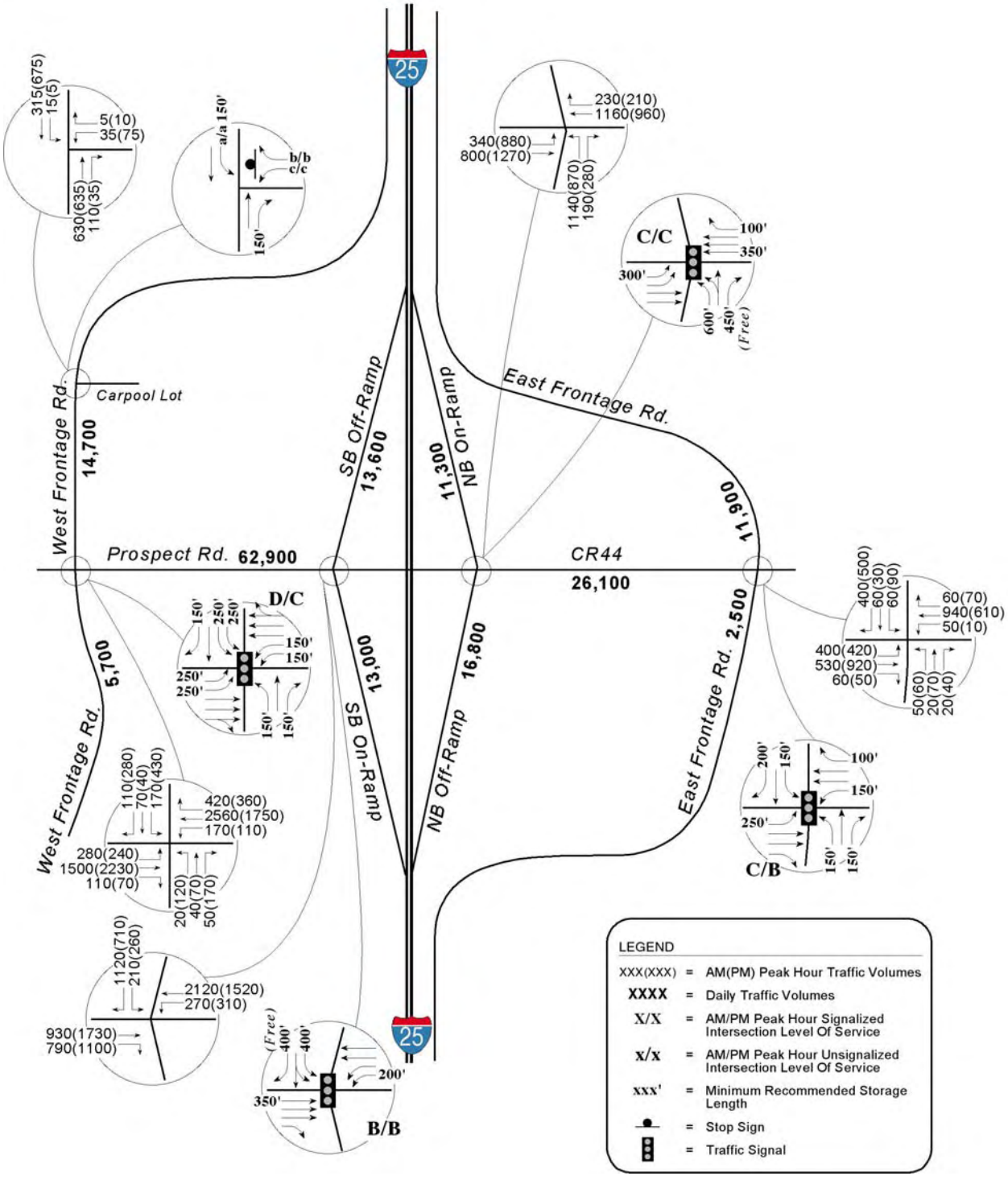

Figure 7. Package A Traffic Forecasts and Levels of Service

Table 5. 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	
Southbound Ramp Terminal					
EB Thru	A	A	120'	260'	Distance to Adjacent Intersection – 820'
EB Right	B	D	210'	490'	Distance to Adjacent Intersection – 820'
WB Left	D	D	560'	610'	Storage Provided in Design – 1,200'
WB Thru	A	A	160'	70'	Distance to Adjacent Intersection – 660'
SB Left	E	D	230'	340'	Storage Provided in Design – 800'
SB Right	Free	Free	N/A	N/A	Storage Provided in Design – 400'
Northbound Ramp Terminal					
EB Left	D	C	380'	960'	Storage Provided in Design – 1,300'
EB Thru	C	B	200'	290'	Distance to Adjacent Intersection – 660'
WB Thru	C	C	450'	420'	Distance to Adjacent Intersection – 620'
WB Right	B	C	70'	100'	Storage Provided in Design – 200'
NB Left	D	E	1070'	990'	Storage Provided in Design – 1,200'
NB Right	Free	Free	N/A	N/A	Storage Provided in Design – 450'
West Frontage Road Intersection					
WB Left	D	D	270'	200'	Storage Provided in Design – 450'
WB Thru/Right	D	B	670'	320'	Distance to Adjacent Intersection – 820'
East Frontage Road Intersection					
EB Left	A	A	210'	230'	Storage Provided in Design – 250'
EB Thru	A	A	130'	120'	Distance to Adjacent Intersection – 620'
EB Right	A	A	10'	10'	Distance to Adjacent Intersection[2] – 620'

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.
2. The northbound free right turn lane from the ramp terminal becomes the EB right-turn lane at the frontage road.

2030 Package B Traffic Operations

Interchange Configuration

The proposed interchange configuration for Prospect Road in Package B is the same as in Package A (Figure 8).

Interchange Operations

Figure 8 shows the levels of service for the ramps and frontage road intersections, along with recommendations for laneage at each location. As shown, the ramp terminals and the frontage road intersections are anticipated to operate at LOS D or better with the forecasted traffic volumes and the enhancements identified.

Table 6 summarizes the levels of service for key individual turning movements at each intersection. As shown in the table, most of the specific movement levels of service at this interchange range from LOS A to LOS D; the only movements operating worse than LOS D are the left turn movement from the southbound off ramp in the AM peak, the left turn movement from the northbound off ramp in the PM peak and the westbound through movement in the AM peak at the west frontage road intersection. These movements operate at LOS E, indicating they operate near capacity but do not exceed the capacity.

Table 6 compares SimTraffic estimates of the 95th percentile queue length for those key movements to the storage distance available for each. For turning movements, the distance listed is the turn lane storage length provided in the design, 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, left-turn queues would be accommodated well within the storage length and would not extend into the I-25 main lanes. Likewise, the right turn from the northbound and southbound off-ramps have free right conditions, so projected queue lengths are well within the available storage length on the ramp.

Table 6. 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	
Southbound Ramp Terminal					
EB Thru	A	A	110'	400'	Distance to Adjacent Intersection – 820'
EB Right	A	B	170'	280'	Distance to Adjacent Intersection – 820'
WB Left	D	D	560'	590'	Storage Provided in Design – 1,200'
WB Thru	A	A	170'	180'	Distance to Adjacent Intersection – 660'
SB Left	E	D	230'	370'	Storage Provided in Design – 800'
SB Right	Free	Free	N/A	N/A	Storage Provided in Design – 400'
Northbound Ramp Terminal					
EB Left	D	C	420'	960'	Storage Provided in Design – 1,300'
EB Thru	C	B	260'	250'	Distance to Adjacent Intersection – 660'
WB Thru	C	D	450'	350'	Distance to Adjacent Intersection – 620'
WB Right	B	C	90'	150'	Storage Provided in Design – 200'
NB Left	D	E	1,090'	890'	Storage Provided in Design – 1,200'
NB Right	Free	Free	N/A	N/A	Storage Provided in Design – 450'
West Frontage Road Intersection					
WB Left	D	D	260'	160'	Storage Provided in Design – 450'
WB Thru/Right	E	B	600'	520'	Distance to Adjacent Intersection – 820'
East Frontage Road Intersection					
EB Left	B	B	250'	270'	Storage Provided in Design – 250'
EB Thru	A	A	200'	250'	Distance to Adjacent Intersection – 620'
EB Right	B	A	30'	20'	Distance to Adjacent Intersection[2] – 620'

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.
2. The northbound free right turn lane from the ramp terminal becomes the EB right-turn lane at the frontage road.

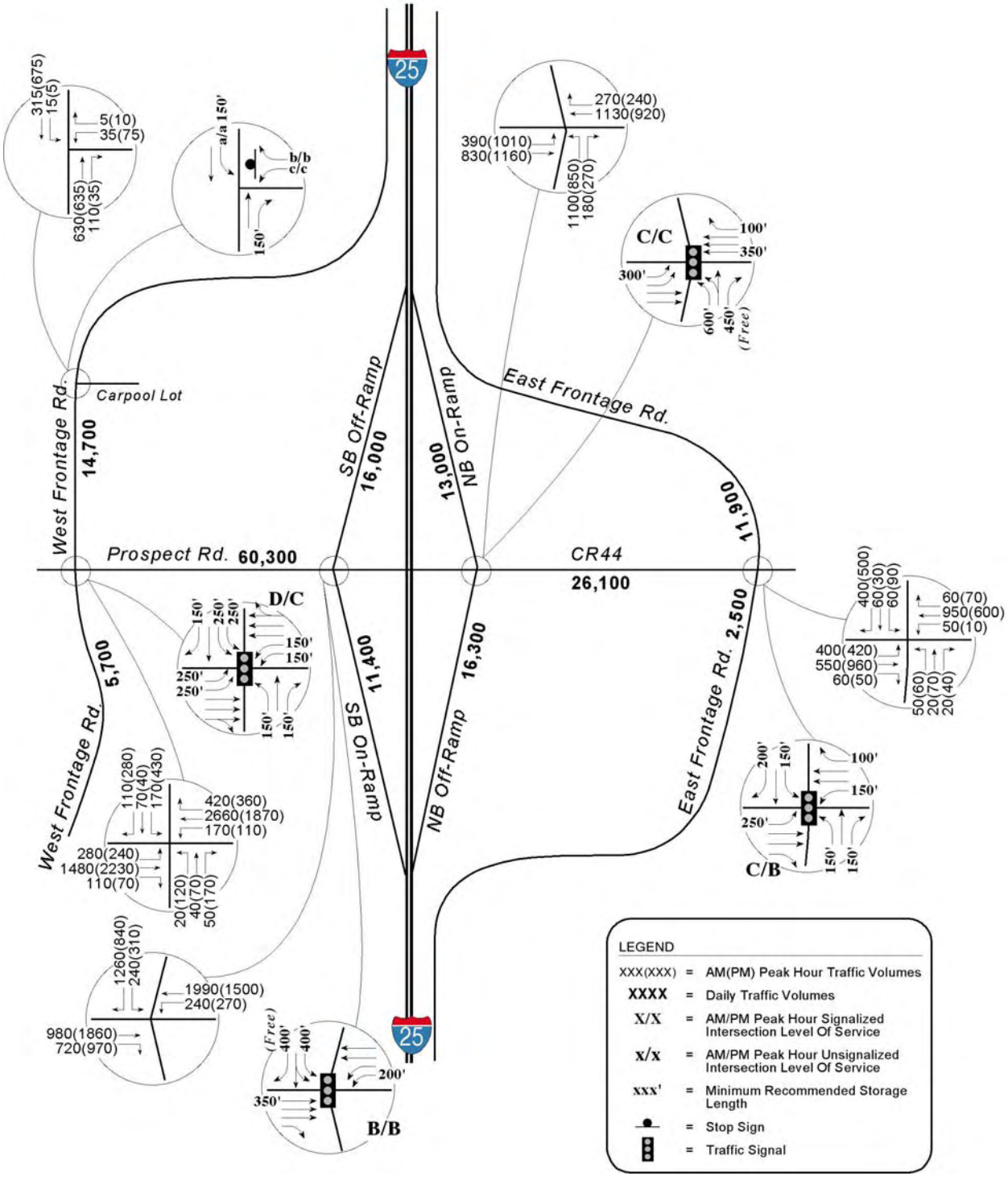

Figure 8 Package B Traffic Forecasts and Levels of Service

As noted above and shown in Figures 7 and 8, Prospect is forecast to carry over 60,000 vpd west of the interchange in both Package A and Package B while such a volume would indicate that a roadway cross section wider than four lanes may be appropriate. It should be noted that a major factor in this traffic forecast is the growth anticipated in homes and jobs near the interchange. Table 7 shows that in the traffic analysis zones near the Prospect interchange projected households increase by about 1,500 from existing conditions and jobs increase by over 4,600. Figures 9 and 10 show the land use forecasts by TAZ in the vicinity of the interchange.

Given the significant growth in land use numbers and the resulting traffic projections, the traffic operational analysis indicates that Prospect Road needs six-lanes through the west frontage road intersection in order to provide at least LOS D operations for the intersection. The analysis also shows the third lane in each direction can begin and end at the southbound ramp terminal and that four lanes across the bridge and east of the interchange can accommodate traffic projections.

Table 7. Forecast Growth near the Prospect Interchange

Interchange Quadrant	Households			Jobs		
	Existing	2030	Increase	Existing	2030	Increase
Northwest	101	519	+418	81	2067	+1,986
Southwest	0	0	0	0	592	+592
Total, West Side	*101*	*519*	*+418*	*81*	*2,659*	*2,578*
Northeast	20	1,129	+1,109	0	2045	+2,045
Southeast	69	82	+13	110	111	+1
Total, East Side	*89*	*1,211*	*+1,122*	*110*	*2,156*	*2,046*
Total	**190**	**1,730**	**1,540**	**191**	**4,815**	**4,624**

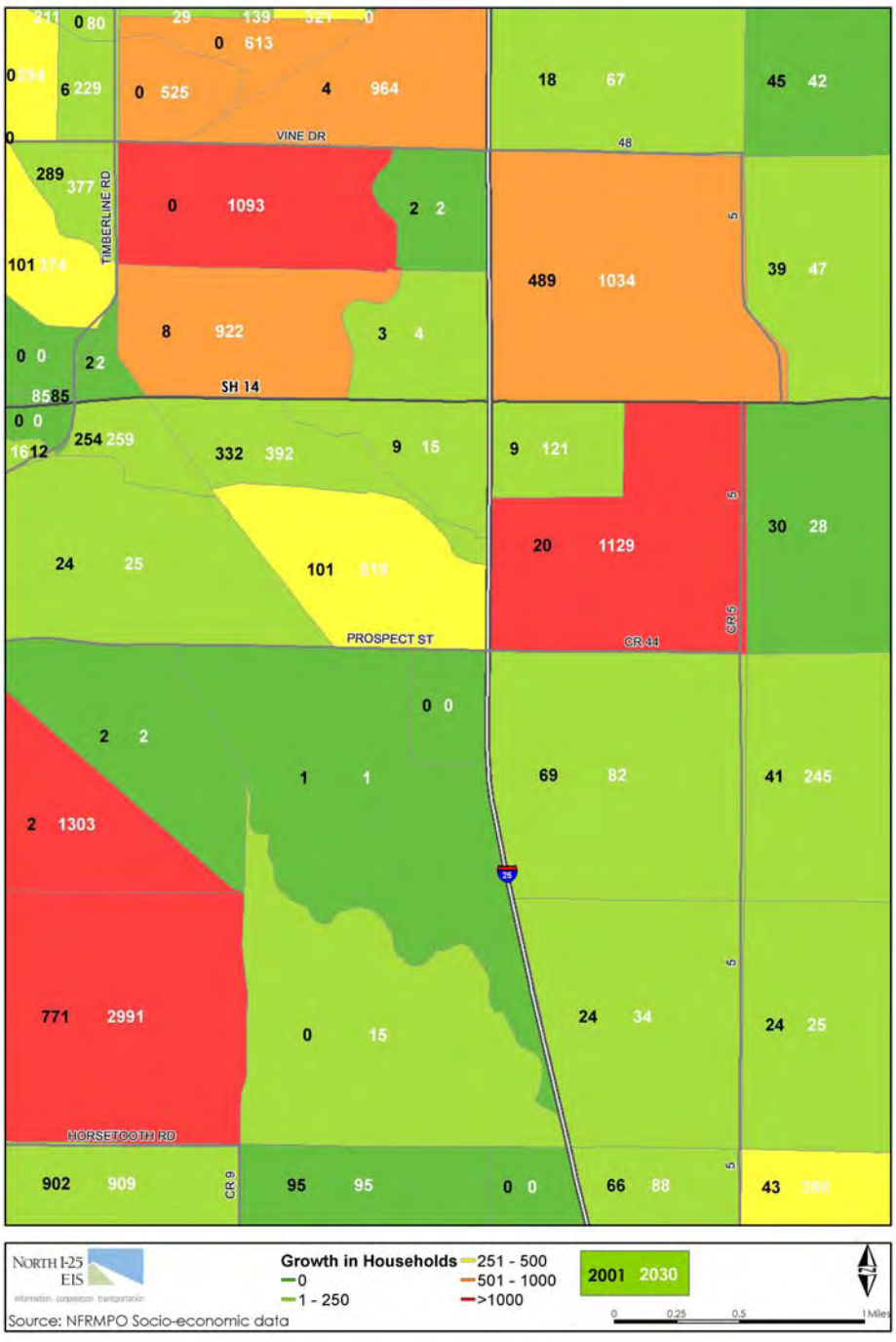

Figure 9 Comparison of Household Forecasts by TAZ

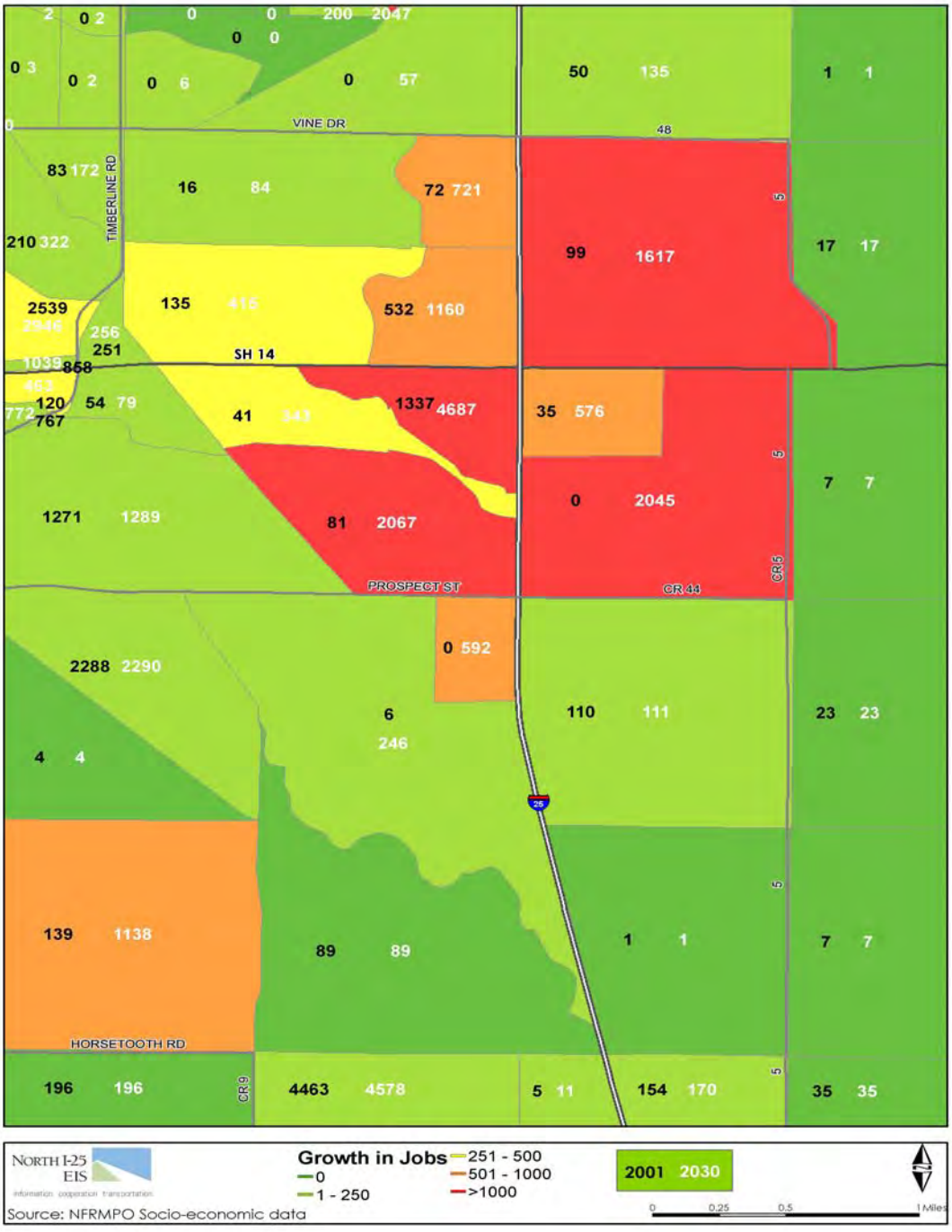

Figure 10. Comparison of Employment Forecasts by TAZ

Alternatives Evaluation Comparison

Traffic Operational Analysis

Table 8 compares the levels of service and delay at the Prospect Road interchange for the three packages. As the table indicates, without improvements at this location, all four intersections would operate at LOS F during one or more peak periods, but with the improvements identified above, all would operate at LOS D or better during both peaks. The levels of service and delays at each intersection are virtually the same for both Package A and Package B, so it would appear that either package would result in adequate operations at this interchange. It should be noted that three through lanes are needed at the west frontage road intersection to provide at least LOS D operations for the intersection.

Table 8. 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
West Frontage Road	LOS F (>80 sec.)	LOS F (>80 sec.)	LOS D (43 sec.)	LOS C (25 sec.)	LOS D (52 sec.)	LOS C (25 sec.)
Southbound Ramps	LOS F (>80 sec.)	LOS F (>80 sec.)	LOS B (10 sec.)	LOS B (17 sec.)	LOS B (10 sec.)	LOS B (11 sec.)
Northbound Ramps	LOS F (>80 sec.)	LOS F (>80 sec.)	LOS C (31 sec.)	LOS C (30 sec.)	LOS C (33 sec.)	LOS C (33 sec.)
East Frontage Road	LOS F (>80 sec.)	LOS D (44 sec.)	LOS C (22 sec.)	LOS B (17 sec.)	LOS C (24 sec.)	LOS B (19 sec.)

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