



# US 85 Commuter Bus – South Greeley DEIS Evaluation

August 20, 2007

## Introduction

The North I-25 DEIS Package A Alternative considers two commuter bus routes: one that would extend from the Denver Union Station (DUS) and a second that would extend from the Denver International Airport (DIA). Both routes will terminate in Greeley. Line stations will be located at designated existing transit stops in Denver, Commerce City, and Brighton, as well as new proposed stops in Fort Lupton, Platteville, Evans, and Greeley.

The proposed commuter bus route generally follows the existing US 85 alignment. In the south Greeley area, the commuter bus follows US 85 to the US 34 and US 85 interchange. North of the interchange the commuter bus follows 8th Avenue through Garden City. Two potential sites for an on-street bus stop are being considered in the south Greeley area, one just south of the 8th Avenue/21st Street intersection and another just north of the 8th Avenue/20th Street intersection. Additionally, a bus station with parking is being considered in the vicinity of 9th Avenue and 26th Street. A map of the commuter bus routes showing the station locations is provided in Figure 1.

This report documents the potential traffic impacts of the proposed commuter bus station in the south Greeley area, and provides technical documentation of the traffic data analysis. The other proposed commuter bus stations are addressed in separate reports.

## Existing Conditions

The proposed commuter bus station is located in the southwest corner of the 9th Avenue/26th Street intersection with approximately 80 parking spaces. The surrounding area includes several land use types, including educational, residential, commercial, retail development, gas stations, and small offices. The proposed commuter bus station will also serve the University of Northern Colorado community.

## United States Highway 85 (US 85)

US 85 is a four lane divided highway from I-76 Exit 12 north through Brighton, Platteville, and Greeley to the north side of Ault. The expressway has grade-separated interchanges at SH 7, SH 52, US 34, and USB 85 (Business Route 85).

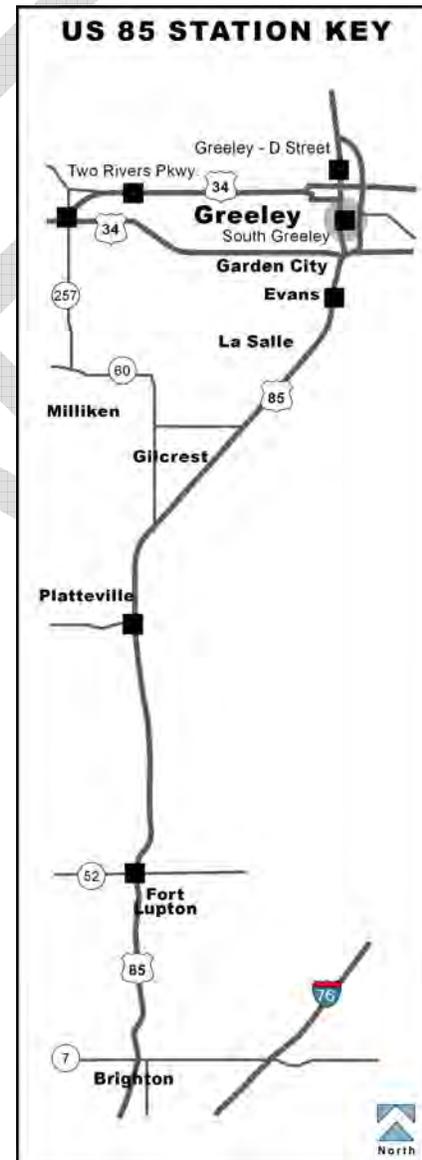


Figure 1. Vicinity Map

## **US 34/8th Avenue intersection**

US 34 travels east-west and is also known as Business Route 34 (USB-34) in Greeley. 8th Avenue is a north-south four-lane major arterial. The US 34/8th Avenue intersection is signalized. The posted speed limit on 8th Avenue near the intersection is 30 mph. Intersection geometry on the eastbound approach includes a right-turn and a left-turn lane while on the westbound approach there is a shared through/left lane, a through lane and a right turn lane. On the southbound approach there are two through lanes and a right-turn lane while on the northbound approach there is a through lane and an exclusive left-turn lane. The intersection experiences heavy westbound traffic during both the AM and PM peak hours and heavy southbound traffic during the PM peak hours.

## **8th Avenue/25th Street intersection**

The 8th Avenue/25th Street intersection is unsignalized. 25th Street runs in the east-west direction with a left turn lane, a through lane and a shared through/right turn lane on the east approach, and a left turn lane, two through lanes and right turn lane on the west approach. 8th Avenue runs in the north-south direction with a left turn lane, a through lane and a shared through/right turn lane on each approach. The posted speed limit near the intersection on 25th Street is 25 mph and on 8th Avenue is 30 mph. At the intersection, 8th Avenue is a major arterial that carries north-south through traffic while 25th Street is a four lane minor arterial that carries residential and commercial traffic to and from the surrounding neighborhoods.

## **8th Avenue/27th Street intersection**

The 8th Avenue/27th Street intersection is an unsignalized offset tee intersection. 27th Street runs east-west and has a single shared left, through, and right turn lane on both approaches. 8th Avenue runs north-south and has two through lanes with a shared left and a shared right-turn lane on both approaches. The posted speed limit near the intersection on 27th Street is 25 mph and on 8th Avenue is 30 mph. At the intersection, 8th Avenue is a major arterial that carries heavy northbound and southbound through traffic while 27th Street is a local road that carries residential and commercial traffic to and from the surrounding neighborhoods.

## **9th Avenue/26th Street intersection**

26th Street is an east-west minor arterial and 9th Avenue is a north-south local residential street. The 9th Avenue and 26th Street intersection is unsignalized. At the intersection, 26th Street has two through lanes with shared left and right turns on each approach. 9th Avenue has a single shared left, through, and right turn lane on each approach. The posted speed limit near the intersection on both streets is 25 mph.

## **11th Avenue/26th Street intersection**

The 11th Avenue/26th Street intersection is signalized. At the intersection, 26th Street runs in the east-west direction and 11th Avenue runs in the north-south direction. 26th Street has an exclusive left-turn lane and a shared right-turn lane on the eastbound approach while on the westbound approach it has a through lane, an exclusive right-turn and an exclusive left-turn lane. 11th Avenue has two through lanes with a shared right-turn and an exclusive left-turn lane.

on both north and south approaches. The posted speed limit near the intersection on both streets is 25 mph.

**8th Avenue/26th Street intersection**

The 8th Avenue/26th Street intersection is an unsignalized offset tee intersection. 26th Street runs in the east-west direction and 8th Avenue runs in the north-south direction. 26th Street has an exclusive left-turn lane and an exclusive right-turn lane on the eastbound and westbound approach. 8th Avenue has two through lanes with a shared right-turn lane and an exclusive left-turn lane on both north and south approaches. The posted speed limit near the intersection on 8th Avenue is 30 mph and on 26th Street is 25 mph.

Figure 2a summarizes the peak hour traffic counts collected in August 2006 within the study area. Additionally, Average Daily Traffic (ADT) data was obtained from the North I-25 Travel Demand Model – 2001 base year. As shown, the average daily traffic on 8th Avenue north of the US-34 WB Ramp and 8th Avenue intersection is around 11,000 vehicles per day (vpd) and south of the intersection is around 8,500 vpd. Average daily traffic on the US 34 WB Ramp west of the intersection is 25,300 vpd and east of the intersection is 7,300 vpd.

**Traffic Operations Evaluation**

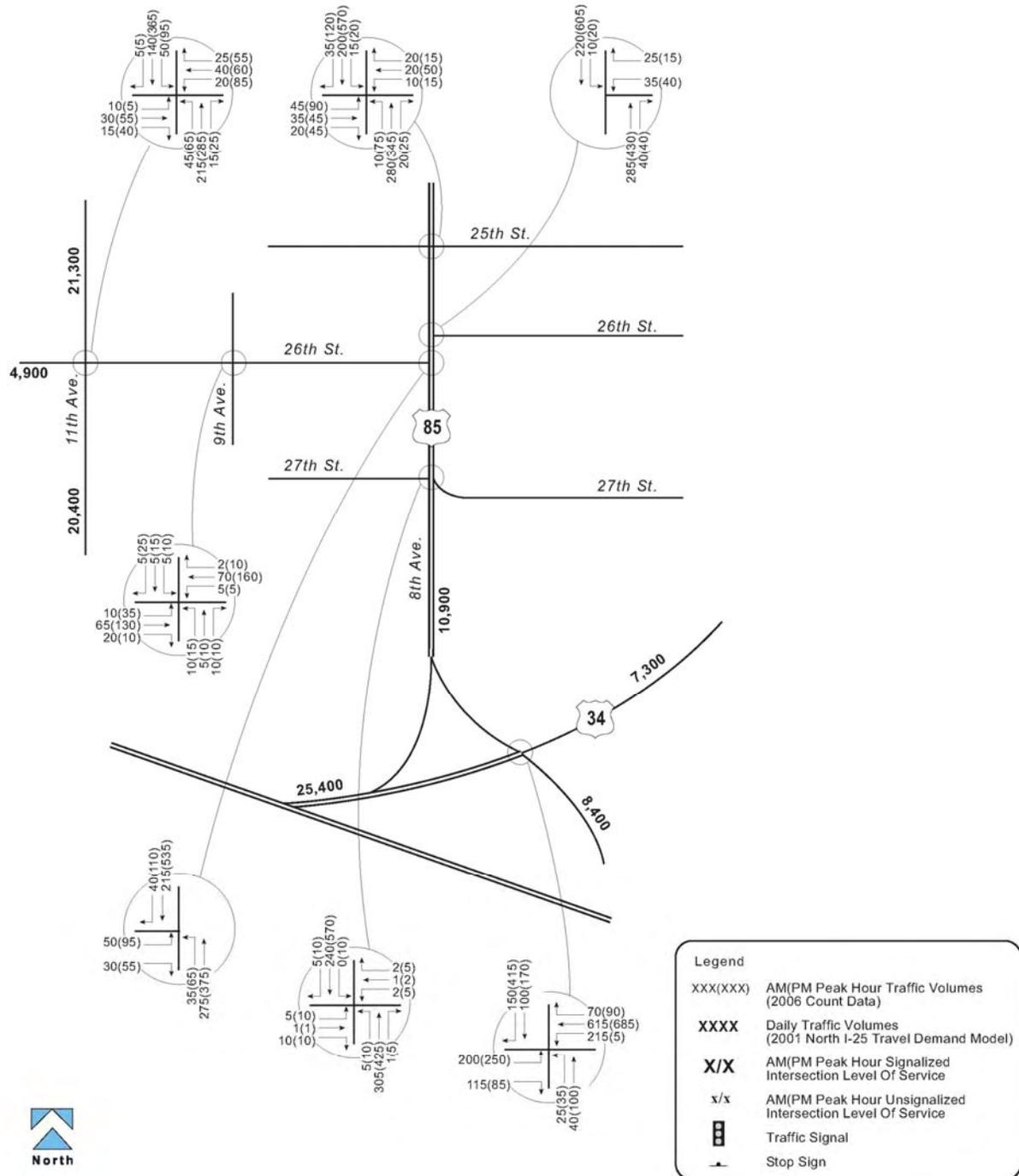
Operational analyses of each key intersection were conducted based on methodology developed in the Highway Capacity Manual (Transportation Research Board, 2000). The result of such analysis is a level of service (LOS) rating. Level of service is a qualitative assessment of the traffic flow based on the average stopped delay per vehicles at intersections controlled by traffic signals and stop-signs.

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**

Level of Service	Average Delay at Signalized Intersections (sec./veh.)	Average Delay at Stop-Controlled intersections (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

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**Figure 2a. Existing Conditions – Volumes**

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Peak hour traffic counts were conducted in August 2006 at the study area intersections. Other background parameters are documented in the *DEIS Traffic Evaluation – Methodology Summary*.

Figure 2b illustrates existing peak period levels of service at the signalized and unsignalized intersections within the study area. As the Figure 2b and Table 2 indicate, evaluated signalized intersections and analyzed movements at unsignalized intersections operate at LOS D or better during both peak periods.

**Table 2 Existing Intersection LOS and Delay**

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
11th Avenue and 26th Street	B	C	19	21
8th Avenue and 25th Street	B	C	19	22
US-34 WB Ramp and 8th Avenue	D	D	44	45
8th Avenue and 26th Street (unsignalized)				
Eastbound Left Turn	B	D	13	30
9th Avenue and 26th Street (unsignalized)				
Northbound Approach	A	B	10	11
8th Avenue and 27th Street (unsignalized)				
Westbound Approach	B	C	12	16

## 2030 Conditions

2030 traffic projections were developed for the alternatives being considered:

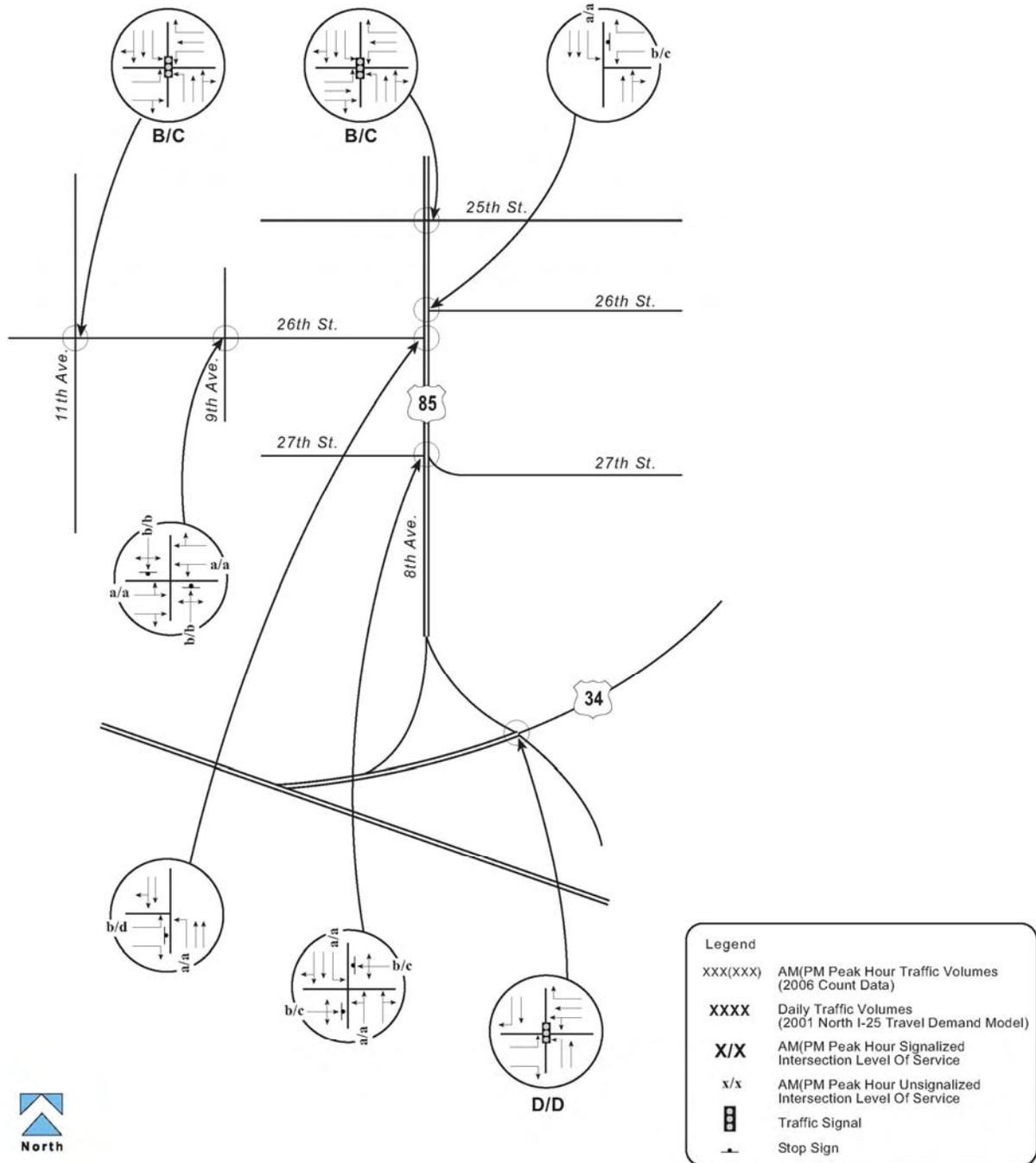
- 1) No Action Alternative
- 2) Package A: GPL + CR + CB 85

These packages are illustrated in Figures 3 and 4. Since there are no project elements in the South Greeley area in Package B, the No-Action results are representative of Package B conditions. In developing peak hour turning movements at the study area intersections, the North I-25 Travel Demand Model – 2001 base year, 2030 No Action and 2030 Package A results were utilized to calculate the growth factors over a 29 year period. Since the actual traffic counts were conducted in year 2006, the growth factors were adjusted to reflect a 24 year growth rate. These growth factors 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 checked for balancing between intersections and reasonableness.

## 2030 No Action Traffic Volumes

The 2030 No Action daily and peak hour projections for the study area intersections are shown in Figure 5. As shown, the average daily volume on 8th Avenue north of the US-34 WB Ramp and 8th Avenue intersection is around 12,600 vehicles per day (vpd) and south of the intersection is around 12,000 vpd. The average daily traffic volume on the US 34 WB Ramp is

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**Figure 2b. Existing Conditions – Levels of Service**

36,000 vpd west of the intersection and 12,600 vpd east of the intersection. During the AM peak hour traffic flows are distributed equally in the southerly and northerly direction. During the PM peak hour major traffic flows are southerly from Greeley towards Evans, and Platteville and westerly towards Fort Collins.

**2030 Package A Traffic Volumes**

The same methodology used to develop the 2030 No Action volumes was applied to estimate 2030 background traffic volumes for the Package A alternative. The North I-25 Travel Demand Model does not include park-and-ride patrons in its traffic assignment procedure. Therefore, in addition to these background forecasts – which are shown in Figure 6 – peak hour site traffic associated with the development of the commuter bus station and park-and-ride lot was estimated and assigned to the local road network according to the methodology outlined in the *Park-and-Ride Trip Generation and Distribution Methodology* report. A summary of this methodology and its application for this park-and-ride is provided below.

**Park-and-Ride Trip Generation**

The number of proposed spaces at the South Greeley park-n-ride lot was determined using the methodology outlined in the *North I-25 DEIS Parking Results* report (Carter & Burgess, November 2006). Using the results of this report, trip generation is estimated at each site by applying the following factors.

- First, a conservative estimate of maximum utilized spaces is determined by multiplying the number of spaces provided by 90 percent (or 0.9). This is referred to as the *number of occupied spaces*.
- Then, the number of occupied spaces is multiplied by the factors shown in Table 3.

**Table 3 – Peak Hour Trip Generation for North I-25 EIS Park-and-Ride Lots**

	Trip Rate	Entering	Exiting
<b>AM Peak Hour</b>			
Trips per occupied space	0.75	87%	13%
<b>PM Peak Hour</b>			
Trips per occupied space	0.50	20%	80%

The South Greeley commuter bus station would be located in the southwest corner of the 9th Avenue/26th Street intersection and would have 80 parking spaces. The future peak hour traffic from this proposed station is shown in Table 4.

**Table 4 Future Peak Hour Traffic from the South Greeley Park-and-Ride Lot**

Location	Daily Trips	AM Peak			PM Peak		
		In	Out	Total	In	Out	Total
South Greeley PNR Lot	170	48	8	56	8	30	38

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Figure 3. No Action Alternative

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### LEGEND

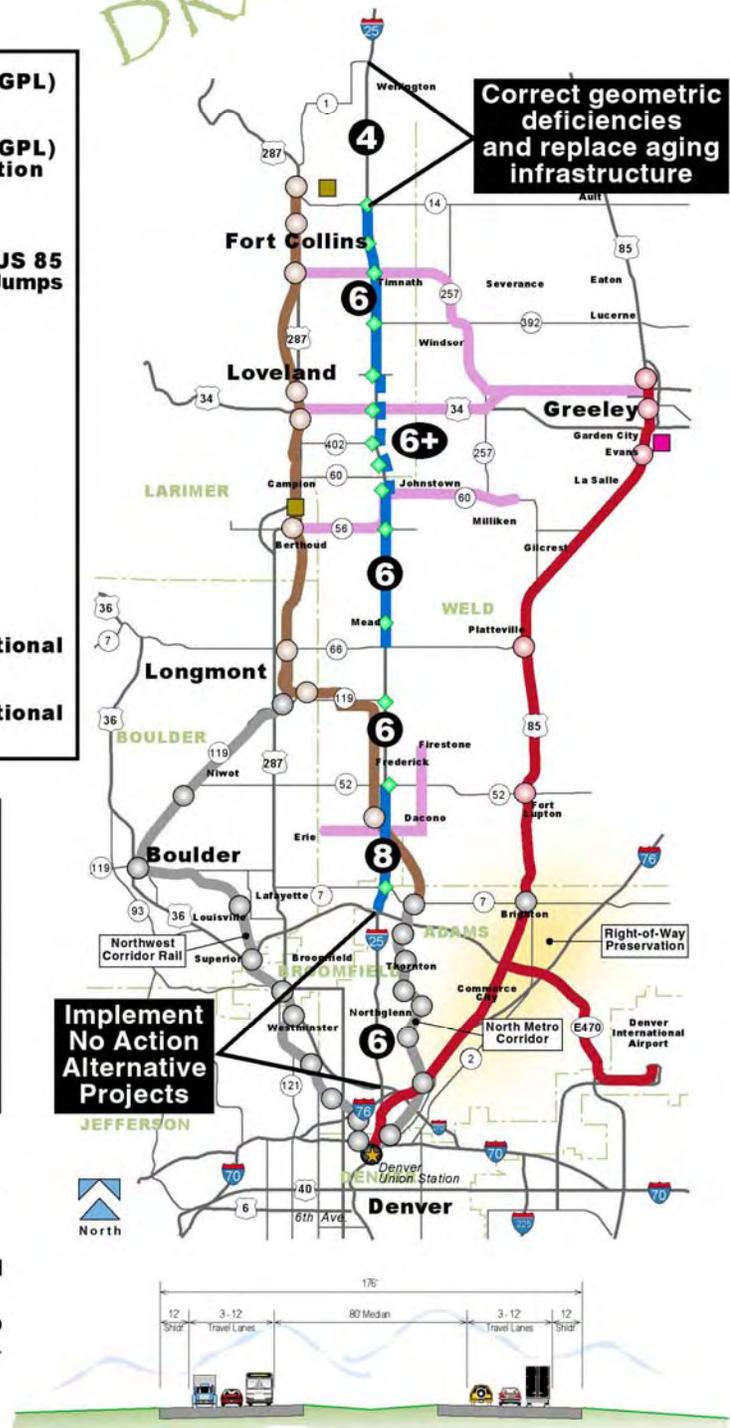
	<b>1 New General Purpose Lane (GPL) in Each Direction</b>
	<b>1 New General Purpose Lane (GPL) + Auxiliary Lane in Each Direction</b>
	<b>Commuter Rail (CR)</b>
	<b>Commuter Bus (CB) Service in US 85 General Purpose Lanes and Que Jumps</b>
	<b>Feeder Bus Service</b>
	<b>Interchange Upgrades</b>
	<b>Number of Lanes</b>
	<b>Commuter Bus Station / Stop</b>
	<b>Commuter Rail Station</b>
	<b>FasTracks Rail Line</b>
	<b>FasTracks Transit Station</b>
	<b>Potential Commuter Rail Operational &amp; Maintenance Facility</b>
	<b>Potential Commuter Bus Operational &amp; Maintenance Facility</b>

**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.

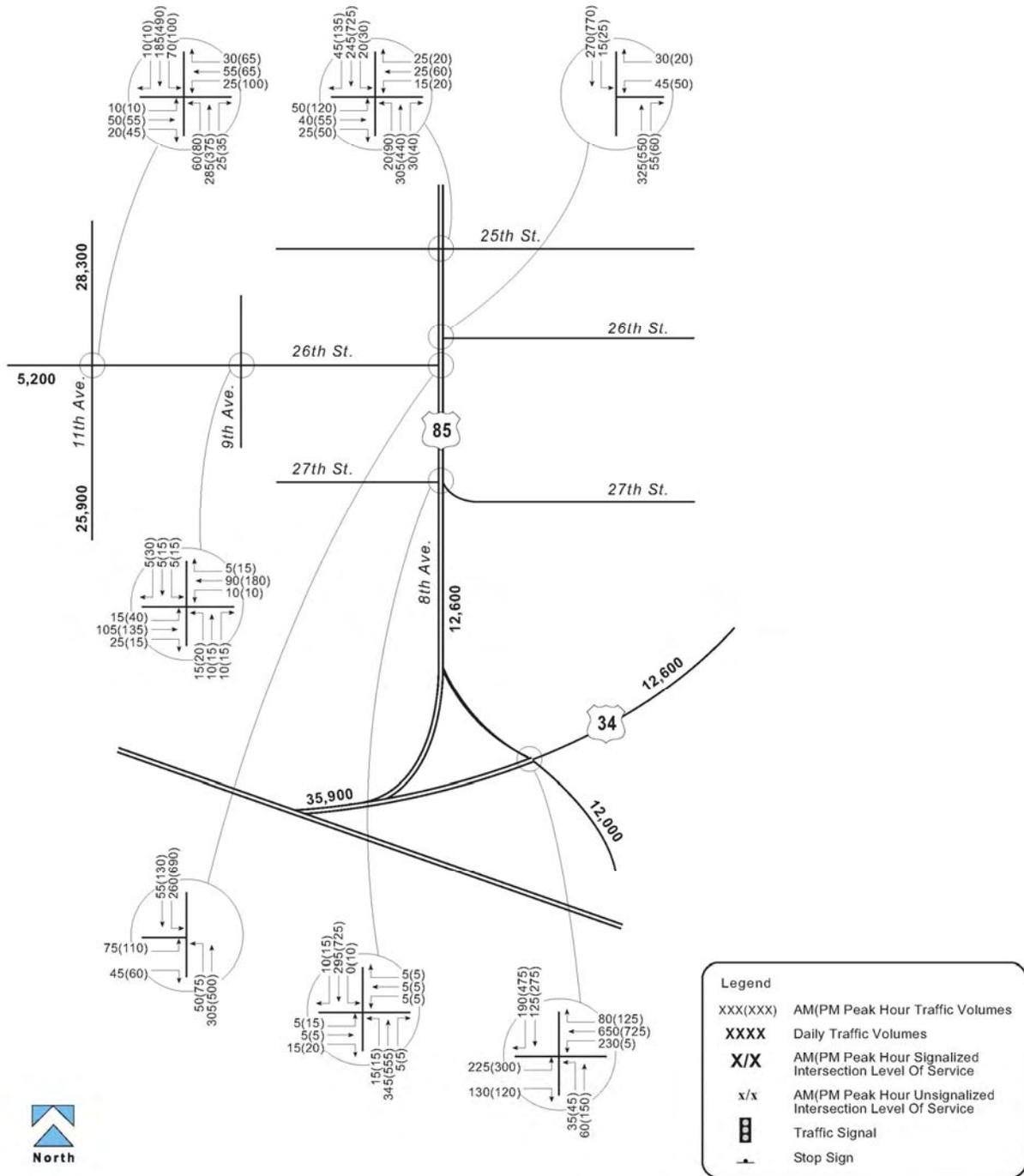


NOT TO SCALE

TYPICAL I-25 CROSS SECTION - 6 GENERAL PURPOSE LANES

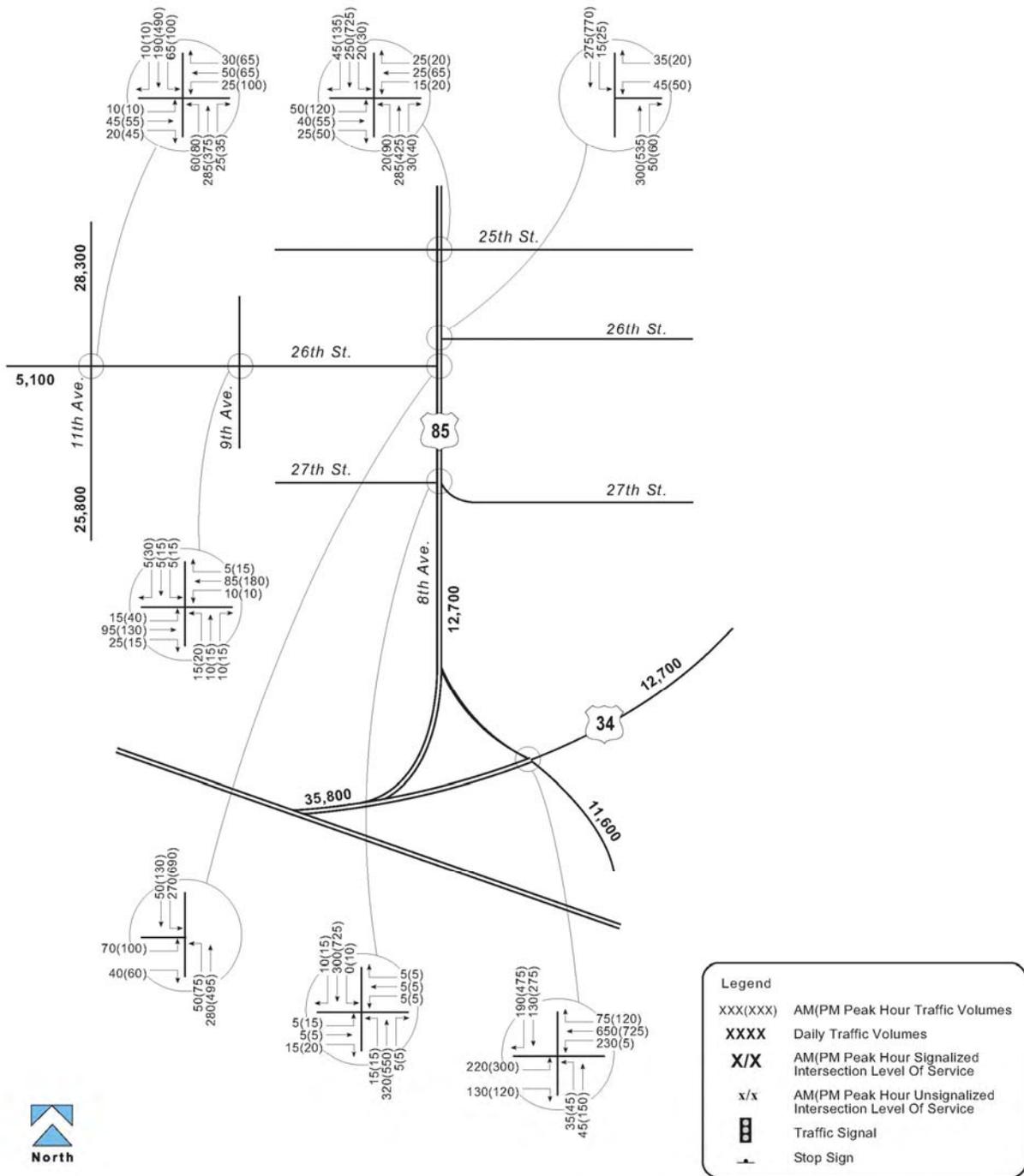
Figure 4. 2030 Package A Alternative

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**Figure 5. 2030 No Action Forecasts**

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**Figure 6. 2030 Package A Background Traffic Forecasts**

## Trip Distribution and Assignment

The trip distribution and assignment for the station was determined based on existing and future residential land use patterns in the vicinity of the site. It was assumed that the access to the station would be provided from 9th Avenue and that most trips would use 26th Street as the primary route to access 9th Avenue. The peak hour trip generation and distribution estimates for the proposed park-and-ride lot are shown in Figure 7. These peak hour trip generation estimates were combined with the background traffic projections to arrive at the total 2030 Package A peak hour projections in Figure 8. In general, daily traffic is projected to be less along US 85 in the Package A alternative, as more regional traffic is attracted to the improved I-25 corridor.

### **2030 No Action Traffic Operations**

Figure 9 shows the projected levels of service at the study area intersections under the No Action scenario. For the purpose of the No Action analysis it was assumed that 8th Avenue would remain as a four-lane roadway since that geometry is more representative of true future no action conditions in the area.

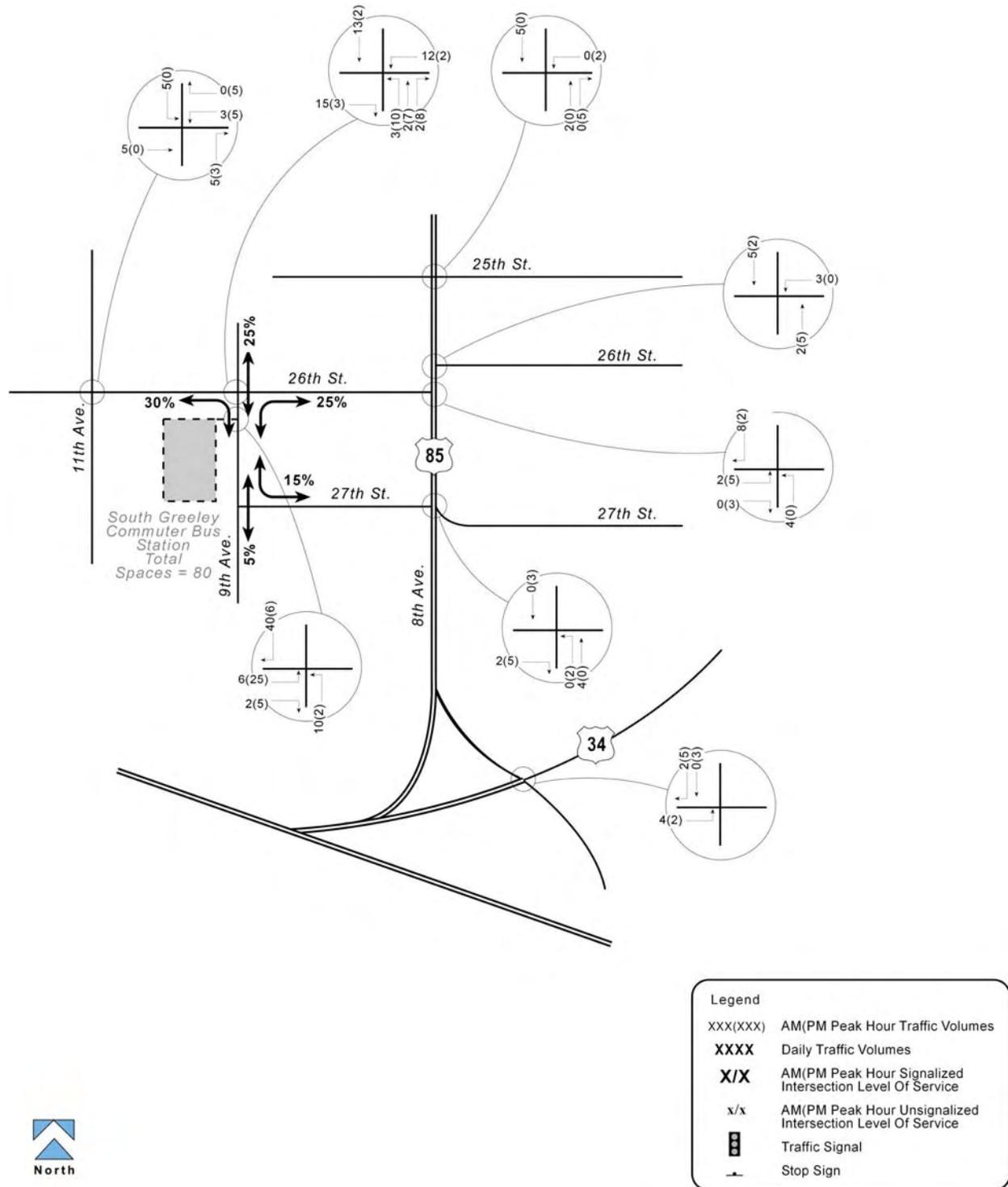
As Figure 9 and Table 3 indicate, the evaluated signalized intersections are projected to operate at LOS D or better during both peak periods. Movements at the unsignalized intersections are projected to operate at LOS D or better in both peak hours as well, with the exception of the eastbound left turn at the 8th Avenue/26th Street intersection, which is projected to operate at LOS F during the PM peak period.

It is not uncommon for movements from driveways and side streets along higher volume roadways to experience poor levels of service, however. As noted in Chapter 17 (Unsignalized Intersections) of the Highway Capacity Manual (2000):

*In evaluating the overall performance of two-way stop control intersections, it is important to consider measures of effectiveness in addition to delay, such as v/c ratios for individual movements, average queue lengths, and 95<sup>th</sup> percentile queue lengths. By focusing on a single measure of effectiveness for the worst movement only, such as delay for the minor street left turn, users may make less effective traffic control decisions.*

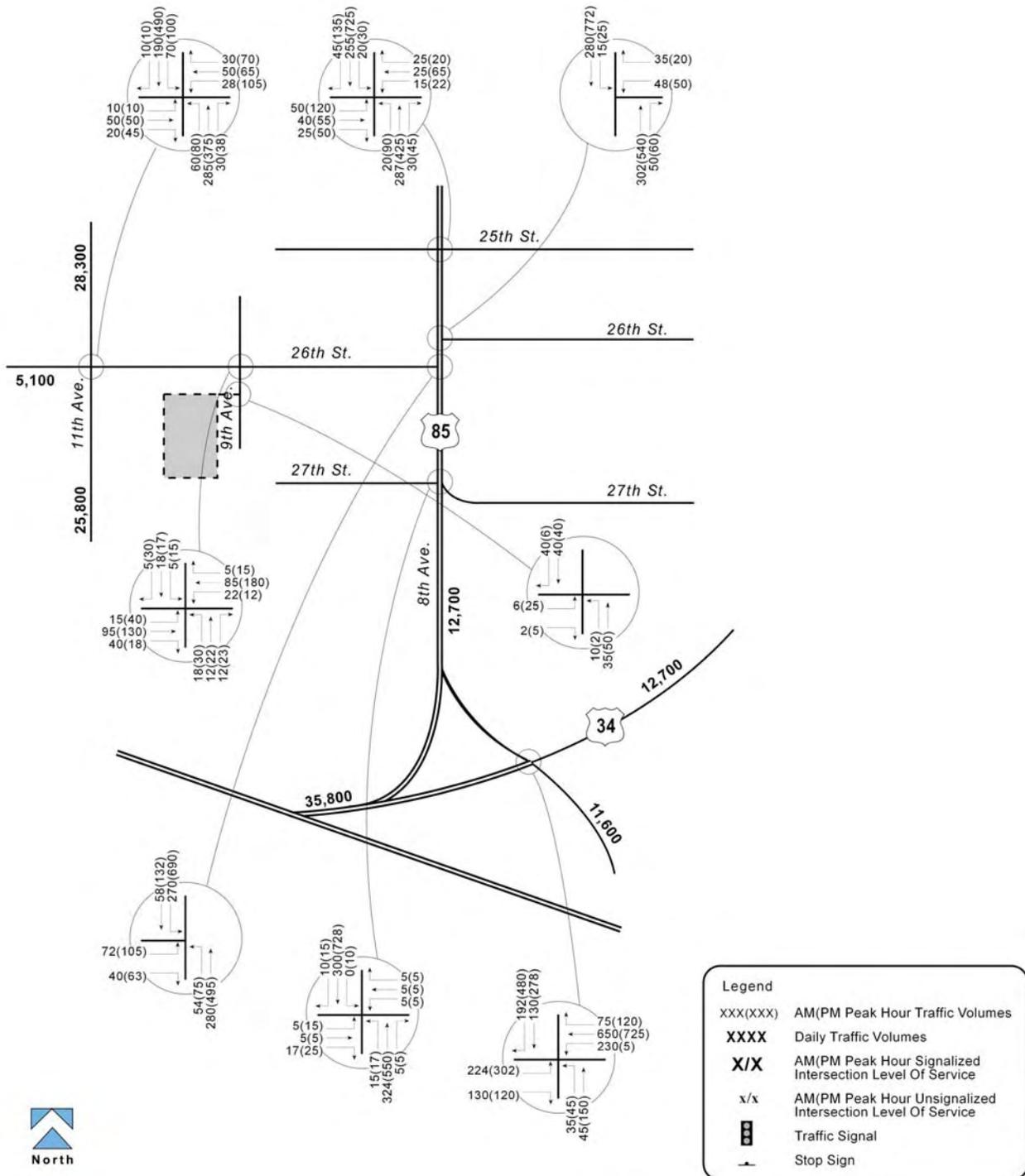
A more detailed analysis of the intersection indicated the v/c ratio for the left turn movement at the 8th Avenue/26th Street intersection was 0.79 and the 95th percentile queue length was about 100 feet, which indicated acceptable traffic operations. Therefore, no improvements are recommended at that location.

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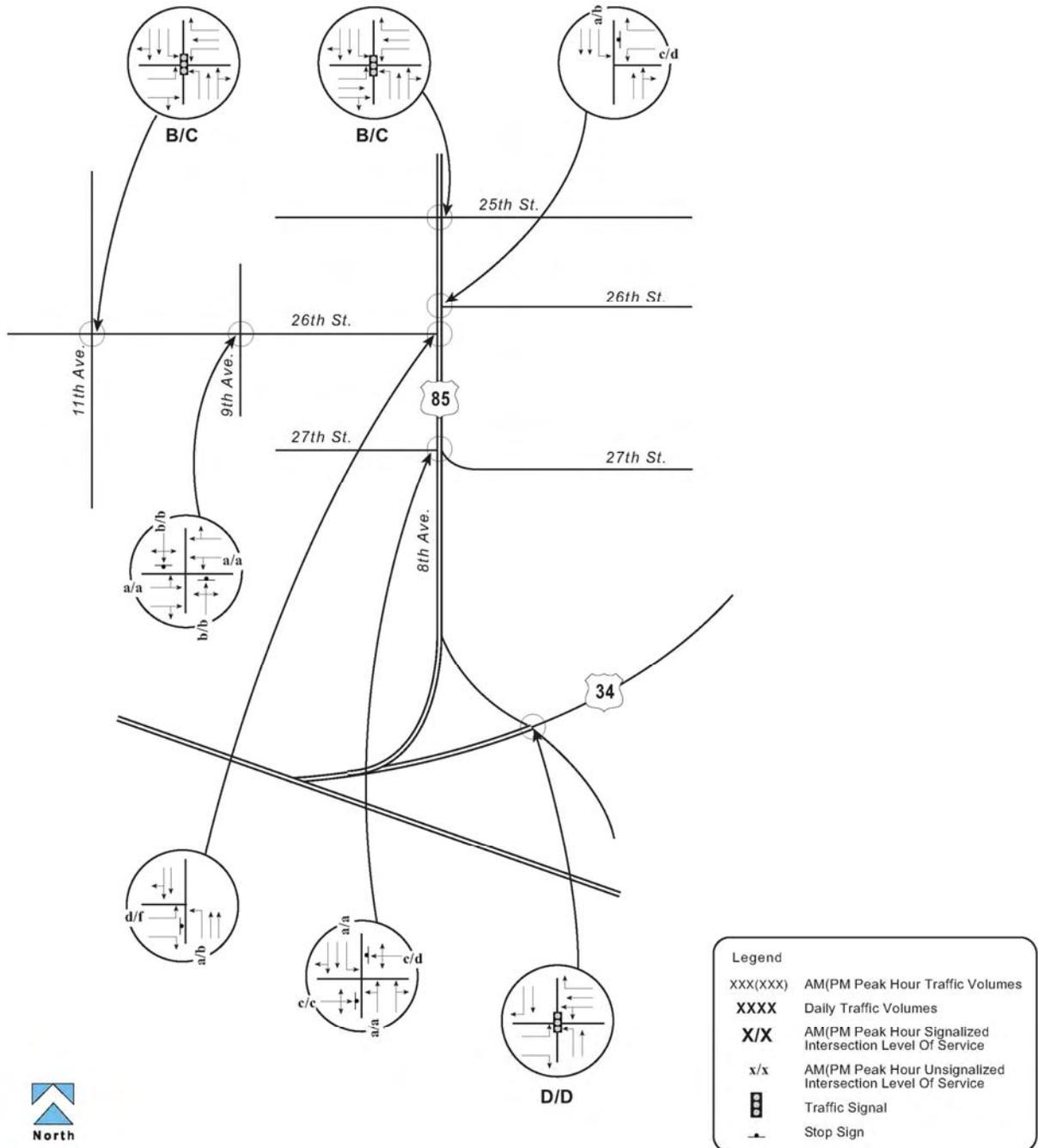
**Figure 7. Park and Ride Lot Trip Distribution and Assignment**

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**Figure 8. 2030 Package A Total Traffic Forecasts**

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**Figure 9. 2030 No Action Levels of Service**

**Table 5. 2030 No Action Intersection LOS and Delay**

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
11th Avenue and 26th Street	B	C	20	22
8th Avenue and 25th Street	B	C	19	24
US-34 WB Ramp and 8th Avenue	D	D	47	52
8th Avenue and 26th Street (unsignalized)				
Eastbound Left Lane	C	F	16	84
9th Avenue and 26th Street (unsignalized)				
Northbound Approach	B	B	10	12
8th Avenue and 27th Street (unsignalized)				
Westbound Approach	B	D	14	26

**2030 Package A Traffic Operations**

As Figure 10 and Table 6 indicate, all signalized intersections in the study area would operate at LOS D or better in 2030 with the proposed station. For unsignalized intersections, all movements would operate at LOS D or better in both peak periods, with the exception of the eastbound left turn at the 8th Avenue/26th Street intersection which would operate at LOS F in the afternoon peak (the same as in No Action conditions). The v/c ratio for that movement was 0.75 and the 95th percentile queue length was four vehicles, which indicates reasonable operations. Therefore, no improvements are recommended at that location.

Access to the commuter bus station will be provided from 9th Avenue south of 26th Street. As shown on Figure 10 and Table 6, this access would be a single lane with stop-control on the station approach, and would operate at acceptable levels of service without any need for laneage improvements to 9th Avenue.

**Table 6 2030 Package A Intersection LOS and Delay**

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
11th Avenue/26th Street	B	C	18	22
8th Avenue/25th Street	B	C	19	24
US-34 WB Ramp/8th Avenue	D	D	47	52
8th Avenue/26th Street (unsignalized)				
Eastbound Left Turn	C	F	16	78
9th Avenue/26th Street (unsignalized)				
Northbound Approach	B	B	11	13
8th Avenue/27th Street (unsignalized)				
Westbound Approach	B	D	13	26
Park and Ride Access/9th Avenue (unsignalized)				
Eastbound Left Turn	A	A	9	9

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## Proposed Mitigation

The Package A alternative includes six general purpose lanes on I-25 and commuter rail in addition to the proposed commuter bus routes. This would result in more trip attractions towards I-25, lowering the average daily and peak hour traffic volumes on US-85 in Greeley area. The results of the traffic analysis indicate that the intersections within study area would operate at an acceptable LOS and no improvements will be needed in the vicinity of the proposed commuter bus station.

## Alternatives Evaluation Comparison

### Traffic Operational Analysis

Table 7 compares the levels of service and delay at the study area intersections for the two packages. As the table indicates, except for the 8th Avenue and 26th Street intersection, the area in the vicinity of the South Greeley commuter bus station would operate at acceptable levels of service. The v/c ratio for that movement was 0.75 and the 95th percentile queue length was four vehicles, which indicates reasonable operations. Therefore, no improvements are recommended at that location under both the No Action and Package A alternatives.

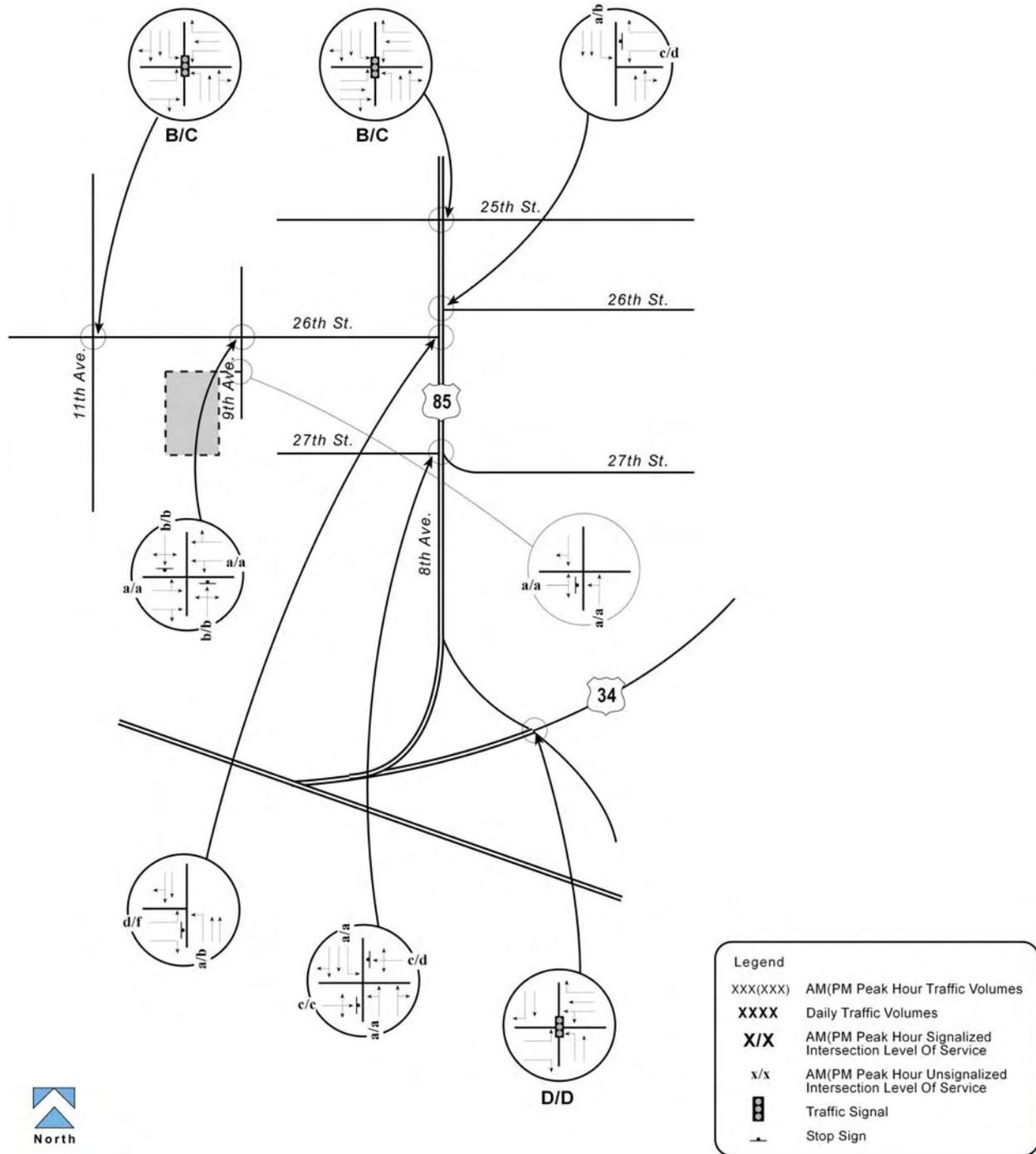
**Table 7. Intersection Level of Service and Delay**

Intersection	No Action		Package A	
	AM Peak	PM Peak	AM Peak	PM Peak
11th Avenue/26th Street	LOS B (20 sec.)	LOS C (22 sec.)	LOS B (18 sec.)	LOS C (22 sec.)
8th Avenue/25th Street	LOS B (19 sec.)	LOS C (24 sec.)	LOS B (19 sec.)	LOS C (24 sec.)
US-34 WB Ramp/8th Avenue	LOS D (47sec.)	LOS D (52 sec.)	LOS D (47sec.)	LOS D (52 sec.)
8th Avenue/26th Street (unsignalized)				
Eastbound Left Turn	LOS C (16 sec.)	LOS F (84 sec.)	LOS C (16 sec.)	LOS F (79 sec.)
9th Avenue/26th Street (unsignalized)				
Northbound Approach	LOS B (10 sec.)	LOS B (12 sec.)	LOS B (11 sec.)	LOS B (13 sec)
8th Avenue/27th Street (unsignalized)				
Westbound Approach	LOS B (14 sec.)	LOS D (26sec.)	LOS B (13 sec.)	LOS D (26 sec.)
Station Access/9th Avenue (unsignalized)				
Eastbound Approach	N/A	N/A	LOS A (9 sec.)	LOS A (9 sec.)

LOS X – Level of service

##.# - Average delay in seconds per vehicle

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**Figure 10. 2030 Package A Levels of Service**

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