NORTH I-25 EIS
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SH 14
FULL DIAMOND
PACKAGE A

DRAFT

GWRR
GWRR
LARIMER COUNTY
LARIMER COUNTY
TOTAL PARKING SHOWN 150 SPACES
22
40
56
32
14
14
LARIMER COUNTY
FORT COLLINS
269
CACHE LA POUDRE RESERVOIR INLET
25

North

SCALE: 1"=200'

October 1, 2007

U.S. Department of Transportation
Federal Highway Administration

SH 14 FULL DIAMOND

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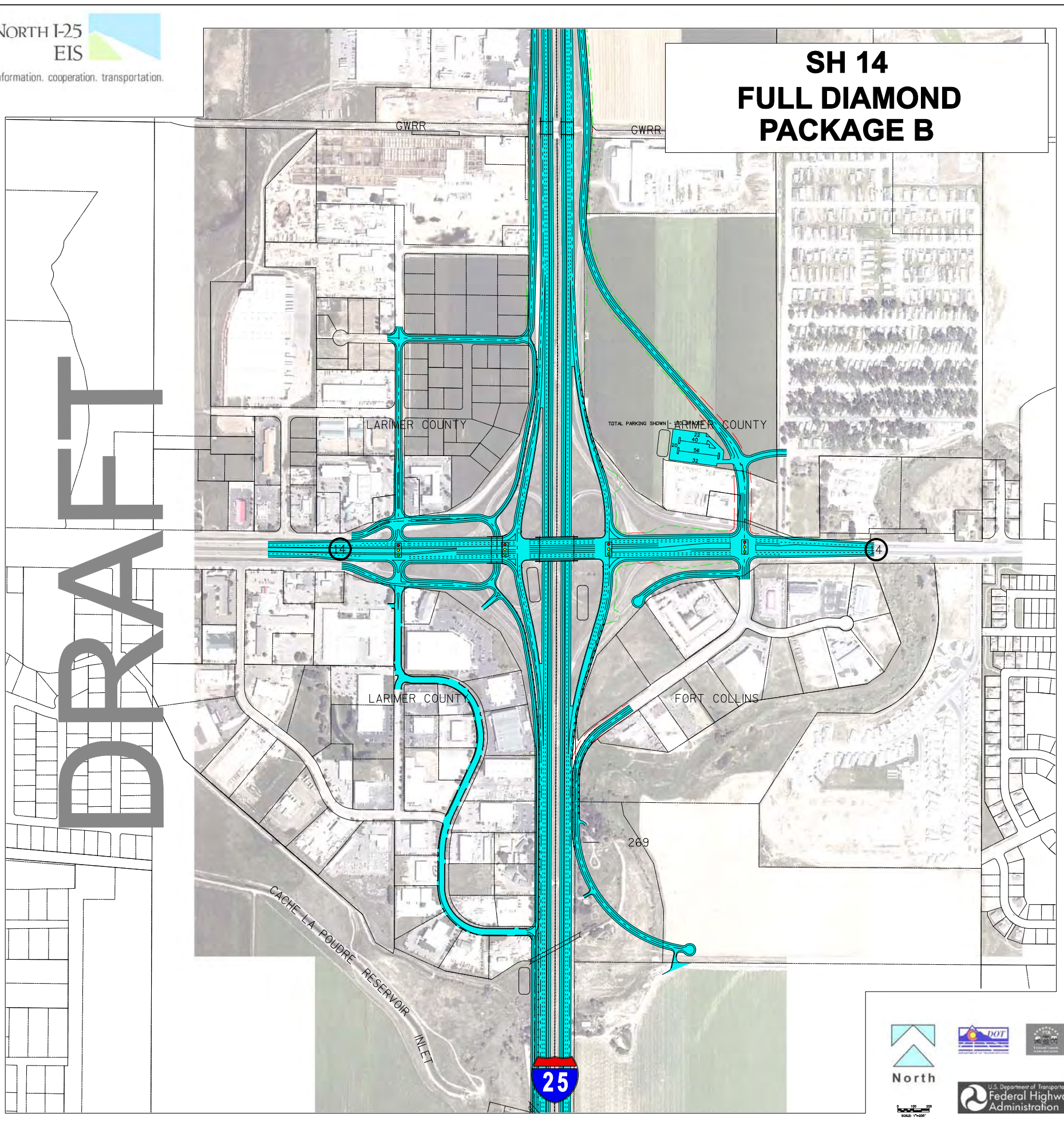
SH 14
FULL DIAMOND
PACKAGE B



North

SCALE: 1"=200'

October 1, 2007

U.S. Department of Transportation Federal Highway Administration

SH 14 FULL DIAMOND

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SH 14 (Mulberry) at I-25
DEIS Interchange Evaluation

NORTH I-25 EIS
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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 SH 14 (Mulberry) with I-25 (milepost 269) connects I-25 to north Fort Collins to the west and to rural Larimer County to the east. It was built in 1966 as a full cloverleaf interchange with loop ramps and straight ramps in all four quadrants, but safety improvements within the last five to six years removed the loop ramp in the southeast corner, thus converting the interchange to a partial cloverleaf. The SH 14 bridges over I-25 consist of two-through lanes in each direction and acceleration/deceleration lanes between on and off loop ramps. The interchange ramps are all single lane.

The interchange area includes the following roadways:

SH 14. SH 14 serves as a major point of access to the City of Fort Collins to the west and therefore is a four-lane facility with parallel frontage roads, traffic signals at major intersections, and turn lanes at access points. To the east, SH 14 continues as a two-lane rural highway connecting to the Town of Ault at US 85 and ending at the Town of Sterling at I-76. The adjacent land along SH 14 west of the interchange has been developed with uses that range from retail to office/warehouses, while east of the interchange the land use is primarily residential for the first few miles but quickly changes to a more rural character. At the interchange there is development in all four quadrants. The speed limit on SH 14 in the vicinity of the interchange is 45 mph.

West Frontage Road. The west side frontage road intersects SH 14 approximately 450 feet west of the I-25 interchange and continues both north and south of SH 14. Because of the alignment of the frontage road approaches, the high volume on SH 14 and the short distance between the frontage road and the beginning of the interchange ramps, the intersection is restricted to ¾ movements and has stop-sign control. The speed limit on the frontage road in the vicinity of the interchange is 30 mph.

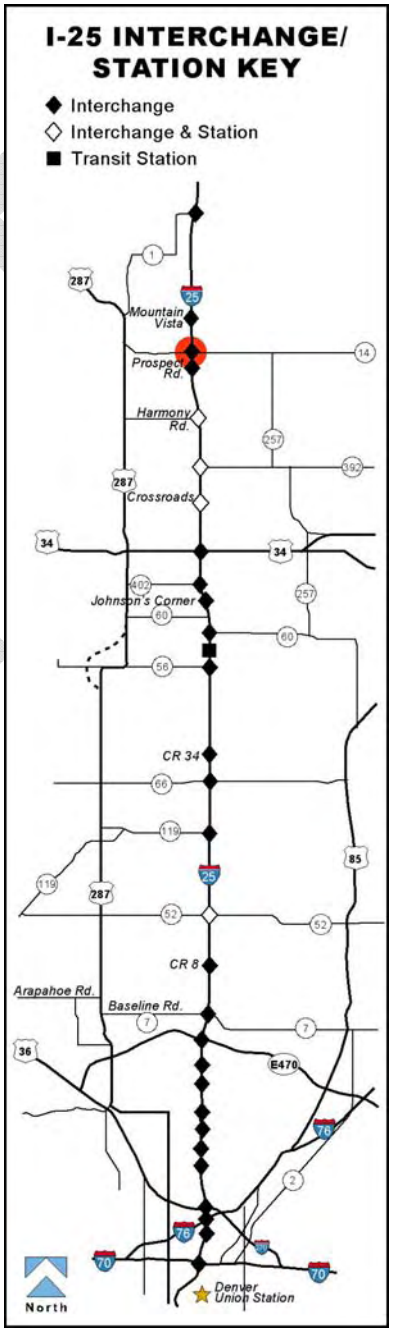

Figure 1. Vicinity Map

East Frontage Road. The east side frontage road intersects SH 14 approximately 500 feet east of the interchange and continues both north and south of SH 14. The south leg was realigned when land in the southeast quadrant developed while the north leg remains in its original alignment. The speed limit on the frontage road is 30 mph in the vicinity of the interchange and the SH 14 intersection has stop-sign control.

Figure 2 shows the existing counts collected in August 2004 at the SH 14 interchange. The counts show that a majority of the traffic at this intersection is oriented to and from the west; average daily traffic is around 30,000 vehicles per day (vpd) west of the interchange, but is only about 15,000 vpd east of the interchange. Daily ramp volumes range between 1,000 and 9,000 vehicles per day, with the higher ramp volumes on the southern oriented ramps. The southbound to eastbound loop ramp experiences the lowest volume at 1,100 vehicles per day while the northbound to westbound loop ramp and the eastbound to southbound ramp both experience over 9,000 vehicles per day.

In addition to interchange and SH 14 counts, data was collected on both frontage roads in the vicinity of the site. Daily traffic volumes on these roads range from 2,300 to 4,000 vpd. Counts collected on roadways in the southwest quadrant range between 600 and 1,500 vehicles per day.

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) and on the density in passenger cars per mile per lane in weaving sections.

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. Along SH 14 levels of service were calculated for weaving sections between frontages and interchange ramps and between interchange ramps. The following table shows how average stopped delay at controlled intersections and density in weaving sections equates to levels of service.

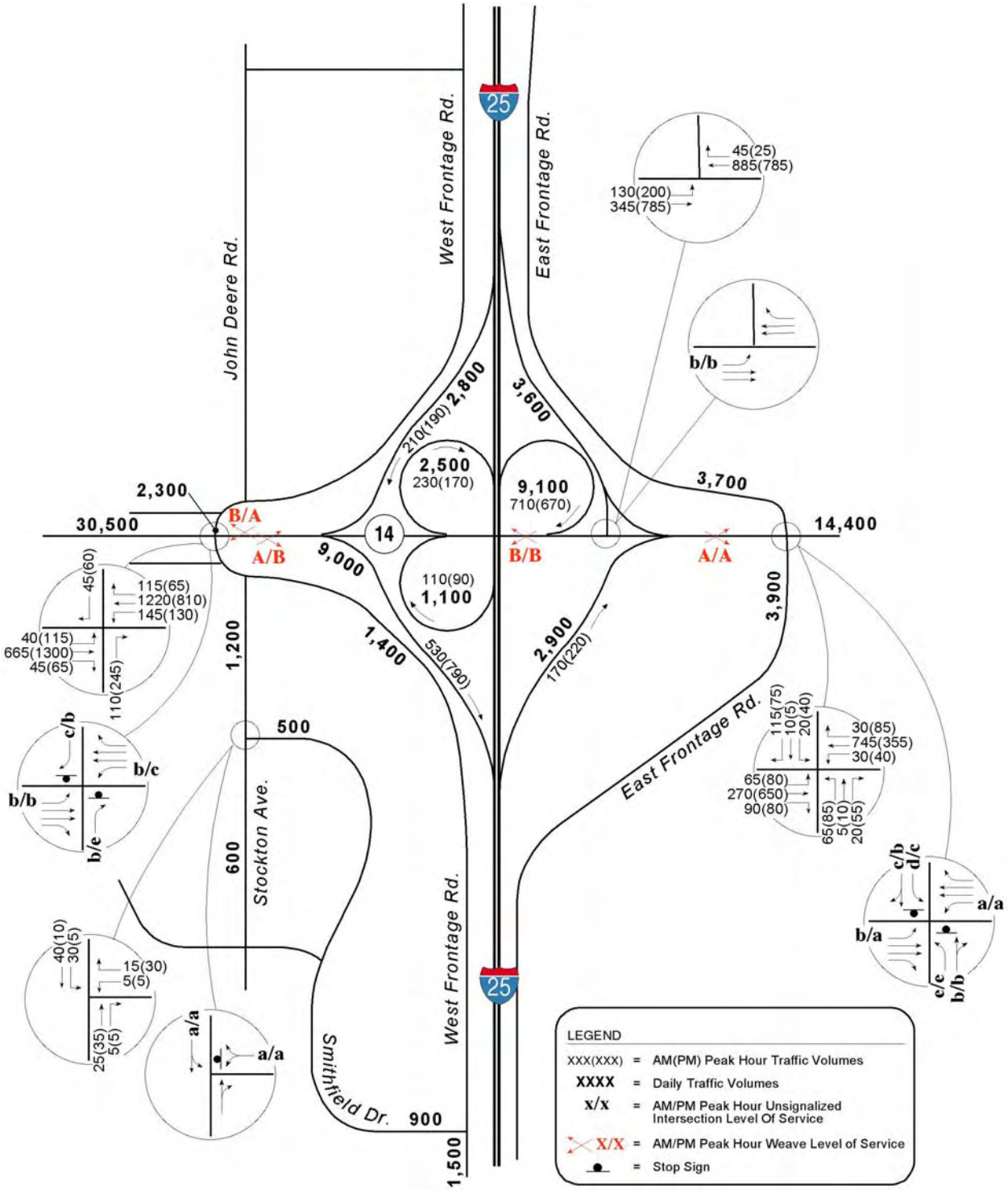

Figure 2. Existing Conditions

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

Level of Service	Average Delay at Signalized Intersections (sec./veh.)	Average Delay at Stop-Controlled intersections (sec./veh.)	Density in Weaving Sections (cars per hour per lane)
A	0 to <=10.	0 to <=10	0 to <=12
B	> 10 to <= 20	> 10 to <= 15	> 12 to <= 24
C	> 20 to <= 35	> 15 to <= 25	> 24 to <= 32
D	> 35 to <= 55	> 25 to <= 35	> 32 to <= 36
E	> 55 to <= 80	> 35 to <= 50	> 36 to <= 40
F	> 80	> 50	> 40

Figure 2 illustrates existing peak period levels of service at the ramp terminals, adjacent intersections and for weaving sections of SH 14. Currently, all turning movements at the east ramp terminal and at the frontage road intersections operate at LOS D or better during both the AM and PM peak periods. In addition, the weaving areas along SH 14 show good levels service operating LOS C or better during the peak periods.

The current partial cloverleaf configuration uses low speed loop ramps to serve three of the eight movements at the interchange. In general, loop ramps have design capacities of 800 to 1,200 vehicles per hour, with the higher capacity being only applicable where there are no trucks and where the design speed for the ramp is 30 mph or higher. In the case of the SH 14 loop ramps, truck percentages are nine percent in the AM peak and two percent in the PM peak and the ramps likely have a design speed of 25 mph at best. This suggests that the SH 14 loop ramps cannot achieve the upper end of typical loop capacities. With that said, existing loop volumes shown on Figure 2 are generally much less than the low end capacity for loops, except for the northbound to westbound loop. Traffic counts show that this loop currently carries over 750 vehicles per hour and therefore may be approaching its capacity.

2030 Conditions

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 provide reasonable forecasts for individuals turning movements, and to balance volumes along the arterial.

Figure 3. No Action Alternative

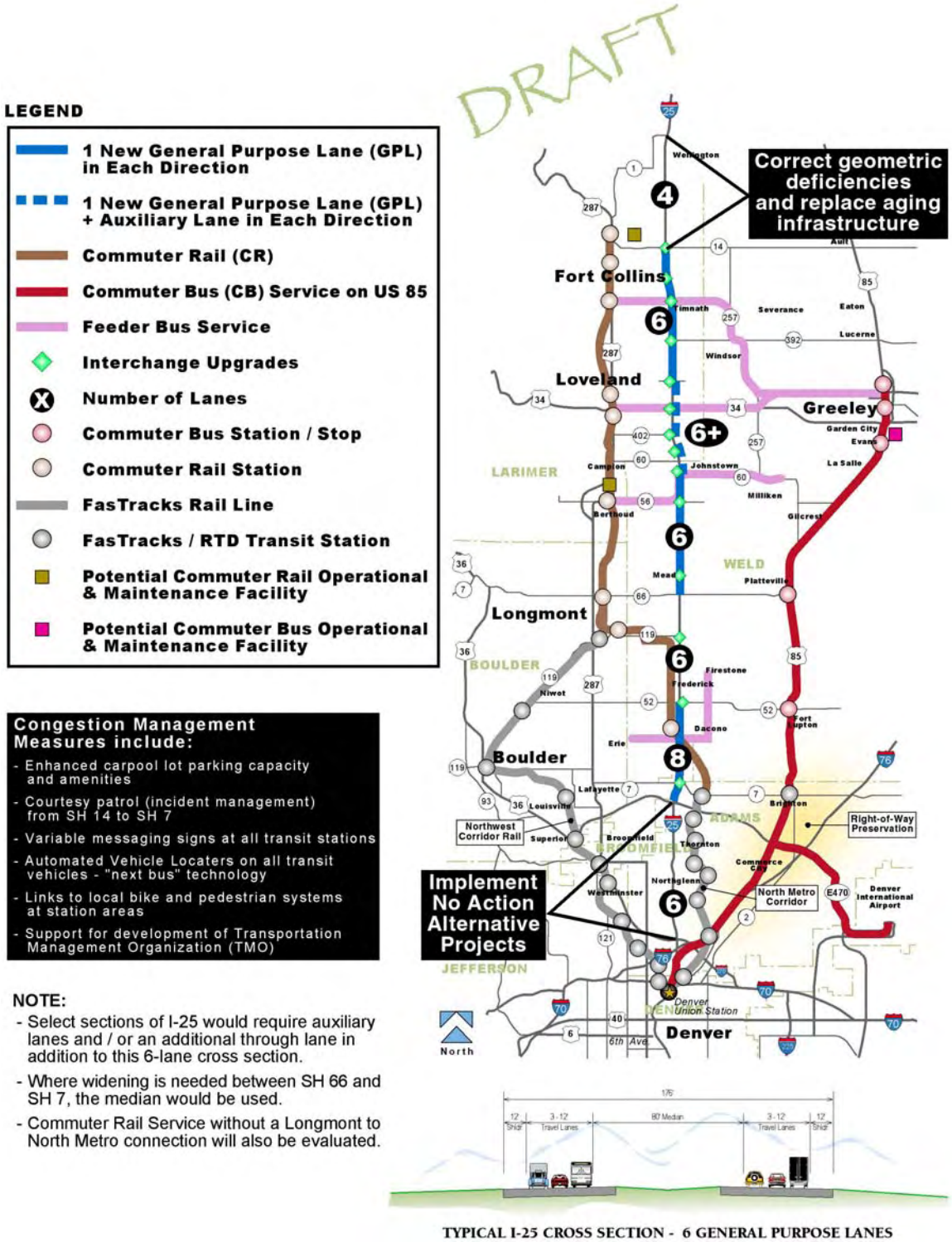

Figure 4. Package A

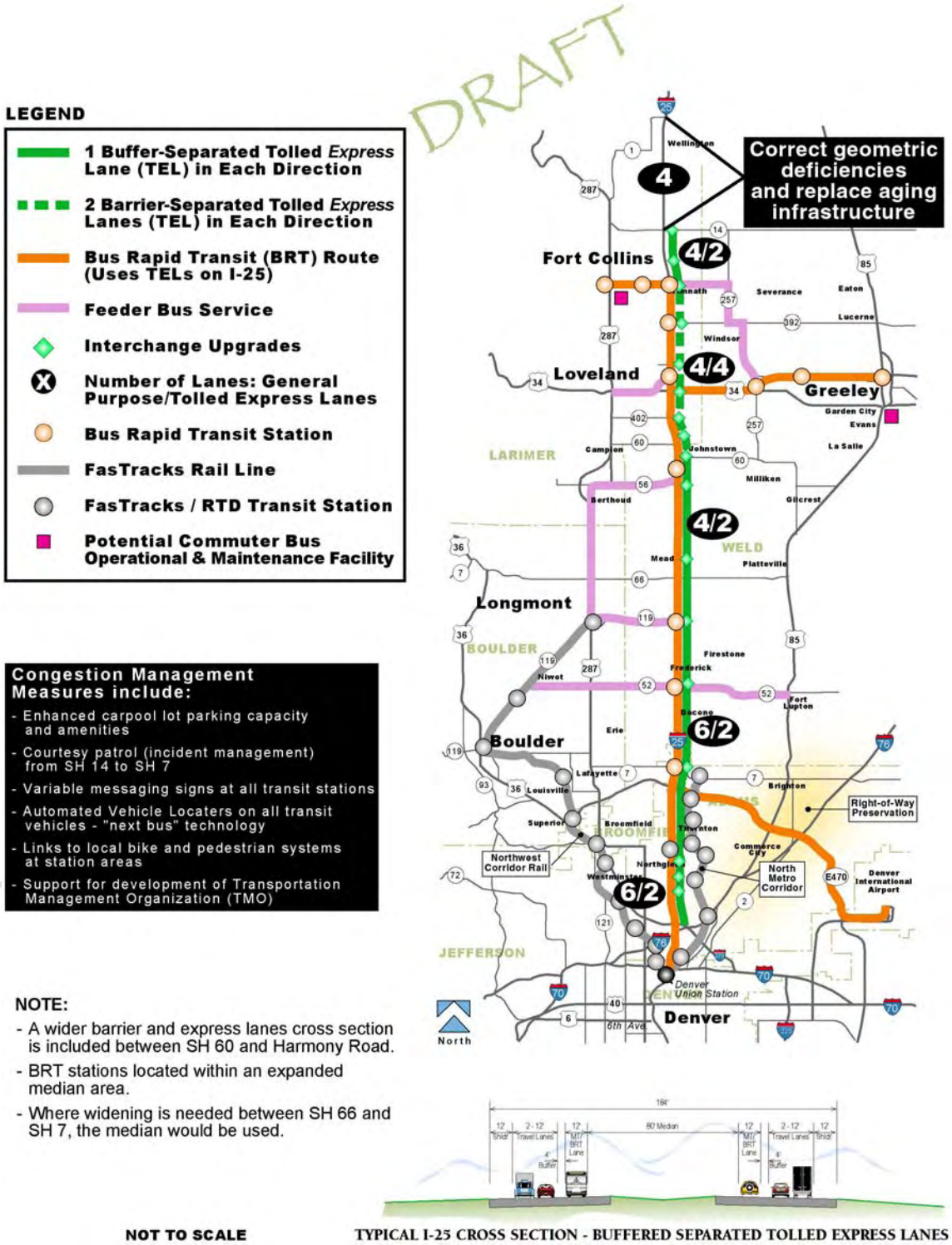

Figure 5. Package B

2030 No Action Traffic Volumes

Figure 6 depicts 2030 daily and peak hour No Action projections for the SH 14 interchange and for adjacent roadways. As shown, daily volume projections on SH 14 range from 24,100 to 60,000 vehicles per day and ramp volumes are all between 3,800 and 17,800 vehicles per day. These volumes show the same patterns as existing counts; westerly to and from Fort Collins and southerly on the ramps. However, volumes to and from the north grew at a faster rate than volumes to and from the south, which reflects anticipated growth in the north area of Fort Collins.

2030 Package A Traffic Volumes

Figure 7 depicts 2030 daily and peak hour Package A projections for the SH 14 interchange and adjacent roadways. 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 SH 14 range from 25,900 vpd east of the interchange to 64,500 vpd west of the interchange, and ramp volumes range from 10,800 to 27,200 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 projections for the SH 14 interchange and adjacent roadways. The volumes in the figure are generally similar to those presented in the No Action Alternative and in Package B Alternatives. Daily volume projections on SH 14 range from 24,700 vpd east of the interchange to 61,500 vpd west of the interchange, and ramp volumes range from 10,800 to 28,500 vehicles per day. The volumes patterns are generally the same patterns as existing conditions, No Action and Package A conditions; the highest traffic flow is westerly to and from Fort Collins and southerly on the ramps.

2030 No Action Traffic Operations

Figure 6 illustrates No Action peak period levels of service at the ramp terminals, adjacent intersections and for weaving sections of SH 14. The level of service analysis shows several turning movements at both the east ramp terminal and at the frontage road intersections operating at LOS F during both the AM and PM peak periods. In weaving areas LOS F conditions are anticipated westbound between the loop ramps and eastbound between the frontage road and the ramp to southbound I-25.

As previously discussed, loop ramps have design capacities of 800 to 1,200 vehicles per hour, depending on the presence of trucks and on the design speed of the loop ramps. No Action volume projections for the northbound to westbound loop ramp exceed the upper end capacity for loop ramps. This suggests that by 2030 vehicles on the northbound to westbound loop ramp would back up onto I-25.

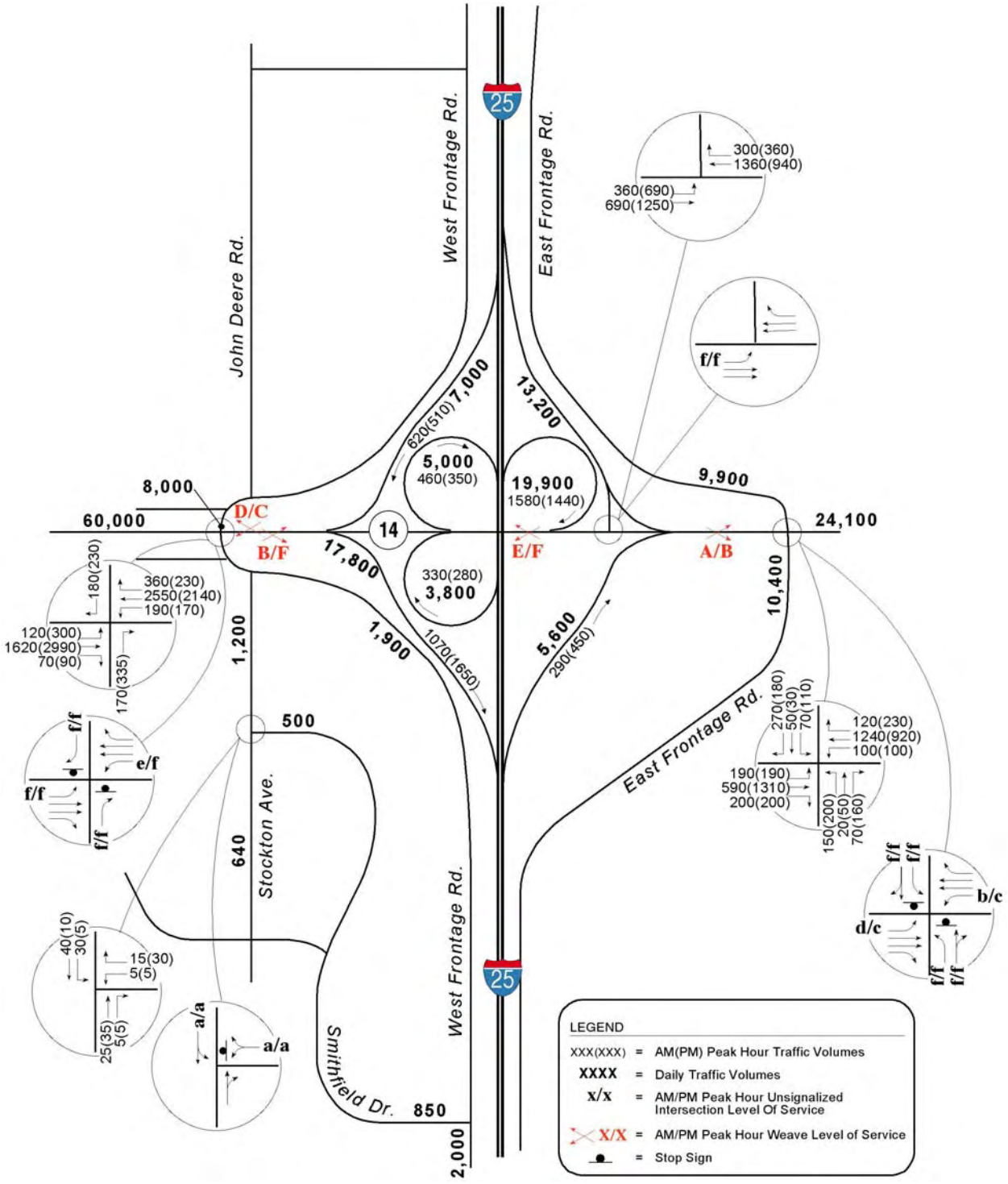

Figure 6. No Action Forecasts and Levels of Service

2030 Package A Traffic Operations

Interchange Configuration

The proposed configuration for the SH 14 interchange is a diamond configuration, which eliminates the weaving sections between the ramps that are inherent in the current cloverleaf design. The existing bridges would be replaced by a new bridge to accommodate dual left-turn lanes at each ramp terminal and three through lanes in each direction. The off-ramps are wider to accommodate dual-left turn lanes on the southbound ramp and triple-left turn lanes on the northbound ramp. Other enhancements include exclusive right-turn lanes, dual right-turn lanes for the eastbound to southbound movement and continuous acceleration / deceleration lanes on SH 14.

Interchange Operations

Figure 7 illustrates Package A peak period levels of service at the ramp terminals and at adjacent intersections on SH 14. As shown, intersections are anticipated to operate at LOS D or better with Package A forecasts and the proposed lanes at the new SH 14 interchange. A carpool lot located in the northwest quadrant would access John Deere Road and turn movements from this lot also show LOS D or better conditions during the peak hours.

In addition to the intersection level of service additional information, level of service and queuing for key movements can provide further insight into operations at this interchange. Table 2 gives level of service, queue lengths, intersection spacing and designed storage lengths for key movements at the interchange.

As shown in the table, anticipated levels of service at this interchange range from LOS A for right turn movements to LOS E for the PM peak hour westbound left turn at the west frontage road. It should also be noted that the southbound left turn and northbound right turn at that intersection are also projected to operate at LOS F. All three movements have relatively low peak hour projections and therefore have a minor impact on overall operations at the west frontage road intersection. Overall, the improvements identified at this interchange appear to provide good operations at both ramp terminals and at the adjacent intersections.

Table 2 also compares SimTraffic estimates of the 95th percentile queue length for each movement to the storage distance provided in the design. The queuing analysis shows that in most cases the estimated 95th percentile queue for through movements would not extend past the adjacent intersection, and that left-turn queues can be accommodated within available left-turn storage. For the northbound and southbound ramp terminals, left and right-turn queues can be accommodated on the ramps will not extend into the I-25 main lanes.

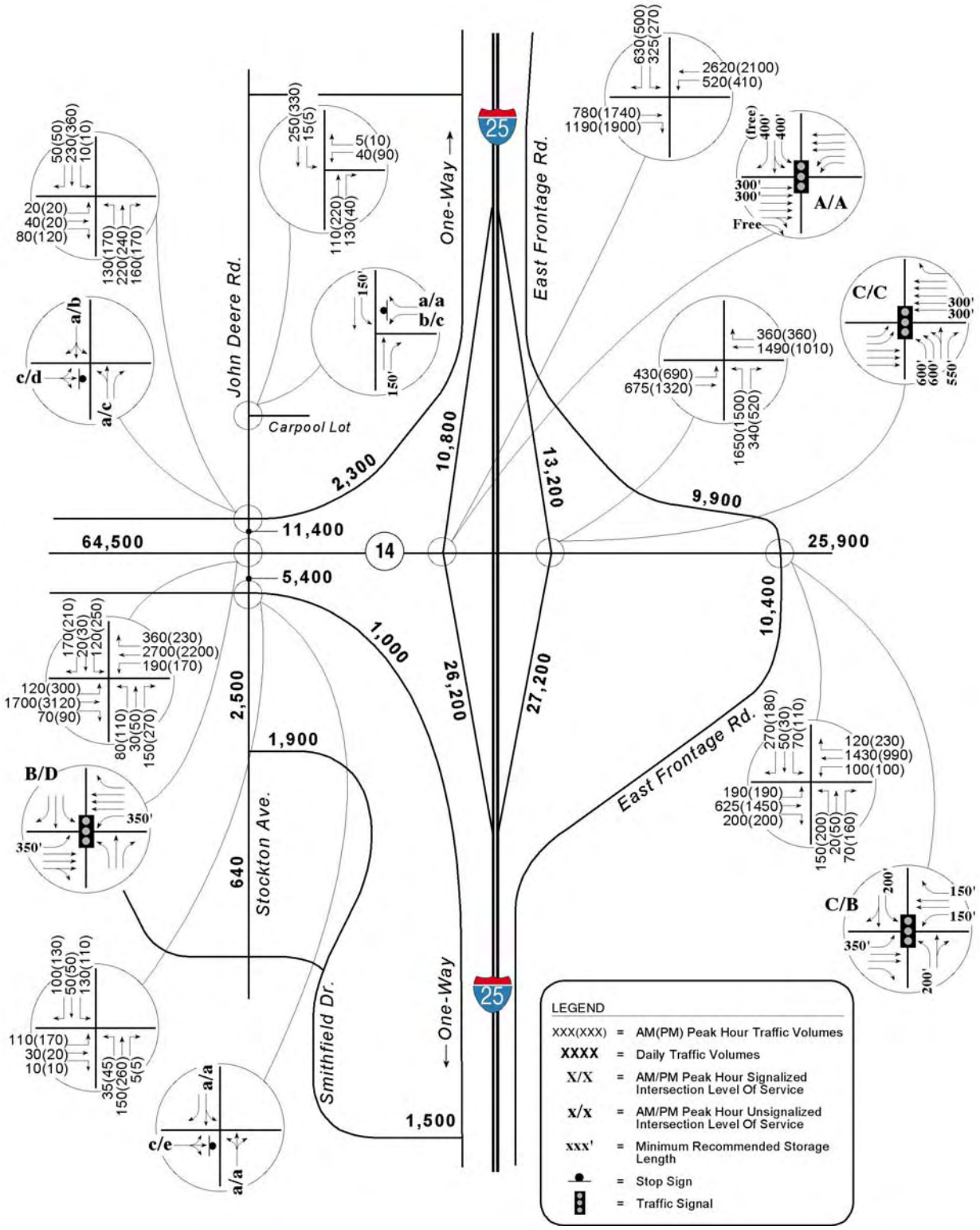

Figure 7. Package A Traffic Forecasts and Levels of Service

Table 2. 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	
Southbound Ramp Terminal					
EB Thru	A	B	130'	150'	Distance to Adjacent Intersection – 560'
EB Right	Free	Free	N/A	N/A	Distance to Adjacent Intersection[1] – 560'
WB Left	A	A	760'	1000'	Storage Provided in Design – 1,420'
WB Thru	A	A	190'	550'	Distance to Adjacent Intersection – 560'
SB Left	D	D	360'	320'	Storage Provided in Design – 800'
SB Right	Free	Free	N/A	N/A	Storage Provided in Design – 400'
Northbound Ramp Terminal					
EB Left	C	B	600'	450'	Storage Provided in Design – 1,420'
EB Thru	A	A	130'	310'	Distance to Adjacent Intersection – 560'
WB Thru	C	C	250'	230'	Distance to Adjacent Intersection – 750'
WB Right	C	E	200'	230'	Distance to Adjacent Intersection[1] – 750'
NB Left	C	D	1030'	1030'	Storage Provided in Design – 1,750'
NB Right	B	D	80'	220'	Storage Provided in Design – 550'
West Frontage Road Intersection					
WB Left	C	E	320'	320'	Storage Provided in Design – 350'
WB Thru	B	B	300'	570'	Distance to Adjacent Intersection – 560'
WB Right	A	A	480'	490'	Distance to Adjacent Intersection[1] – 560'
East Frontage Road Intersection					
EB Left	D	C	210'	180'	Storage Provided in Design – 350'
EB Thru	A	B	110'	160'	Distance to Adjacent Intersection – 750'
EB Right	A	A	60'	60'	Distance to Adjacent Intersection – 750'

[1] Storage is the continuous accel / decel. lane between the ramp terminals and the frontage road intersections.

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

Interchange Operations

Figure 8 illustrates Package B peak period levels of service at the ramp terminals and at adjacent intersections on SH 14. As shown, intersections are anticipated to operate at LOS D or better with Package A forecasts and the proposed lanes at the new SH 14 interchange. A carpool lot located in the northwest quadrant would access John Deere Road; turning movements from this lot would also operate at LOS D or better conditions during the peak hours.

Table 3 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. As shown anticipated levels of service at this interchange range from LOS A for right turn movements to LOS E for the PM peak hour westbound left turn at the west frontage road. It should also be noted that the southbound left turn and northbound right turn at that intersection are also projected to operate at LOS F. All three movements have relatively low peak hour projections and therefore have a minor impact on overall operations at the west frontage road intersection. Overall, the improvements identified at this interchange appear to provide good operations at both ramp terminals and at the adjacent intersections.

Table 3 also compares SimTraffic estimates of the 95th percentile queue length for each movement to the storage distance provided in the design. The queuing analysis shows that in most cases the estimated 95th percentile queue for through movements would not extend past the adjacent intersection, and that left-turn queues can be accommodated within available left-turn storage. For the northbound and southbound ramp terminals, left and right-turn queues can be accommodated on the ramps will not extend into the I-25 main lanes.

Table 3. 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	
Southbound Ramp Terminal					
EB Thru	A	B	210'	190'	Distance to Adjacent Intersection – 560'
EB Right	Free	A (free)	N/A	N/A	Distance to Adjacent Intersection[1] – 560'
WB Left	A	A	620'	950'	Storage Provided in Design – 1,420'
WB Thru	A	A	190'	360'	Distance to Adjacent Intersection – 560'
SB Left	D	D	340'	320'	Storage Provided in Design – 800'
SB Right	Free	A (free)	N/A	N/A	Storage Provided in Design – 400'
Northbound Ramp Terminal					
EB Left	D	B	550'	600'	Storage Provided in Design – 1,420'
EB Thru	A	A	130'	310'	Distance to Adjacent Intersection – 560'
WB Thru	C	C	250'	200'	Distance to Adjacent Intersection – 750'
WB Right	C	E	190'	220'	Distance to Adjacent Intersection[1] – 750'
NB Left	D	D	1,110'	990'	Storage Provided in Design – 1,750'
NB Right	B	D	210'	200'	Storage Provided in Design – 550'
West Frontage Road Intersection					
WB Left	C	E	300'	340'	Storage Provided in Design – 350'
WB Thru	B	B	330'	510'	Distance to Adjacent Intersection – 560'
WB Right	A	A	250'	400'	Distance to Adjacent Intersection[1] – 560'
East Frontage Road Intersection					
EB Left	D	C	280'	140'	Storage Provided in Design – 350'
EB Thru	A	B	280'	280'	Distance to Adjacent Intersection – 750'
EB Right	A	A	50'	50'	Distance to Adjacent Intersection – 750'

[1] Storage is the continuous accel / decel. lane between the ramp terminals and the frontage road intersections.

[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 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.

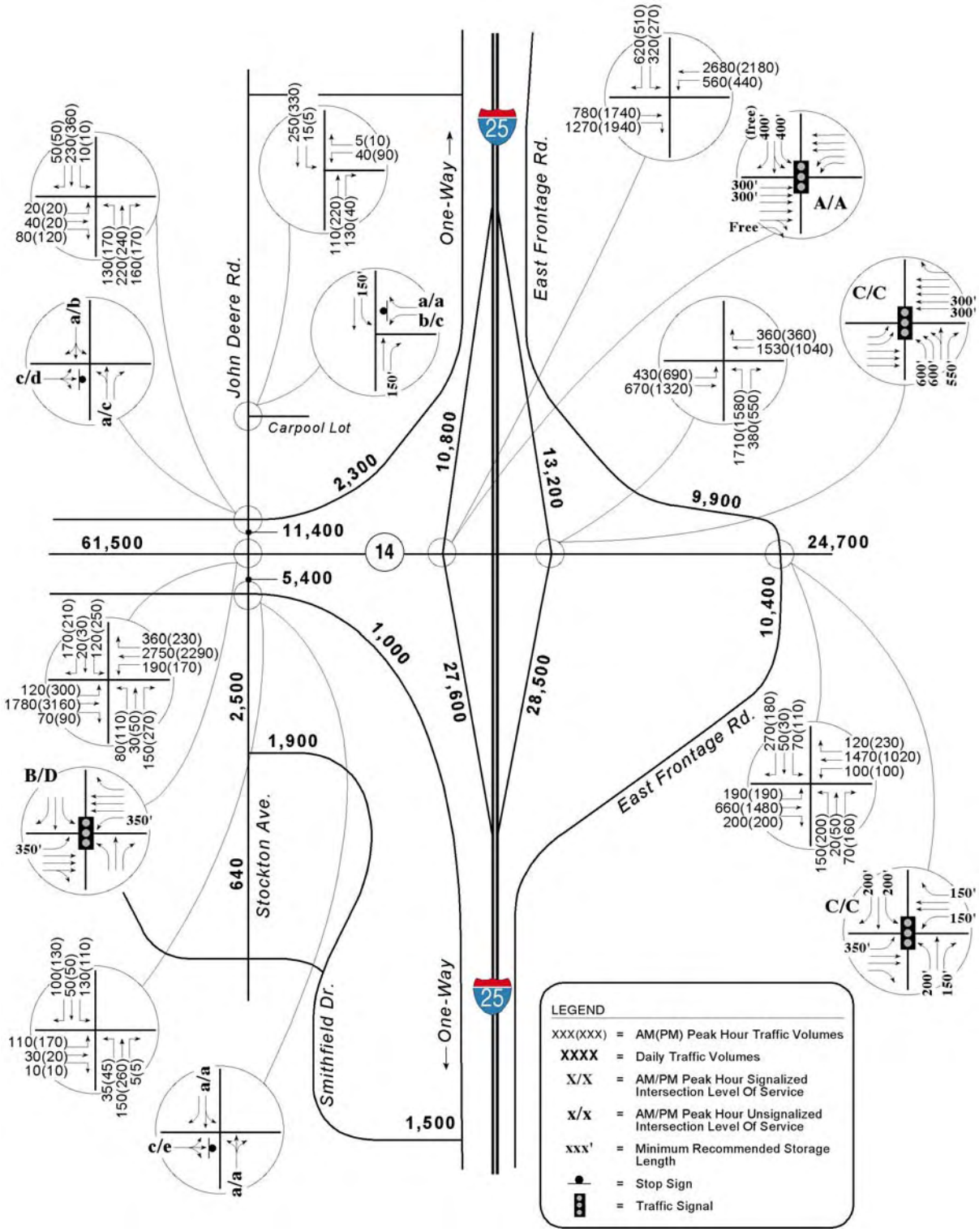

Figure 8. Package B Traffic Forecasts and Levels of Service

In both Package A and B the proposed interchange configuration includes northbound triple left turn lanes on the northbound off-ramp due to the very high level of traffic projected for the northbound to westbound turn movement. Northern Colorado has very little experience with triple left-turn lanes (the first triple left-turn lanes were recently implemented at the Centerra Parkway intersection with US 34), but triple left-turn lanes are currently operating at several Denver metro area intersections such as the I-25/Hampden interchange, Arapahoe Road/Parker Road intersection and at the Colfax Avenue/Indiana Street intersection.

The analysis in Table 2 shows the proposed triple left-turn lanes at the SH 14 interchange operating at a LOS D or better with 95th percentile queue lengths of 300 to 400 feet. These results suggest that triple left-turn lanes would provide a reasonable level of service and would result in manageable queue lengths. Dual left-turn lanes cause (during the AM peak period) the northbound ramp intersection to operate at LOS E and the northbound left-turn movement to operate at LOS F. One option to triple left turns would be a flyover ramp. The flyover option improves overall operations at the interchange but would impact right-of-way and existing businesses and restrict access from northbound I-25 to the west frontage road. Another option is to extend the off-ramp so that queues could be stored on the ramp without extending into the I-25 main lanes. This longer ramp shortens the weaving distance between the Prospect Road and SH 14 interchanges and thus would affect operations along I-25. Dual left turn lanes also take away green time from SH 14 which reduces progression efficiencies along SH 14.

Alternatives Evaluation Comparison

Traffic Operational Analysis

Table 4 compares the levels of service and delay at the SH 14 interchange for packages A and B. The No Action is not given in the table since most intersections listed would not exist or be signalized in the No Action since the No Action has a partial cloverleaf interchange. As the table indicates, 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 packages, so it would appear that either package would result in adequate operations at this interchange.

Table 4. Intersection Level of Service and Delay

Intersection	Package A		Package B	
	AM Peak	PM Peak	AM Peak	PM Peak
West Frontage Road	LOS B (18 sec.)	LOS D (50 sec.)	LOS B (19 sec.)	LOS D (54 sec.)
Southbound Ramps	LOS A (5 sec.)	LOS A (7 sec.)	LOS A (5 sec.)	LOS A (7 sec.)
Northbound Ramps	LOS C (26 sec.)	LOS C (28 sec.)	LOS C (27 sec.)	LOS C (29 sec.)
East Frontage Road	LOS C (27 sec.)	LOS C (23 sec.)	LOS C (28 sec.)	LOS C (23 sec.)

LOS X = Level of Service
- Average Delay in seconds per vehicle

Local Roadway Network Changes

The additional lanes on I-25 associated with both Package A and B and the design criteria for the southbound on-ramp, potentially will impact the west side frontage road currently connecting SH 14 to Prospect Avenue. The following describes various options for the frontage road:

- Shift the frontage road alignment west and maintain two-way operations. This impacts existing property and would mean a loss of parking in several business lots, but it maintains business access.
- Convert the frontage road to one-way southbound from Stockton Avenue to Smithfield Drive and redirect northbound traffic to Smithfield Drive. This has less property impacts to existing businesses and their parking lots, but limits accessibility to inbound only from the north.
- Close the frontage road and redirect all frontage road traffic to Smithfield Drive. This has minimal property impacts but eliminates all business accessibility from the frontage road and requires business access from Smithfield Drive.

In an effort to minimize impacts to businesses along the frontage road and still provide the improvements recommended at the SH 14 interchange, the frontage road south of SH 14 is recommended to be converted to a one-way southbound roadway. (The frontage road north of SH 14 would also be converted to one-way northbound with southbound traffic redirected to John Deere Road.) Figures 7 and 8 depict daily traffic volume projections along Smithfield Drive and Stockton Avenue with a one-way frontage road. Compared to existing daily counts and accounting for additional growth in frontage road traffic volumes, Smithfield Drive daily volumes increase by about 750 vpd and Stockton Avenue volumes increase by about 1,300 vpd.

Despite the increase in traffic to Smithfield Drive and Stockton Avenue, these roadways should maintain their local street status; however, they would require improvements to upgrade them to current Larimer County Street Standards. Figure 9 shows the typical existing cross section for Smithfield Road and Stockton Avenues. Both roadways are two-lane local streets that provide business and loading dock access to several businesses and carry relatively low traffic volumes. Existing right-of-way widths for Smithfield Drive and Stockton Avenue are not known, but from plat lines and aerial photography it appears the existing right-of-way is somewhere between 60 to 65 feet.

If Smithfield Drive and Stockton Avenue were upgraded to a county street standard, it appears that when considering traffic volumes, access and continuity, both Smithfield Drive and Stockton Avenue would best fit the Industrial Local Street classification, according to the Larimer County Urban Area Street Standards. Figure 10 depicts the cross section for an Industrial Local Street. Comparing the existing cross section to the Industrial Local Street cross section, both Smithfield Drive and Stockton Avenue would need roadway widening to accommodate curb and gutter and parking; however, streetscape improvements such as the detached sidewalk could be accommodated within the existing right-of-way.

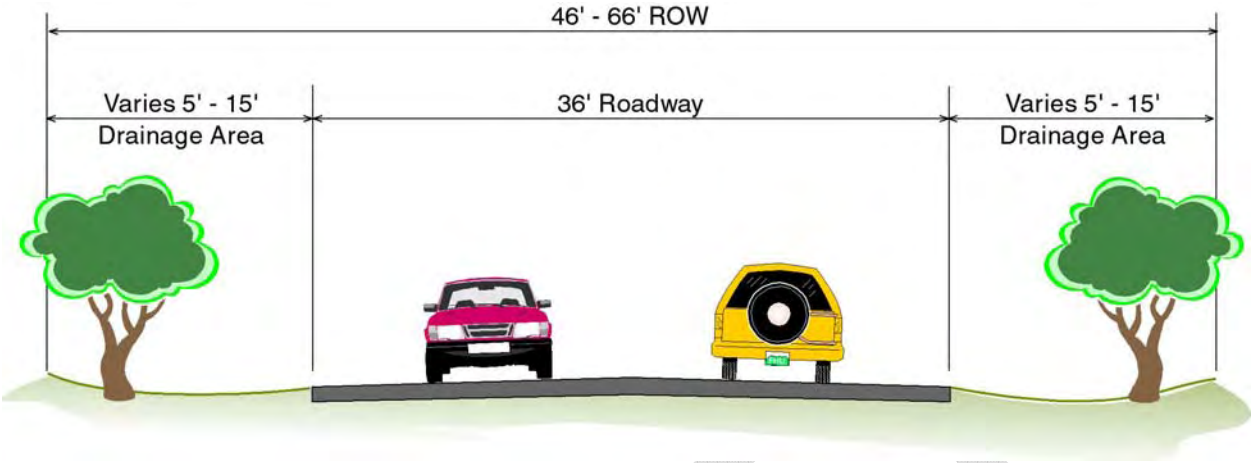

Figure 9. Existing Smithfield Drive Cross Section

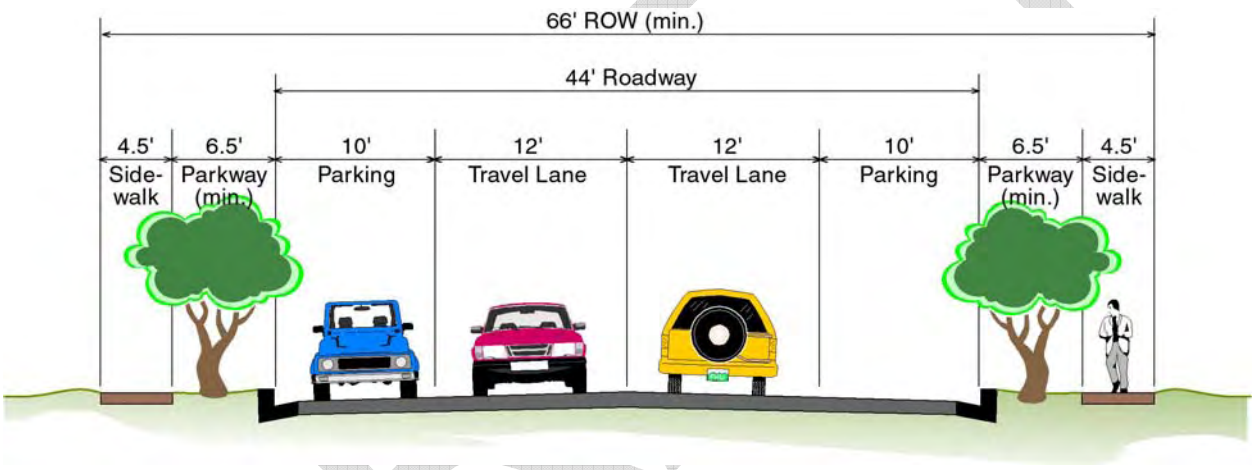

Figure 10. Industrial Local Street Classification per Larimer County Urban Area Street Standards

West Frontage Road Intersection Alternative

In both Package A and B the west frontage road intersection with SH 14 is replaced with a new intersection aligning with Stockton Avenue and John Deere Road (compare Figures 6 to 7 or 8). This modification allows for signalization of the west frontage road intersection but creates intersections along Stockton and John Deere in close proximity to the intersection with SH 14. These closely spaced intersections can create confusion as drivers try to sort out who has the right-of-way when the John Deere and Stockton have a green indication. An option to address this situation is to limit turns at the SH 14 intersection in order to reduce queuing along Stockton and John Deere. This option, shown in Figures 11 and 12, eliminates all left-turns at the SH 14/John Deere/Stockton intersection and adds an underpass under SH 14 connecting the I-25 frontage roads on either side of SH 14. In this option, the I-25 frontage roads between the underpass road and John Deere or Stockton remains two-way while the I-25 frontage road north and south of the underpass road converts to one-way operation as discussed in the previous section.

Figure 11 depicts traffic volumes and levels of service at the John Deere/Stockton intersection with SH 14 and at the I-25 frontage road intersections with John Deere and Stockton. As shown, the SH 14 intersection would still need signalization, even with the elimination of all left-turn movements, because there are not sufficient gaps in the SH 14 traffic to sufficiently process the increased right-turn volume. However, eliminating the left-turn movements at the SH 14 intersection has the following operational and safety benefits.

- The SH 14 intersection is reduced from four-phase operation to two-phase operation, which improves the AM peak level of service from LOS B to LOS A. The PM peak level of service would be LOS D in either four or two phase operation but the overall intersection delay reduces from 54 sec./veh. to about 44 sec./veh.

- The level of service and delay for the John Deere and Stockton approaches to SH 14 remain about the same in the AM peak. In the PM peak the John Deere approaches improves from LOS F to LOS D and the Stockton approaches improves from LOS F to LOS E.

- The John Deere and Stockton intersections with the frontage road spend less time blocked. According to SimTraffic results, these intersections would spend between 55% and 80% of the time blocked with full movement at the SH 14 intersection compared to between 20% and 40% with right-turns only at the SH 14 intersection.

- Restricting left-turn movements at the SH 14 intersection eliminates broad side accidents between left-turn and through movements.

Figure 12 shows the route will change for vehicles that would ordinarily turn left at the SH 14 intersection with John Deere and Stockton. Eliminating left-turn movements introduces less than a quarter of a mile of out-of-direction travel.

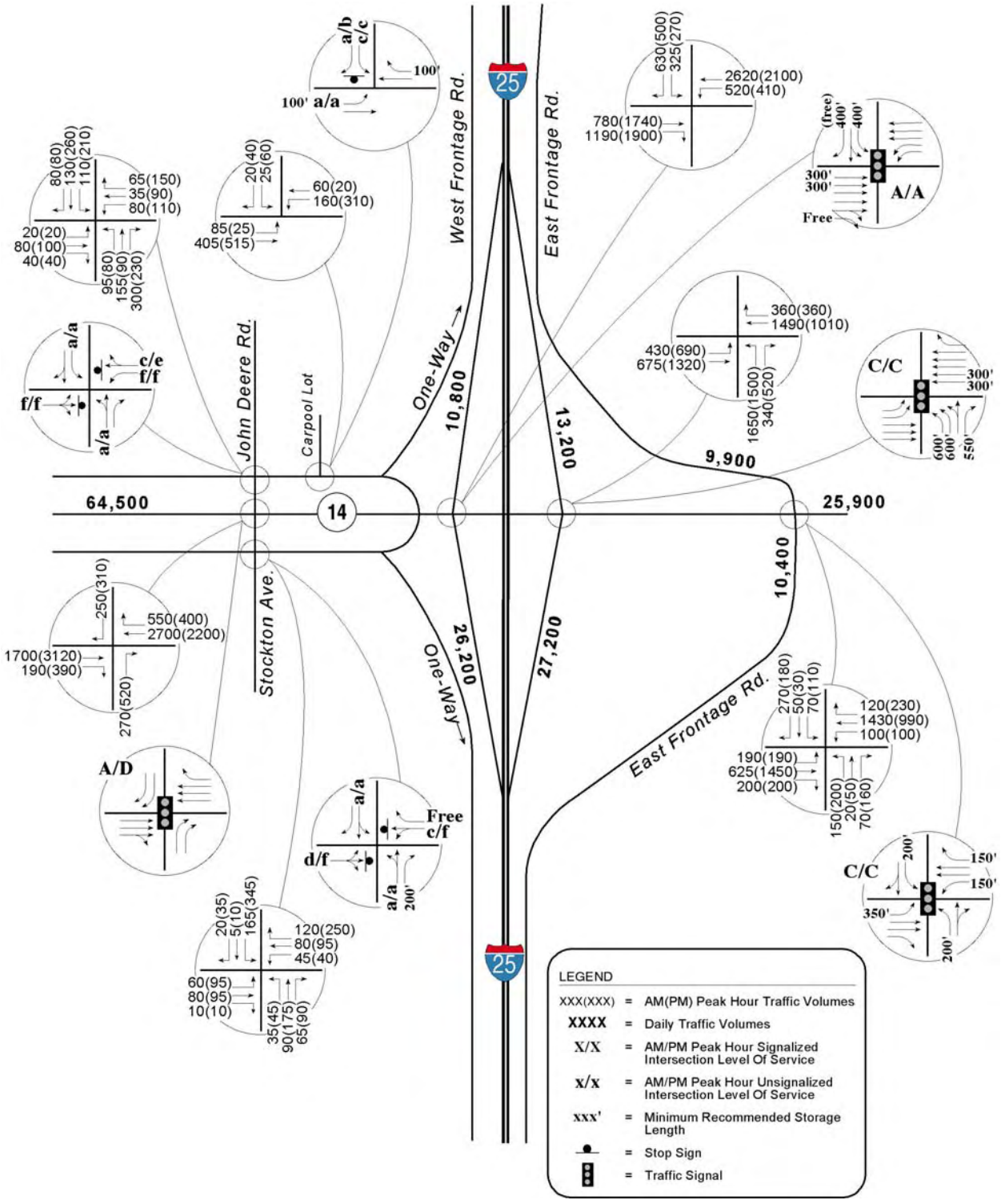

Figure 11. Package A Traffic Forecasts and Levels of Service with Underpass

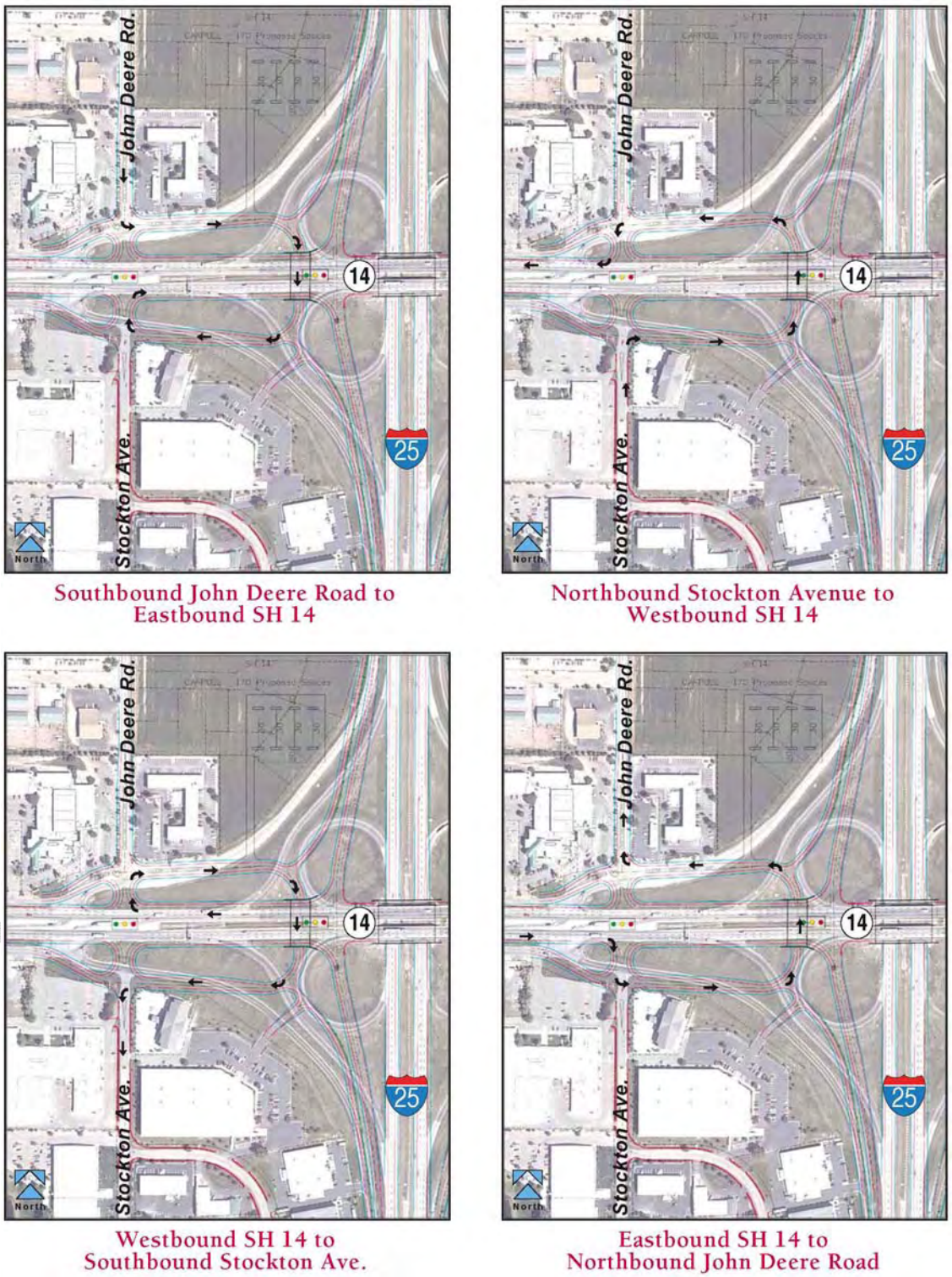

Figure 12. Travel Pattern Changes with SH 14 Underpass