Berthoud – State Highway 56 and BNSF DEIS Commuter Rail Station Evaluation

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.

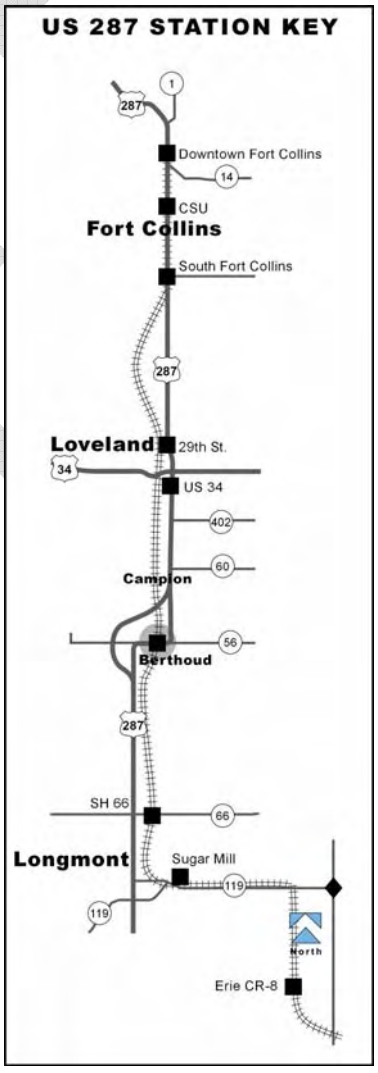

Figure 1. Vicinity Map

The proposed Berthoud State Highway 56 (SH-56) and BNSF commuter rail station will be located just north of SH-56 and the park-and-ride will be located on the northwest corner of SH-56 and 2nd Street, just east of the BNSF rail line.

This report documents potential traffic impacts the proposed commuter rail station may have within the vicinity of the 1st Street and SH-56 intersection and provides technical documentation of the traffic data analysis. The other commuter rail stations are addressed in separate reports.

Existing Conditions

The proposed study area includes the following roadways and intersections:

Turner Avenue

Turner Avenue is a two-lane, east/west minor road located one block north of SH-56 on the east side of the city of Berthoud. Turner Avenue does not cross the BNSF railroad and dead-ends east of 1st Street within a new developing neighborhood. Parallel parking is located on both sides of the street. Intersections on Turner Avenue are stop sign controlled. The posted speed limit along Turner Avenue is 25 mph.

SH-56

SH-56 is a two-lane, east/west arterial that bisects the city of Berthoud. Within the area of interest, SH-56 is wide enough to

allow for parallel parking on both sides of the road. The posted speed limit along the majority of SH-56 in the study area is 50 mph. The speed is reduced to 30 mph when approaching 1st St.

Turner Avenue & 2nd Street

2nd Street is a two-lane, north/south minor road that runs the full length of the city of Berthoud one block west of 1st Street. The width of 2nd Street allows for parallel parking on both sides of the street along with a speed limit of 30 mph. Intersection control at the intersection of Turner Avenue and 2nd Street is provided by two-way stop signs located on the Turner Avenue approaches.

Turner Avenue & 1st Street

1st Street is a variable width, two-lane, north/south arterial located on the east side of the city of Berthoud. The northbound 1st Street approach at Turner Avenue consists of designated left turn, through, and right turn lanes. The eastbound-to-northbound right is a stop movement with an acceleration lane on 1st Street. The southbound 1st Street approach has a designated left turn lane and a shared through/right lane. Two-way stop signs placed on Turner Avenue's east and westbound approaches control the intersection. The posted speed limit for 1st Street is 30 mph.

SH-56 & 2nd Street

The north and southbound approaches of 2nd Street are controlled with two-way stop signs while SH-56 is a free movement. The speed limit on 2nd Street at this intersection is 30 mph.

SH-56 & 1st Street

This intersection is unique in that the through movements are to/from the north and west approaches. SH-56 east of 1st Street and west of the 1st Street curve has a speed limit of 50 mph. 1st Street has a speed limit of 25 mph south of SH-56/US287. All other speed limits within this study area are 30 mph.

Figure 2 summarizes the traffic counts collected in March of 2006 within the study area. As shown, average daily traffice (ADT) on SH-56 just west of 1st Street is approximately 11,000 vehicles per day (vpd) and ADT on SH-56 just east of 1st Street is 4,600 vpd. ADT on 1st Street ranges from about 2,300 vpd south of SH-56 to about 9,900 north of Turner Avenue.

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.

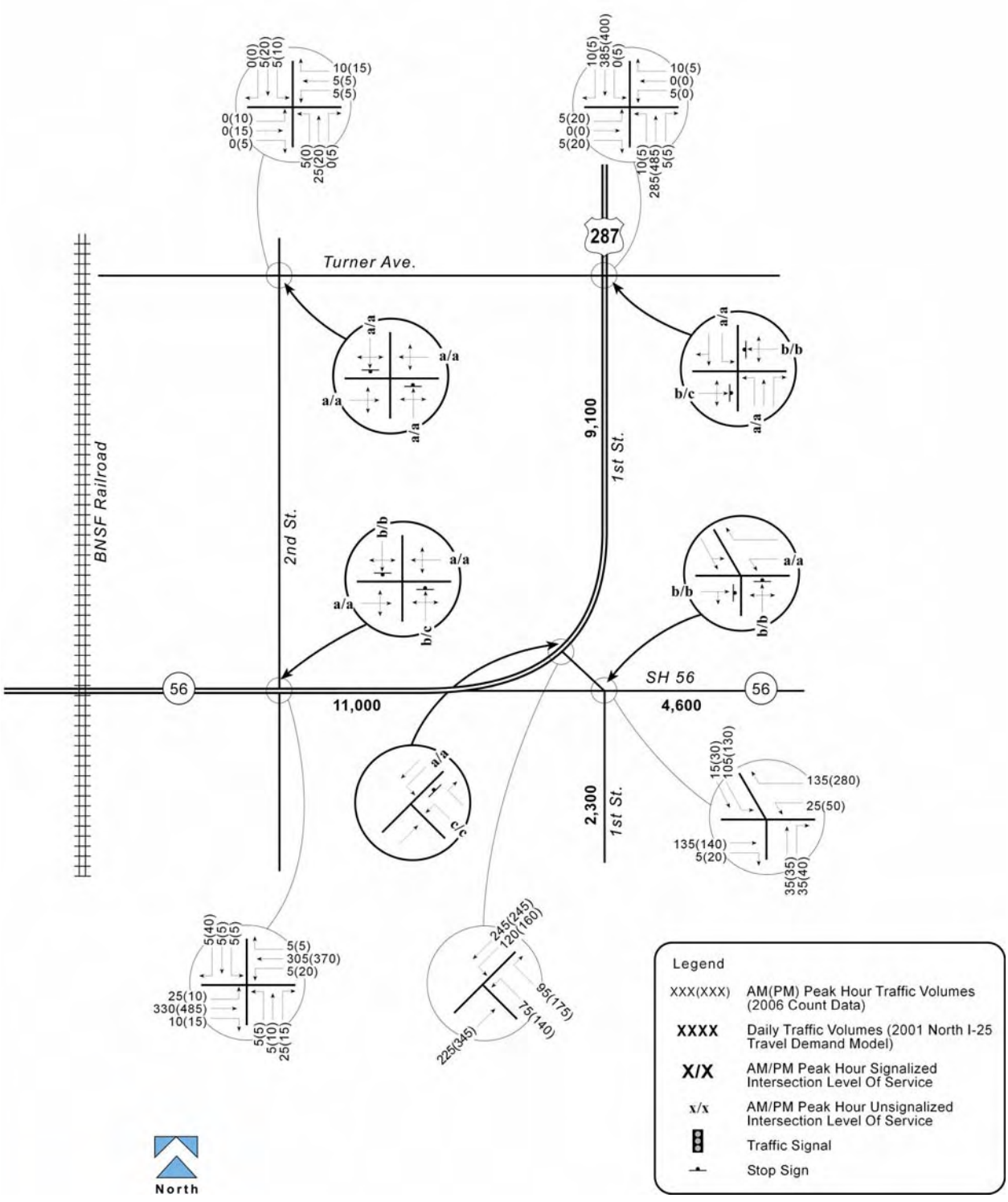

Figure 2. Existing Conditions

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 study area intersections. Other background parameters are documented in the *DEIS Traffic Evaluation – Methodology Summary*.

Figure 2 and Table 2 illustrate existing peak period levels of service at the unsignalized intersections within the study area. Currently all intersections and approaches within the study area operate at acceptable levels of service during both AM and PM peak hours.

Table 2. Existing Intersection LOS and Delay

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
Turner Ave. & 2nd St. (unsignalized)				
Northbound Approach	A	A	9	9
Southbound Approach	A	A	9	9
Turner Ave. & 1st St. (unsignalized)				
Eastbound Approach	B	C	14	17
Westbound Approach	B	B	11	12
SH 56 & 2nd St. (unsignalized)				
Northbound Approach	B	C	12	16
Southbound Approach	B	B	14	12
SH 56 & 1st St. (South) (unsignalized)				
Eastbound Approach	B	B	12	12
Northbound Approach	B	B	10	11
SH 56 & 1st St. (North) (unsignalized)				
Northwest-bound Left Turn	C	C	15	22

2030 Conditions

2030 traffic projections were developed for the two 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 Berthoud 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 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.

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, average daily volume projections on SH-56 and 1st Street have decreased to approximately 7,500 vpd and 6,900 vpd respectively. This decrease in volume is mostly due to the effect of the US-287 bypass located west of Berthoud, which was under construction during this analysis, and is reflected in the 2030 traffic projections. Average daily traffic east of 1st Street along SH-56 and south of SH-56 along 1st Street are both projected to increase to approximately 7,000 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 6 – 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. 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 SH 56 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.

Figure 3. No Action Alternative

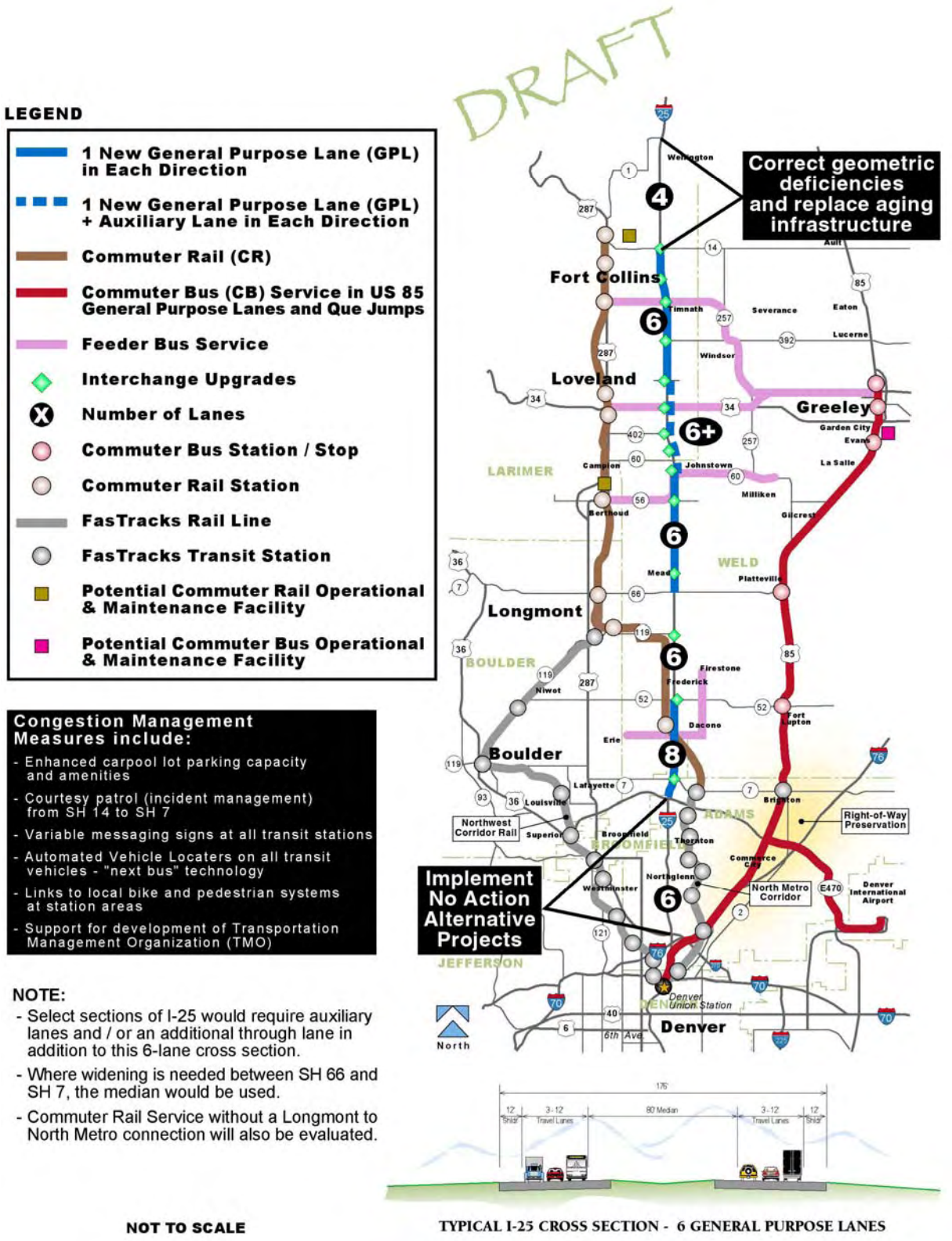

Figure 4. 2030 Package A Alternative

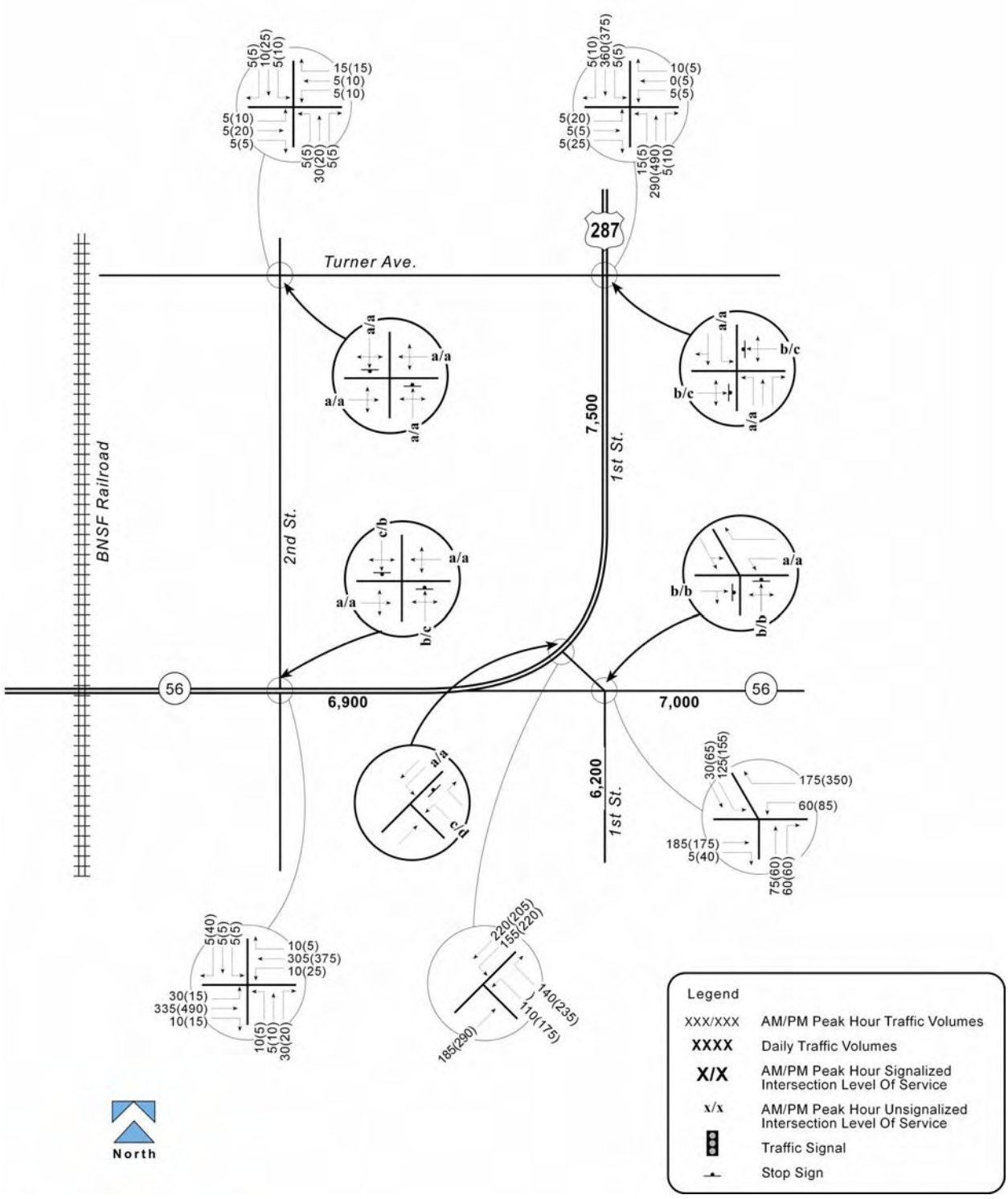

Figure 5. 2030 No Action Forecasts and Levels of Service

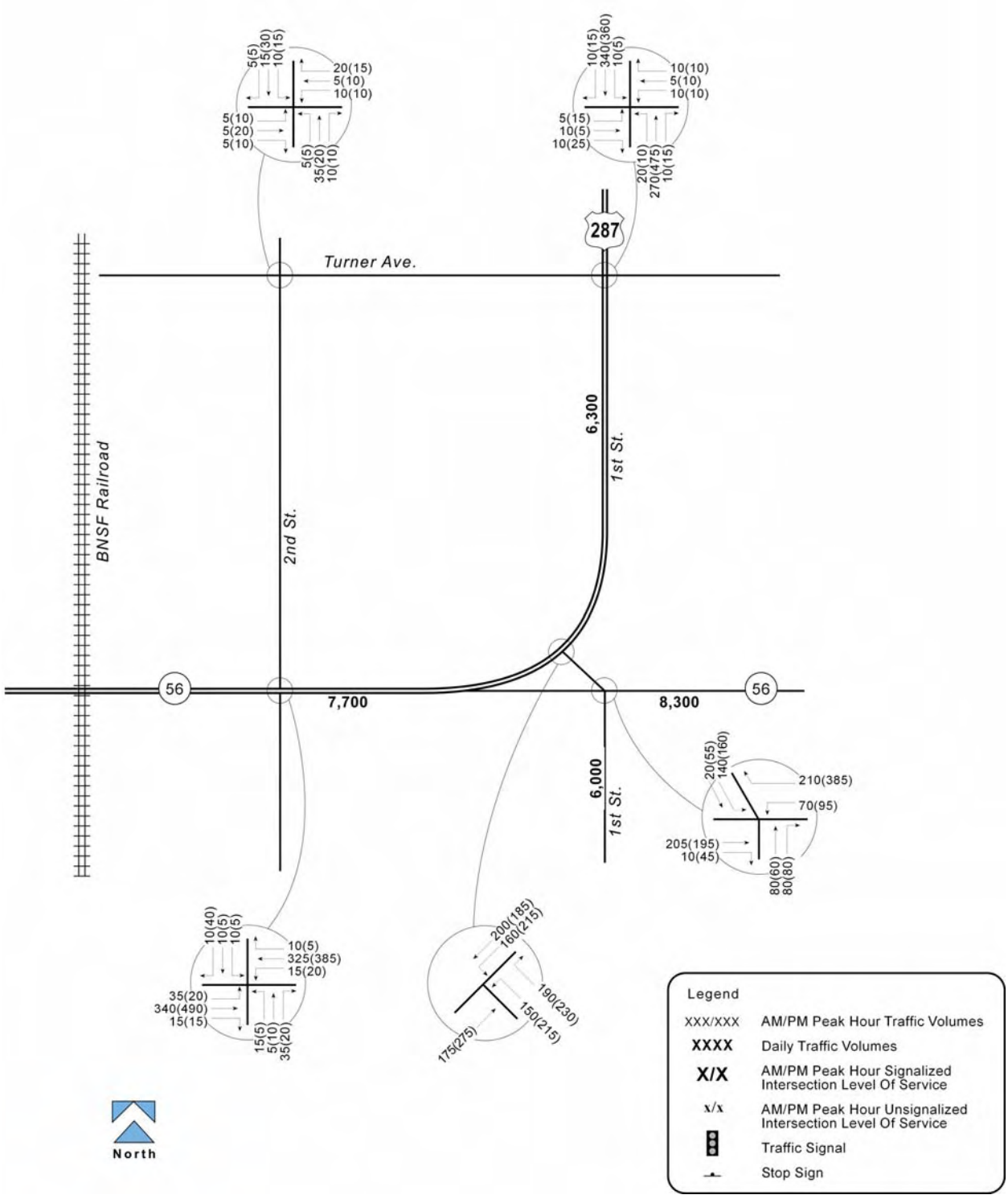

Figure 6. 2030 Package A Background Traffic Forecasts

- 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
AM Peak Hour			
Trips per occupied space	0.75	87%	13%
PM Peak Hour			
Trips per occupied space	0.50	20%	80%

The Berthoud commuter rail station would be located on the northwest corner of the SH 56/2nd Street intersection and would have 72 parking spaces. The future peak hour traffic from the proposed station is shown in Table 4.

Table 4 Future Peak Hour Traffic from the Berthoud Park-and-Ride Lot

Location	Daily Trips	AM Peak			PM Peak		
		In	Out	Total	In	Out	Total
SH 56 PNR Lot	155	42	6	48	6	26	32

Trip Distribution

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 2nd Street. 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 slightly higher along SH 56 under the Package A alternative, as more regional traffic is attracted to the improved I-25 corridor.

2030 No Action Traffic Operations

Figure 5 and Table 5 show the projected levels of service at the study area intersections under the No Action alternative. All intersections and approaches within the study area will operate at acceptable levels of service during both AM and PM peak hours under the no-action scenario.

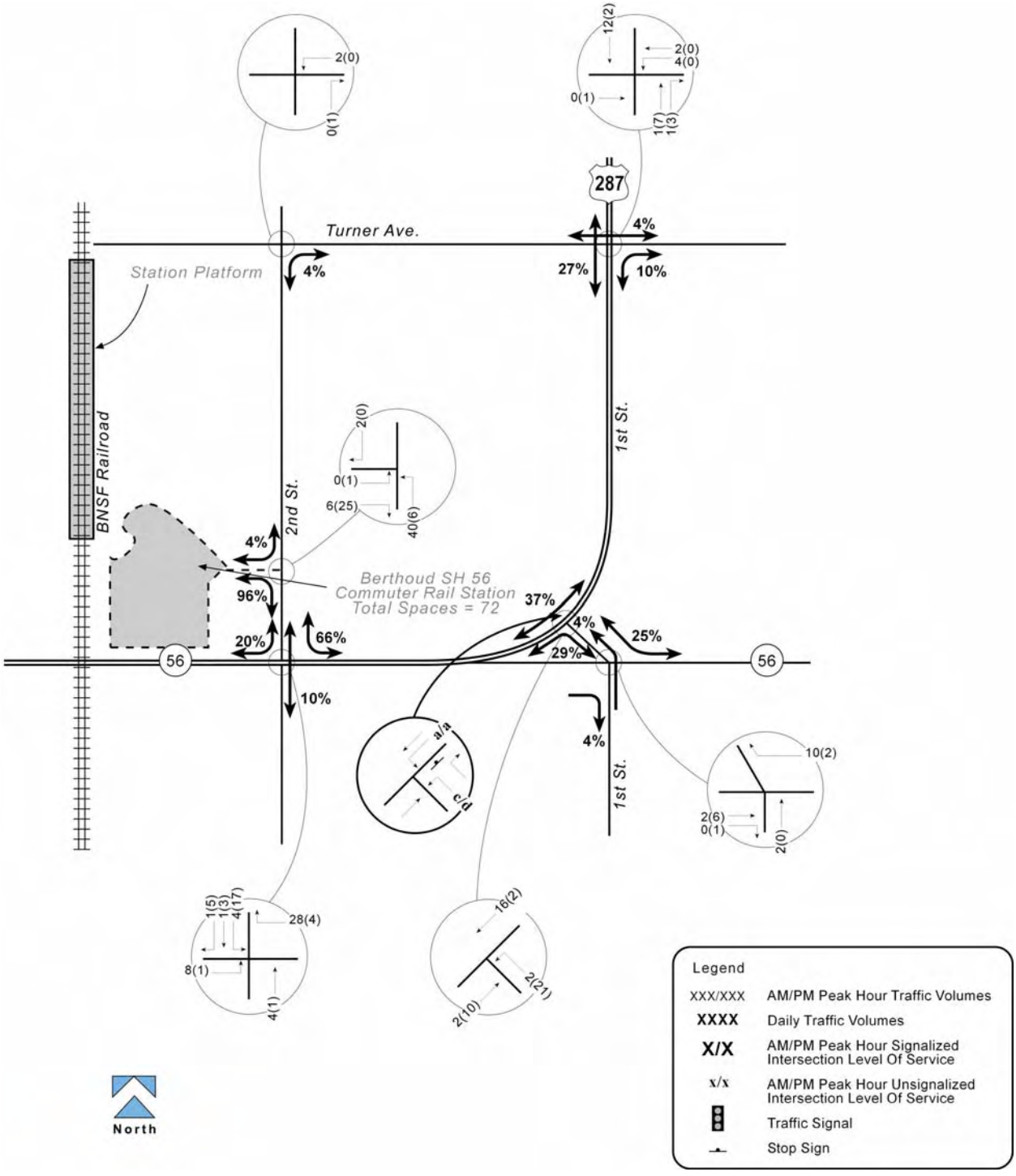

Figure 7. Park and Ride Lot Trip Distribution and Assignment

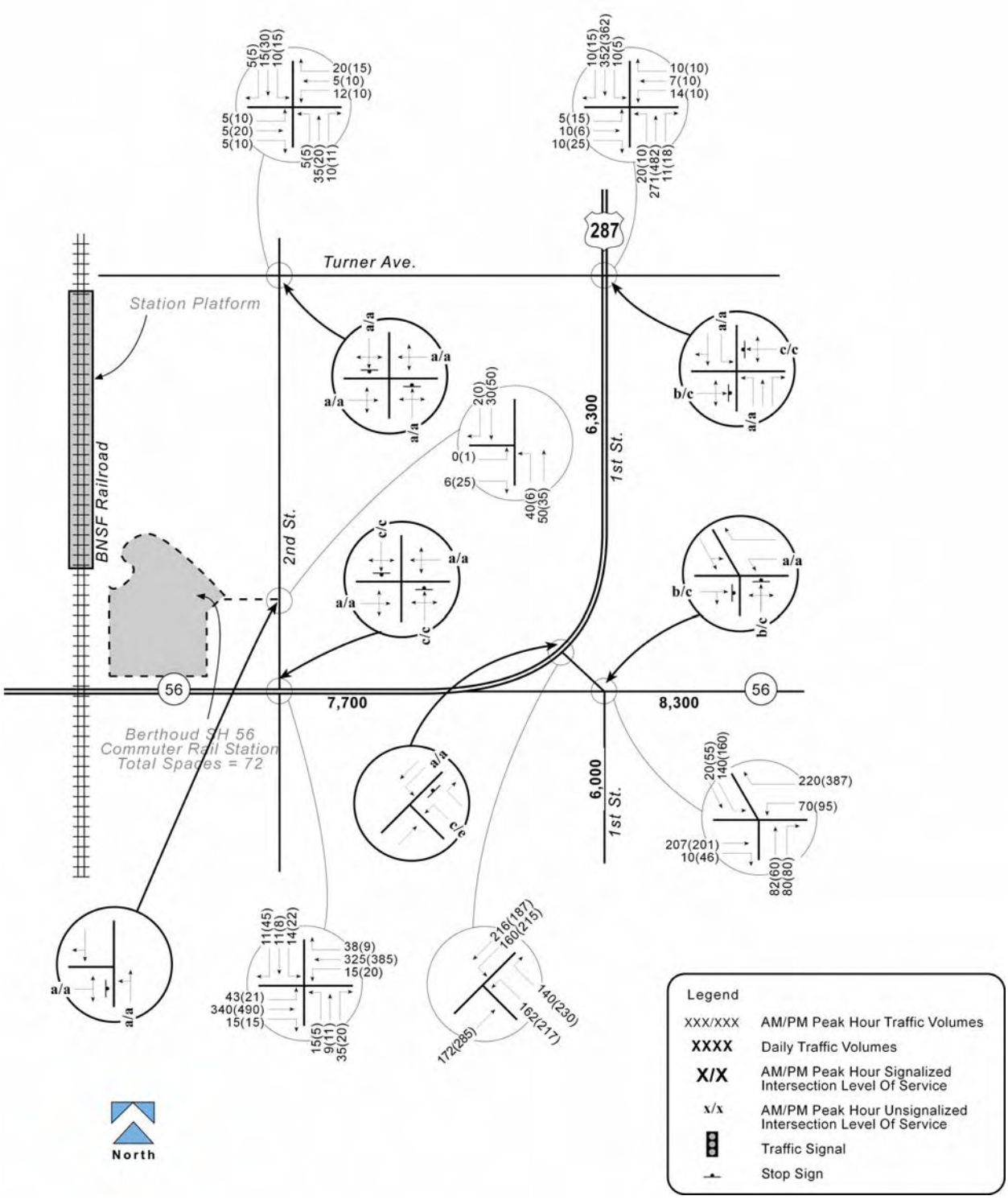

Figure 8. 2030 Package A Total Traffic Forecasts and Levels of Service

Table 5. 2030 No Action Intersection LOS and Delay

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
Turner Ave. & 2nd St. (unsignalized)				
Northbound Approach	A	A	9	10
Southbound Approach	A	A	9	10
Turner Ave. & 1st St. (unsignalized)				
Eastbound Approach	B	C	14	17
Westbound Approach	B	C	11	15
SH 56 & 2nd St. (unsignalized)				
Northbound Approach	B	C	13	18
Southbound Approach	C	B	15	14
SH 56 & 1st St. (South) (unsignalized)				
Eastbound Approach	B	B	14	15
Northbound Approach	B	B	12	14
SH 56 & 1st St. (North) (unsignalized)				
Northwest-bound Left Turn	C	D	17	31

2030 Package A Traffic Operations

Figure 8 and Table 6 show the projected levels of service at the study area intersections under the Package A alternative. As indicated, all intersections and approaches within the study area will operate at acceptable levels of service during both AM and PM peak hours in this alternative.

Table 6. 2030 Package A Intersection LOS and Delay

Intersection / Movement	Level of Service		Delay (seconds)	
	AM	PM	AM	PM
Turner Ave. & 2nd St. (unsignalized)				
Northbound Approach	A	A	10	9
Southbound Approach	A	A	9	10
Turner Ave. & 1st St. (unsignalized)				
Eastbound Approach	B	C	15	17
Westbound Approach	C	C	15	19
SH 56 & 2nd St. (unsignalized)				
Northbound Approach	C	C	15	19
Southbound Approach	C	C	18	20
SH 56 & 1st St. (South) (unsignalized)				
Eastbound Approach	B	C	14	16
Northbound Approach	B	C	13	15
SH 56 & 1st St. (North) (unsignalized)				
Northwest-bound Left Turn	C	E	20	39
PNR Access/2nd St. (unsignalized)				
Eastbound Approach	A	A	9	9

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, the Package A alternative has little impact on the key intersections in the study area, with the exception of the SH 56 & 1st Street intersection, which would operate at LOS E in the Package A alternative. This intersection may require improvements in the future, and the City of Berthoud is currently considering a roundabout at this location. Due to the recent construction of the US 287 Berthoud Bypass, the operations at this intersection are currently being monitored by CDOT and the NFRMPO, and various design strategies are being considered for improvements to the intersection, including the possibility of a roundabout, due to the unique geometry of the intersection. These improvements would be independent of the Package A consideration, and would be completed prior to construction of the commuter rail station

Table 7. Intersection Level of Service and Delay

Intersection	No Action		Package A	
	AM Peak	PM Peak	AM Peak	PM Peak
Turner Ave. & 2nd St. (unsignalized)				
Northbound Approach	LOS A (9 sec.)	LOS A (10 sec.)	LOS A (10 sec.)	LOS A (9 sec.)
Southbound Approach	LOS A (9 sec.)	LOS A (10 sec.)	LOS A (9 sec.)	LOS A (10 sec.)
Turner Ave. & 1st St. (unsignalized)				
Eastbound Approach	LOS B (14 sec.)	LOS C (16.8 sec.)	LOS B (15 sec.)	LOS C (17 sec.)
Westbound Approach	LOS B (11 sec.)	LOS C (15 sec.)	LOS C (15 sec.)	LOS C (19 sec.)
SH 56 & 2nd St. (unsignalized)				
Northbound Approach	LOS B (13 sec.)	LOS C (18 sec.)	LOS C (15 sec.)	LOS C (18 sec.)
Southbound Approach	LOS C (15 sec.)	LOS B (14 sec.)	LOS C (18 sec.)	LOS C (20 sec.)
SH 56 & 1st St. (South) (unsignalized)				
Eastbound Approach	LOS B (14 sec.)	LOS B (15 sec.)	LOS B (14 sec.)	LOS C (16 sec.)
Northbound Approach	LOS B (12 sec.)	LOS B (14 sec.)	LOS B (13 sec.)	LOS C (15sec.)
SH 56 & 1st St. (North) (unsignalized)				
Northwest-bound Left Turn	LOS C (17 sec.)	LOS D (31 sec.)	LOS C (20 sec.)	LOS E (39 sec.)
PNR Access/2nd St. (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