

# Fort Collins – South Transit Center DEIS Commuter Rail/BRT Station Evaluation

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August 20, 2007

## Introduction

The North I-25 DEIS Package A alternative considers a single commuter rail route that will extend from the end of the planned RTD North Metro Commuter Rail Line and terminate in the city of Fort Collins. Proposed stations will be located in Erie, Longmont, Berthoud, Loveland, and Fort Collins.

The proposed commuter rail route follows the existing BNSF alignment which generally parallels the US 287 alignment from Fort Collins to Longmont. Between the Sugar Mill station in Longmont and the North Metro end-of-line station at SH-7, the alignment will parallel SH-119, WCR-7, and the UP Boulder branch. A map of the commuter rail route with station locations is provided in Figure 1.

Also, The North I-25 DEIS Package B alternative considers three bus rapid transit (BRT) routes: one that would extend from the Denver Union Station (DUS) and terminate in Fort Collins at the proposed Fort Collins South Transit Center; a second that would extend from the Denver International Airport (DIA) and also terminate in Fort Collins; and a third route from DUS to downtown Greeley. Stations would be located at various interchanges along I-25, as well as along both US 34 east of I-25 and Harmony Road west of I-25.

The Fort Collins South Transit Center commuter rail/BRT station would be located near the BNSF rail line just to the northwest of Fairway Lane and College Avenue. Potential station parking would be located on the east side of the station.

This report documents potential traffic impacts the proposed commuter rail/BRT station may have within the vicinity of College Avenue (US 287) between Harmony Road and Fossil Creek Drive and provides technical documentation of the traffic data analysis. The other commuter rail and BRT stations are addressed in separate reports.

CDOT's South College Avenue (US 287) Access Control Plan Update Report (2002) was used as a reference for future conditions and recommendations in this report.

## Existing Conditions

The following major roadways and intersections are in the vicinity of the proposed site.

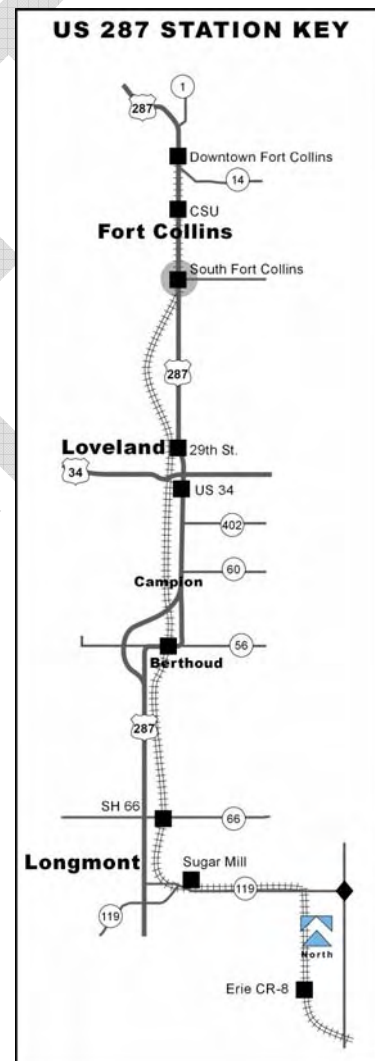


Figure 1. Vicinity Map

## **College Avenue (US 287)**

College Avenue (US 287) is a four lane, north/south major arterial that bisects the town of Ft. Collins. Intersections within the area of interest on College Avenue consist of two-way stops (side streets), and two four-way traffic signals. Left turns can be made from designated left turn lanes or from a multi-purpose center lane. Striped shoulders become designated right turn and acceleration lanes at intersections.

## **Harmony Road/College Avenue Intersection**

Harmony Road is a four lane arterial located on the southern end of Ft. Collins that runs east/west. The intersection of Harmony Road and College Avenue is signalized with designated double left and single right turn lanes on each approach. All four approaches have designated crosswalks and there is a striped bike lane on the westbound approach. The speed limit for Harmony Road is 35 mph whereas College Avenue has a speed limit of 40 mph for the north and southbound approaches.

## **Mason Street/College Avenue Intersection**

Mason Street is a two lane road that runs east/west when intersecting College Avenue and north/south beyond that. Mason Street becomes a minor unstriped neighborhood access on the east side of College Avenue, while the west side is striped with a multipurpose center lane. The speed limit on Mason St. is 20 mph with intersection control consisting of a two-way stop. The speed limit for College Avenue is 50 mph for the north and south bound approaches.

## **Fairway Lane/College Avenue Intersection**

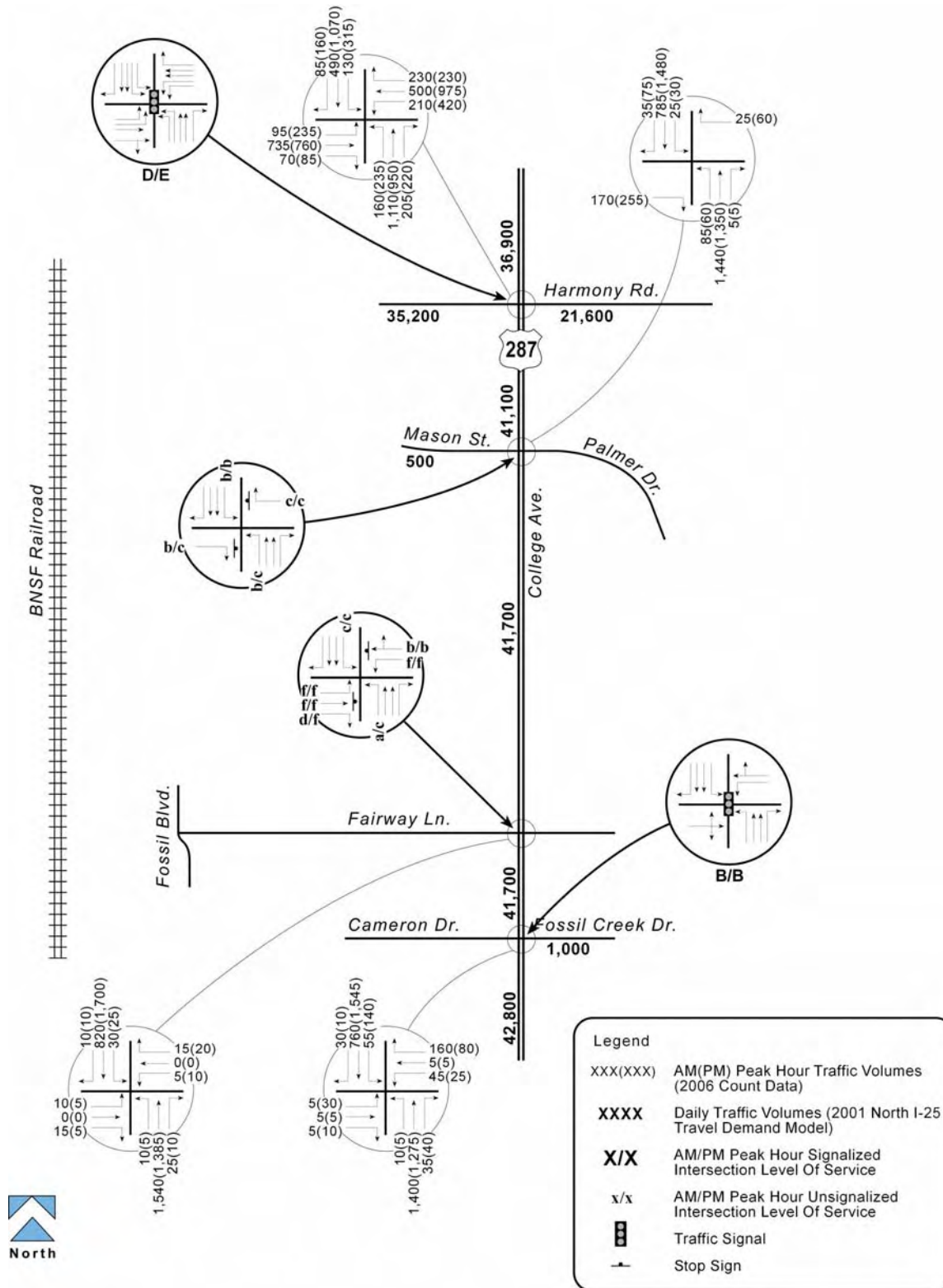
Fairway Lane is a minor two lane east/west road that is one block south of Mason Street. Fairway Lane is a minor unstriped neighborhood access on the east side of College Avenue, whereas the west side is striped and accesses one residence and a couple of businesses. The speed limit on Fairway Lane is 20 mph with intersection control consisting of a two-way stop. The speed limit for College Avenue increases to 55 mph for the north and south bound approaches.

## **Fossil Creek Drive (Cameron Drive)/College Avenue Intersection**

Fossil Creek Drive/Cameron Drive are minor two lane east/west neighborhood accesses located one block south of Fairway Lane. These streets are divided with raised medians and striped with designated left and right turn lanes. Crosswalks are striped on three of the four approaches. The speed limit on Fossil Creek Drive and Cameron Drive is 20 mph whereas the north and southbound approaches to College Avenue are posted at 55 mph. This intersection is controlled by a traffic signal.

Figure 2 summarizes the traffic counts collected in March of 2006 within the study area. As shown, average daily traffic (ADT) on College Avenue is about 37,000 – 43,000 vehicles per day (vpd). ADT on Harmony Road is about 22,000 – 35,000 vpd.

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**Figure 2. Existing Conditions**

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At the Harmony Road and College Avenue intersection, the westbound to southbound left-turning movement represents the highest turning volume during the AM and PM peak hours with counts of 210 vehicles per hour (vph) and 420 (vph) respectively.

## 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 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

Peak hour traffic counts were conducted in March, 2006 at the intersections of interest. Other background parameters are documented in the *DEIS Traffic Evaluation – Methodology Summary*.

Figure 2 and Table 2 summarize existing peak period levels of service at the signalized and unsignalized intersections within the study area. As shown, the intersection of Harmony Road and College Avenue operates at an acceptable LOS during the AM peak hour. However, operation during the PM peak becomes unacceptable at an LOS E with a 66 second delay. Also, at the unsignalized Fairway Lane/College Avenue intersection, the minor eastbound and westbound approaches operate at poor levels of service. 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 revealed that the v/c ratio for the side street movements was less than 1.50 and the 95th percentile queue length was less than 50 feet, which indicated that operations are adequate at this intersection.

**Table 2. Existing Intersection LOS and Delay**

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
<b>Harmony Rd. &amp; College Ave. (US 287)</b>	D	E	42	66
<b>Mason St. &amp; College Ave. (unsignalized)</b>				
<b>Eastbound Right Turn</b>	B	C	12	20
<b>Westbound Right Turn</b>	C	C	17	17
<b>Fairway Ln. &amp; College Ave. (unsignalized)</b>				
<b>Eastbound Left Turn</b>	F*	F*	>100*	>100*
<b>Eastbound Thru</b>	F*	F	>100*	>100
<b>Eastbound Right Turn</b>	D	F	27	>100
<b>Westbound Left Turn</b>	F*	F	>100*	>100
<b>Westbound Thru/Right Turn</b>	B	B	12	12
<b>Fossil Creek Dr. &amp; College Ave. (US 287)</b>	B	B	12	13

\* Queue lengths for this movement are less than 50 feet and volume/capacity ratios are less than 1.5, so operations are adequate. However, this intersection is identified for potential future signalization in CDOT's South College Avenue (US 287) Access Control Plan and should be monitored for signal warrant analysis based on future traffic growth.

**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 packages are illustrated in Figures 3 through 5. In developing peak hour turning movements at the study area intersections, the North I-25 Travel Demand Model – 2001 base year and 2030 No Action – results were utilized to calculate 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 results were checked for reasonableness and adjusted where necessary. The 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

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Figure 3. No Action Alternative



### 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>

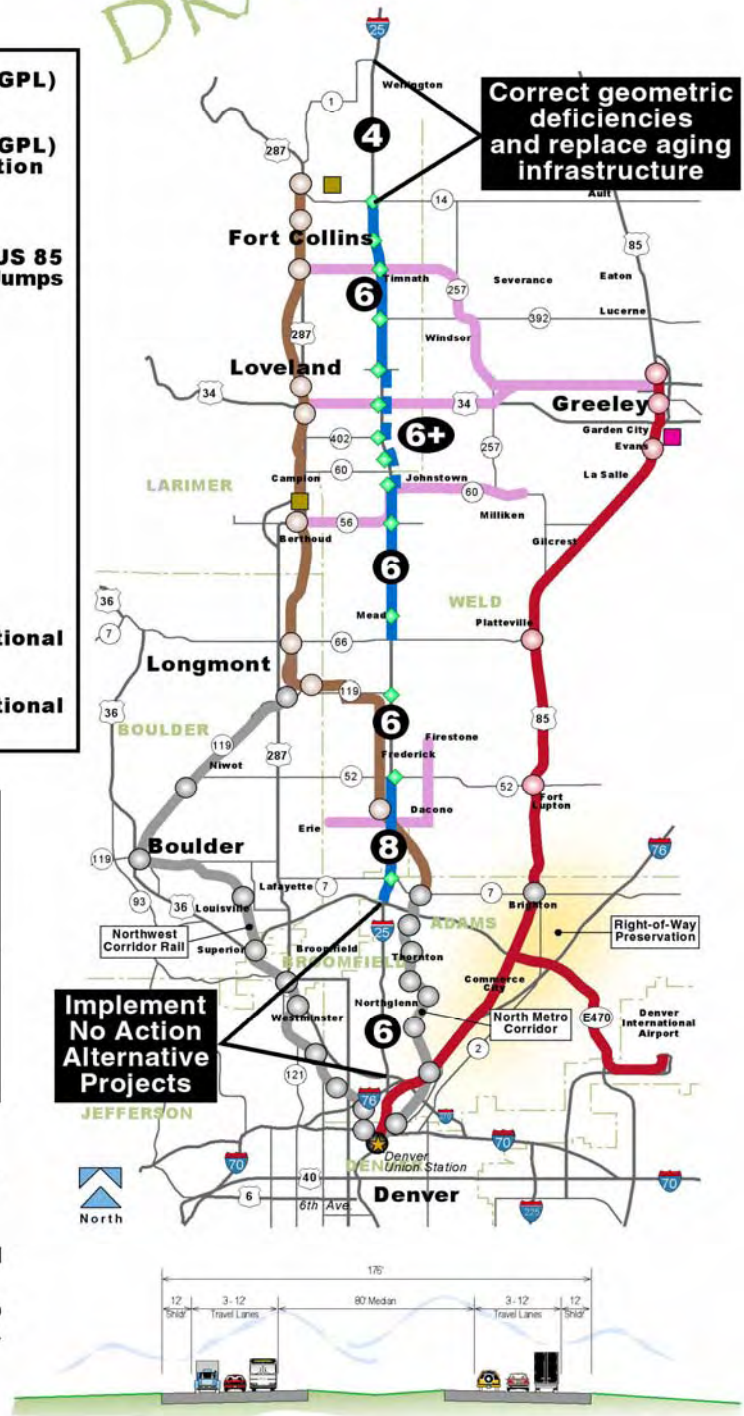
### Congestion Management Measures include:

- 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 Locators 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.

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NOT TO SCALE

TYPICAL I-25 CROSS SECTION - 6 GENERAL PURPOSE LANES

Figure 4. Package A Alternative

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### LEGEND

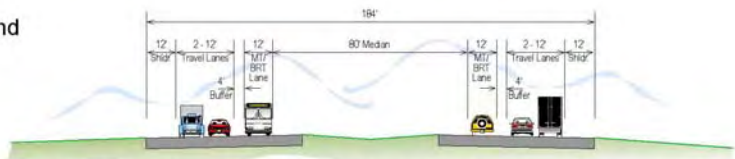
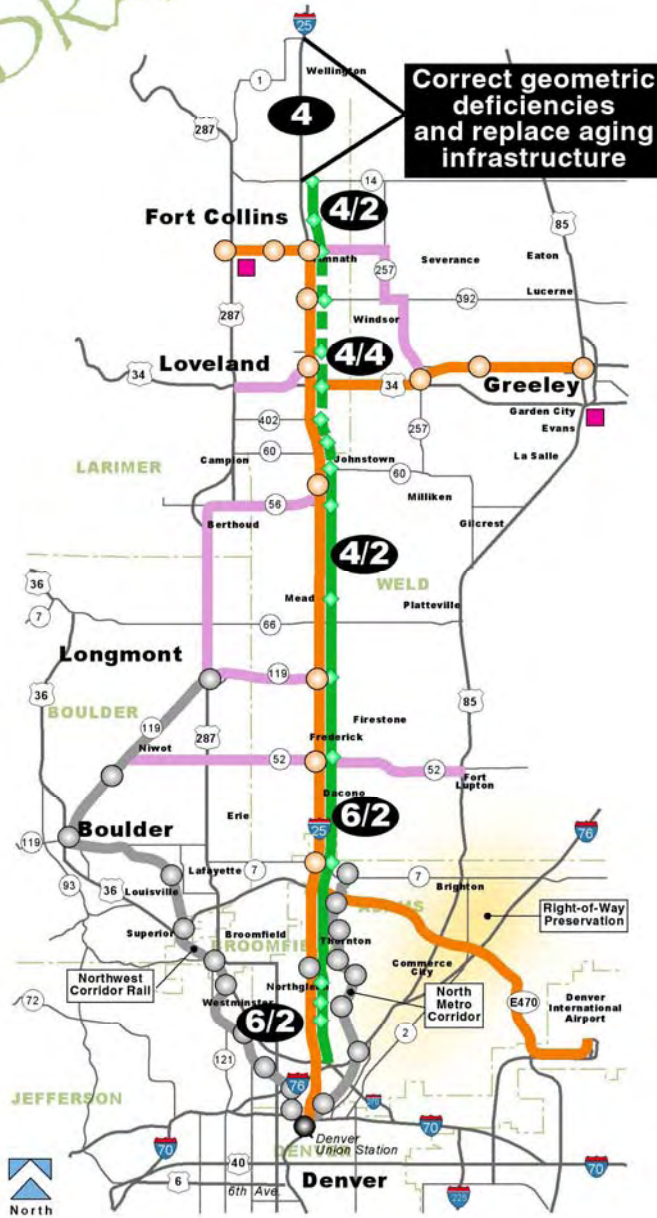
- 1 Buffer-Separated Tolled Express Lane (TEL) in Each Direction**
- 2 Barrier-Separated Tolled Express Lanes (TEL) in Each Direction**
- Bus Rapid Transit (BRT) Route (Uses TELs on I-25)**
- Feeder Bus Service**
- Interchange Upgrades**
- X **Number of Lanes: General Purpose/Tolled Express Lanes**
- Bus Rapid Transit Station**
- FasTracks Rail Line**
- FasTracks Transit Station**
- 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:**

- A wider barrier and express lanes cross section is included between SH 60 and Harmony Road.
- BRT stations located within an expanded median area.
- Where widening is needed between SH 66 and SH 7, the median would be used.



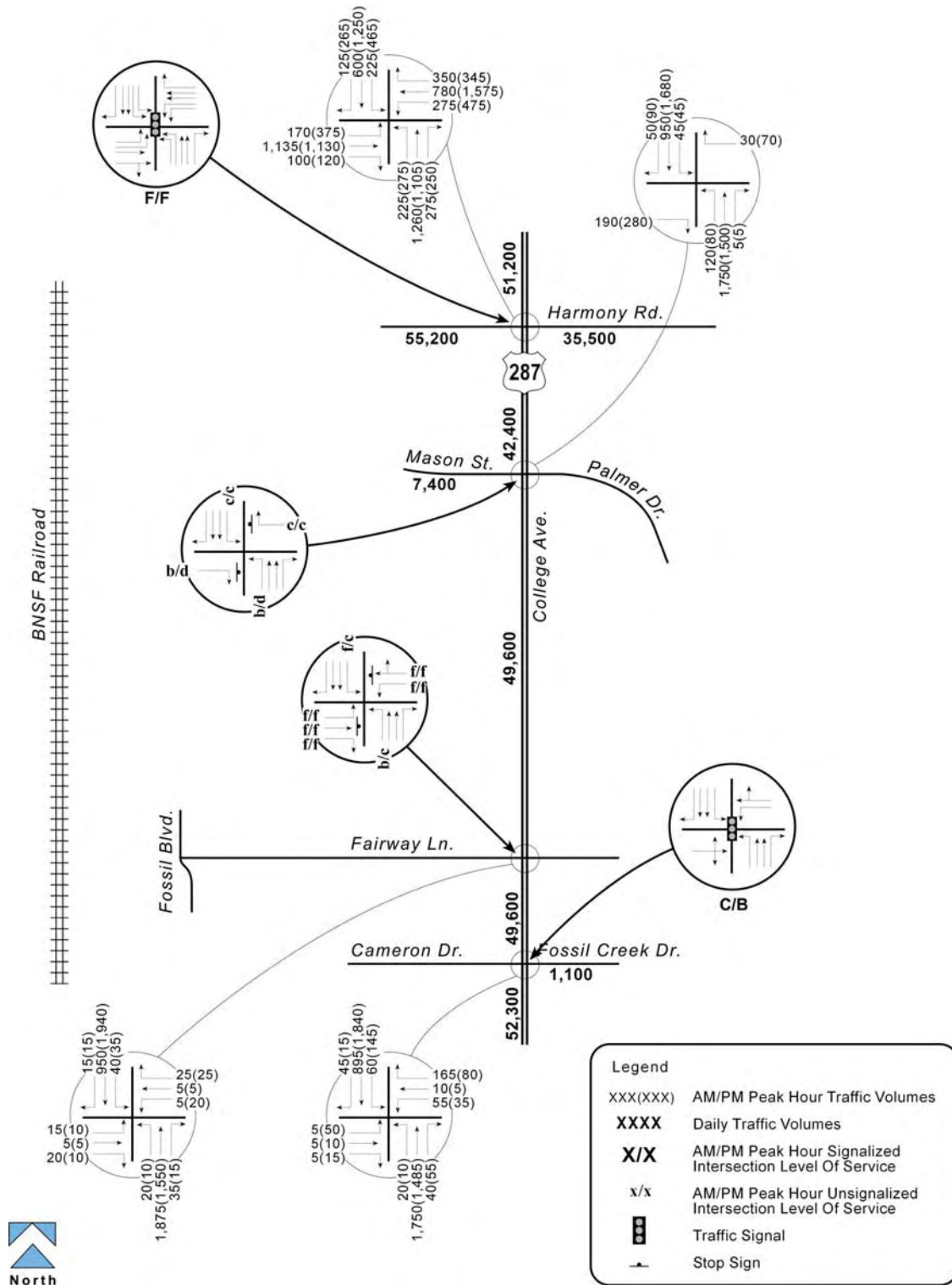
NOT TO SCALE

TYPICAL I-25 CROSS SECTION - BUFFERED SEPARATED TOLLED EXPRESS LANES

Figure 5. Package B Alternative



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**Figure 6. 2030 No Action Forecasts and Levels of Service**

**2030 No Action Traffic Volumes**

The 2030 No Action daily and peak hour projections for the study area intersections are shown in Figure 6. As shown, the average daily traffic (ADT) projection on College Avenue varies from about 42,000 to 52,000 vehicles per day (vpd). The ADT projection on Harmony Road varies from 35,000 to 55,000 vpd.

**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 7 – peak hour site traffic associated with the development of the commuter rail 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.

**2030 Package B Traffic Volumes**

Again, the same methodology used to develop the 2030 No Action volumes was applied to estimate 2030 background traffic volumes for the Package B alternative. And as in Package A, in addition to these background forecasts – which are shown in Figure 8 – peak hour site traffic associated with the development of the BRT 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**

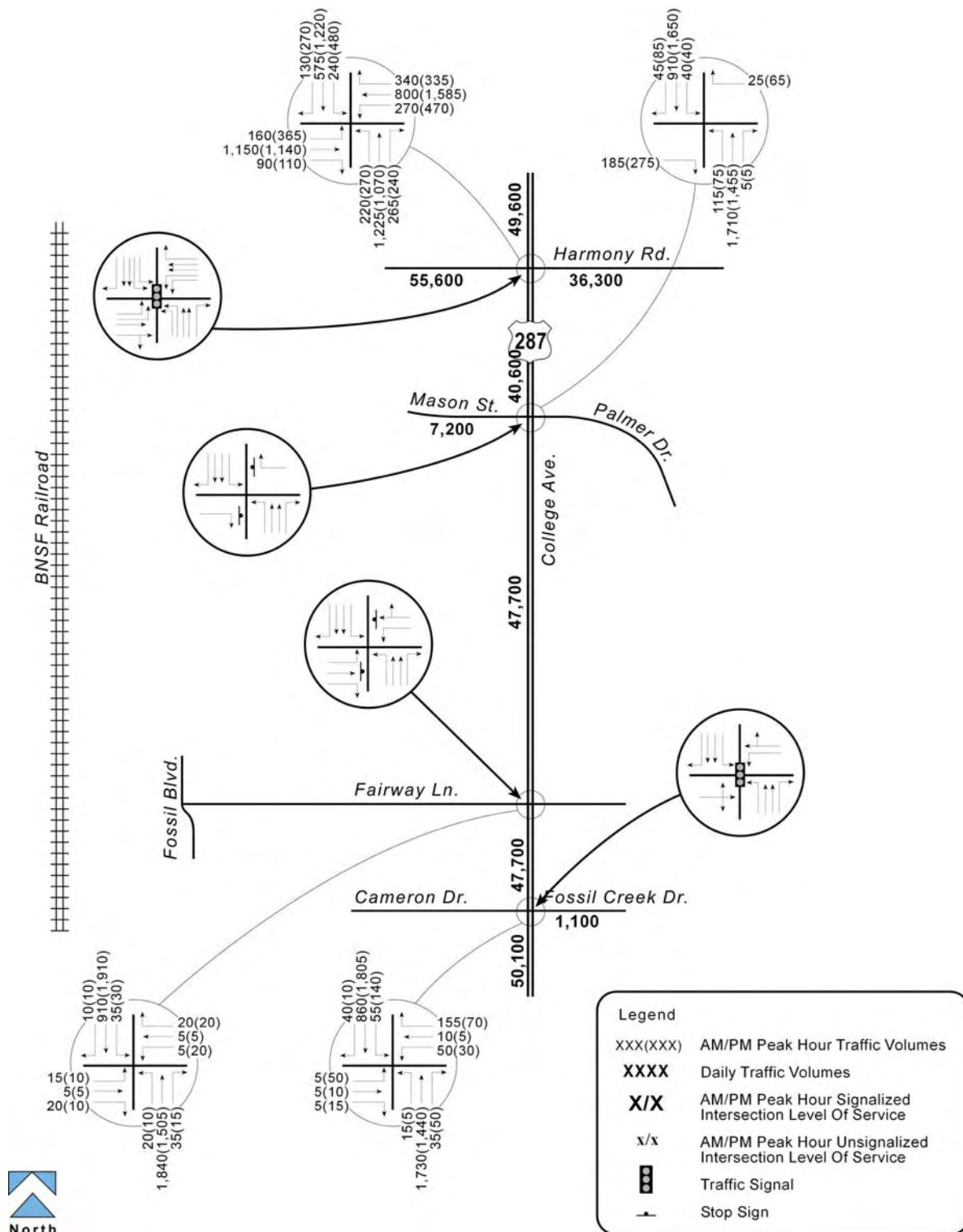
The number of proposed spaces at the Fort Collins South Transit Center park-and-ride was determined using the methodology outlined in the *North I-25 DEIS Parking Results* report (Carter & Burgess, November 2006). Using the results of this report, trip generation is estimated, by applying the following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

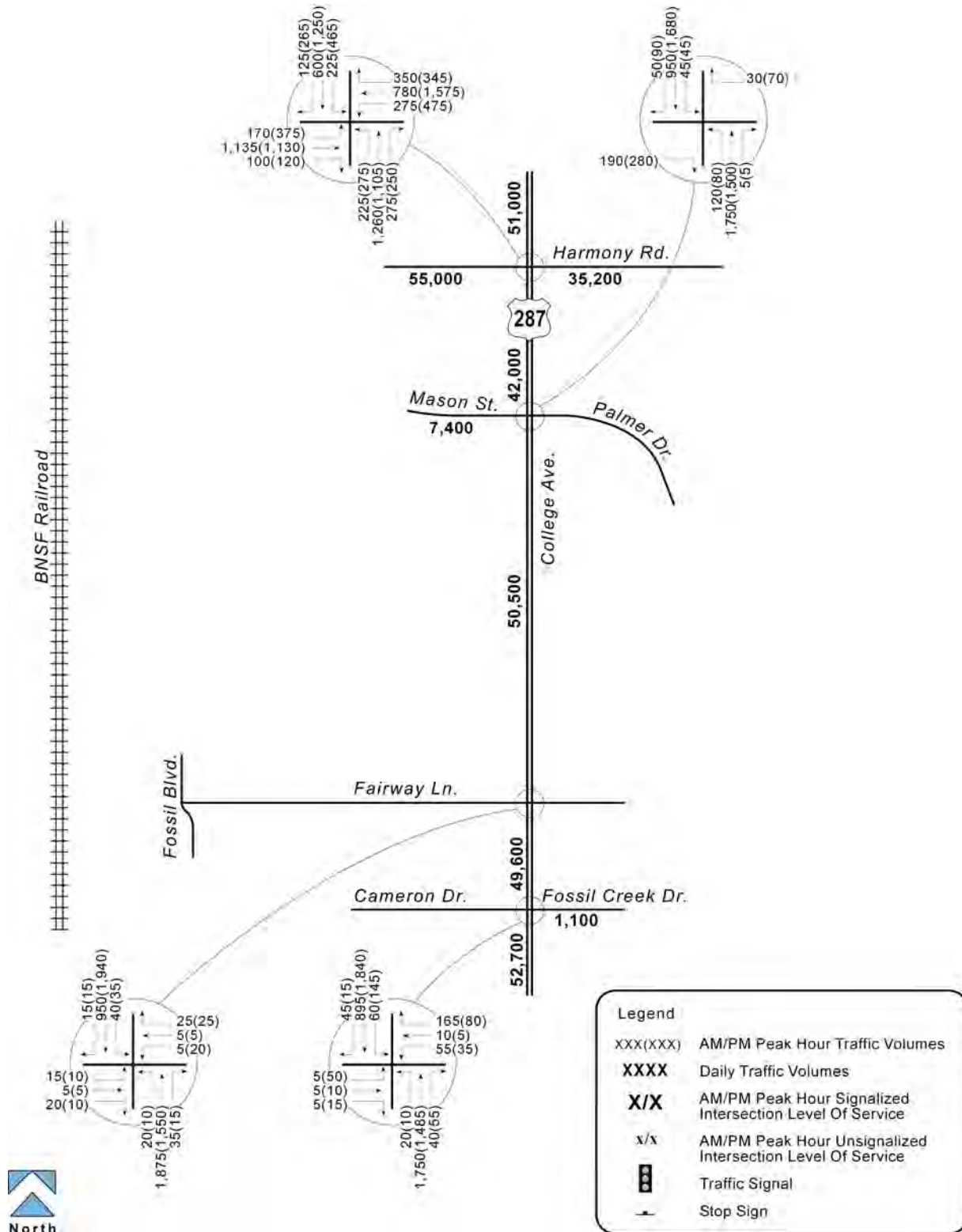
**Table 3. Peak Hour Trip Generation for North I-25 EIS Park-and Ride Lots**

	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%

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**Figure 8. 2030 Package B Background Traffic Forecasts**

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A commuter rail station with 112 parking spaces and a BRT station with 70 parking spaces are proposed along the BNSF corridor just north of Fairway Lane. The future peak hour traffic from the proposed park-and-ride lot was determined and is shown in Table 4 below.

**Table 4. Future Peak Hour Traffic from the South Transit Center Park-and-Ride Lots**

Location	Daily Trips	AM Peak			PM Peak		
		In	Out	Total	In	Out	Total
South Transit Center Commuter Rail PNR Lot	220	66	10	76	10	40	50
South Transit Center BRT PNR Lot	150	41	6	47	6	25	31

### Trip Distribution

The trip distribution and assignment for each type of 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 Fairway Lane and Fossil Blvd. Fossil Blvd. is a dead-end at this location, and would simply be extended north to the proposed station and park-and-ride. The peak hour trip generation and distribution estimates for the proposed park-and-ride lots are shown in Figures 9 and 10, for Package A and B, respectively. These peak hour trip generation estimates were combined with the background traffic projections to arrive at the total 2030 Package A and Package B peak hour projections in Figures 11 and 12, respectively.

### 2030 No Action Traffic Operations

Figure 6 and Table 5 summarize the projected levels of service at the study area intersections under No Action conditions. The intersection of Harmony Road/College Avenue would operate at an unacceptable LOS F with an average vehicle delay greater than 80 seconds for both AM and PM peak hours. Overall levels of service at Fairway Lane/College Avenue are C for both AM and PM peak hours; but, both eastbound and westbound approaches yield a LOS F with significant delay and high volume/capacity ratios during the AM and PM peak hours. This intersection has been identified in CDOT’s *South College Avenue (US 287) Access Control Plan Update Report, 2002*, as an intersection which may require signalization. This improvement would likely yield acceptable operations if implemented. Fossil Creek Drive/College Avenue is projected to operate at an acceptable LOS during both peak hours.

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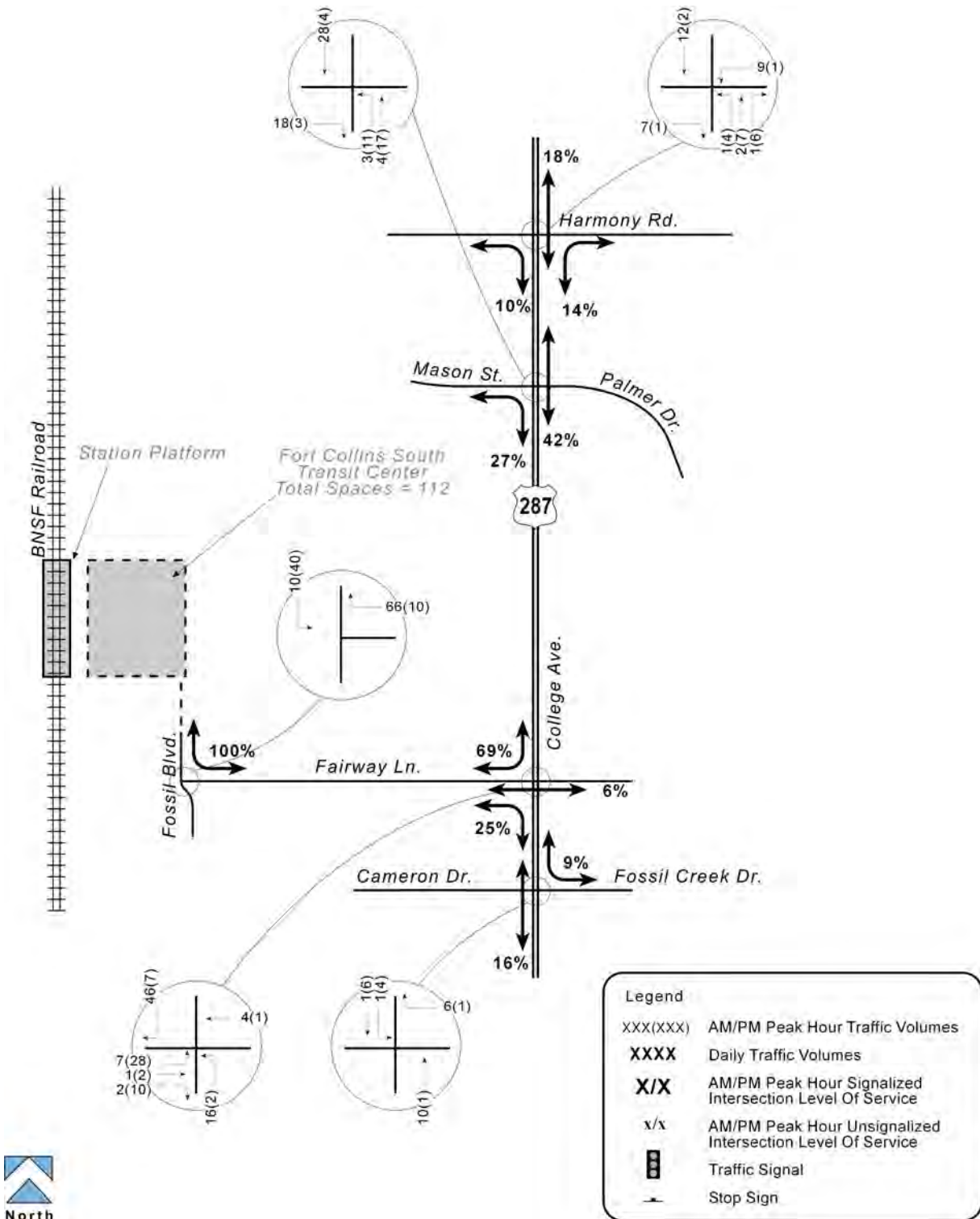


Figure 9. Package A Park and Ride Lot Trip Distribution and Assignment

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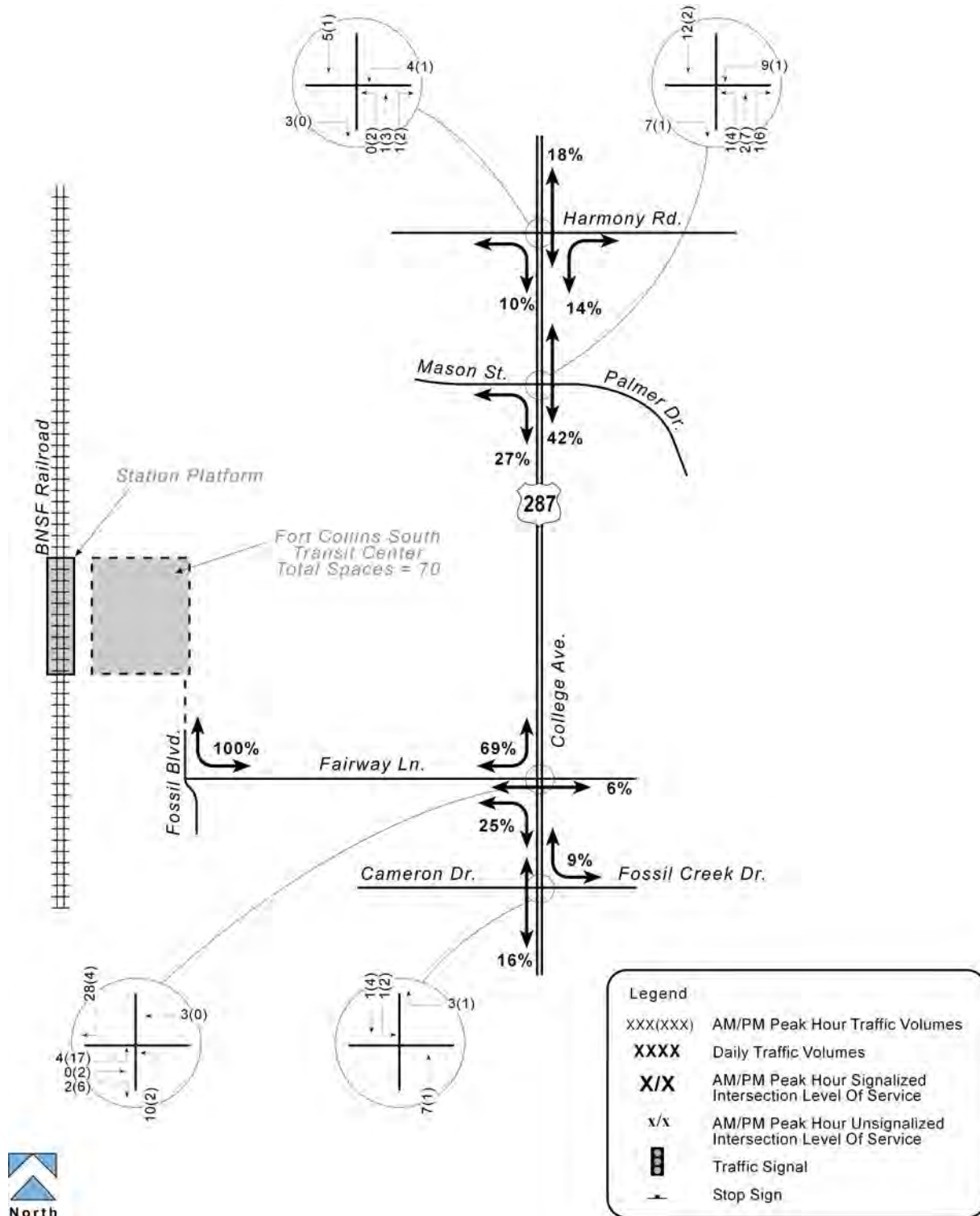
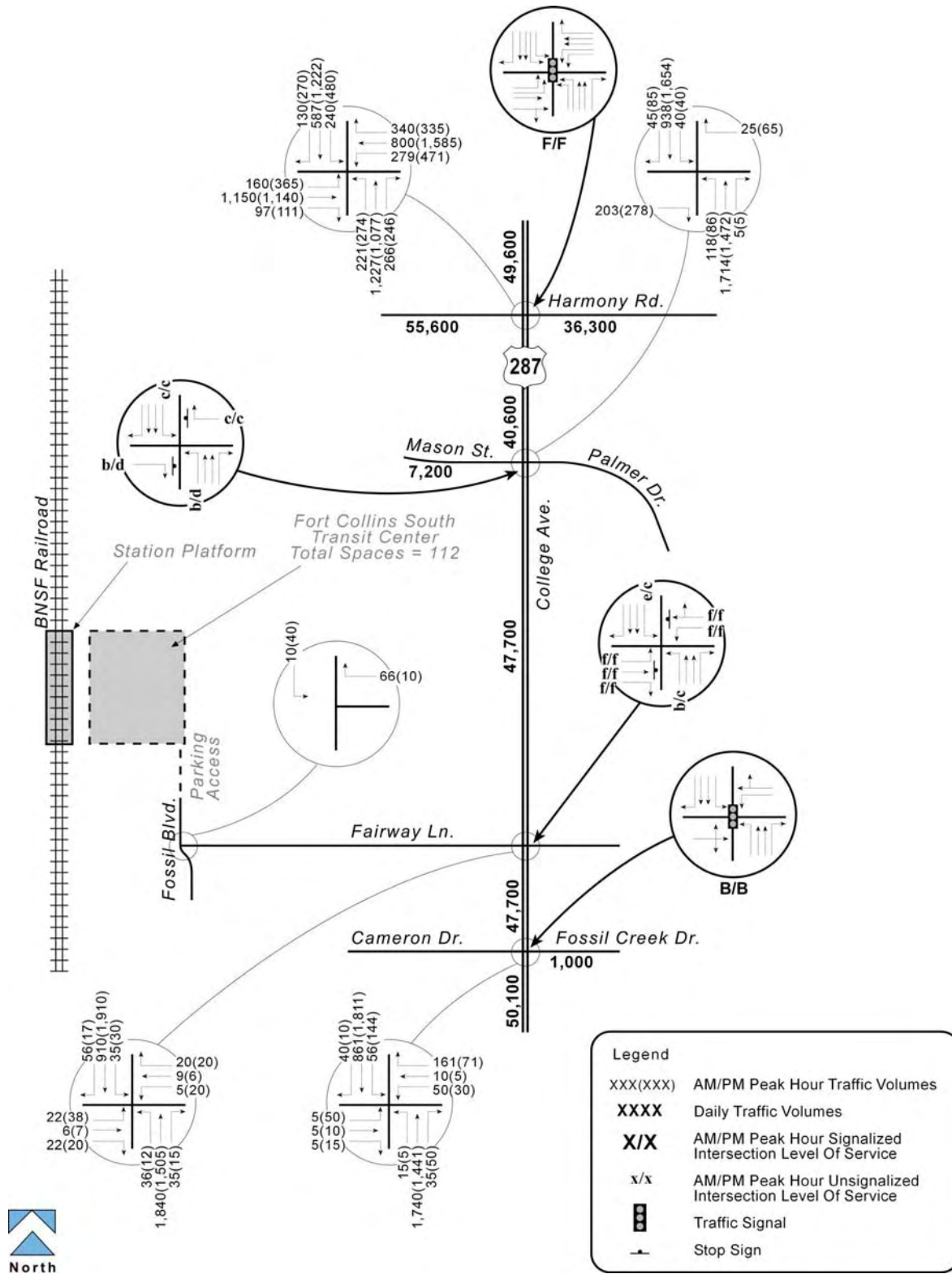


Figure 10. Package B Park and Ride Lot Trip Distribution and Assignment

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**Figure 11. 2030 Package A Total Traffic Forecasts**



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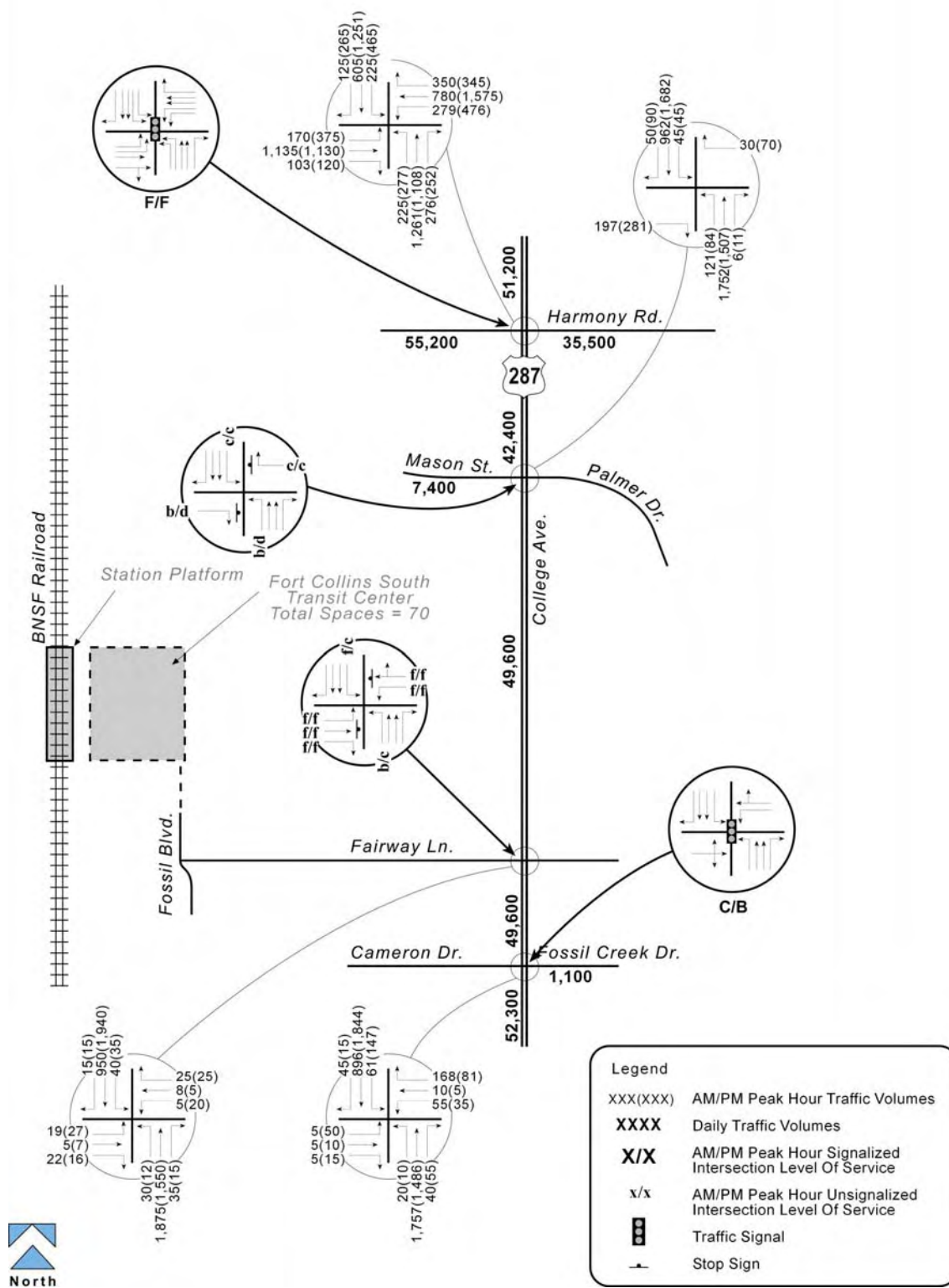


Figure 12. 2030 Package B Total Traffic Forecasts

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

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
Harmony Rd. & College Ave. (US 287)	F	F	88	>100
Mason St. & College Ave. (unsignalized)				
Eastbound Right Turn	B	D	14	32
Westbound Right Turn	C	C	21	20
Fairway Ln. & College Ave. (unsignalized)				
Eastbound Left Turn	F	F	>100	>100
Eastbound Thru	F	F	>100	>100
Eastbound Right Turn	F	F	>100	>100
Westbound Left Turn	F	F	>100	>100
Westbound Thru/Right Turn	F	F	>100	>100
Southbound Left Turn (Free)	F*	C	51*	21
Fossil Creek Dr. & College Ave. (US 287)	C	B	20	18

\* Queue lengths for this movement are less than 50 feet and volume/capacity ratios are less than 1.5, so operations for this movement are adequate.

**2030 Package A Traffic Operations**

Figure 11 and Table 6 summarize the 2030 Package A level of service and delay results. As shown, the projected levels of service at key intersections in the study area are essentially the same as the 2030 No Action results. Because traffic is attracted to the improved I-25 corridor and thus away from US 287, a slight change in LOS at the southbound left movement at Fairway Lane is seen.

**Table 4. 2030 Package A Intersection LOS and Delay**

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
Harmony Rd. & College Ave. (US 287)	F	F	88	>100
Mason St. & College Ave. (unsignalized)				
Eastbound Right Turn	B	D	14	30
Westbound Right Turn	C	C	20	19
Fairway Ln. & College Ave. (unsignalized)				
Eastbound Left Turn	F	F	>100	>100
Eastbound Thru	F	F	>100	>100
Eastbound Right Turn	F	F	>100	>100
Westbound Left Turn	F	F	>100	>100
Westbound Thru/Right Turn	F	F	>100	>100
Southbound Left Turn (Free)	E*	C	44*	19
Fossil Creek Dr. & College Ave. (US 287)	B	B	19	18

\* Queue lengths for this movement are less than 50 feet and volume/capacity ratios are less than 1.5, so operations for this movement are adequate.

**2030 Package B Traffic Operations**

Figure 12 and Table 7 summarize the 2030 Package B level of service and delay results. As in Package A, level of service a delay results are essentially the same as the No Action alternative.

**Table 7. 2030 Package B Intersection LOS and Delay**

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
<b>Harmony Rd. &amp; College Ave. (US 287)</b>	F	F	90	>100
<b>Mason St. &amp; College Ave. (unsignalized)</b>				
Eastbound Right Turn	B	D	15	30
Westbound Right Turn	C	C	19	18
<b>Fairway Ln. &amp; College Ave. (unsignalized)</b>				
Eastbound Left Turn	F	F	>100	>100
Eastbound Thru	F	F	>100	>100
Eastbound Right Turn	F	F	>100	>100
Westbound Left Turn	F	F	>100	>100
Westbound Thru/Right Turn	F	F	>100	>100
Southbound Left Turn (Free)	E*	C	49*	20
<b>Fossil Creek Dr. &amp; College Ave. (US 287)</b>	C	B	20	18
* Queue lengths for this movement are less than 50 feet and volume/capacity ratios are less than 1.5, so operations for this movement are adequate.				

**Alternatives Evaluation Comparison**

**Traffic Operational Analysis**

Table 8 compares the levels of service and delay at the study area intersections for the three packages. As the table indicates, the Package A alternative and the Package B both have little impact on the key intersections in the study area.

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**Table 8. Intersection Level of Service and Delay**

Intersection/Movement	No Action		Package A		Package B	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Harmony Rd. & College Ave. (US 287)	LOS F (88)	LOS F (>100)	LOS F (88)	LOS F (>100)	LOS F (90)	LOS F (>100)
Mason St. & College Ave. (unsignalized)						
Eastbound Right Turn	LOS B (14)	LOS D (30)	LOS B (14)	LOS D (32)	LOS B (15)	LOS D (30)
Westbound Right Turn	LOS C (21)	LOS C (19)	LOS C (20)	LOS C (20)	LOS C (19)	LOS C (18)
Fairway Ln. & College Ave. (unsignalized)						
Eastbound Left Turn	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)
Eastbound Thru	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)
Eastbound Right Turn	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)
Westbound Left Turn	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)
Westbound Thru/Right Turn	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)	LOS F (>100)
Southbound Left Turn (Free)	LOS F* (51)	LOS C (19)	LOS D (4)	LOS C (21)	LOS D (49)	LOS C (20)
Fossil Creek Dr. & College Ave. (US 287)	LOS C (20)	LOS B (18)	LOS B (19)	LOS B (18)	LOS C (20)	LOS B (18)

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

**Appendix A**  
**Existing AM Peak Hour**

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