# APPENDIX B CORRIDOR CONDITIONS REPORT

# NORTH I-25 PEL

# CORRIDOR CONDITIONS REPORT

*Prepared for:*

**Colorado Department of Transportation**

*Prepared by:*

**Felsburg Holt & Ullevig**
6300 South Syracuse Way, Suite 600
Centennial, CO 80111
303/721-1440

FHU Reference No. 11-166-01
March 2013
Updated June 2014

# TABLE OF CONTENTS

Page

**1.0 INTRODUCTION ---------- 1**

**2.0 PROJECT STUDY AREA CONTEXT ---------- 2**

2.1 Study Area ---------- 2

2.2 Previous Studies ---------- 2

2.2.1 TIGER IV ---------- 2

2.2.2 North I-25 Environmental Impact Statement, August 2011 and North I-25 Record of Decision, December 2011 ---------- 2

2.2.3 North Metro Environmental Impact Study, January 2011 ---------- 2

2.2.4 North Metro Transportation Study, October 2001 ---------- 4

**3.0 EXISTING TRANSPORTATION SYSTEM ---------- 5**

3.1 Roadway Network ---------- 5

3.1.1 Mainline I-25 ---------- 5

3.1.2 Surface Streets ---------- 6

3.1.3 Recent Construction Projects ---------- 10

3.2 Current Travel Markets Analysis ---------- 11

3.2.1 Trip Purpose ---------- 11

3.2.2 Composition of Southbound AM Peak Period I-25 Volume ---------- 12

3.3 Existing Traffic Volumes ---------- 13

3.3.1 Daily Traffic Volumes ---------- 13

3.3.2 Peak Hour Traffic Patterns ---------- 15

3.4 Traffic Operations ---------- 18

3.4.1 Mainline I-25 Bottleneck Analysis ---------- 18

3.4.2 I-25 Interchanges ---------- 32

3.4.3 Arterial Streets ---------- 33

3.5 Traffic Safety Review ---------- 34

3.5.1 Crash History and Problem Analysis ---------- 37

3.5.2 I-25 Section Crash History (US 36 to SH 7) ---------- 39

3.5.3 Safety Analysis Summary ---------- 44

3.6 Transit Conditions ---------- 46

3.6.1 Background ---------- 46

3.7 Bicycle and Pedestrian Conditions ---------- 51

3.7.1 Existing Bicycle and Pedestrian Accommodation ---------- 51

3.7.2 Pedestrian and Bicycle Evaluation ---------- 52

**4.0 NO ACTION TRANSPORTATION CONDITIONS ---------- 53**

4.1 Definition of Near-Term No Action ---------- 53

4.1.1 Selection of Analysis Year ---------- 53

4.1.2 Planned Regional Improvements ---------- 53

4.2 2035 No Action Travel Markets Analysis ---------- 54

4.2.1 Trip Purpose ---------- 54

4.2.2 Composition of Southbound AM Peak Period I-25 Volume ---------- 55

4.2.3 Origins and Destinations for Southbound AM Trips using I-25 ---------- 56

4.2.4 Dynamic Traffic Assignment Analysis ---------- 59

**5.0 SUMMARY OF CORRIDOR CONDITIONS ---------- 61**
**6.0 ENVIRONMENTAL RESOURCES ---------- 62**
6.1 Air Quality ---------- 62
6.1.1 Methodology ---------- 63
6.1.2 Results ---------- 63
6.1.3 Conclusions ---------- 64
6.2 Environmental Justice ---------- 65
6.2.1 Methodology ---------- 65
6.2.2 Results ---------- 65
6.2.3 Conclusions ---------- 68
6.3 Floodways/Floodplains ---------- 69
6.3.1 Methodology ---------- 69
6.3.2 Results ---------- 69
6.3.3 Conclusions ---------- 72
6.4 Hazardous Materials ---------- 72
6.4.1 Methodology ---------- 72
6.4.2 Results ---------- 73
6.4.3 Conclusions ---------- 74
6.5 Historic Resources ---------- 76
6.5.1 Methodology ---------- 76
6.5.2 Results ---------- 76
6.5.3 Conclusions ---------- 79
6.6 Land Use ---------- 79
6.6.1 Methodology ---------- 79
6.6.2 Results ---------- 79
6.7 Noise ---------- 84
6.7.1 Methodology ---------- 84
6.7.2 Results ---------- 85
6.7.3 Conclusions ---------- 85
6.8 Parks, Recreation, and Trails ---------- 87
6.8.1 Methodology ---------- 87
6.8.2 Results ---------- 87
6.8.3 Conclusions ---------- 92
6.9 Threatened and Endangered Species / Wildlife Corridors ---------- 92
6.9.1 Methodology ---------- 92
6.9.2 Results ---------- 93
6.9.3 Conclusions ---------- 94
6.10 Wetlands ---------- 98
6.10.1 Methodology ---------- 98
6.10.2 Results ---------- 98
6.10.3 Conclusions ---------- 99
**7.0 REFERENCES ---------- 100**

# LIST OF FIGURES

Page

Figure 2.2-1 Study Area ---- 3
Figure 3.1-1 Existing Roadway Network and Traffic Control ---- 7
Figure 3.1-2 Corridor Intelligent Transportation Systems (ITS) Devices ---- 8
Figure 3.2-1 2010 I-25 Trip Purposes – Peak Periods ---- 11
Figure 3.2-2 2010 AM Peak Hour Traffic Composition ---- 12
Figure 3.3-1 Existing Daily Traffic Volumes ---- 14
Figure 3.3-2 AM Peak Hour Traffic Contributions ---- 16
Figure 3.3-3 PM Peak Hour Traffic Contributions ---- 17
Figure 3.4-1 AM Peak Period Screen Captures from Google and Cotrip.Org Sites ---- 20
Figure 3.4-2 PM Peak Period Screen Captures from Google and Cotrip.Org Sites ---- 21
Figure 3.4-3 24-hour Speed Plot – Southbound I-25 (Recurring Congestion Analysis) ---- 22
Figure 3.4-4 Southbound I-25 Congestion – AM Peak Period (Recurring Congestion Analysis) ---- 23
Figure 3.4-5 24-hour Speed Plot – Northbound I-25 (Recurring Congestion Analysis) ---- 25
Figure 3.4-6 Northbound I-25 Congestion – PM Peak Period (Recurring Congestion Analysis) ---- 26
Figure 3.4-7 Current I-25 Congestion (9/28/2011 Conditions) ---- 28
Figure 3.4-8 Southbound I-25 Congestion – AM Peak Period (Non-Recurring Congestion Analysis) ---- 30
Figure 3.4-9 Northbound I-25 Congestion – PM Peak Period (Non-Recurring Congestion Analysis) ---- 31
Figure 3.5-1 Corridor Safety Analysis Segments ---- 36
Figure 3.5-2 Section 1 Safety Performance Function Plot ---- 39
Figure 3.5-3 Section 1 Crash Distribution Chart ---- 40
Figure 3.5-4 Section 2 Safety Performance Function Plot ---- 41
Figure 3.5-5 Section 2 Crash Distribution Chart ---- 42
Figure 3.5-6 Section 3 Safety Performance Function Plot ---- 43
Figure 3.5-7 Section 3 Crash Distribution Chart ---- 44
Figure 3.6-1 Existing Transit Routes ---- 47
Figure 4.2-1 2035 I-25 Purposes–Peak Periods ---- 54
Figure 4.2-2 2035 Southbound AM Peak hour Traffic Composition ---- 55
Figure 4.2-3 2035 Trip Destinations ---- 56
Figure 4.2-4 2035 Origins and Destinations for Trips on Southbound 120th Avenue to I-25 Ramp ---- 57
Figure 4.2-5 2035 Origins and Destinations for Trips on E-470 to Southbound I-25 Ramps ---- 58
Figure 4.2-6 2035 No Action – DynusT Findings ---- 60
Figure 6.1-1 Wind Speeds and Directions, Thornton ---- 64

Figure 6.2-1 Environmental Justice Populations ---------- 66
Figure 6.3-1 Floodplains/Floodways in the PEL Study Area ---------- 71
Figure 6.4-1 Sites with Potential and Recognized Environmental Conditions within the Study Area ---------- 75
Figure 6.5-1 Listed, Eligible, and Potential Historic Sites in the PEL Study Area ---------- 77
Figure 6.6-1 Existing Land Uses in the PEL Study Area ---------- 81
Figure 6.6-2 Future Land Uses in the PEL Study Area ---------- 83
Figure 6.7-1 Proposed Noise Barriers in the Study Area ---------- 86
Figure 6.8-1 Existing Parks and Open Space Areas in the Study Area ---------- 89
Figure 6.8-2 Existing Trails in the Study Area ---------- 90
Figure 6.9-1 Existing T&E, Protected Nests, and Wildlife Corridors in the Study Area ---------- 97

# LIST OF TABLES

Page

Table 3.4-1 Crash History for Analysis Date Options ---------- 19
Table 3.4-2 Speed Drops During Congestion – Southbound AM Peak Period (Recurring Congestion Analysis) ---------- 24
Table 3.4-3 Speed Drops During Congestion – Northbound PM Peak Period (Recurring Congestion Analysis) ---------- 27
Table 3.4-4 I-25 Crashes-September 22, 2011 ---------- 29
Table 3.4-5 Speed Drops During Congestion – Southbound AM Peak Period (Non-Recurring Congestion Analysis) ---------- 30
Table 3.4-6 Speed Drops During Congestion – Northbound PM Peak Period (Non-Recurring Congestion Analysis) ---------- 32
Table 3.4-7 I-25 Interchanges in Study Area ---------- 32
Table 3.4-8 Existing Interchange Ramp Terminal Intersection Levels of Service ---------- 33
Table 3.4-9 Current Arterial Volume-to-Capacity Ratios ---------- 34
Table 3.5-1 Comparison of Crash Listing Patterns ---------- 37
Table 3.6-1 2010 I-25 Corridor Bus Ridership Comparison ---------- 50
Table 6.1-1 National Ambient Air Quality Standards ---------- 63
Table 6.2-1 County Minority Populations ---------- 67
Table 6.2-2 County Low-Income Populations ---------- 68
Table 6.3-1 Drainageway Floodplain Summary ---------- 70
Table 6.4-1 Sites with Potential and Recognized Environmental Conditions within the Study Area ---------- 73
Table 6.5-1 Previously Identified Historic Sites (Listed from North to South) ---------- 76
Table 6.5-2 Potential Historic Sites (Listed from North to South) ---------- 78
Table 6.7-1 CDOT Noise Abatement Criteria ---------- 84
Table 6.8-1 Existing Park, Trail, and Open Space Resources ---------- 87
Table 6.8-2 Future Master Planned Recreation Resources ---------- 91
Table 6.9-1 Existing Wildlife Resources ---------- 95
Table 6.10-1 Summary of Identified Wetlands ---------- 98

# 1.0 INTRODUCTION

The Colorado Department of Transportation (CDOT), in conjunction with several other agencies, is currently conducting a Planning and Environmental Linkage (PEL) study (referred to herein as the North I-25 PEL) for a portion of I-25 between US 36 and State Highway (SH) 7, in North Metro Denver. The North I-25 PEL is being conducted to identify existing conditions and anticipated problem areas, and develop/evaluate a range multimodal improvements to reduce congestion and improve operations and safety of the highway within the study corridor.

This Corridor Conditions report has been prepared as part of the North I-25 PEL study, and documents current and anticipated future condition of the corridor with regard to transportation and environmental resources. The information presented in this report will be used as a basis in developing and evaluating possible transportation improvements for the corridor.

This Corridor Conditions report has drawn information from a number of sources, including the recently completed North I-25 Final Environmental Impact Statement and Record of Decision, CDOT traffic and safety evaluations, and information obtained from other state, regional and local agencies. Information gathering has benefited from a comprehensive agency coordination effort, which is expected to continue as the PEL study proceeds.

# 2.0 PROJECT STUDY AREA CONTEXT

## 2.1 Study Area

The North I-25 PEL study area boundaries are illustrated in **Figure 2.2-1**. As shown, the boundary extends from US 36 to SH 7 along I-25. The boundary also captures the major north/south parallel arterials on either side of I-25 including Pecos Street, Huron Street and Washington. The communities of Broomfield, Erie, Federal Heights, Northglenn, Westminster, and Thornton as well as Adams County are represented along the corridor.

## 2.2 Previous Studies

Over the last several years, a number of transportation related studies have been conducted along the corridor. The follow section describes these studies to provide some background on the PEL project and the study area.

### 2.2.1 TIGER IV

CDOT submitted a TIGER Discretionary Grant Request to the USDOT in March 2012. The grant request sought $15 million from FHWA to complete the funding package for the I-25. North Managed Lanes Extension and Express Bus project. The grant would complete the funding package for a $44 million investment to provide one new managed toll lane in each direction of I-25 from US 36 to 120th Avenue. The project would convert the inside shoulder of I-25 into a new managed lane in each direction utilizing existing infrastructure.

### 2.2.2 North I-25 Environmental Impact Statement, August 2011 and North I-25 Record of Decision, December 2011

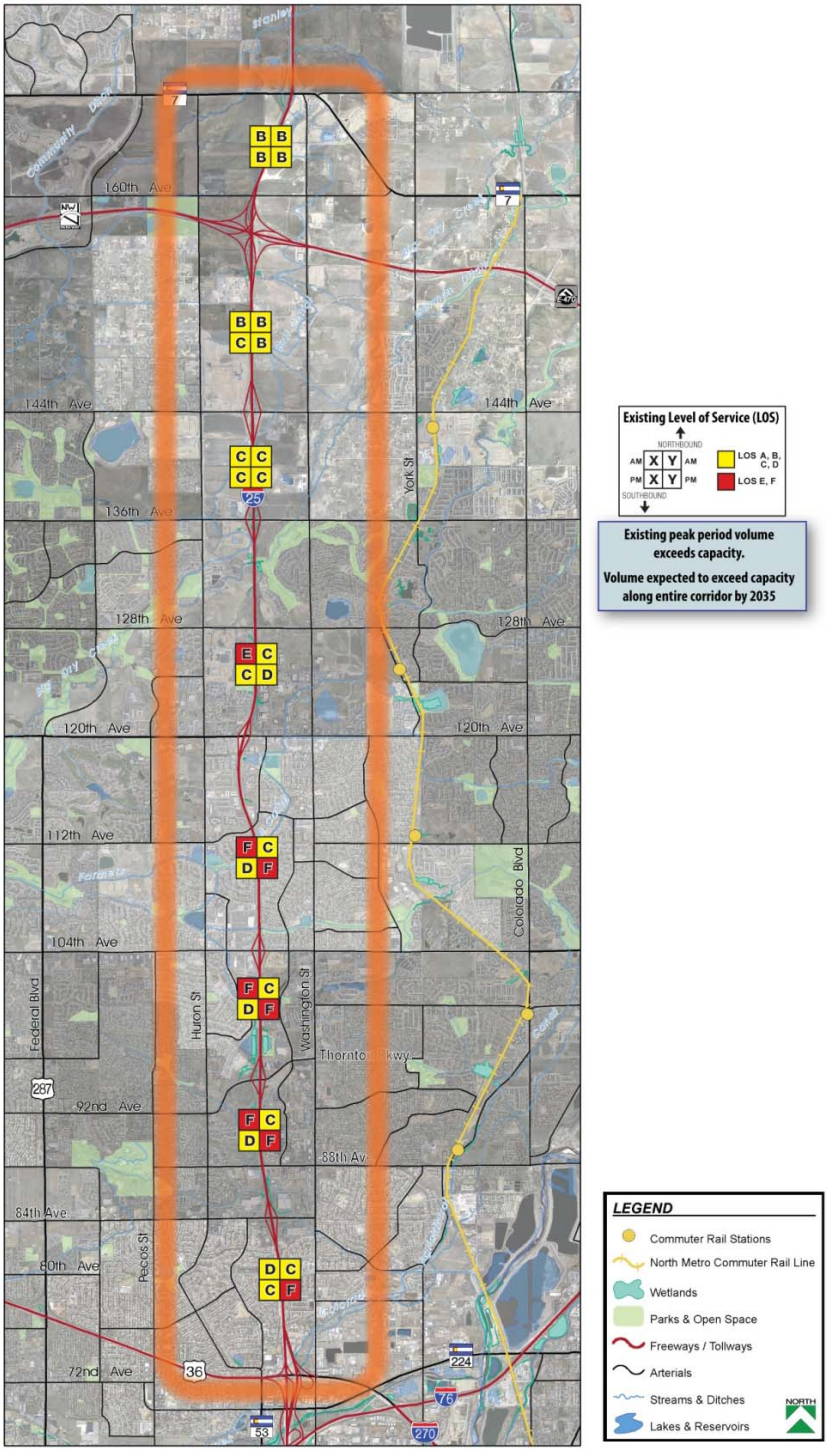
The FEIS, completed on behalf of CDOT Region 4, evaluated multimodal improvements between Wellington and the Denver Metropolitan area to address the transportation needs of the rapidly growing communities along the corridor. The Preferred Alternative includes the addition of tolled express lanes (1 buffer-separated lane in each direction) and enhanced bus service on I-25 between US 36 and SH 7.

The Record of Decision environmentally clears Phase 1 improvements of the Preferred Alternative. This includes tolled express lanes (1 buffer-separated lane in each direction) in the ultimate configuration on I-25 between US 36 and SH 7.

### 2.2.3 North Metro Environmental Impact Study, January 2011

This study evaluated transit alternatives between Denver Union Station and SH 7/162nd Avenue in Thornton. The preferred alignment is 18.4 miles long and runs from adjacent to and just east of the BNSF mainline (Brush Subdivision). The alignment connects with the UP Boulder Branch right-of-way near west 70th Avenue. Eight stations are planned along the line. The Record of Decision for this project was issued by the Federal Transit Administration in April 2011. Regional Transportation District (RTD) anticipates initiating construction of this line in 2014.

## Figure 2.2-1 Study Area



### 2.2.4 North Metro Transportation Study, October 2001

This study, prepared for the RTD, was a Major Investment Study for the North I-25/Northeast Corridor in the Denver Metropolitan area. The study developed and evaluated multimodal transportation investments to address the needs of the northeast metropolitan area through the year 2020. The Locally Preferred Alternative included the following elements related to this PEL project:

Bus/HOV lanes on I-25:

- US 36 to 92nd 1 lane, reversible barrier separated
- 92nd to 120th Avenue, 1 lane in each direction buffer separated
- 120th to SH 7, 1 peak hour HOV lane in each direction buffer separated

General Purpose widening on I-25 and I-76:

- US 36 to 120th Avenue, 1 lane in each direction

LRT/DMU along UPRR Boulder Branch

- Union Station to 124th Avenue (technology to be determined)

Transportation Management Elements

# 3.0 EXISTING TRANSPORTATION SYSTEM

## 3.1 Roadway Network

The Study Area roadway network consists of the I-25 spine and the surface street network extending approximately one mile east and west from I-25. The following text describes the characteristics of this roadway network, also depicted on **Figure 3.1-1**.

### 3.1.1 Mainline I-25

I-25 is a 1,000-plus mile north-south freeway that connects Las Cruces, New Mexico with Buffalo, Wyoming. Major cities along I-25 include Albuquerque, Colorado Springs, Denver, Cheyenne and Casper. I-25 provides two travel lanes in each direction, and widens to accommodate additional lanes through developed areas such as Metropolitan Denver.

The North I-25 PEL Study Area includes an approximate 12-mile length of I-25 in the north Metro Denver area. There are seven grade separated interchanges along this length. Three travel lanes are provided in each direction along mainline I-25, with additional auxiliary lanes at interchange ramp connections. The posted speed limit changes within the Study Area from 55 miles per hour (mph) at the south end to 75 mph at the north end.

**Figure 3.1-2** depicts Intelligent Transportation Systems (ITS) devices currently furnished along mainline I-25 and interchanges. There is a fiber optic communications backbone along I-25 up to 120th Avenue. This backbone allows for connectivity to field devices to remotely control, view, and monitor the travel conditions and provide traveler information. The presence of more substantial current traffic congestion on the south end of the corridor, coupled with the fiber optic backbone being available, results in more devices being present on the southern section of the corridor. ITS field devices north of 120th are communicated to using wireless technology, such as cellular, dial-up, or spread spectrum.

There is a mix of traffic data collection devices along the corridor, including:

- Doppler radar units collect speed and volume information by lane in both the southbound and northbound directions.
- Side-fire Microwave Vehicle Radar Detection (MVRD) units also collect speed and volume information.
- Travel Time Indicators (TTI) collect travel time over a segment by reading toll tag transponders and matching tag IDs between two readers.

Variable Message Signs (VMS) are predominately in the southbound direction, with one VMS northbound approaching 120th Avenue. There are three southbound VMS dedicated to the I-25 EXpress Lanes that display the toll rate and status of the reversible lane gate closures (i.e, OPEN or CLOSED). The other VMS are general purpose and provide real-time traveler information. There are three ramp meters southbound (plus a fourth inactive location at 120th Avenue) and two northbound that regulate traffic entering the freeway during the peak travel periods. Road Weather Information System (RWIS) are located at 92nd Avenue and SH 7, and monitor air and pavement weather conditions. A series of automated reversible gate closures are located at the southbound entry to the I-25 Express Lanes.

### 3.1.2 Surface Streets

Surface Streets provide for parallel and cross-connectivity throughout the Study Area, and are described as follows. The descriptions include functional classification, jurisdiction, posted speed, number of travel lanes, intersection traffic control, multi-modal accommodations, and Right-of-way (ROW). Roadway information was gleaned from available regional and local transportation plans, aerial photography and CDOT GIS data.

North-South Parallel Roadways

**Huron Street** – Huron Street is an arterial roadway extending through the Cities of Westminster, Northglenn, Thornton, Broomfield and Adams County and it parallels I-25 on its west side. Huron Street provides 4 travel lanes to 144th Avenue and 2 lanes north of 144th Avenue. There are 28 signalized intersections along Huron Street along its Study Area length, with the majority of signalized intersections concentrated south of 128th Avenue. The posted speed is 40 mph south of 128th Avenue and north of 144th Avenue, with a section posted at 45 mph between 128th and 144th Avenues.

**Washington Street** – Washington Street is classified as a major arterial in the *City of Thornton Transportation Plan* (July 2009) and a Principal Arterial in the *Adams County Transportation Plan*. It runs parallel to I-25 on the east side, providing 4 travel lanes along much of its length through the Study Area, transitioning to 2 lanes north of 144th Avenue and providing additional lanes within the developed area immediately south of SH 7. There are 37 signalized intersections along Washington through the Study Area. South of the Study Area, Washington Street continues to downtown Denver. Washington Street is posted at 35–40 mph in the south portion of the Study Area and 45 mph farther north.

**Pecos Street** – Pecos Street is classified as a collector/minor arterial in Thornton's Plan, and is a Principal Arterial in the Adams County Plan (south of Thornton Parkway). Pecos Street extends from 124th to 112th Avenues and from 104th Avenue south past the edge of the Study Area but does not provide a connection between 112th and 104th Avenues. In the Year 2011, a construction project was completed to provide a Pecos Street grade separation over a series of railroad tracks south of I-76, previously an at-grade crossing. Pecos Street provides four travel lanes though the Study Area, with the exception of the portion between 104th and 92nd Avenues, which travels through a residential area. The posted speed along Pecos Street varies from 25 mph through residential areas to 40 mph through wider portions south of Thornton Parkway.

**Grant Street** – Grant Street serves as a minor arterial/collector roadway between 104th and 84th Avenues. It parallels I-25 on the east side. Grant Street serves a complementary role, providing local circulation and access to commercial properties east of I-25. The posted speed on Grant Street is 30 mph.

## Figure 3.1-1 Existing Roadway Network and Traffic Control

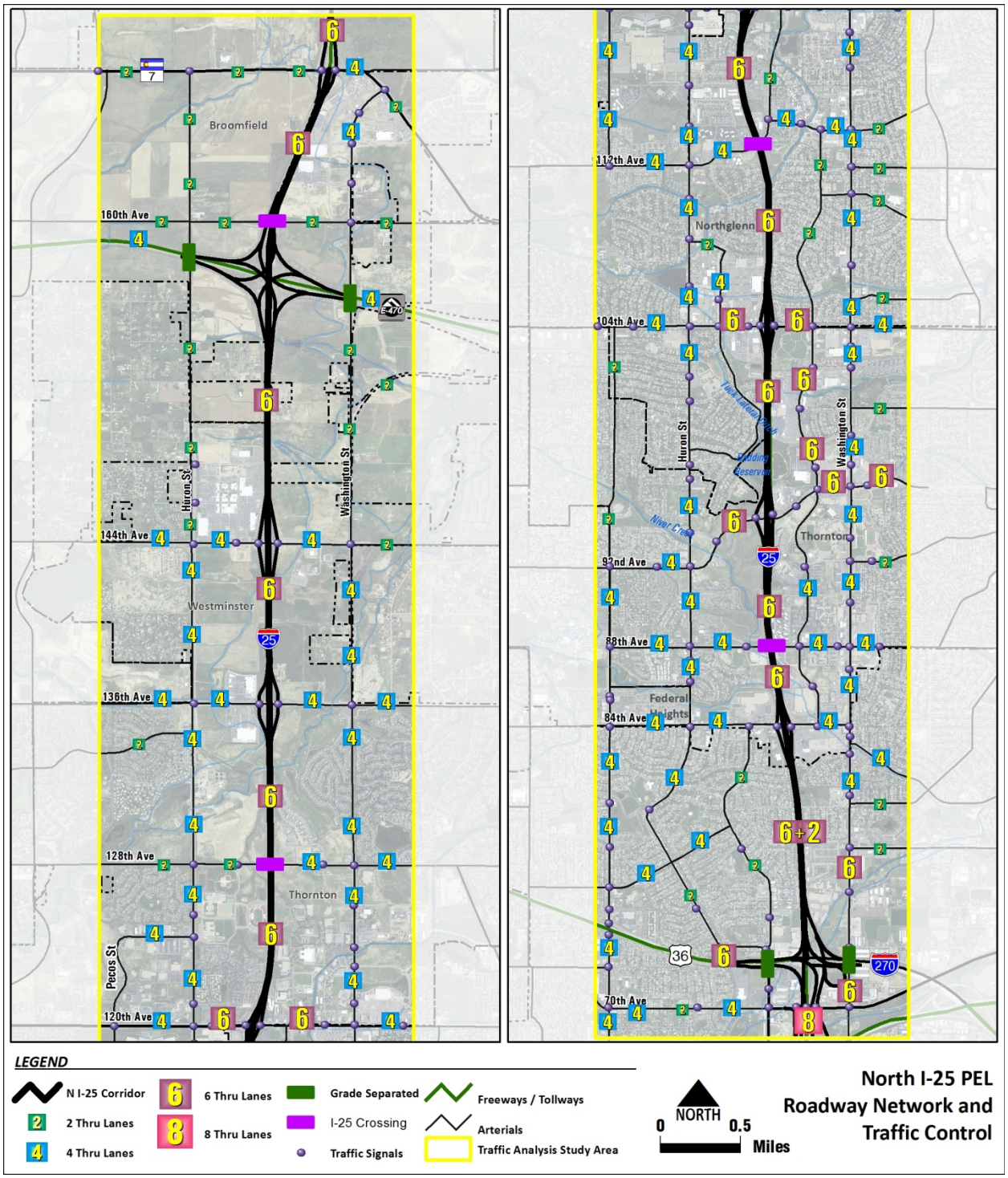
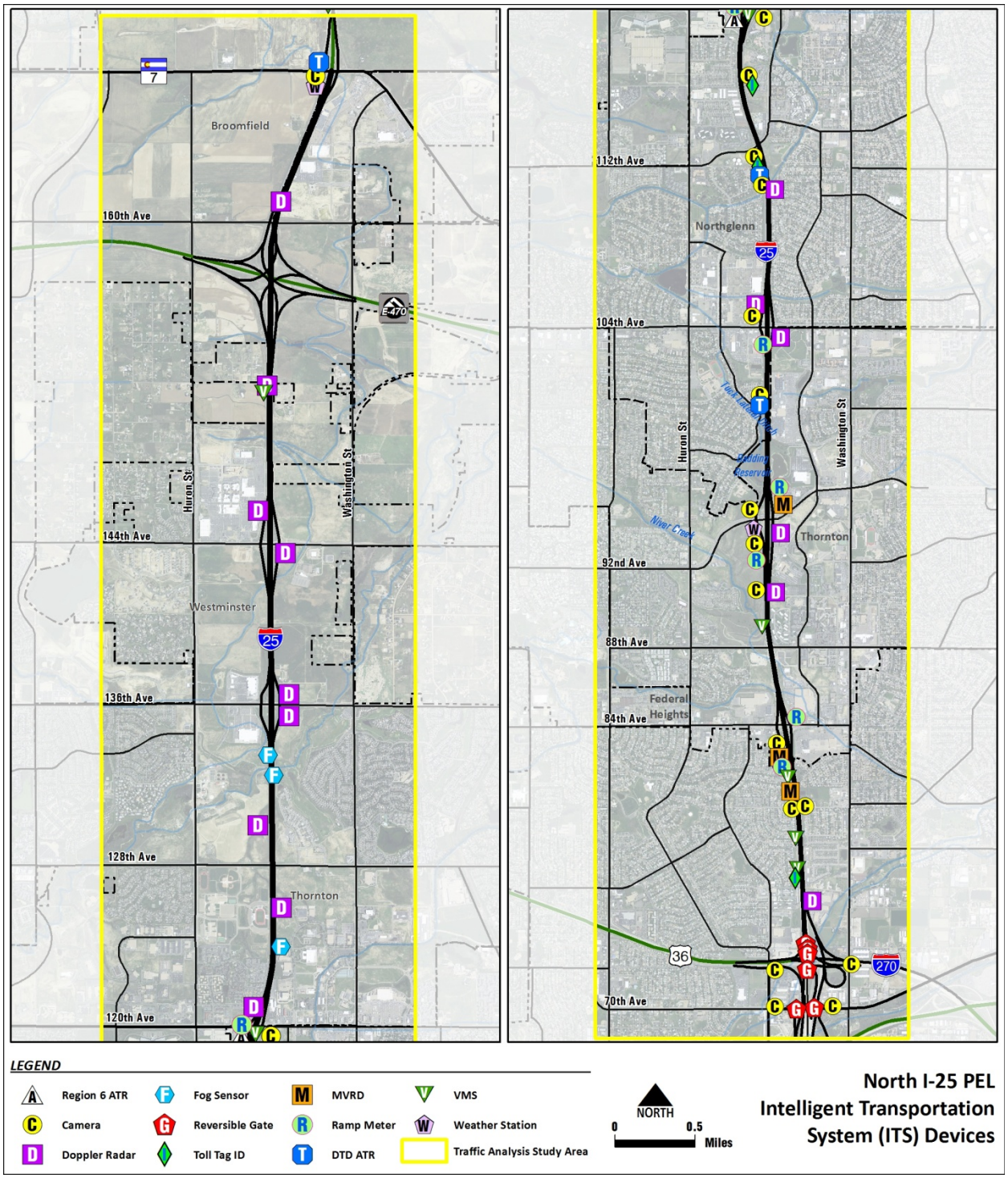


**Figure 3.1-2 Corridor Intelligent Transportation Systems (ITS) Devices**



East-West Cross Roadways

**84th Avenue** – 84th Avenue is a major arterial roadway posted at 35 mph. The I-25/84th Avenue interchange is a standard diamond with signalized ramp terminal intersections and ramp metering locations along both on-ramps. 84th Avenue provides four travel lanes with a center turn lane west of I-25 and four lanes with a raised median east of I-25. 84th Avenue continues east of Washington Street as Essex Drive, a residential collector street. West of the Study Area, 84th also becomes a collector roadway serving a residential neighborhood in Westminster.

**Thornton Parkway/92nd Avenue** – Thornton Parkway is a major arterial roadway posted at 40 mile per hour (mph) west of I-25 and 35 mph east of I-25. The Thornton Parkway/I-25 interchange is a standard diamond interchange with signalized ramp terminal intersections and ramp metering locations along both on-ramps. Thornton Parkway provides 6 travel lanes between Huron and Washington Streets with a raised median east of I-25.

**104th Avenue** – 104th Avenue is State Highway 44 (SH 44) through the Study Area and a major arterial. Similar to the other I-25 interchanges in the Study Area, the 104th Avenue/I-25 interchange is a standard diamond with signalized ramp termini and a ramp metering location for the southbound on-ramp. 104th Avenue is posted at 35 mph.

**120th Avenue** – 120th Avenue is State Highway 128 (SH 128) through the Study Area and is classified as a Major Arterial. Similar to the other I-25 interchanges in the Study Area, the 120th Avenue/I-25 interchange is a standard diamond with signalized ramp termini and a ramp metering location for the southbound on-ramp. 120th Avenue is posted at 45 mph.

**136th Avenue** – 136th Avenue is a major arterial that provides four travel lanes on either side of I-25. The I-25/136th Avenue interchange is a standard diamond interchange with signalized ramp terminal intersections. 136th Avenue is posted at 45 mph.

**144th Avenue** – 144th Avenue is a major arterial with four travel lanes on either side of I-25. The I-25/144th Avenue interchange is a standard diamond interchange with signalized ramp terminal intersections. 144th Avenue is posted at 45 mph.

**Northwest Parkway** – The Northwest Parkway is a regional tollway facility with a fully directional interchange at I-25.

**88th Avenue** – 88th Avenue is a major arterial crossing of I-25, but does not provide access to I-25. It is posted at 35 mph and provides 4 travel lanes.

**Community Center Drive/112th** Avenue – Posted at 40 mph crossing I-25 and 25 mph east of I-25, Community Center Drive provides a local connection across I-25. The cross-section provides 4 travel lanes.

**128th Avenue** – Posted at 40 mph, 128th Avenue provides 2 travel lanes and a I-25 overpass north of 120th Avenue.

### 3.1.3 Recent Construction Projects

A number of roadway construction projects have been completed in the Study Area over the past 5–10 years, including:

- 144th Avenue/I-25 Interchange – Constructed in 2006
- 136th Avenue/I-25 Interchange – Constructed in 2003
- 120th Avenue/I-25 Interchange – Reconstructed in 2006
- 104th Avenue/I-25 Interchange – Reconstructed in 2010
- 84th Avenue/I-25 Interchange – Ongoing reconstruction to be complete by October 2012
- Northwest Parkway/I-25 Interchange – Constructed in 2003
- Pecos Street – Railroad Grade Separation south of I-76 – Constructed in 2011
- Southbound I-25 to Eastbound I-270 flyover ramp – Constructed in 2005

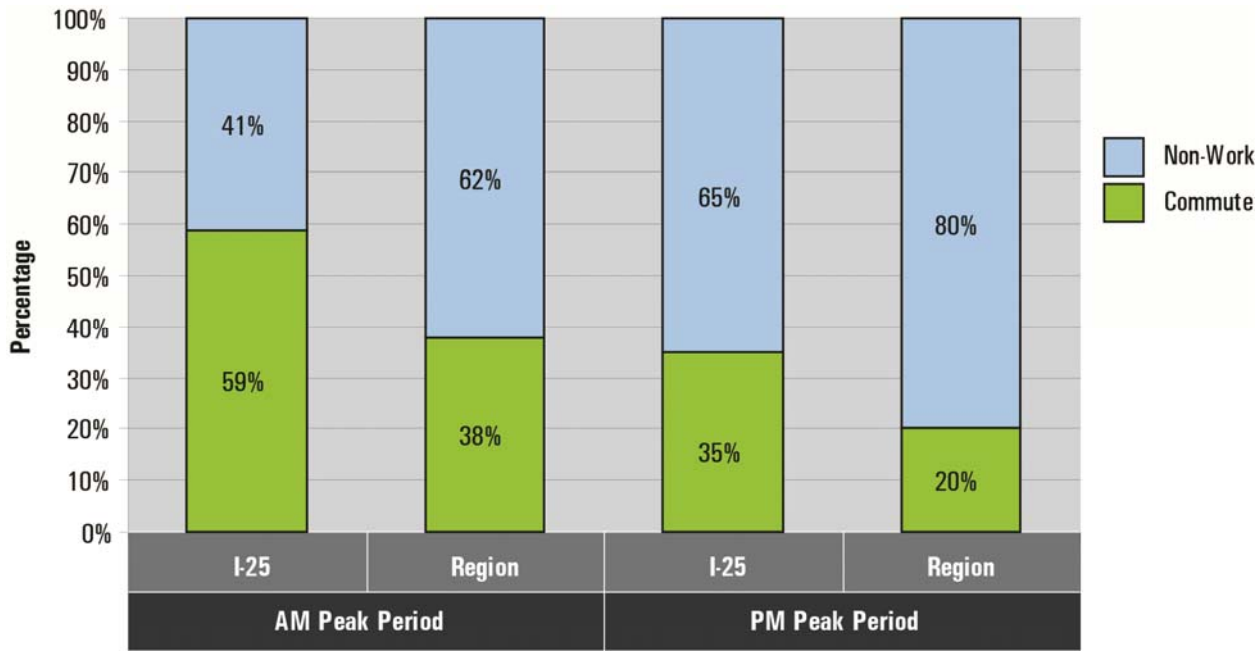
## 3.2 Current Travel Markets Analysis

The 2010 Denver Regional Council of Governments (DRCOG) Travel Demand Model was used to evaluate the travel markets for the I-25 corridor.

### 3.2.1 Trip Purpose

In 2010, the I-25 corridor serves a variety of trip types in the AM Peak Period. Commute trips account for about 59 percent of all trips. Regionally, commute trips account for approximately 38 percent of all trips in the AM Peak Period, so I-25 serves a heavy commuter market. This is in line with expectations, as longer trips utilize freeways more often than shorter non-work trips. **Figure 3.2-1** illustrates trip purposes.

**Figure 3.2-1 2010 I-25 Trip Purposes – Peak Periods**



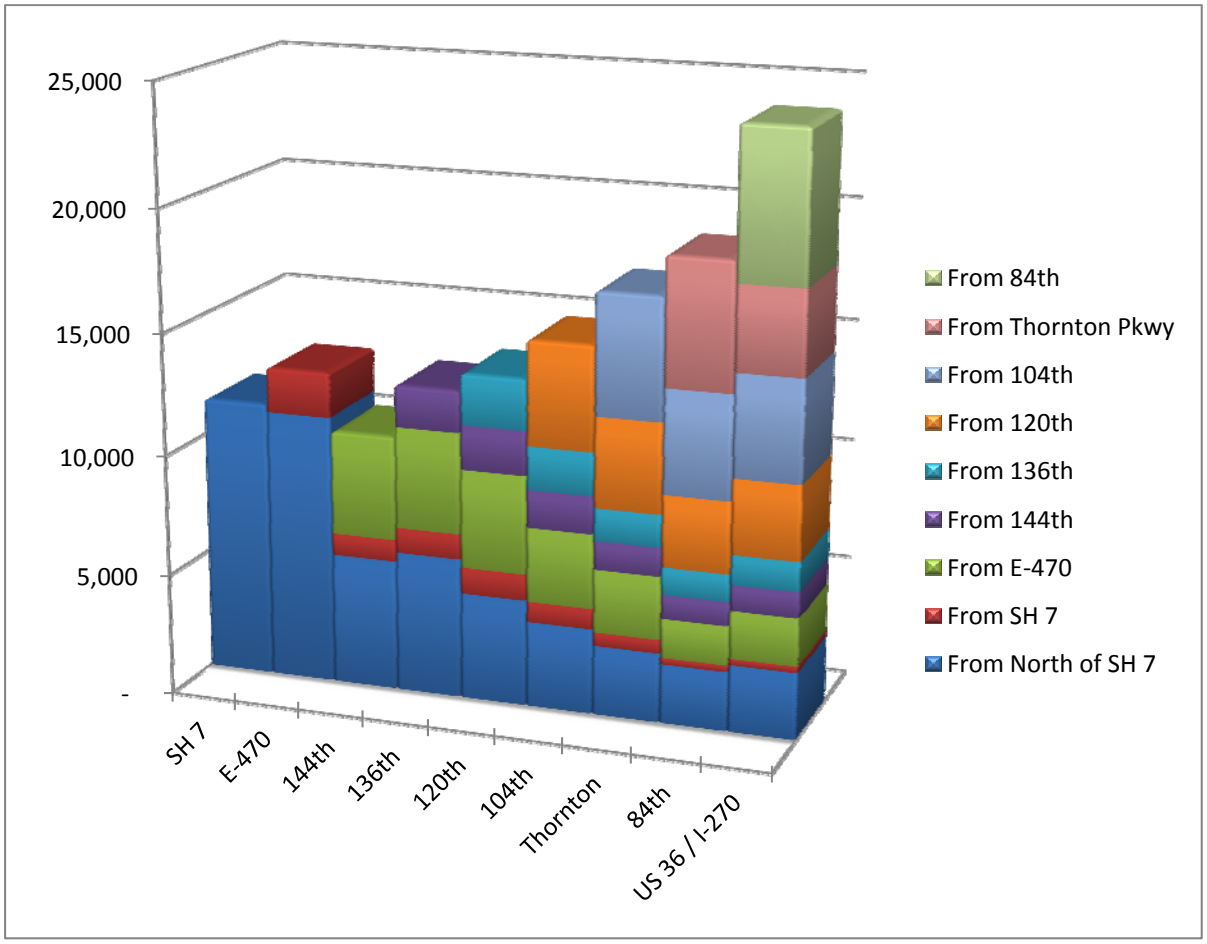

<u>Observations:</u>

- Traveler familiarity is high
  - This could increase the range of alternatives considered

### 3.2.2 Composition of Southbound AM Peak Period I-25 Volume

**Figure 3.2-2** displays the traffic along I-25 in the AM Peak Period. Each color on the chart corresponds to where vehicles entered the freeway. For example, the blue bar at the left is traffic on I-25 north of SH 7. This bar shrinks as traffic exits along the corridor, while traffic from other interchanges enters the interstate.

**Figure 3.2-2 2010 AM Peak Hour Traffic Composition (north of ??)**




Observations:

- Low percentage of total trips are through trips.
- Traffic builds up along the corridor, moving south.
- Many trips both enter and exit I-25 within the Study Area.
  - Parallel facilities could support these local trips.

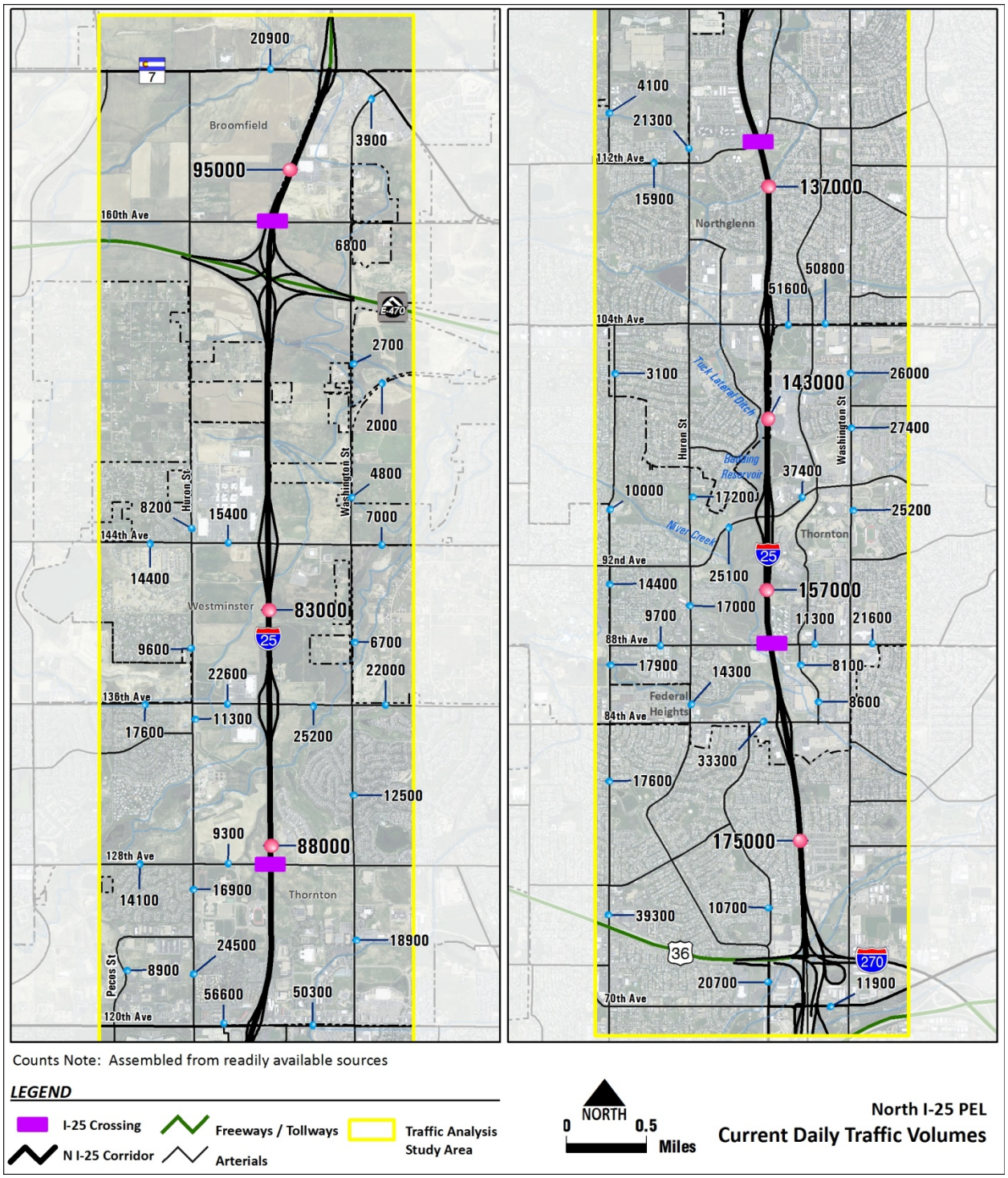
## 3.3 Existing Traffic Volumes

### 3.3.1 Daily Traffic Volumes

Daily traffic counts along Study Area roadways were assembled from information provided by the Cities of Westminster and Thornton and counts conducted as a part of the North I-25 FEIS effort. The counts shown on **Figure 3.3-1** are limited to the past five years, as older counts are likely to be inaccurate. Trends reflected in the daily traffic volumes are highlighted as follows:

- Of the two arterials parallel and adjacent to mainline I-25, Washington Street and Huron Street, Washington Street carries more daily traffic. South of 120th Avenue, Washington Street carries more than 25,000 vehicles per day (vpd) while Huron Street carries approximately 15,000 to 20,000 vpd.
- There are currently four roadways that cross I-25 without an interchange; overpasses along 88th Avenue, 112th Avenue, and 128th Avenue and the 160th Avenue underpass. Daily traffic counts are not readily available along 160th Avenue, but the three overpasses crossings carry approximately 10,000-15,000 vpd.
- Of the major arterials with I-25 interchanges in the Study Area, 120th Avenue and 104th Avenue carry the most traffic. However, all of the cross arterials show relatively high daily traffic. Thornton Parkway east of I-25 carries more than 37,000 vpd and 84th Avenue more than 33,000 vpd. Though the 136th Avenue interchange has been open for less than a decade, 136th Avenue carries 25,000 vpd east of I-25.
- I-25 daily traffic volumes dissipate from south to north moving away from Denver's City Center.

## Figure 3.3-1 Existing Daily Traffic Volumes



### 3.3.2 Peak Hour Traffic Patterns

Counts along mainline I-25 indicate that southbound traffic peaks during the morning peak period and northbound traffic during the afternoon peak period. To characterize this directional distribution and identify the contribution of each interchange to peak hour I-25 traffic, the project team developed **Figures 3.3-2** and **3.3-3**. These graphics depict scaled arrows representing each movement. Summary points are provided as follows:

- During the morning peak hour, 53% of traffic entering southbound I-25 enters from locations east of I-25. During the afternoon peak hour, approximately 59 percent of northbound trips exiting I-25 exit to locations east of I-25.
- Nearly 4,000 vehicles per hour (vph) exit southbound I-25 at the US 36/I-270/I-76 interchange complex during the AM peak hour. Most of this traffic exits to westbound I-76 and to eastbound I-270. 830 vph enter the southbound I-25 Tolled Express Lane, which begins at this interchange complex.
- Nearly 3,000 vph enter northbound I-25 at the US 36/I-270/I-76 interchange complex during the PM peak hour. Of the entering traffic, the westbound I-270 on-ramp contributes the most at 1,185 vph.
- Adding AM and PM peak hour interchange ramp traffic together yields the following ranking of interchanges based on peak hour ramp traffic levels:
  1. I-270/I-76/US 36 Interchange complex
  2. 120th Avenue Interchange
  3. 104th Avenue Interchange
  4. 84th Avenue Interchange
  5. 136th Avenue Interchange
  6. Thornton Parkway Interchange
  7. SH 7 Interchange
  8. 144th Avenue Interchange
- The presence of the Wagon Road park-n-Ride west of I-25 along 120th Avenue is reflected in southbound traffic levels exiting I-25 at 120th Avenue during the AM peak hour and returning in the afternoon.

**Figure 3.3-2 AM Peak Hour Traffic Contributions**

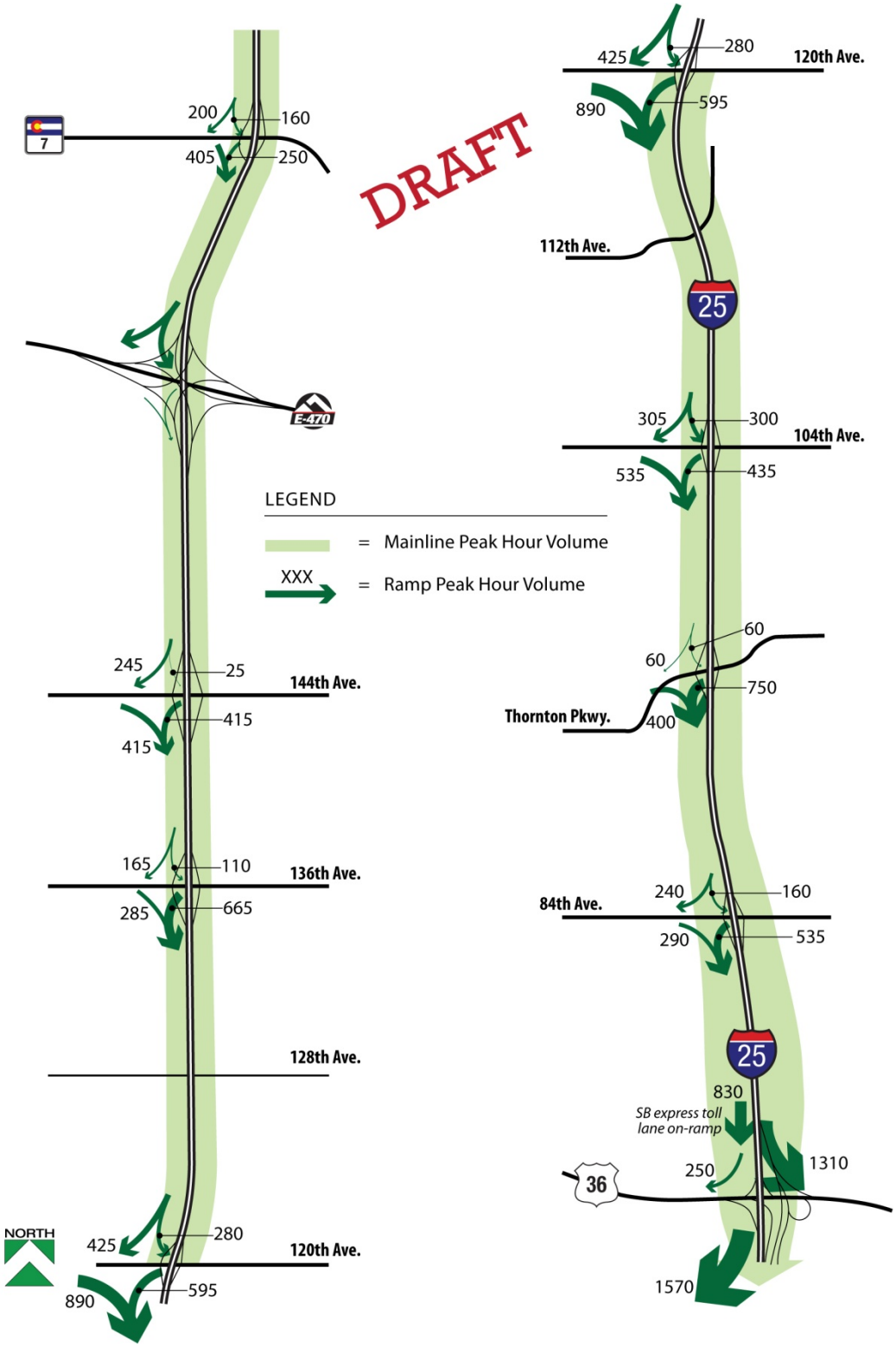
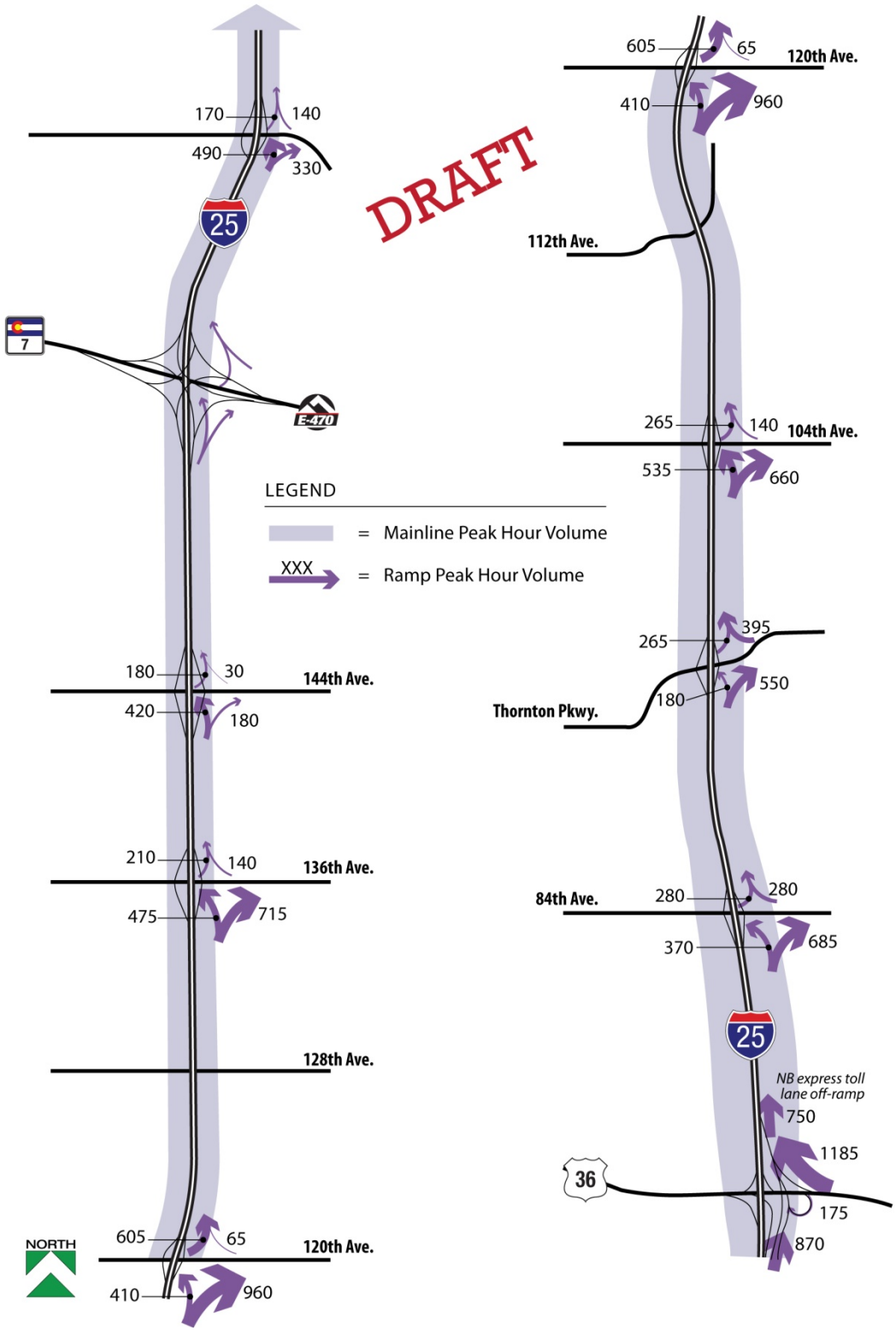


**Figure 3.3-3 PM Peak Hour Traffic Contributions**



## 3.4 Traffic Operations

The project team has developed a traffic operations analysis of mainline I-25 and the supporting surface street network using a combination of existing traffic data and simulation modeling with the DynusT Dynamic Traffic Assignment (DTA) computer simulation model. Traffic conditions are described in the following text.

### 3.4.1 Mainline I-25 Bottleneck Analysis

In traffic operations terms, a bottleneck is a location along a roadway which constricts roadway capacity, causing congestion and delay. Bottlenecks result from particular physical conditions that affect travel speeds or reduce available travel lanes. Analyses of I-25 were conducted to locate bottlenecks and quantify the temporal and spatial extent of their effects on traffic flow.

Congestion along I-25 can be categorized as recurring and non-recurring. Recurring congestion can be observed on a repeated basis during peak travel periods at predictable locations. Non-recurring congestion is caused by incidents, work zones, weather, or special events and is less predictable than recurring congestion. The Federal Highway Administration (FHWA) estimates that roughly half of traffic congestion experienced by Americans is recurring (http://ops.fhwa.dot.gov/program_areas/reduce-recur-cong.htm), implying that the other half is non-recurring.

Both recurring and non-recurring congestion are significant, particularly along a major Interstate corridor. Analyses of both types are provided as follows.

#### 3.4.1.1 Recurring Congestion

A variety of tools were used to complete the analysis of recurring congestion. The Colorado Department of Transportation (CDOT) provides traffic speed maps at the website www.cotrip.org, and Google maps provides travel speeds based on the tracked speeds of smartphone users (www.google.com). Both sources provide graphical displays of travel speeds and clearly depict locations where speeds are reduced from free-flow levels. Screen captures from both are shown below, in **Figures 3.4-1** and **3.4-2**.

Online observations of I-25 (using both sources) through the Study Area on a typical weekday demonstrate the effects of recurring congestion, as traffic slows from free-flow speed during peak periods. Slower speeds are evident in the southern portion of the Study Area, between US 36 and 120th Avenue southbound and between Thornton Parkway and US 36 northbound . In general, recurring bottlenecks affect southbound traffic in the morning and northbound traffic in the evening.

To quantify the location and temporal extent of traffic congestion along I-25 through the Study Area, the project team gathered data available from twenty Doppler radar speed sensors located between 58th Avenue and SH 7. The sensors are used by CDOT to communicate travel speeds to the public, and are spaced an average of ¾ miles apart. Sensor locations are depicted on **Figure 3.1-2**. Doppler sensors located south of the Study Area were included in the analysis to identify and evaluate the effects of congestion originating beyond the Study Area.

Speed data were gathered from the Doppler radar locations during two consecutive weeks for six total weekdays in September of 2011 to provide a basis for selection of a typical weekday for analysis. Review of the speed data indicated that Wednesday, September 28 provides a representative condition for recurring congestion. The project team also reviewed historic traffic

crash information for these days and noted that there were no crashes during congested time periods within the corridor on September 28, further supporting the selection of Wednesday, September 28 as the appropriate analysis day.

**Table 3.4-1** lists the crashes that occurred on each of the dates considered for analysis.

### Table 3.4-1 Crash History for Analysis Date Options

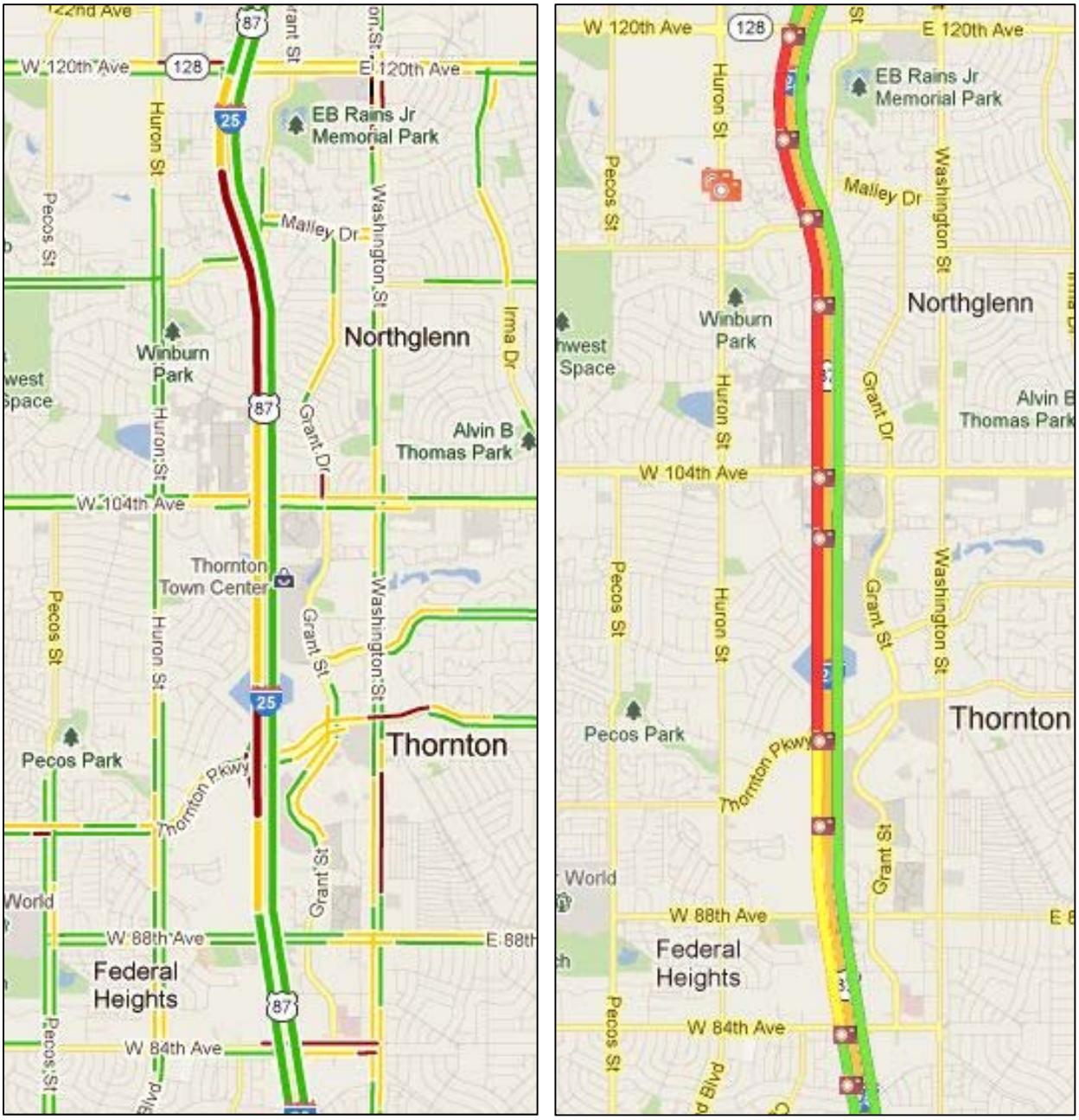
| Date | Type | MP (On mainline unless noted otherwise) / Location | Direction | Time |
|---|---|---|---|---|
| Tuesday, September 20th, 2011 | Rear end | 220.53 / Between Thornton Pkwy and 104th | SB | 8:50 AM |
| | Rear end | 218.8 / Just south of 88th overpass | NB | 5:08 PM |
| Wednesday, September 21st, 2011 | Rear end | 220.86 / Just south of 104th overpass | SB | 8:26 AM |
| | Rear end | 222.29 / Just north of Community Center Dr overpass | SB | 4:13 PM |
| Thursday, September 22nd, 2011 | Rear end | 218.46 / Under 84th overpass | SB | 5:44 AM |
| | Rear end | 219.15 / Just north of 88th overpass | SB | 6:10 AM |
| | Rear end | 221.03 (Ramp A) / On 104th Ave between ramps | WB | 6:17 AM |
| | Rear end | 219.68 (Ramp E) / Thornton Pkwy SB on-ramp | SB | 3:26 PM |
| | Rear end | 219.02 / Under 88th overpass | NB | 5:11 PM |
| | Rear end | 224.94 / Just south of 136th overpass | NB | 5:13 PM |
| | Sideswipe (Same direction) | 219.57 / Just south of Thornton Parkway overpass | SB | 10:26 PM |
| Tuesday, September 27th, 2011 | Rear end | 224.98 / Just south of 136th overpass | SB | 6:50 AM |
| | Rear end | 219.48 / Just south of Thornton Pkwy overpass | SB | 8:04 AM |
| Wednesday, September 28th, 2011 | Concrete Highway Barrier | 227.73 / Just south of NW Pkwy overpasses | SB | 9:55 AM |
| Thursday, September 29th, 2011 | Vehicle Debris or Cargo | 228 / Just north of NW Pkwy overpasses | NB | 12:45 PM |
| | Sideswipe (Same direction) | 217.5 / Near SB exit to I-270 | SB | 2:35 PM |

The following sections describe results of the analysis of the selected weekday, by direction:

#### Southbound Direction

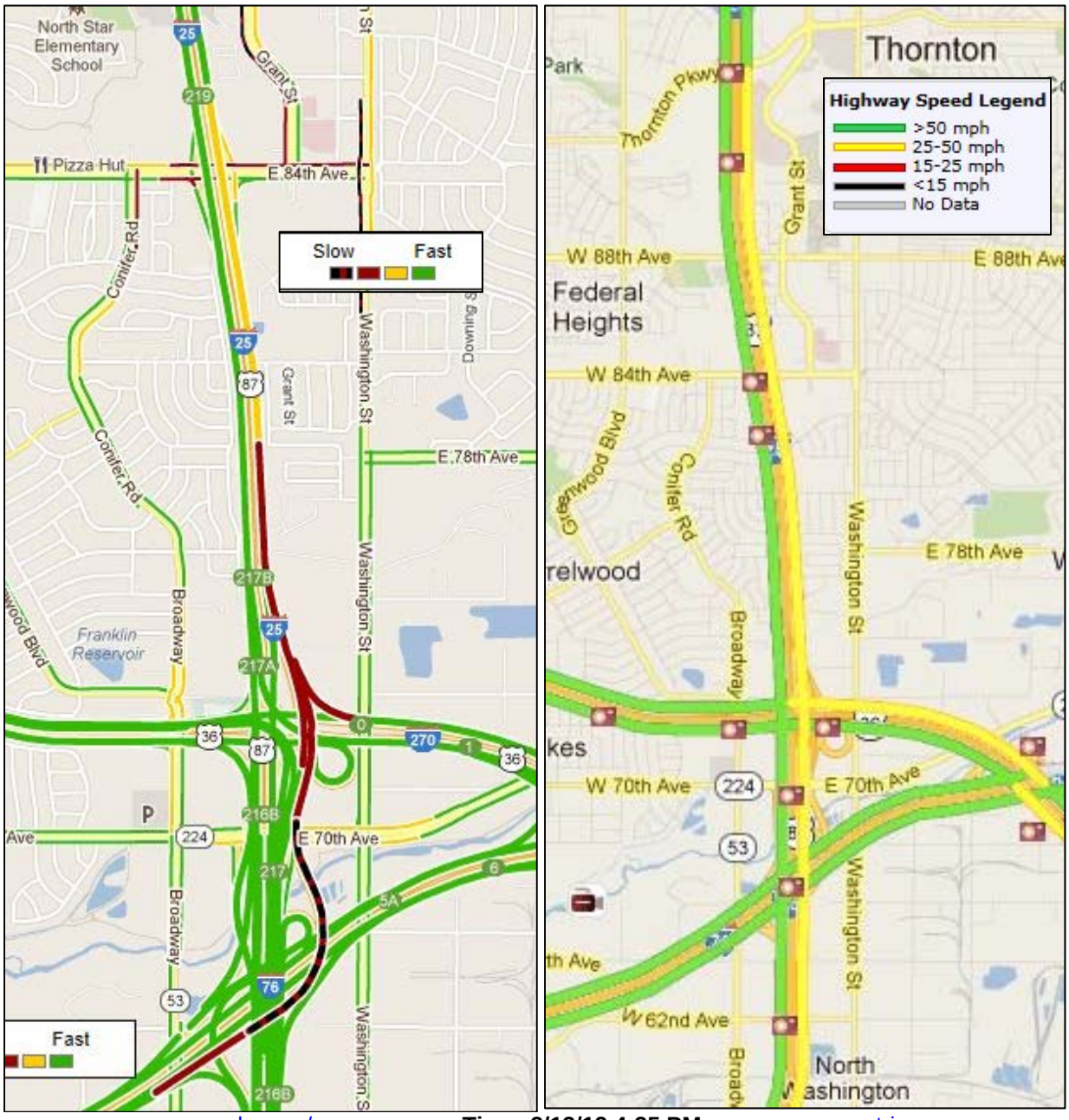
Using the Doppler speed data, the design day readings along the entire corridor were plotted to determine the location were vehicular traffic slows during the peak period. **Figure 3.4-3** depicts southbound traffic speeds in mph recorded along I-25 starting at approximately 2:30 am on September 28. The 24-hour plot shows that southbound speeds dip in morning peak period at a number of Doppler stations in the south portion of the Study Area. North of 123rd Avenue, southbound speeds remain at free-flow levels throughout the day.

**Figure 3.4-1 AM Peak Period Screen Captures from Google and Cotrip.Org Sites**




www.google.com/maps **Time: 3/22/12 6:35 AM** www.cotrip.org

**Figure 3.4-2 PM Peak Period Screen Captures from Google and Cotrip.Org Sites**




www.google.com/maps **Time: 3/13/12 4:35 PM** www.cotrip.org

**Figure 3.4-3 24-hour Speed Plot – Southbound I-25 (Recurring Congestion Analysis)**

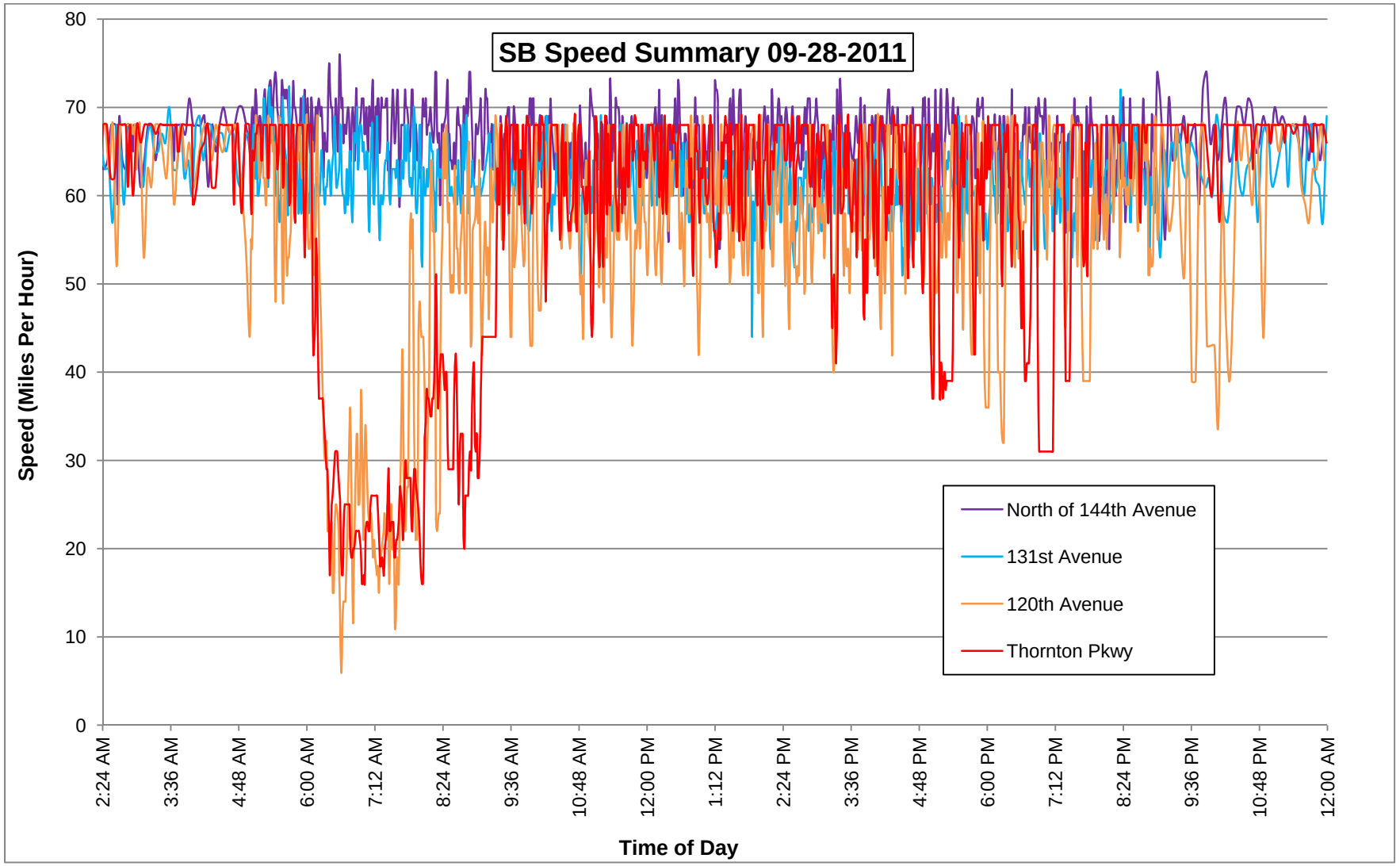
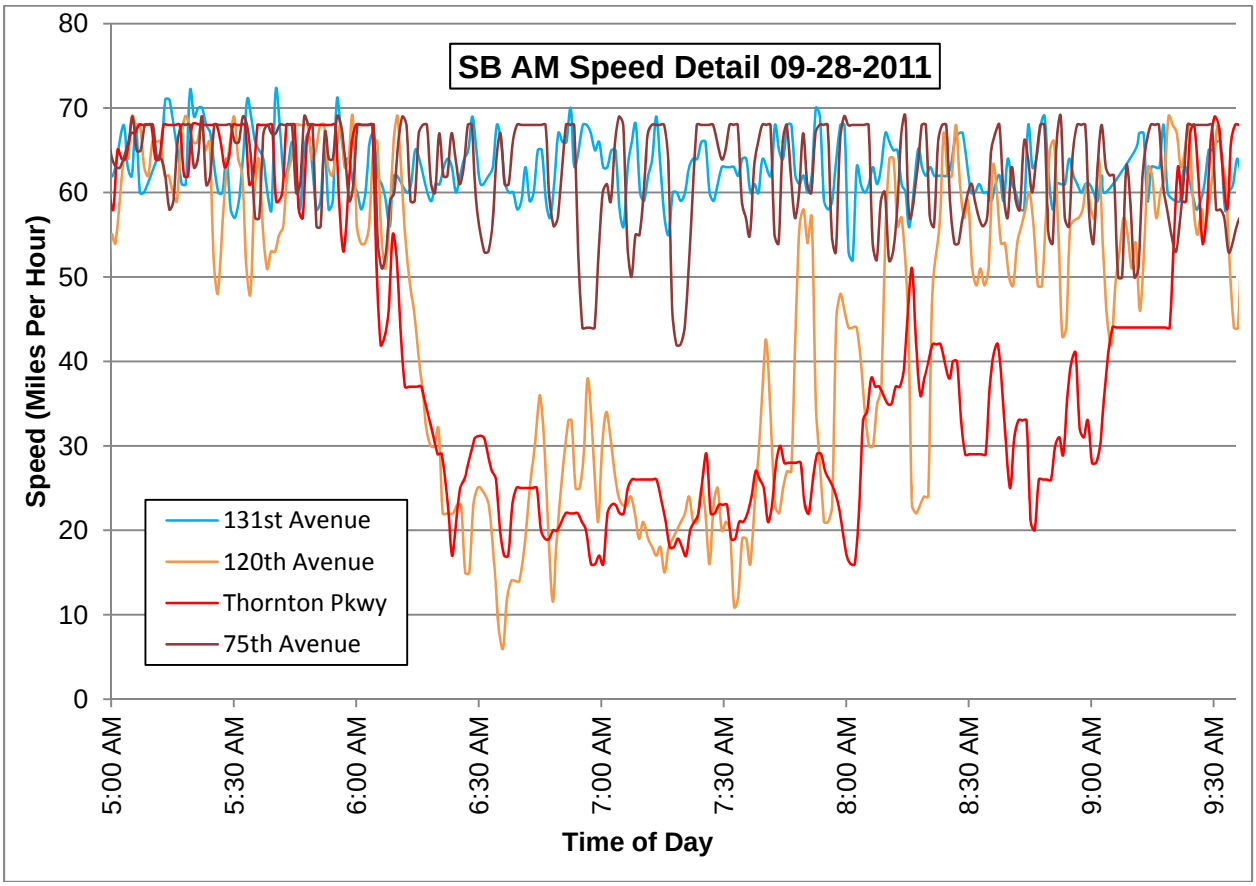


**Figure 3.4-4** provides a closer look at the locations showing a speed reduction. The data show that vehicular speeds began slowing from free flow conditions near Thornton Parkway (red line) around 6:15 am. Vehicular speeds drop to less than 25 mph on average, resulting in a vehicular queue that quickly extends north past 120th Avenue (orange line) by 6:30 am. At Thornton Parkway, vehicle speeds bottom out at approximately 6:20 am and conditions along I-25 gradually improve until the end of the peak period at 9:15 am when vehicle speeds reach 60 mph.

**Figure 3.4-4 Southbound I-25 Congestion – AM Peak Period (Recurring Congestion Analysis)**




Poor peak period operations downstream at the I-70/I-25 merge area slow traffic speeds later in the peak period, and the resulting vehicular queues extend back on mainline I-25 into the south portion of the Study Area. However, southbound weekday morning traffic congestion is shown to originate within the Study Area between US 36 and Thornton Parkway. Congestion south of US 36 does not begin until later in the morning peak period, demonstrating that the Study Area contains one or more southbound mainline I-25 bottleneck(s).

**Table 3.4-2** summarizes the speed reductions experienced during peak periods along southbound I-25 at each Doppler Station. As shown, the speed drop initiates near Thornton Parkway (likely south of Thornton Parkway), then propagates upstream through 120th Avenue.

**Table 3.4-2 Speed Drops During Congestion – Southbound AM Peak Period (Recurring Congestion Analysis)**

| Doppler Station | Speed Drop During Congestion | Time Speed Drop Begins | Time Speed Drop Ends | Total Duration of Congestion |
|---|---|---|---|---|
| 75th Avenue | 65 mph to 47 mph | 7:04 AM | 7:13 AM | 9 min |
| Thornton Parkway | 65 mph to 16 mph | 6:04 AM | 9:21 AM | 3 hrs, 17 min |
| 120th Avenue | 65 mph to 6 mph | 6:06 AM | 8:24 AM | 2 hrs, 22 min |

The poor southbound morning operation of I-25 between US 36 and 88th Avenue can be attributed to several factors including:

- A significant amount of southbound volume enters the I-25 corridor between Thornton Parkway and 84th Avenue (approx. 1500 vehicles per hour during peak morning flows) The high volume of merging on-ramp traffic coupled with the lack of acceptable gaps along I-25 cause mainline I-25 traffic to slow at merge / diverge points, resulting in vehicular queues that extend north through 120th Avenue.
- The downstream I-25 lane assignments also contribute to the poor operation. When vehicles pass 84th Avenue, two separate weaving movements must occur. First, the farthest west southbound lane, which is also the 84th Avenue merge lane, drops at the I-76/US 36 interchange. The lane assignment requires all vehicles entering the traffic stream at 84th Avenue wanting to travel south on I-25 to merge over one lane. Faded lane markings on I-25 indicate that a significant amount of traffic either leaving the 84th Avenue merge lane to head south on I-25, or traffic entering the 84th Avenue merge lane to position themselves to exit at US 36/I-76 complete this movement just south of 84th Avenue. Additional weaving occurs due to vehicles entering the right (west) edge of southbound I-25 at 84th Avenue seeking to reach the I-270 flyover ramp located on the left (east) edge.

  The interaction of these weaving movements contributes to the poor operation of I-25 during the morning peak period.

<u>Northbound Direction</u>

- The Doppler speed data was again plotted to determine the location where vehicular traffic slows during the afternoon peak period. A 24-hour northbound speed plot is depicted on **Figure 3.4-5**. The data depict a speed reduction at several locations during the afternoon peak period, most notably at 75th Avenue. Speeds recorded near Thornton Parkway are erratic during the peak period as traffic breaks loose from queues farther south.

**Figure 3.4-5 24-hour Speed Plot – Northbound I-25 (Recurring Congestion Analysis)**

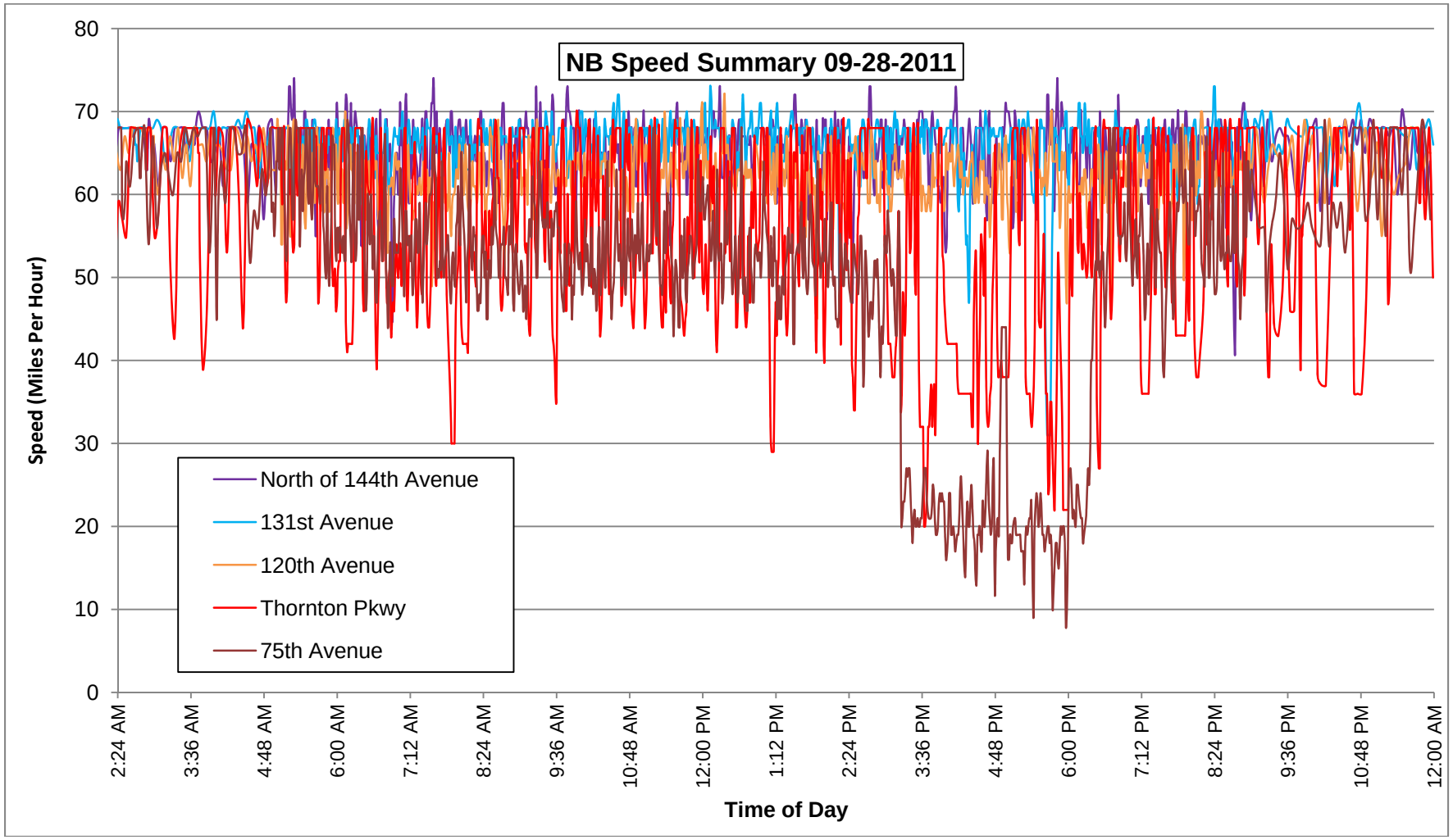
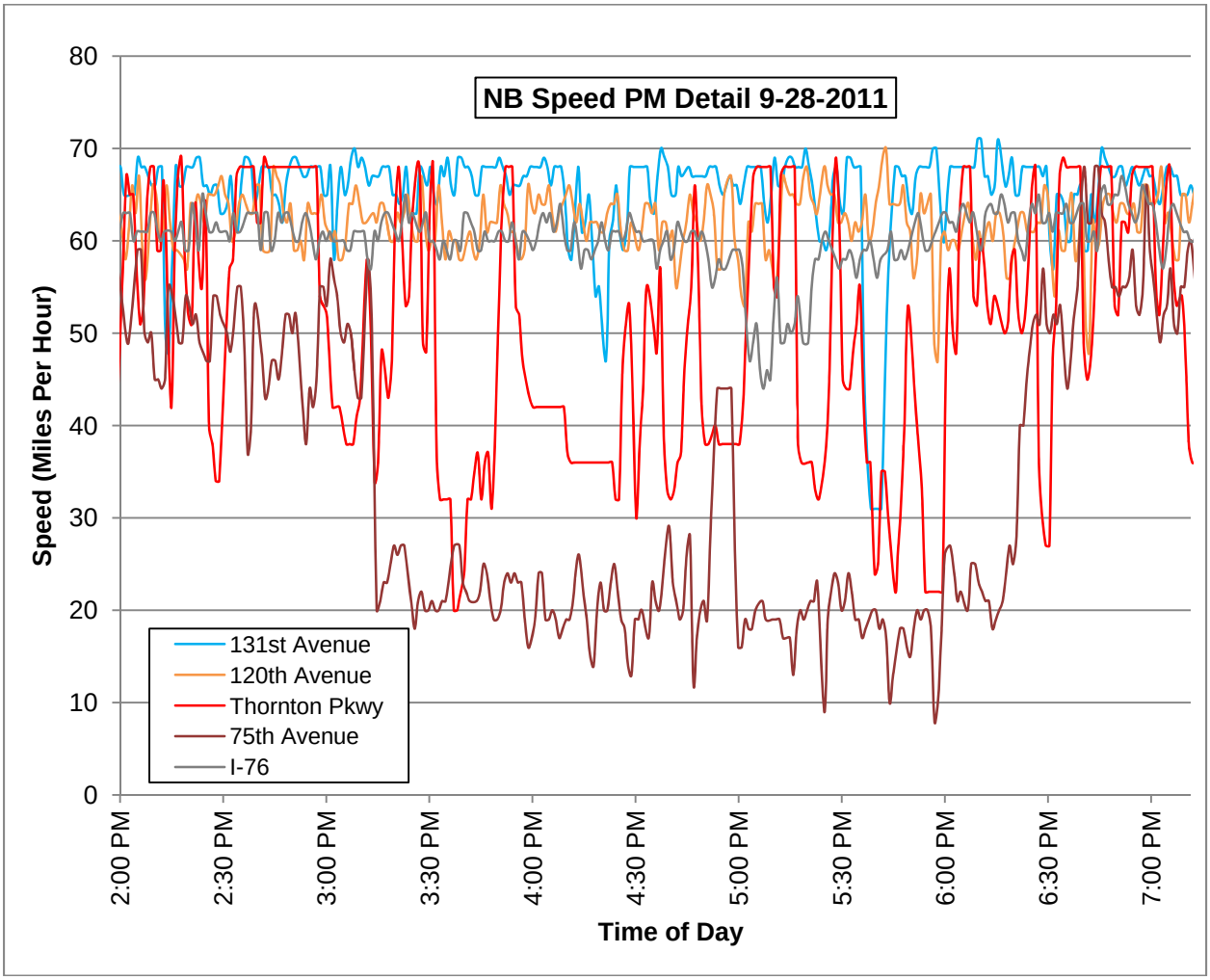


**Figure 3.4-6** provides a closer look at the locations showing a speed reduction. The data show that vehicles traveling at free flow speeds slowed down to 20 mph at 75th Avenue (maroon line) beginning at 3:15 pm. The resulting vehicular queues created by the slower northbound speeds do not extend back through I-76 (gray line) south of the Study Area.

**Figure 3.4-6 Northbound I-25 Congestion – PM Peak Period (Recurring Congestion Analysis)**




Once vehicles travel north through 75th Avenue, speeds fluctuated between 30 mph and 45 mph past Thornton Parkway and I-25 northbound at Thornton Parkway experiences some lingering effects of congestion until about 6:30 pm. Congestion does not extend north past 120th Avenue. Traffic conditions along the entire corridor return to free flow speeds by about 7:00 pm.

**Table 3.4-3** summarizes the speed reductions experienced during peak periods along southbound I-25 at each Doppler Station. As shown, the speed drop initiates at the 75th Avenue location. This congestion extends south, affecting I-25 at its junction with I-76.

**Table 3.4-3 Speed Drops During Congestion – Northbound PM Peak Period (Recurring Congestion Analysis)**

| Doppler Station | Speed Drop During Congestion | Time Speed Drop Begins | Time Speed Drop Ends | Total Duration of Congestion |
|---|---|---|---|---|
| 131st Avenue | 68 mph to 32 mph | 5:45 PM | 5:55 PM | 10 min |
| Thornton Parkway | 55 mph to 40 mph | 3:30 PM | 6:00 PM | 2 hrs, 30 min |
| 75th Avenue | 58 mph to 20 mph | 3:15 PM | 6:30 PM | 3 hrs, 15 min |
| I-76 | 60 mph to 50 mph | 5:00 PM | 5:20 PM | 20 min |

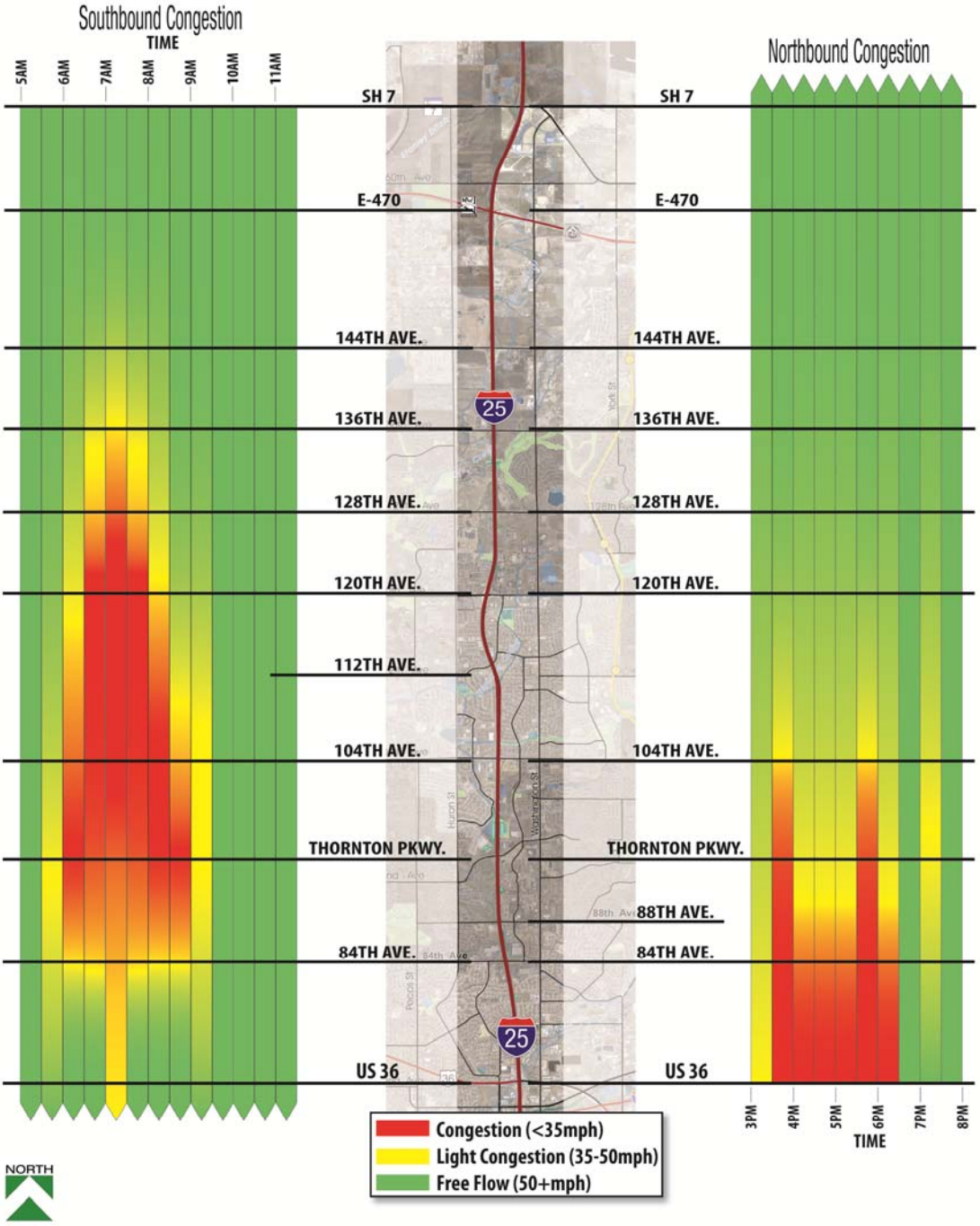
The poor northbound operation of I-25 at 75th Avenue starting at 3:15 pm can be attributed to two merge points and downstream lane drops. Just north of the I-76 /US 36 interchange, vehicles from the northbound I-270 on-ramp as well as vehicles exiting the high occupancy toll (HOT) lanes both merge onto northbound I-25 within 1,100 feet of one another. Once vehicles from both movements merge onto mainline I-25, vehicles in farthest east northbound through lane must weave to the west as the lane drops at the 84th Avenue off-ramp. Both merging movements as well as vehicles positioning themselves to avoid the drop lane slow traffic during the PM peak period.

After passing through 75th Avenue, vehicles begin positioning themselves to exit at downstream interchanges at 84th Avenue, Thornton Parkway and 104th Avenue, mirroring the AM peak hour flows. The high volume of traffic exiting each interchange, as well as the interaction between the weaving movements and the merge / diverge points impacting vehicular speeds along mainline I-25 contributing to the congestion. This interaction eventually degrades I-25 mainline operations enough that vehicular queues extend back through 75th Avenue, and eventually the I-76/US 36 interchange.

Summary – Recurring Congestion

**Figure 3.4-7** summarizes the speeds recorded along I-25 during the morning southbound and evening northbound in a color-coded time space diagram. The red portions of the graphic depict speed reductions currently experienced during peak periods. As shown and previously described, morning southbound congestion extends from 84th Avenue north to roughly 128th Avenue and lasts approximately 3.5 hours. Evening northbound congestion affects traffic south of 104th Avenue and also lasts approximately 3.5 hours.

**Figure 3.4-7 Current I-25 Congestion (9/28/2011 Conditions)**




**(NOTE**: Graphic based on conditions observed along I-25 on September 28, 2011, selected as a representative typical day.)

### 3.4.1.2 Non-Recurring Congestion

As noted by FHWA, non-recurring congestion can comprise a significant portion of the overall congestion along a corridor. A review of Year 2011 crashes along I-25 through the Study Area revealed that a crash happened along mainline I-25 on 296 of the 365 days. Based on this sampling, the probability of a crash happening in the Study Area on a given day is 81 percent. In addition, approximately 18 percent of all crashes happen during the AM (8-9 AM) and PM (5-6 PM) peak hours.

As a case study on the impacts of non-recurring congestion upon the I-25 PEL corridor, the project team reviewed crash histories for September 2011 days with speed data available. This review revealed six crashes along I-25 on a single day, September 22. **Table 3.4-4** provides an overview of the six crashes, listing the type, location, time, and severity.

**Table 3.4-4 I-25 Crashes-September 22, 2011**

| Crash Type | Location (MP/Description) | Dir. | Time | Severity |
|---|---|---|---|---|
| Rear end | 218.46/Under 84th overpass | SB | 5:44 AM | PROPERTY DAMAGE ONLY |
| Rear end | 219.15/Just north of 88th overpass | SB | 6:10 AM | |
| Rear end | 219.68 (Ramp E)/Thornton Pkwy SB on-ramp | SB | 3:26 PM | |
| Rear end | 219.02/Under 88th overpass | NB | 5:11 PM | |
| Rear end | 224.94/Just south of 136th overpass | NB | 5:13 PM | |
| Sideswipe | 219.57/Just south of Thornton Parkway overpass | SB | 10:26 PM | |

Of the six crashes, five occurred during the morning and evening peak periods, potentially exacerbating congested conditions. Though no direct observations of I-25 were conducted on this particular day, it is evident from the records that these crashes could have had an effect on traffic flows, activating non-recurring congestion.

Upon identifying September 22 as an appropriate day for representing crash-related congestion, the project team repeated the bottleneck analysis performed for the recurring congestion condition, this time analyzing the selected day for comparison with September 28 conditions.

The following sections describe results of the non-recurring congestion analysis, by direction:

<u>Southbound Direction</u>

Using the Doppler speed data, speed readings along the corridor were plotted to determine the location where vehicular traffic slows during the peak period. **Figure 3.4-7** depicts southbound traffic speeds in mph recorded along I-25 starting at approximately 5:00 AM. The data show that vehicular speeds began slowing from free flow conditions near the Thornton Parkway interchange (red line) prior to 6:00 am, coinciding with a crash that happened near 84th Avenue at 5:44 am. The bottleneck caused by this crash extended upstream quickly, reaching north of 120th Avenue by approximately 6:15 am. Speeds dropped to less than 10 mph, compared to roughly 25 mph during recurring congestion. Recovery from the crash was hampered by increasing demand during the AM peak period, and full recovery was not realized until approximately 8:45 am at Thornton Parkway.

**Figure 3.4-8 Southbound I-25 Congestion – AM Peak Period (Non-Recurring Congestion Analysis)**

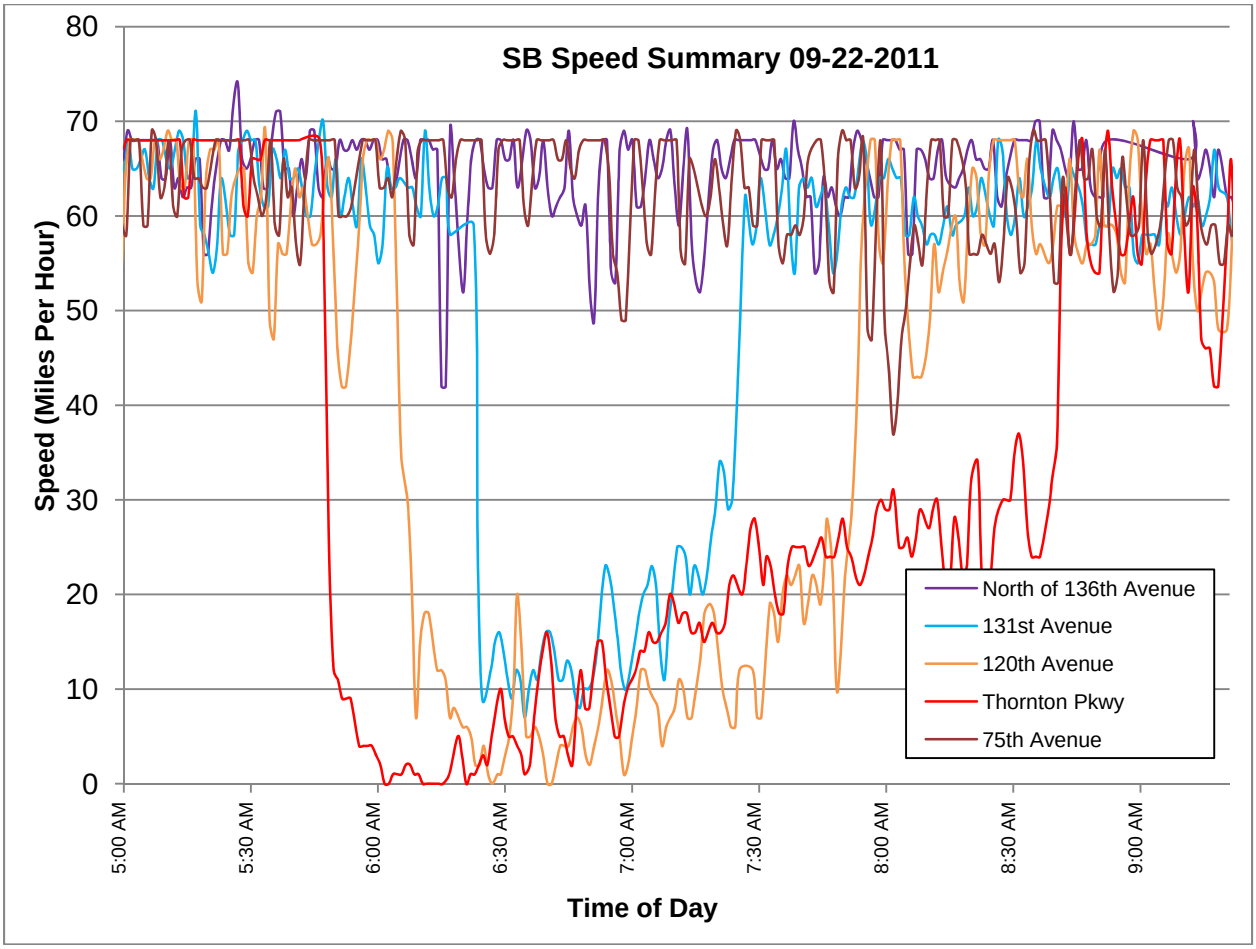



**Table 3.4-5** summarizes the speed reductions experienced during peak periods along southbound I-25 at each Doppler Station. As shown, the speed drop initiated at the Thornton Parkway location, then propagated upstream through 120th Avenue.

**Table 3.4-5 Speed Drops During Congestion – Southbound AM Peak Period (Non-Recurring Congestion Analysis)**

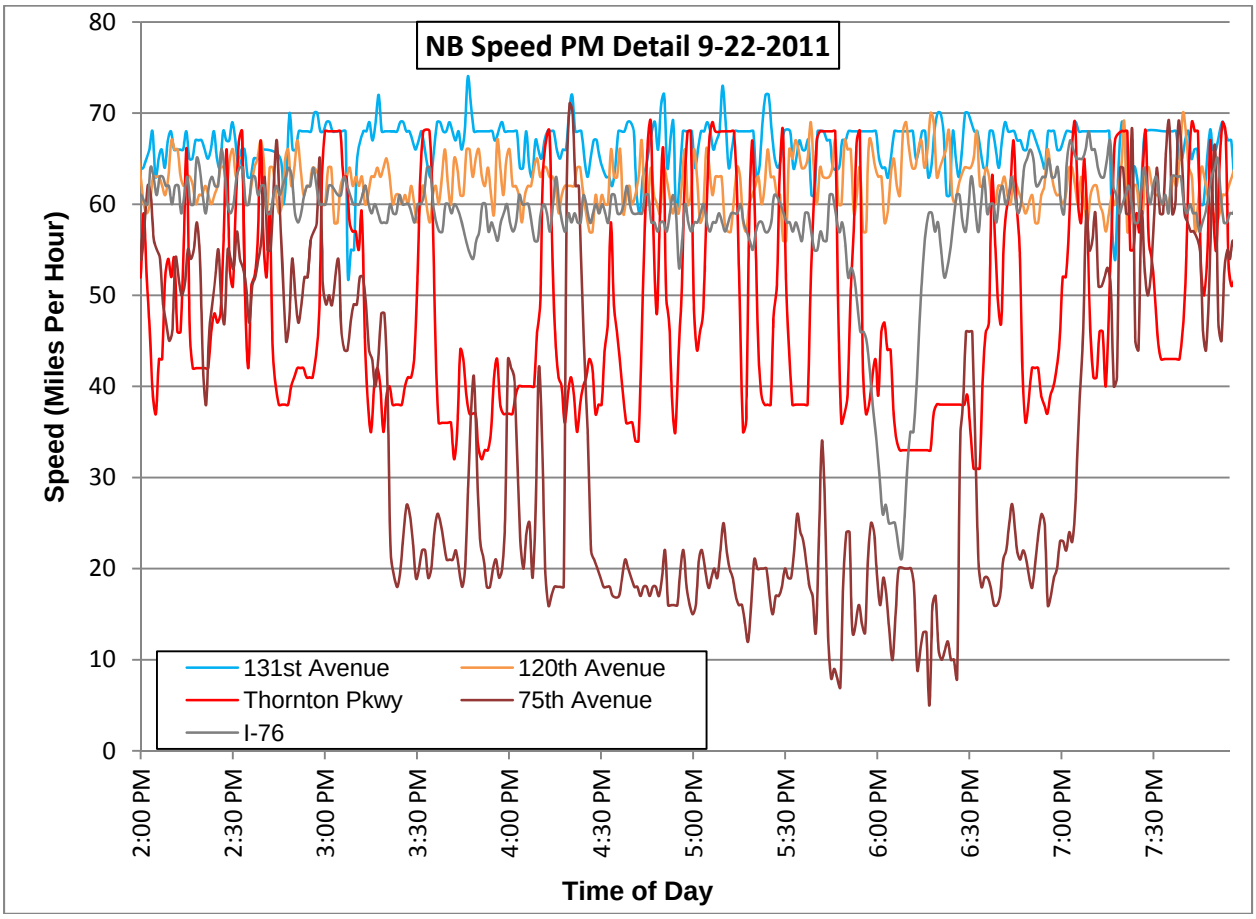
| Doppler Station | Speed Drop During Congestion | Time Speed Drop Begins | Time Speed Drop Ends | Total Duration of Congestion |
|---|---|---|---|---|
| 75th Avenue | 65 mph to 37 mph | 7:57 AM | 8:06 AM | 9 min |
| Thornton Parkway | 65 mph to <5 mph | 5:48 AM | 8:50 AM | 3 hrs, 2 min |
| 120th Avenue | 65 mph to <5 mph | 6:05 AM | 8:00 AM | 1 hr, 55 min |
| 131st Avenue | 65 mph to 15 mph | 6:20 AM | 7:35 AM | 1 hr, 15 min |

In comparison with recurring congestion levels, the occurrence of crashes during the morning peak period increased the depth of congestion, causing speeds to drop below five mph at multiple locations. However, the overall duration of peak congestion decreased. Possible explanations for this include the diversion of drivers away from mainline I-25 to avoid the crash areas or the metering effect of the crashes on traffic volumes. It is evident, however, that the crashes caused a precipitous drop in travel speeds, more so than typically occurs with recurring congestion.

Northbound Direction

The Doppler speed data was again plotted to determine the location where vehicular traffic slowed during the afternoon peak period on September 22. A northbound speed plot starting at approximately 2:00 pm is depicted on **Figure 3.4-8**. The data show that vehicles traveling at free flow speeds slowed down to 20 mph at 75th Avenue (maroon line) beginning at 3:15 pm.

**Figure 3.4-9 Northbound I-25 Congestion – PM Peak Period (Non-Recurring Congestion Analysis)**




The occurrence of an incident in the northbound direction at approximately 5:11 PM at 88th Avenue served to increase congestion in comparison with recurring levels.

**Table 3.4-6** summarizes the speed reductions experienced during peak periods along southbound I-25 at each Doppler Station. As shown, the speed drop initiated at the 75th Avenue location. Later in the peak period, congestion starts farther north, at Thornton Parkway, and extends south beyond the Study Area.

In comparison with recurring congestion levels, the occurrence of crashes during the afternoon peak period added approximately 30 minutes to the duration of congestion on average, increased the portion of I-25 impacted by queueing and dropped speeds below 10 mph as opposed to the 20–25 mph speed typically experienced by I-25 peak period travelers.

**Table 3.4-6 Speed Drops During Congestion – Northbound PM Peak Period (Non-Recurring Congestion Analysis)**

| Doppler Station | Speed Drop During Congestion | Time Speed Drop Begins | Time Speed Drop Ends | Total Duration of Congestion |
|---|---|---|---|---|
| Thornton Parkway | 65 mph to 40 mph | 3:10 PM | 7:15 PM | 4 hrs, 5 mins |
| 75th Avenue | 50 mph to 15 mph | 3:15 PM | 7:15 PM | 4 hrs |
| I-76 | 60 mph to 21 mph | 5:48 PM | 6:17 PM | 29 min |

Based on this simplified comparison, the effects of non-recurring congestion can be substantial within the Study Area. In addition to the bottlenecks experienced on mainline I-25, local streets are burdened with diverting traffic, extending delays to the municipalities adjacent to I-25.

### 3.4.2 I-25 Interchanges

The Study Area includes seven interchanges with cross-street facilities, including a fully directional interchange at the I-25/Northwest Parkway/E-470 junction. **Table 3.4-7** lists the study interchanges, their type and date of construction or reconstruction. As shown in the table, many of the interchanges have been built or rebuilt within the past 10 years.

**Table 3.4-7 I-25 Interchanges in Study Area**

| I-25 Interchange | Type and Date of (re)construction |
|---|---|
| Northwest Parkway/E-470 | Fully directional interchange, constructed in 2003 |
| 144th Avenue | Standard Diamond Interchange, constructed in 2006 |
| 136th Avenue | Standard Diamond Interchange, constructed in 2003 |
| 120th Avenue | Standard Diamond Interchange, reconstructed in 2006 |
| 104th Avenue | Standard Diamond, reconstructed in 2010 |
| Thornton Parkway | Standard Diamond, constructed in 1985 |
| 84th Avenue | Standard Diamond, bridge reconstructed by October 2012 |

Six of the seven I-25 interchanges in the Study Area were analyzed as a part of the North I-25 FEIS, excluding only the fully directional interchange of I-25 with E-470/Northwest Parkway (NWP). This interchange is also excluded from analysis in the North I-25 PEL, as no improvements are anticipated to this interchange.

The SH 7/I-25 interchange is not listed in **Table 3.4-7** because this interchange is being analyzed in the ongoing State Highway 7 PEL project. Coordination efforts will ensure that analyses and alternatives proposed as a part of the SH 7 PEL will be reflected in this study.

Current operational performance of the interchanges was evaluated based on Year 2006 Level of Service (LOS) Analyses reported in the North I-25 FEIS. Where appropriate, the analyses were updated to reflect changes since the Year 2006. **Table 3.4-8** provides a listing of the interchanges and LOS results. All ramp terminal intersections analyzed currently operate at LOS D or better during peak hours.

**Table 3.4-8 Existing Interchange Ramp Terminal Intersection Levels of Service**

| Interchange | AM/PM Peak Hour Intersection Level of Service | | | |
|---|---|---|---|---|
| | Northbound Ramps | | Southbound Ramps | |
| | FEIS Document | Updated for PEL | FEIS Document | Updated for PEL |
| I-25 /144th Avenue | n/a | B/B | n/a | B/A |
| I-25 /136th Avenue | B/B | B/C | C/C | C/D |
| I-25/120th Avenue | C/C | B/C | B/C | B/B |
| I-25/104th Avenue | C/E | C/C | B/C | C/C |
| I-25/Thornton Parkway | C/C | C/C | C/D | C/D |
| I-25/84th Avenue | D/F | Under Construction | D/E | Under Construction |

### 3.4.3 Arterial Streets

A network of surface streets runs parallel to and crosses mainline I-25 within the Study Area, and the arterials serve a wide variety of trip purposes and lengths. The sub-area current conditions DynusT model being developed for the corridor will incorporate the network of arterials and mainline I-25. Results from the model will allow the project team to identify current capacity constraints along arterials, and quantify the influence of peak period congestion on I-25 on arterial operations. The DynusT modeling effort is currently in progress and results are pending.

To provide an overall picture of arterial operations in the Study Area, the project team calculated volume-to-capacity ratios for key arterial links in the Study Area based on current daily traffic volumes and generalized arterial capacity assumptions based on the number of travel lanes. **Table 3.4-9** depicts the results.

**Table 3.4-9 Current Arterial Volume-to-Capacity Ratios**

| Arterial | Location | Daily Volume (Vehicles Per Day) | Estimated Capacity | Volume-to-Capacity Ratio |
|---|---|---|---|---|
| Washington Street | s/o Thornton Pkwy | 25,200 | 32,000 | 0.79 |
| | n/o Thornton Pkwy | 27,400 | 32,000 | 0.86 |
| | s/o 128th Avenue | 18,900 | 32,000 | 0.59 |
| | n/o 144th Avenue | 4800 | 16,000 | 0.30 |
| Huron Street | s/o 88th Avenue | 14,300 | 32,000 | 0.45 |
| | n/o Thornton Pkwy | 17,200 | 32,000 | 0.54 |
| | n/o 120th Avenue | 24,500 | 32,000 | 0.77 |
| | n/o 144th Avenue | 8200 | 16,000 | 0.51 |
| Pecos Street | n/o 84th Avenue | 17,900 | 32,000 | 0.56 |
| | n/o 92nd Avenue | 10,000 | 16,000 | 0.63 |
| 84th Avenue | w/o I-25 | 33,300 | 32,000 | 1.04 |
| 88th Avenue | e/o I-25 | 11,300 | 32,000 | 0.35 |
| Thornton Pkwy | w/o I-25 | 25,100 | 48,000 | 0.52 |
| | e/o I-25 | 37,400 | 48,000 | 0.78 |
| 104th Avenue | e/o I-25 | 51,600 | 48,000 | 1.10 |
| 112th Avenue | w/o Huron St | 15,900 | 32,000 | 0.50 |
| 120th Avenue | w/o I-25 | 56,600 | 48,000 | 1.18 |
| | e/o I-25 | 50,300 | 48,000 | 1.05 |
| 128th Avenue | Across I-25 | 9300 | 16,000 | 0.58 |
| 136th Avenue | w/o I-25 | 22,600 | 32,000 | 0.71 |
| | e/o I-25 | 25,200 | 32,000 | 0.79 |
| 144th Avenue | w/o I-25 | 15,400 | 32,000 | 0.48 |
| SH 7 | w/o I-25 | 20,900 | 16,000 | 1.31 |

A Volume-to-Capacity (V/C) ratio exceeding 1.0 indicates that the current daily traffic level is exceeding the estimated roadway capacity. As shown in the table, there are a number of locations currently operating at or above capacity, including SH 7 west of I-25, 120th Avenue on both sides of I-25, 84th Avenue west of I-25 and 104th Avenue east of I-25. Huron Street appears to possess some reserve capacity in comparison with Washington Street.

## 3.5 *Traffic Safety Review*

The project team conducted a traffic safety review to highlight safety problems along I-25 identified in previous safety assessments and provide safety analyses at locations not analyzed previously. The safety review includes the following items:

- A summary of the applicable findings from the previous safety assessment reports completed along the corridor
- Assessment of the magnitude and nature of the safety problem within the study limits

- Relation between crash causality and roadway geometrics, roadside features, traffic control devices, traffic operations, driver behavior and vehicle type
- Suggestion of cost-effective counter measures to address identified problems and guidance on how to maximize crash reduction

The safety analysis and review utilized the most recent crash data (January 2008 to December 2010) as well as recently completed safety assessment reports along the I-25 corridor.

### Safety Review Location

As mentioned, the safety analysis addresses a section of Interstate 25 beginning at MP 217.00 (at the interchange with US 36) and extending to MP 229.11 which is in the vicinity of the interchange with SH 7. The direction of increasing milepost (primary direction) for I-25 is northbound. In addition to the two interchanges at each end of the study corridor, there are several other interchanges along the corridor which include 84th Avenue, Thornton Parkway, 104th Avenue, 120th Avenue, 136th Avenue, 144th Avenue and E-470.

### Corridor Safety Conditions and Sectioning

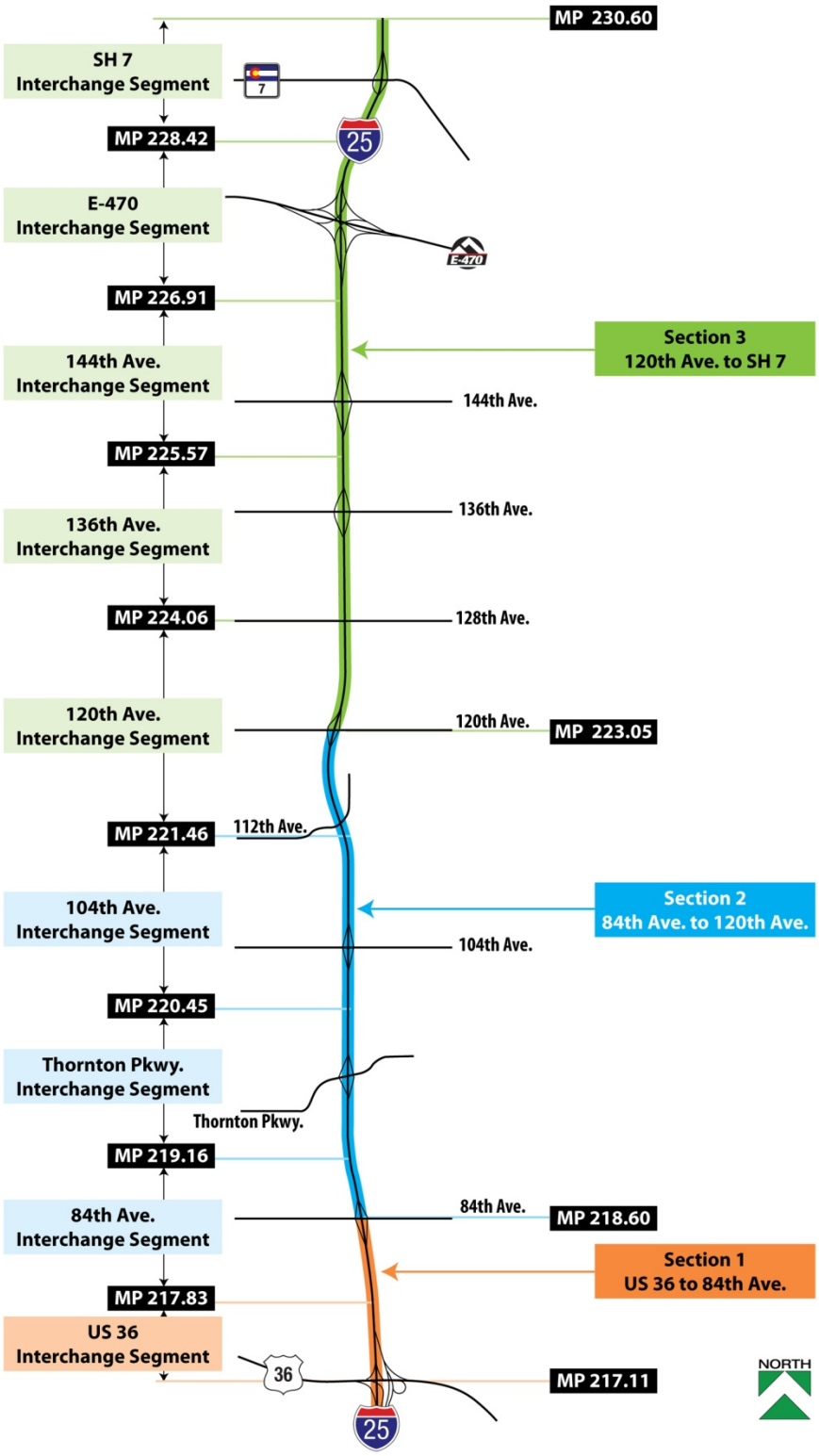
According to CDOT records, the 2009 average annual daily traffic (AADT) on I-25 was approximately 174,000 vpd at the south end of the corridor and 86,000 vpd at the north end of the corridor. As a percentage of the total vehicular traffic volume, the average truck volume across the section is between 8 and 13 percent.

The I-25 corridor is an Urban 8-Lane Freeway on the south end and an Urban 6-Lane Freeway on the north end. The study corridor has been broken down into three main sections, two of which have been studied in previous CDOT safety assessment reports. These three sections are:

- **Section 1**: US 36 to 84th Avenue – Crash experience studied in a September 2011 report titled Safety *Assessment Report State Highway 25A and 36B Highway Resurfacing MP 217.11 to MP 218.60 MP 56.50 to MP 57.25*
- **Section 2**: 84th Avenue to 120th Avenue – Crash experience studied in a December 2004 report titled *Safety Assessment Report I-25, MP 218.46 to MP 223.05*
- **Section 3**: 120th Avenue to SH 7 – No applicable safety study available

The findings of the previously completed safety analyses for the first two sections have been reviewed and included in this review. A new analysis has been conducted for the portion of the study corridor north of 120th Avenue. As part of this new analysis Section 3 has been divided into sub segments that are associated with each of the interchanges along the corridor. This is the same method used to subdivide Sections 1 and 2 in the previously completed safety assessment reports. The sectioning and interchange sub segments for the PEL corridor can be seen on **Figure 3.5-1** on the following page.

**Figure 3.5-1 Corridor Safety Analysis Segments**



The sub segments to Section 3 include:

- 120th Avenue interchange
- 136th Avenue interchange
- 144th Avenue interchange
- E-470 interchange
- SH 7 interchange

The results of the previous two studies as well as the new analyses are discussed in more detail in the following sections.

### 3.5.1 Crash History and Problem Analysis

Crash history for a three-year period, January 1, 2008 through December 31, 2010, was examined to locate crash clusters and identify crash causes. For the two southern sections on the corridor, the crash patterns from this new listing were compared to the crash patterns reported in the previous safety assessment report. This was done to confirm the applicability of the previous reports.

**Table 3.5-1** summarizes the existing crash patterns on mainline I-25 over the three-year study period and provides a comparison to the applicable previous safety studies. Of note, the years that previous crash data came from are also presented in this table.

**Table 3.5-1 Comparison of Crash Listing Patterns**

| Crash Type | Section 1: US 36 to 84th (MP 217 to MP 218.60) | | Section 2: 84th to 120th (MP 218.60 to MP 223.05) | | Section 3: 120th to SH 7 (MP 223.05 to MP 230.60) | |
|---|---|---|---|---|---|---|
| | Previous (2007–2009) | Current (2008–2010) | Previous (2000–2002) | Current (2008–2010) | Previous | Current (2008–2010) |
| Rear End | 53% | 58% | 59% | 64% | N/A | 32% |
| Sideswipe Same | 25% | 22% | 12% | 14% | N/A | 19% |
| Fixed Object | 17% | 13% | 17% | 16% | N/A | 32% |
| All Others | 5% | 7% | 12% | 6% | N/A | 17% |
| Use for PEL | Previous Safety Study | | Previous Safety Study | | New Analysis | |

As can be seen in this table, for the two southern sections where previous safety assessment reports exist, the current crash patterns are very similar to the previously reported crash patterns. The largest difference is the proportion of rear end crashes which are approximately 5 percent higher in the current listing than what was shown in previous reports. This is not unexpected due to the fact that as traffic volumes grow the number of rear end crashes also typically grow. Based on the similarity of crash patterns between the previous safety studies and the current crash listing, the findings of the previous safety reports are assumed to be valid and will be utilized in this review.

#### 3.5.1.1 Safety Performance Function Analysis

The assessment of the magnitude of safety problems on select highway sections has been refined through the use of Safety Performance Function (SPF) methodology. The SPF reflects the complex relationship between exposure (measured in ADT) and the crash count for a section of roadway measured in accidents per mile per year (APMPY). The SPF models provide an estimate for the expected crash frequency for each interchange influence area, for a range of ADT, among similar facilities. SPF functions are limited to mainline crashes only and as such do not include crashes that occur on ramps.

Development of the SPF lends itself well to the conceptual formulation of the Levels of Service of Safety (LOSS). The concept of level of service uses qualitative measures that characterize safety of a roadway segment in reference to its expected performance and severity. If the level of safety predicted by the SPF will represent a normal or expected number of crashes at a specific level of ADT, then the degree of deviation from the norm can be stratified to represent specific levels of safety.

LOSS-I – Indicates low potential for crash reduction

LOSS-II – Indicates better than expected safety performance

LOSS-III – Indicates less than expected safety performance

LOSS-IV – Indicates high potential for crash reduction

SPF analyses have been completed for each of the corridor Sections and are discussed in more detail in the following sections.

Of note, for the two previously studied sections on the south end of the corridor, the majority of the SPF sub segments were LOSS II which indicates better than expected safety performance. The only exception was the 84$^{th}$ Avenue interchange segment which is in the LOSS III category, indicating a less than expected safety performance.

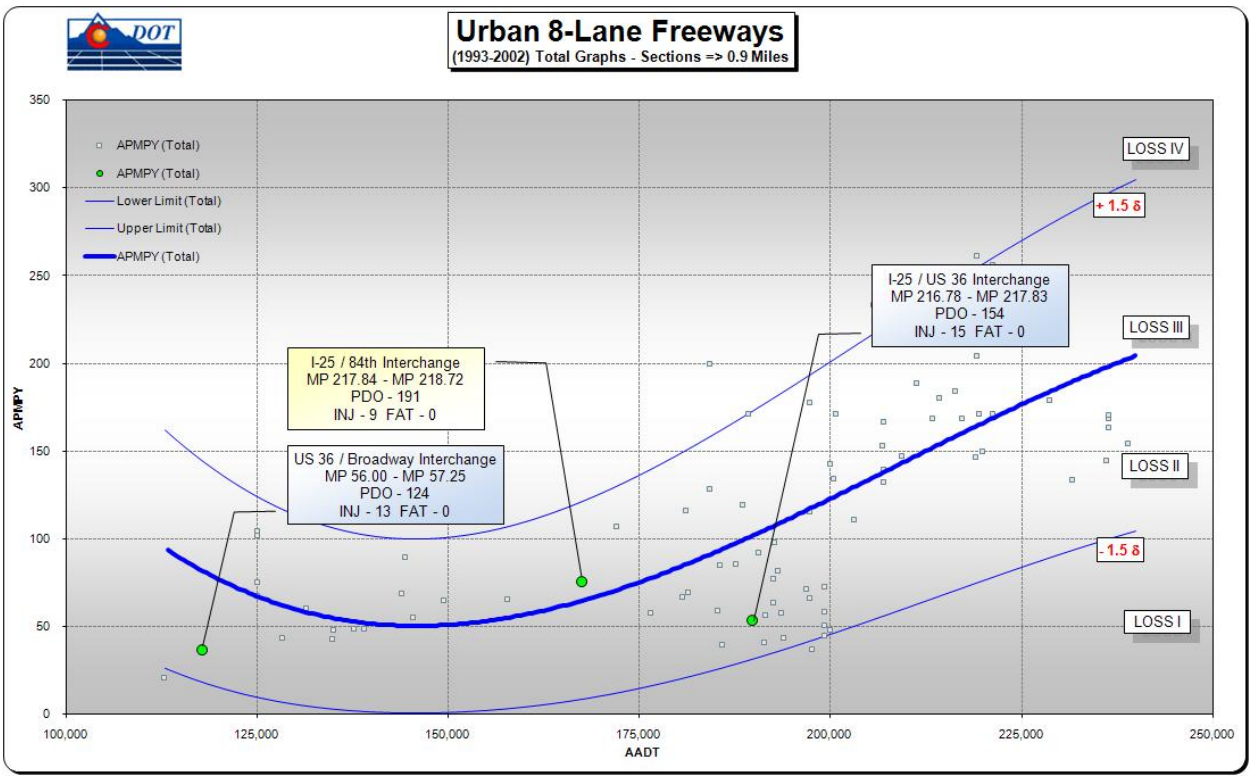
### 3.5.2 I-25 Section Crash History (US 36 to SH 7)

The following sections provide a brief summary of the crash patterns along the PEL study corridor.

#### 3.5.2.1 Section 1 Crash History (US 36 to 84th Avenue)

As mentioned, the southern portion of the corridor is an urban 8-Lane freeway. Data for three years of crash history for each interchange sub segment have been plotted for evaluation on the SPF figure below. This SPF analysis was taken from the September 2011 safety assessment report competed for this Section is shown on **Figure 3.5-2**, which was originally presented in the September 2011 report, depicts the total crash SPF based on the given crash data.

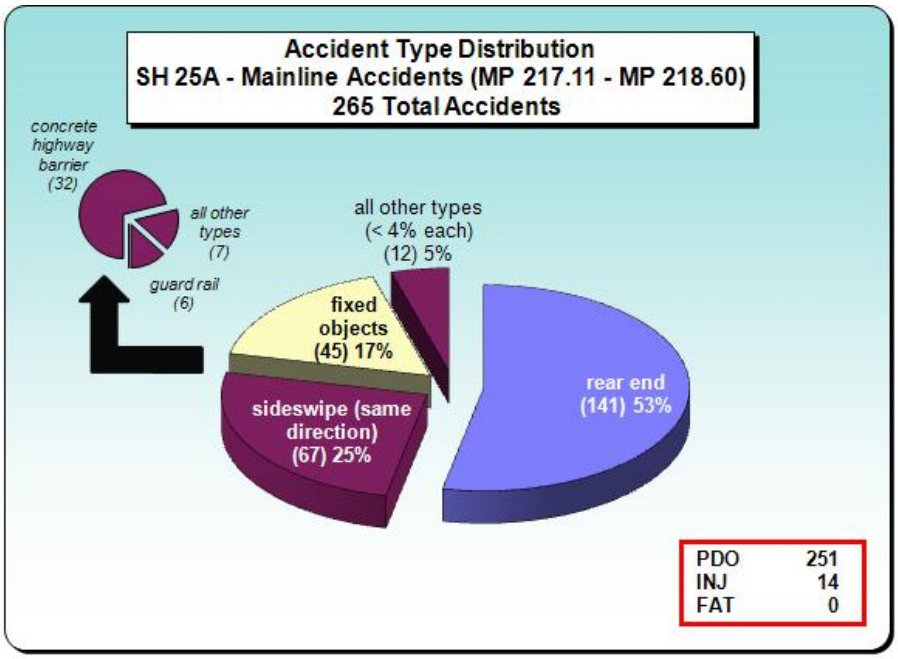
**Figure 3.5-2 Section 1 Safety Performance Function Plot**




As can be seen, the SPF segment for the I-25/US 36 interchange is below the average expected crash rate for the given AADTs. This places the SPF segment in the LOSS II category, which indicates better than expected safety performance. However, the SPF segment for the I-25/84th Avenue interchange is above the average expected crash rate for the given AADTs. This places the SPF segment in the LOSS III category, which indicates less than expected safety performance and an opportunity to reduce the number of crashes on this segment.

During the three-year period analyzed for Section 1 (MP 217.11 to MP 218.60) in the previous safety assessment study it was found that the proportion of rear end, sideswipe (same direction) and concrete highway barrier crashes were higher than expected on mainline I-25. **Figure 3.5-3** shows the crash distribution chart provided in that previous study for mainline I-25

**Figure 3.5-3 Section 1 Crash Distribution Chart**




In general, it was found that the rear end and sideswipe type crashes coincided with the AM (southbound predominantly) and PM (northbound predominantly) peak hours. It was also found that the sideswipe crashes were primarily related to weaving / lane changes between US 36 and 84th Avenue. With regard to the concrete barrier crashes, it was found that they primarily occurred at night but that the barrier prevented a more serious crash from occurring.

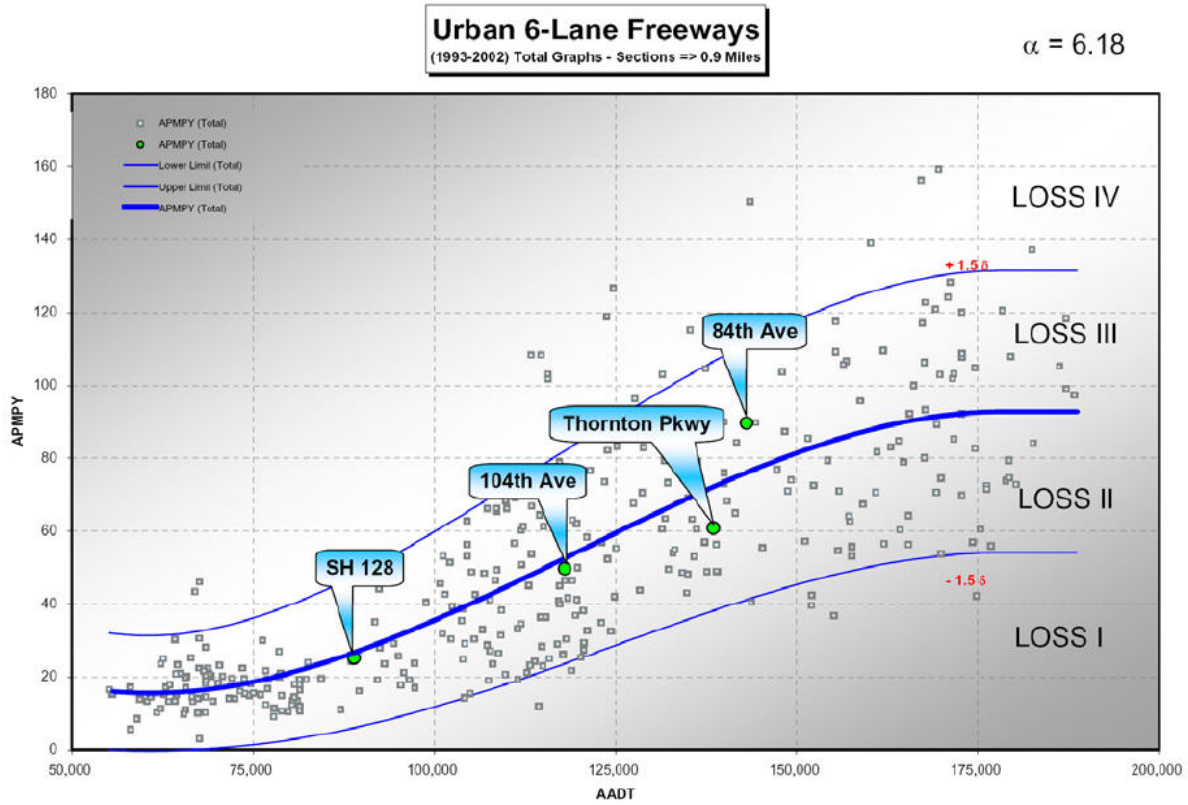
As a part of this previous study, ramp crashes were also reviewed for the US 36 interchange. The 84th Avenue interchange is covered in more detail in the Section 2 discussion. Overall, it was found that only two of the ramps at the US 36 interchange had a pattern in need of correction. The following provides a summary of the correctable crash patterns:

- The first ramp was Ramp C which is the HOV ramp to/from US 36. This ramp was found to have a higher than normal occurrence of barrier crashes. These crashes typically occurred due to excessive travel speeds on this ramp which resulted in the vehicle losing control and striking the barrier.
- The second ramp with an identified crash problem was Ramp D which the SB I-25 to WB US 36 ramp. This ramp was found to have a run-off-road crash type problem. As with Ramp C it was found that vehicles lost control due to travel speed as they attempted to traverse the curve in Ramp D. In addition to the run-off road crash problem, multiple rear-end crashes were noted due to the presence of a signalized intersection at the ramp terminal.

### 3.5.2.2 Section 2 Crash History (84th Avenue to 120th Avenue)

Section 2 of the PEL corridor is an Urban 6-Lane Freeway. Data for three-years of crash history for each interchange sub segment have been plotted for evaluation on the SPF figure below. This SPF analysis was taken from the December 2004 safety assessment report completed for this Section. **Figure 3.5-4**, which was originally presented in the December 2004 report, depicts the total crash SPF based on the given crash data.

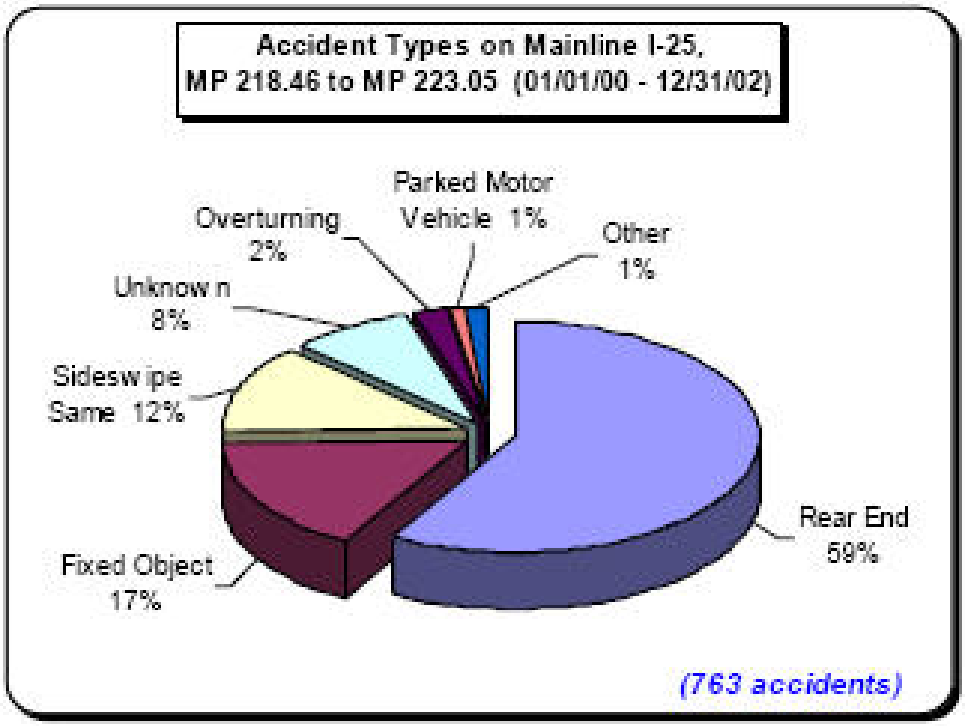
**Figure 3.5-4 Section 2 Safety Performance Function Plot**




As can be seen, the SPF segments for the Thornton Parkway, 104th and 120th Avenue interchanges are below the average expected crash rate for the given AADTs. This places these SPF segments in the LOSS II category, which indicates better than expected safety performance. However, the SPF segment for the I-25/84th Avenue interchange is above the average expected crash rate for the given AADTs. This places the SPF segment in the LOSS III category, which indicates less than expected safety performance and an opportunity to reduce the number of crashes on this segment.

During the three-year period analyzed in the previous safety assessment study for Section 2 (MP 218.46 to MP 223.05) it was found that the proportion of rear end and barrier / rail crashes were higher than expected on mainline I-25. **Figure 3.5-5**, also taken from the December 2004 study, shows the crash distribution chart provided in that study for mainline I-25.

**Figure 3.5-5 Section 2 Crash Distribution Chart**




Based on a review of the data, it was found that the rear end crashes were primarily in the southbound direction and were related to the congestion experienced on I-25 during the morning peak hour. The barrier and rail crashes were also found to be mostly in the southbound direction and were typically caused by a combination of the downhill grade on I-25 and freeway congestion. Southbound vehicles typically swerved to avoid the back of the queue and struck either a barrier or guard rail.

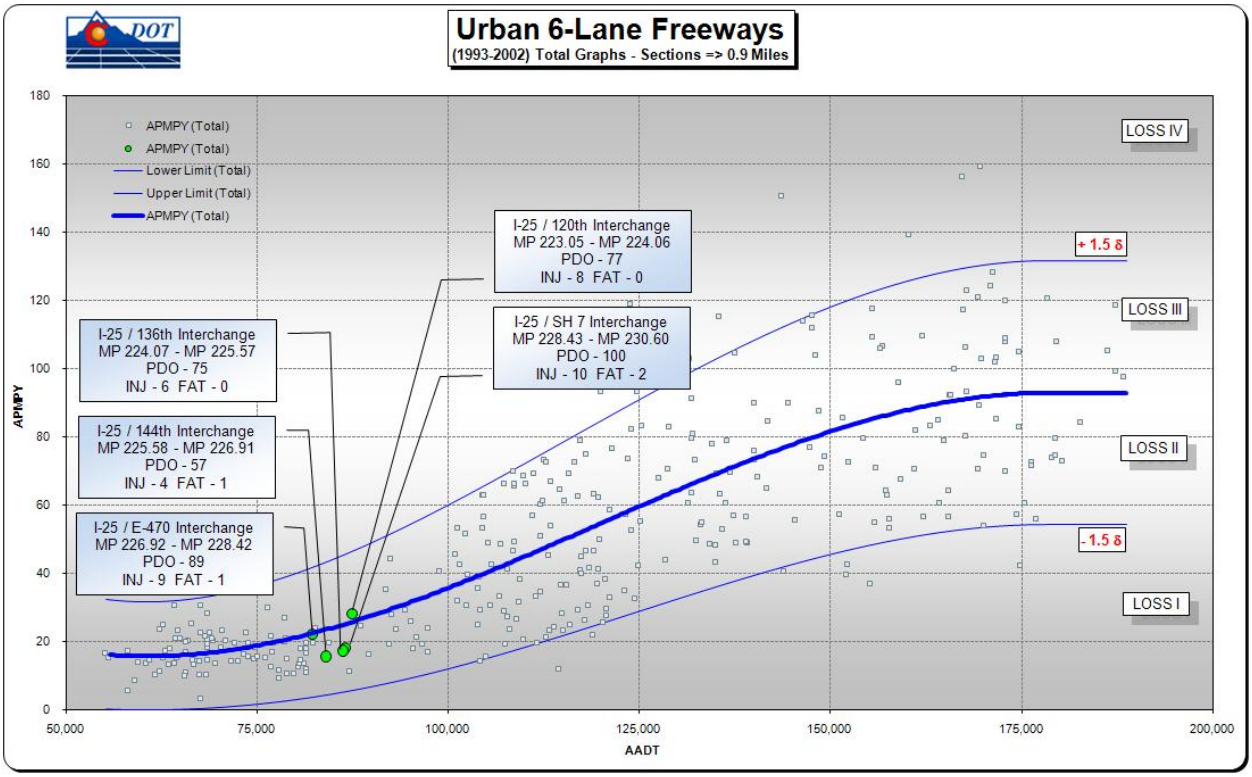
As with Section 1, ramp crashes were also reviewed as part of the previous safety assessment study for Section 2. The following ramps were identified to have higher than expected crash occurrences:

- Higher than normal occurrence of rear end crashes
  - 84th Avenue southbound off ramp which is likely caused by congestion
  - 120th Avenue / southbound I-25 ramp terminal
- Higher than normal occurrence of approach turn crashes
  - 84th Avenue / northbound I-25 ramp terminal
  - Thornton Parkway / northbound I-25 ramp terminal
  - 120th Avenue / northbound I-25 ramp terminal
- Higher than normal occurrence of sideswipe (same direction) crashes
  - 104th Avenue / southbound I-25 ramp terminal

#### 3.5.2.3 Section 3 Crash History (120th Avenue to SH 7)

As mentioned previously, the northern section of the PEL study corridor is an Urban 6-Lane Freeway. Data for three years of crash history on each sub segment of Section 3 has been plotted for evaluation on the SPF figure below. **Figure 3.5-6** depicts the total crash SPF for Section 3 on I-25 based on the given crash data.

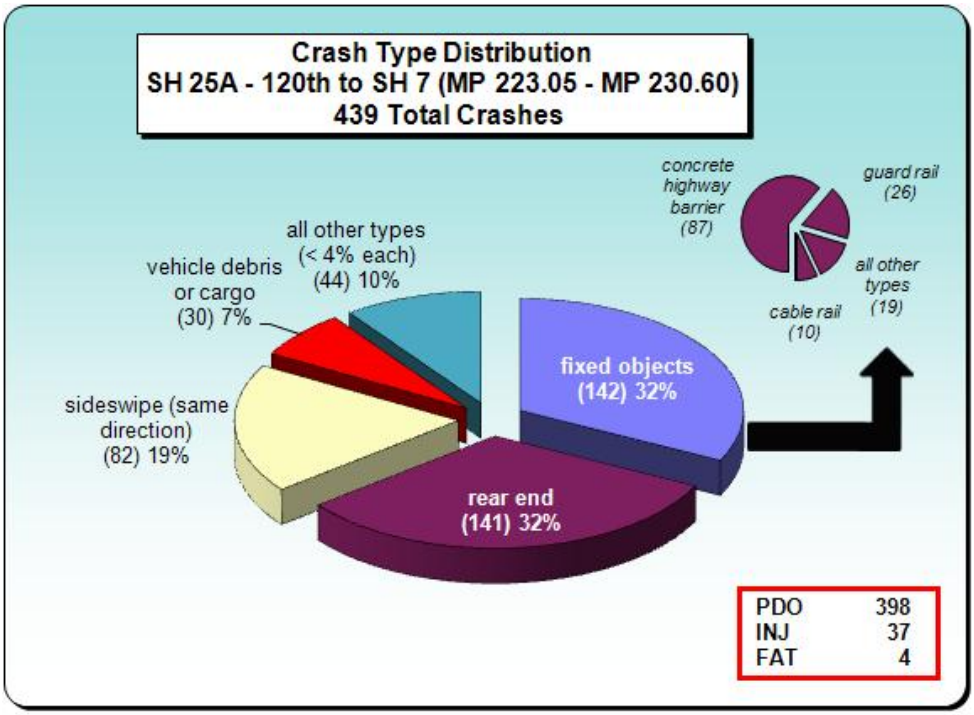
**Figure 3.5-6 Section 3 Safety Performance Function Plot**




As can be seen, the SPF points for the majority of the sub segments are at or below the average expected crash rate for the given AADTs. This places these SPF segments in the LOSS II category, which indicates better than expected safety performance. However, the SPF segments for the I-25/120th Avenue interchange is slightly above the average expected crash rate for the given AADTs. This places the SPF segment in the LOSS III category, which indicates less than expected safety performance and an opportunity to reduce the number of crashes on this segment.

During the three-year period newly analyzed for this study for Section 3 (MP 223.05 to MP 230.60) it was found that the proportion of rear end and concrete highway barrier/rail crashes were higher than expected on mainline I-25. **Figure 3.5-7** shows the crash distribution chart developed for mainline I-25.

**Figure 3.5-7 Section 3 Crash Distribution Chart**




In general, it was found that the rear end type crashes coincided with the AM (southbound predominantly), midday (northbound predominantly) and PM (both directions) peak hours. With regard to the concrete barrier / rail crashes, it was found that they primarily occurred in inclement road conditions (nearly 60%) and at night (about 50 percent). However, the barrier typically prevented a more serious crash from occurring.

Similar to the previous two sections, ramp crashes were also reviewed for each of the interchanges. The following provides a summary of the correctable crash patterns at each of the interchanges along Section 3:

- The number of broadside crashes is higher than expected at the following three locations: 144th Avenue/northbound I-25 ramp terminal and both ramp termini at the SH 7 interchange.

### 3.5.3 Safety Analysis Summary

The conclusions and recommendations of this analysis are based on the two previously completed safety assessment reports for Sections 1 and 2 and a newly completed analysis for Section 3. As previously mentioned, the existing crash listing for Sections 1 and 2 were compared to the crash listings utilized in the previous safety assessments to confirm the validity of the previous reports. This comparison can be seen earlier in **Table 3.5-1**. Of note, all safety analyses contained within this document are based on three years of crash history.

Based on SPF analysis, the LOSS for the various interchange segments through the corridor are at Level II and Level III with the 84th Avenue interchange as the only segment clearly in the LOSS III category. As previously discussed, LOSS II indicates better than expected safety performance while LOSS III indicates less than expected safety performance.

Based on the crash analyses and review completed for the three Sections along the PEL corridor, several improvements have been recommended. The following summarizes the recommended improvements from the previous two safety assessment reports for Sections 1 and 2 as well as the new recommendation developed for Section 3.

Mainline I-25 (All Three Sections)

- Resurfacing and restriping of the pavement with highly reflective materials would help to improve skid resistance and delineation throughout the corridor.
- Consideration should be given to replacing all delineator post reflector buttons, rail reflector tabs and installing linear barrier delineation to provide better and consistent nighttime delineation throughout the corridor. The linear barrier delineation should be placed on all ramp curves as well.
- Consider replacing damaged median barrier and guard rail as the barrier and rails may not perform as designed when damaged.
- Consider using “Safety Edge” methods when paving the shoulders where the guardrail is not against the paved shoulder to help make it easier for vehicles to reenter the roadway in a controlled manner.

In addition to corridor wide mainline crashes, there are several other locations of higher than expected crash concentration and severity throughout the study corridor. These locations generally coincide with interchange ramps or ramp terminals. The following recommendations are made with respect to these locations. Of note, several of the higher than expected crash locations at ramps and ramp termini on Section 2 have been addressed since the completion of the safety assessment report for Section 2 and have not been mentioned in the summary below.

**I-25 US 36 Interchange Ramps**

*Ramp C – HOV Ramp to / from US 36*

- Consideration should be given to placing chevrons (W1-8) through the curve in both directions to provide additional warning for drivers.

*Ramp D – SB I-25 to WB US 36*

- Consideration should be given to installing a concrete barrier on the outside of the curve along with chevrons (W1-8) through the curve to prevent drivers from leaving the ramp while also providing additional warning.

**I-25/84th Avenue Interchange**

- Consider protected only left turn signal phasing for eastbound left at northbound I-25 ramp terminal. This could help to reduce the number of approach turn crashes.

**I-25/Thornton Pkwy Interchange**

- Consider protected only left turn signal phasing for eastbound left at northbound I-25 ramp terminal. This could help to reduce the number of approach turn crashes.

**I-25/144th Avenue Interchange**

- At the northbound I-25 ramp terminals, consider verifying that the existing yellow/red clearance intervals are sufficient for eastbound / westbound through vehicles on 144th Avenue. In addition, consideration should be given to moving the existing stop bar on the eastbound approach of 144th closer to the northbound I-25 ramp.

**I-25/SH 7 Interchange**

- At both ramp termini, consider reviewing existing yellow / red clearance intervals to ensure they are sufficient.

## 3.6 Transit Conditions

### 3.6.1 Background

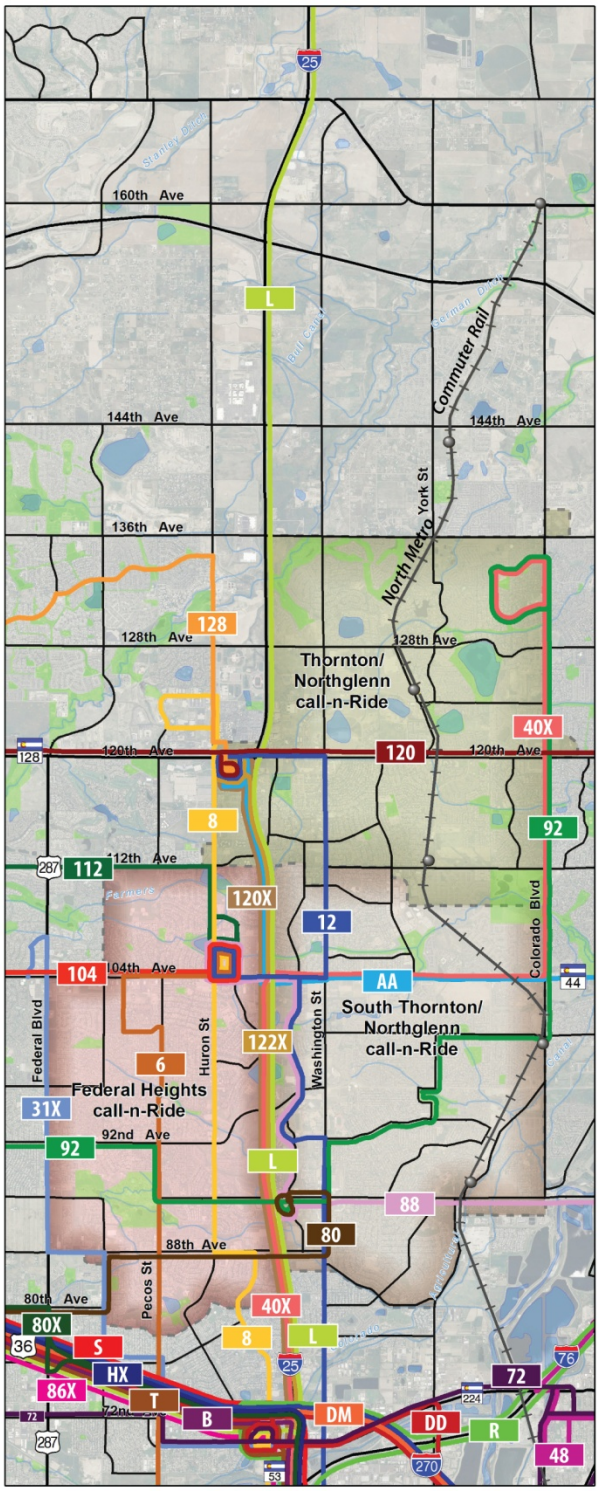
Transit service within the North I-25 PEL Study Area is provided by the RTD. RTD provides public transportation options to residents in the eight-county Denver metro area. Services within the I-25 PEL Study Area include local, commuter, and regional bus service, Access-a-Ride, and call-n-Ride. Transit routes summarized for this study include routes which provide north-south service within the Study Area. There are many east-west routes within the Study Area which provide transit service intersecting and interacting with these identified north-south routes. **Figure 3.6-1** provides all of the routes currently operated by RTD in the study corridor.

Park-n-Rides

The Study Area includes three park-n-Rides operated by RTD. These lots are described below including routes providing service, the parking capacity at each, and historic percent use of the lots.

- Wagon Road – This park-n-Ride is located at 120th Avenue and Huron Street and provides service to Routes 8, 12, 120, 120X, 122X, 128, and AA. The parking capacity at this lot is 1540 vehicles and the historic percent use of the lot is 92 percent of capacity; parking demand for this facility exceeds the current parking supply.
- 104th & Washington – This park-n-Ride is located at 104th Avenue and Washington Street and provides service to Routes 12, 40X, and AA. The parking capacity at this lot is 73 vehicles and the historic percent use of the lot is 55 percent of capacity.
- Thornton – This park-n-Ride is located at I-25 and 88th Avenue and provides service to Routes 80, 88, 92, 120X, and 122X. The parking capacity at this lot is 817 vehicles with parking located on both sides of I-25. The historic percent use of the lot is 63 percent of capacity. Observations of this park-n-Ride indicate that the demand for parking on the east side exceeds the current parking supply.

## Figure 3.6-1 Existing Transit Routes




LEGEND

- 80X = West 80th Express
- 104 = 104th Ave.
- 120 = 120th Ave. / Brighton
- HX = 28th St. / Civic Center
- 72 = 72nd Ave.
- 80 = 80th Ave. - 80
- 92 = 92nd Ave. - 92
- DM = Boulder / Anschutz-Fitzsimons
- DD = Boulder / Colorado Blvd.
- AB = Boulder / DIA
- B = Boulder / Denver
- T = Boulder / Greenwood Plaza
- R = Brighton / Denver
- 128 = Broomfield / Wagon Rd.
- S = Denver / East Boulder
- 12 = Downing St.
- 48 = East 48th Ave. / Commerce City
- 6 = E. 6th Ave. / North Pecos
- L = Longmont Denver
- 8 = North Broadway / Huron
- 40X = North Colorado Express
- 31X = North Federal Express
- 88 = Northglenn / Commerce City / Stapleton
- 122X = Wagon Rd. / Civic Center Express
- AA = Wagon Rd. / DIA
- 120X = Wagon Rd. / Thornton Express
- 112 = West 112th Ave.
- 86X = Westminster Center Express
- = Federal Heights call-n-Ride
- = South Thornton / Northglenn call-n-Ride
- = Thornton / Northglenn call-n-Ride

NORTH

## Bus Service

The study corridor includes local, commuter, and regional bus services serving a variety of corridors and destinations. The transit routes chosen for inclusion in the below discussion each provide substantial north-south service within the Study Area; as a result, these routes have the potential for attracting trips from the I-25 corridor and reducing overall net travel demand on the interstate within the Study Area. These transit routes are described below including the service routing and major destinations, operating characteristics, and historic ridership.

**Route AA Wagon Road/DIA** – This is a skyRide route that operates along I-25 between the Wagon Road park-n-Ride at 120th Avenue south to 104th Avenue before heading east to Denver International Airport via 104th Avenue with interim stops including the 104th Avenue & Washington park-n-Ride and the 104th Avenue & Revere Parkway park-n-Ride. Daily this route operates at one-hour headways.

**Route L Longmont/Denver** – This is a series of regional routes that operate between Longmont and Downtown Denver. The routes all originate near the intersection of SH 66 and US 287 and end in Downtown Denver. This route consists of four separate route patterns to provide timely service between the two cities including the Routes L and LX which use US 287, US 36, and I-25 to reach downtown, and Route LNX and LSX which I-25 to reach downtown. Daily this route operates with increased frequency during the morning period in the southbound direction and during the afternoon period in the northbound direction to serve commuters originating from Longmont and surrounding areas. During the peak of operations the route operates at approximately ten minute headways and during the off-peak of operations the route operates at approximately one hour headways.

**Route 6 East 6th Avenue/North Pecos** – This is a CBD local route that operates along Pecos Street between 106th Avenue and 38th Avenue before providing service in downtown Denver and then proceeding down 6th Avenue terminating at the Aurora Municipal center at Alameda Avenue and Sable. Daily this route operates at 30-minute headways.

**Route 8 North Broadway/Huron** – This is a CBD local route that operates along Huron Street between 120th Avenue and 84th Avenue before using Broadway and Fox Street to connect into downtown Denver. This route has interim stops along the I-25 corridor including the Wagon Road park-n-Ride and 70th Avenue & Broadway park-n-Ride. Daily this route operates at 30-minute headways and one hour headways during peak and off-peak periods, respectively.

**Route 12 Downing Crosstown** – This is a CBD local route that operates along Washington Street between 120th Avenue and I-70before using Downing Street to connect into downtown and continuing south eventually terminating at the Englewood Station at Hampden Avenue and Santa Fe. This route has interim stops along the I-25 corridor including the Wagon Road park-n-Ride and 104th Avenue & Washington park-n-Ride. Daily this route operates at 15-minute headways during the morning peak period, 30-minute headways during the afternoon peak periods, and at one hour headways during off peak periods.

**Route 88 Thornton/Commerce City** – This is a suburban local route that operates between the Northglenn Marketplace (located at I-25 & 104th Avenue) and the Stapleton park-n-Ride. Within the I-25 study corridor, this route parallels I-25 between 104th Avenue and 88th Avenue along Grant Street before traveling 88th Avenue to the east to provide local service within Commerce City. This route has interim stops along the I-25 corridor including the Thornton park-n-Ride. This route operates at 30-minute headways during the daytime with one hour headways during the evening service period.

**Route 120X Thornton/Wagon Road Express** – This is an express route that begins at the Wagon Road park-n-Ride and operates along I-25 connecting to downtown Denver near Denver Union Station. This route has one interim stop at the Thornton park-n-Ride. Service along the corridor is provided at varied headways during the day with minimum headways of five minutes during the peak periods and up to one-hour headways during the off-peak late night hours.

**Route 122X Wagon Road/Civic Center Express** – This is an express route that begins at the Wagon Road park-n-Ride and operates along I-25 connecting to downtown Denver and providing local service in the downtown core. This route has one interim stop at the Thornton park-n-Ride. This route only operates in the southbound direction during the morning peak period and in the northbound direction during the afternoon peak period with five to twenty minute headways during the service period.

**Route 128 Broomfield/Wagon Road** – This is a suburban local route that operates between the Wagon Road park-n-Ride and the US 36 & Broomfield park-n-Ride. Within the I-25 study corridor, this route parallels I-25 between 120th Avenue and 136th Avenue along Huron Street before traveling west towards Broomfield and eventually connecting to the US 36 & Broomfield park-n-Ride. This route operates at 30-minute headways during the peak periods with on-hour headways during the off-peak periods.

### Call-n-rides

RTD operates three call-n-Rides in the Study Area. These services are described below including the coverage area and the historic ridership.

**Federal Heights** - Service within this call-n-Ride area is provided Monday-Friday, 5:30 am-7:00pm and the service area is generally bounded by Federal Boulevard to the west, 80th Avenue to the south, I-25 to the east, and 112th Avenue to the north. This Study Area includes one park-n-Ride:

- The Thornton park-n-Ride provides connections to Routes 80, 92, 120X, and 122X. This service was initiated in 2012.
- **South Thornton/Northglenn** –Service within this call-n-Ride area is provided Monday-Friday, 5:30 am-8:00 pm and the service area is generally bounded by I-25 to the west, Coronado Parkway to the south, Colorado Boulevard to the east, and 112th Avenue to the north. This Study Area includes two park-n-Rides: the 104th Avenue/Washington park-n-Ride provides connections to Routes 12, 88, 104, 40X, and AA and the Thornton park-n-Ride provides connections to Routes 80, 92, 120X, and 122X.

**Thornton/Northglenn** - Service within this call-n-Ride area is provided Monday-Friday, 5:30 am-8:00 pm and the service area is generally bounded by Huron Street to the west, 112th Avenue to the south, Colorado Boulevard to the east, and 136th Avenue to the north. This Study Area includes one park-n-Ride: the Wagon Road park-n-Ride provides connections to Routes 8, 12, 120, 128, 120X, 122X, and AA.

**Table 3.6-1** lists the 2010 annual ridership for each the of routes that travel along the corridor and provides a comparison of the number of boarding per hour for each route compared to RTD average for that service type. As shown express routes that serve Wagon Road and connect to downtown Denver (120X and 122X) far exceed RTD's average boardings per hour for express routes. The call-n-Rides and other local services have fewer than average boarding per hour but are within the normal range when compared to other similar services operated by RTD.

### Table 3.6-1 2010 I-25 Corridor Bus Ridership Comparison

| Route | | 2010 Annual Boardings | 2010 Boardings/ Service Hour |
|---|---|---|---|
| **CBD Local** | | | |
| | 6 | 1,087,055 | 26.1 |
| | 8 | 301,955 | 20.3 |
| | 12 | 521,152 | 22.0 |
| RTD CBD Local Average | | NA | 35.9 |
| **Suburban Local** | | | |
| | 88 | 428,344 | 18.3 |
| | 128 | 66,084 | 11.5 |
| RTD Suburban Local Average | | NA | 16.1 |
| **Regional** | | | |
| | L | 309,798 | 18.5 |
| RTD Regional Average | | NA | 23.8 |
| **SkyRide** | | | |
| | AA | 173,831 | 15.0 |
| RTD SkyRide Average | | NA | 18.9 |
| **Express** | | | |
| | 40x | 54,914 | 34.1 |
| | 120x | 637,891 | 53.1 |
| | 122x | 400,795 | 71.0 |
| RTD Express Average | | NA | 41.4 |
| **Call-n-Ride** | | | |
| | Federal Heights | NA | NA |
| | S. Thornton/ Northglenn | 11,835 | 3.0 |
| | Thornton/ Northglenn | 12,787 | 3.3 |
| RTD Call-n-Ride Average | | NA | 4.4 |

NA = Not applicable

## 3.7 Bicycle and Pedestrian Conditions

### 3.7.1 Existing Bicycle and Pedestrian Accommodation

Existing Trail System(s)

There is an extensive network of trails throughout the Study Area, including:

- Coronado Parkway Trail
- Thornton Civic Center Trail
- 104th Avenue Trail
- Farmer's Highline Canal Trail
- Lincoln Street (Northglenn Drive) Trail
- 128th Avenue Trail
- Big Dry Creek Trail
- Quail Creek Trail

I-25 Crossings

Excluding the interchanges, there are eight options for bicyclists and pedestrians to cross I-25 in the Study Area, listed as follows moving south to north:

- Coronado Parkway Trail underpass (south of 88th Avenue)
- 88th Avenue overpass
- Kennedy Street Trail overpass
- Farmer's Highline Canal Trail underpass (south of 120th Avenue)
- 112th Avenue overpass
- 128th Avenue overpass
- Big Dry Creek Trail underpass (132nd Avenue)
- 160th Avenue overpass

Destinations

There are numerous important bicycle and pedestrian destinations along I-25 between Washington and Huron Streets. Several of these destinations are listed as follows.

- RTD park-n-Ride facilities at 88th Avenue and 120th Avenue
  - Retail centers located along I-25 at each interchange
  - Kaplan College
  - Everest College
  - North Star Elementary School and Park
  - Western Hills Elementary School
  - Thornton Civic Center
  - Thornton High School
  - Winburn Park and Vantage Point High School
  - Northglenn Community Center and Rains Park

- Northglenn High School
- Mountain Range High School
- Willowbrook Park

### 3.7.2 Pedestrian and Bicycle Evaluation

Continuity of Regional Trail System

Review of the regional trail system(s) indicates good continuity of trails across multiple municipalities. Points of discontinuity are highlighted as follows:

- The area south of 84th is without trail connections.
- There are a number of trail alignments proposed north of 136th Avenue, but little is currently constructed.

I-25 Crossing Gaps

There are currently crossings of I-25 available between each interchange, with the following exceptions:

- I-25 between US 36 and 84th Avenue
- I-25 between Thornton Parkway and 104th Avenue
- I-25 between 136th and 144th Avenues
- I-25 between 144th and E-470/Northwest Parkway

Pedestrian and Bicycle Access to Destinations/Transit

Access to key destinations along I-25 between Washington and Huron Streets is generally adequate, particularly in the southern portion of the Study Area where trail density is greater. It is noted that trail connections are currently in the planning stages north of 136th Avenue, which will help improve access for bicyclists and pedestrians. Both the 88th Avenue (Thornton) and Wagon Road park-n-Ride's have nearby I-25 crossings available and good access to the surrounding street system.

# 4.0 NO ACTION TRANSPORTATION CONDITIONS

## *4.1 Definition of Near-Term No Action*

To set the stage for alternatives development, screening and selection, the project team has identified a near-term No Action configuration.

### 4.1.1 Selection of Analysis Year

Based on input from the DRCOG, CDOT, and FHWA Staff, the Year 2035 was selected as the analysis year for the following reasons:

- Alternatives recommended in the PEL are anticipated to be implemented within the 2013-2020 time frame, and a Year 2035 analysis would incorporate additional future traffic growth to provide an appropriate test of alternative performance under increased future traffic levels.

Federal regulations state that MPO's like DRCOG must address no less than a 20-year planning horizon in the metropolitan transportation planning process. In addition, federal law states that highway improvement plans and specifications shall be adequate to accommodate traffic levels for a 20-year period from plan approval. The Year 2035 analysis will address these legal conditions.

- Regional travel demand modeling completed for the Year 2035 condition includes RTD's North Metro commuter rail line (only between Denver Union Station and 72nd Avenue) as indicated in the latest fiscally constrained RTP. Therefore, the 2035 analysis of the PEL study area incorporates the travel demand effects of this important regional line. Preliminary travel demand analyses have demonstrated that the North Metro line is not anticipated to dramatically reduce I-25 traffic volumes.

The analysis year of 2035 will serve as the baseline for traffic modeling and analysis efforts for the No Action condition and the PEL components.

### 4.1.2 Planned Regional Improvements

The Year 2035 No Action configuration will incorporate a number of planned regional improvements, including:

**Managed Lane on Existing Infrastructure** – CDOT and regional partners are currently pursuing federal funding for this project, slated for implementation within the next five years. The project will build a Managed Lane on Existing Infrastructure on the existing inside portion of I-25 between US 36 and 120th Avenue.

**RTD North Metro Commuter Rail Line** - The new commuter rail line is anticipated to be built between Denver Union Station with RTD's FasTracks program. The rail alignment will run parallel to I-25 several miles east.

**Other fiscally constrained regional improvements** – Other transportation improvements anticipated to occur between now and Year 2025 in the Study Area will be included in the No Action analysis.

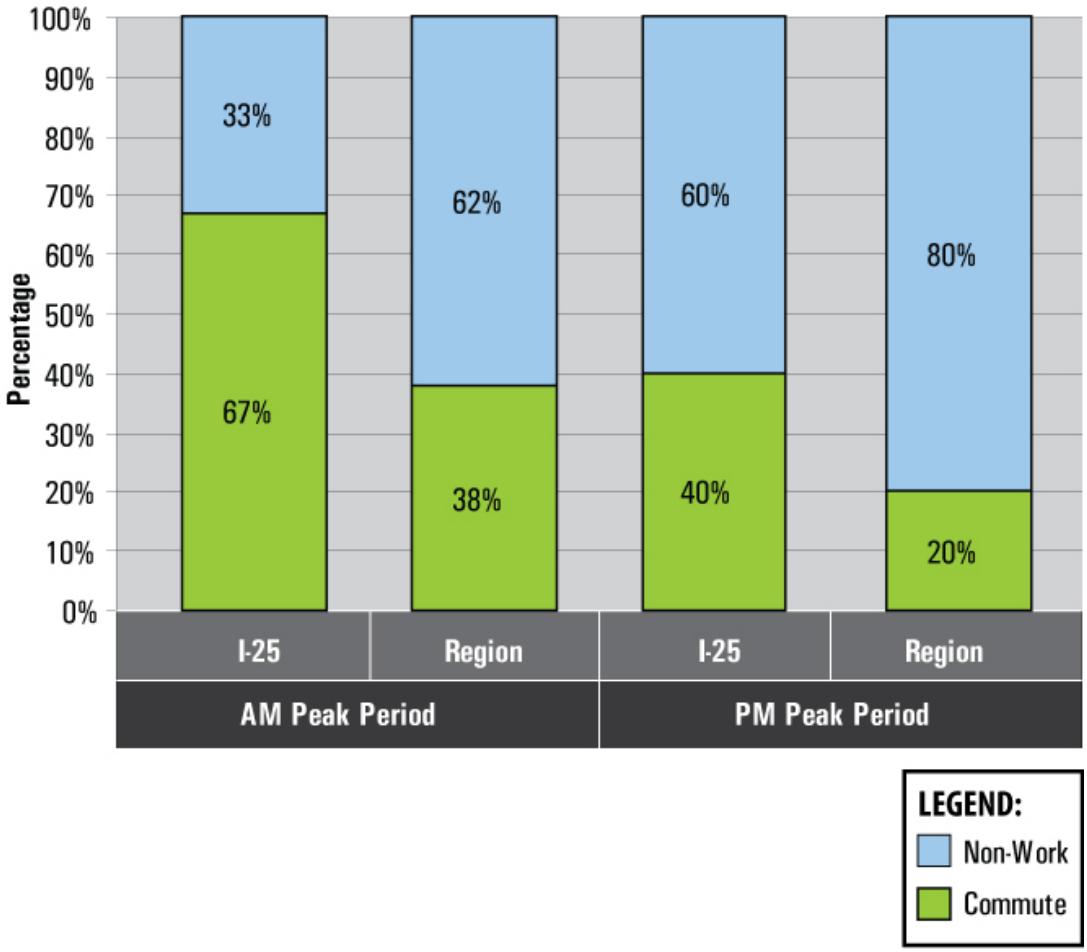
## 4.2 2035 No Action Travel Markets Analysis

The 2035 DRCOG Travel Demand Model was used to evaluate the travel markets for the I-25 corridor. Findings and observations are provided as follows.

### 4.2.1 Trip Purpose

In 2035, the I-25 corridor would serve a variety of trip types in the AM Peak Period. Commute trips would account for about 67 percent of all trips. Regionally, commute trips account for approximately 38 percent of all trips in the AM Peak Period, so I-25 serves a heavy commuter market. This is in line with expectations, as longer trips utilize freeways more often than shorter non-work trips. **Figure 4.2-1** illustrates propose peaks.

**Figure 4.2-1 2035 I-25 Purposes–Peak Periods**



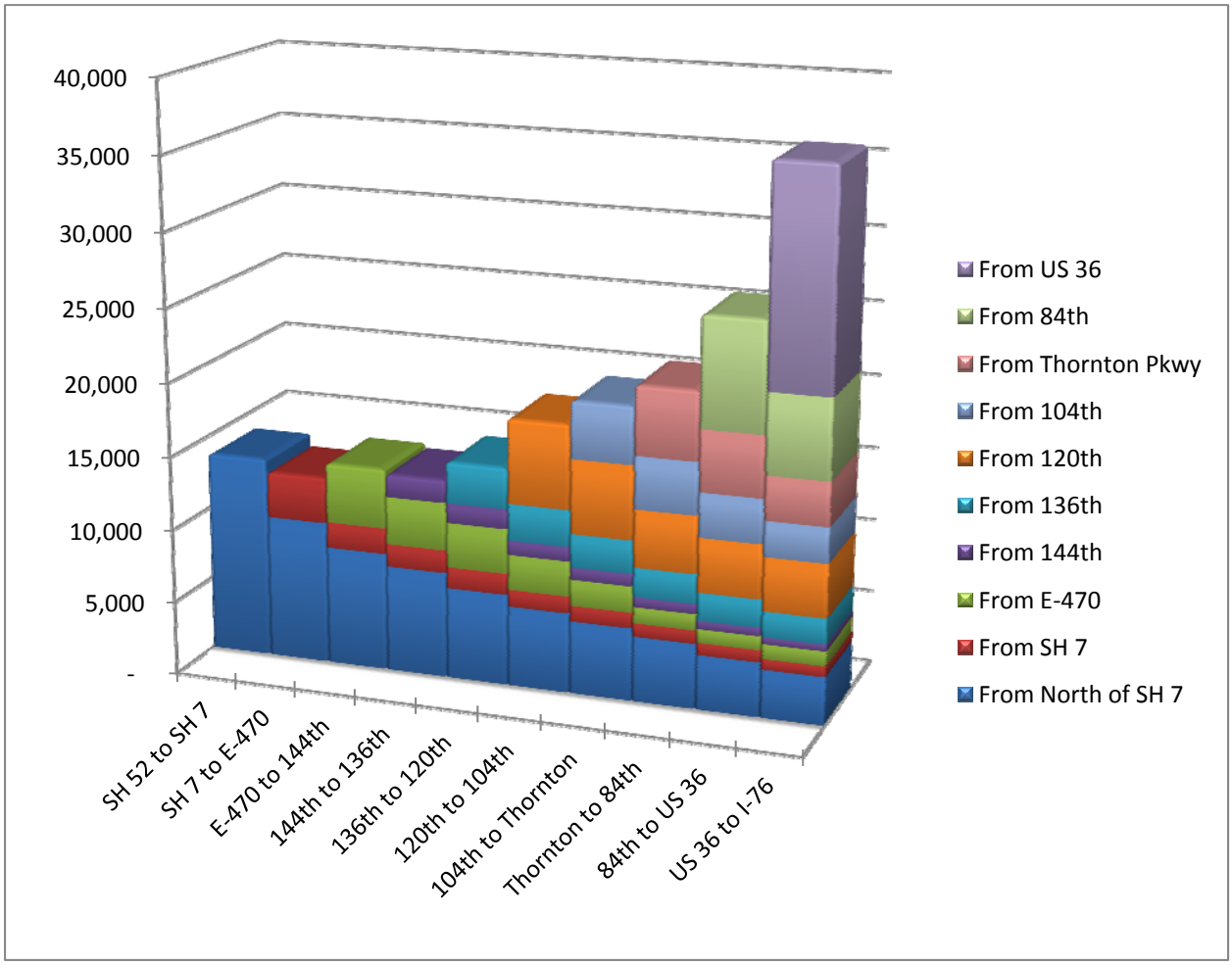

<u>Observations:</u>

- Traveler familiarity is high
  - This could increase the range of alternatives considered

### 4.2.2 Composition of Southbound AM Peak Period I-25 Volume

**Figure 4.2-2** displays the traffic along I-25 in the AM Peak Period. Each color on the chart corresponds to where vehicles entered the freeway. For example, the blue bar at the left is traffic on I-25 north of SH 7. This bar shrinks as traffic exits along the corridor, while traffic from other interchanges enters the interstate.

**Figure 4.2-2 2035 Southbound AM Peak hour Traffic Composition**



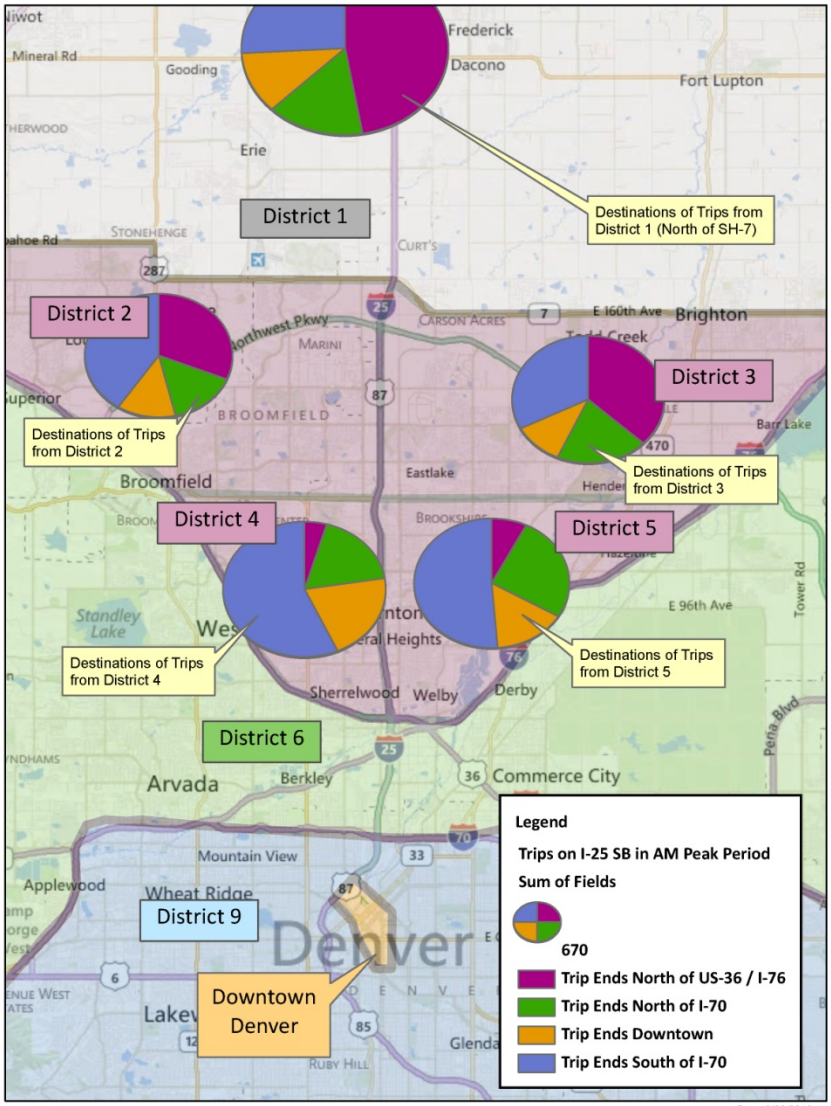

Observations:

- Low percentage of 2035 total trips are through trips.
- Traffic builds up along the corridor, moving south.
- Many trips both enter and exit I-25 within the Study Area.
  - Parallel facilities could support these local trips.

### 4.2.3 Origins and Destinations for Southbound AM Trips using I-25

**Figure 4.2-3** displays 2035 destinations of trips from five districts north of US 36 and I-76.

**Figure 4.2-3 2035 Trip Destinations**

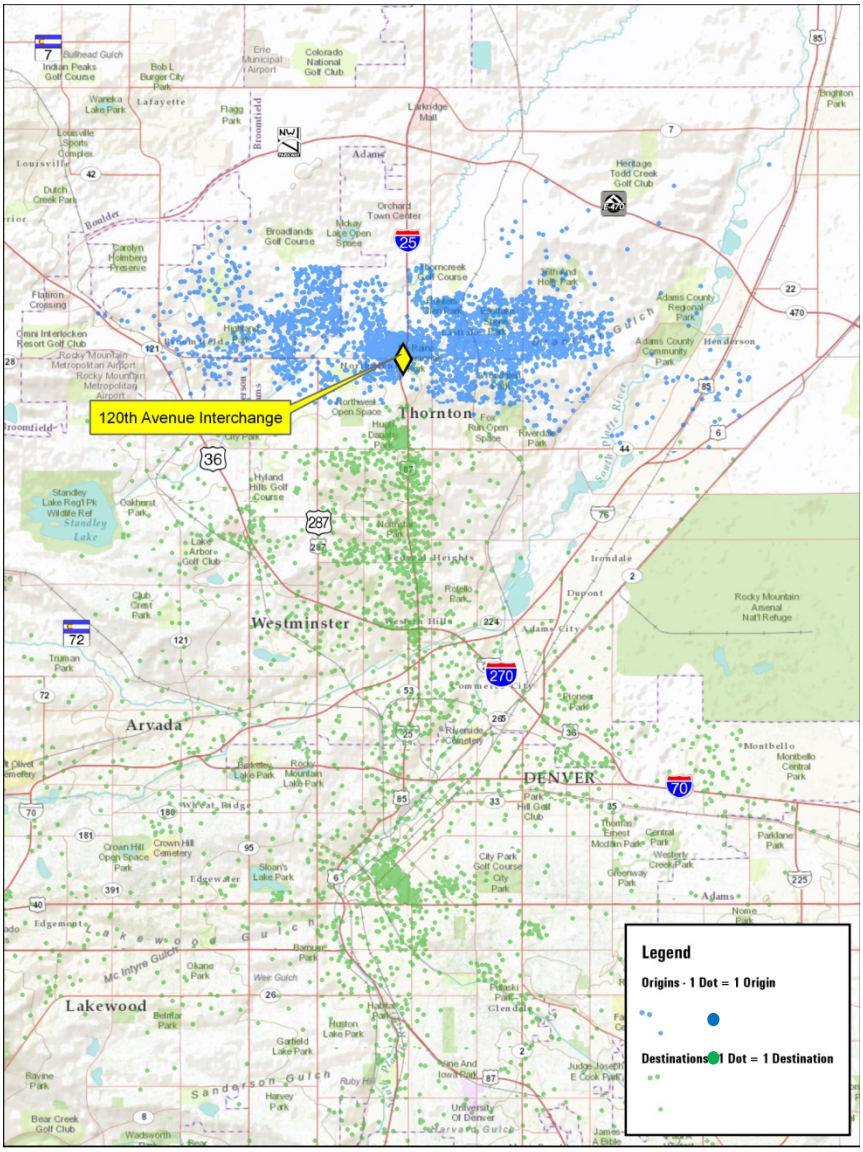



**Observations:**

- Of all 2035 southbound trips on I-25 north of SH 7, 36% are destined for locations south of I-70.
- 21 percent of trips in 2035 from Districts 2, 3, 4, and 5 are local trips with destinations within those districts.
- 12 percent of 2035 trips from Districts 1, 2, 3, 4, and 5 are destined for Downtown Denver.

**Figures 4.2-4**, **4.2-5**, and **4.2-6** display 2035 trip origins and destinations for three of the locations along the corridor. Blue dots represent origins and green dots represent destinations.

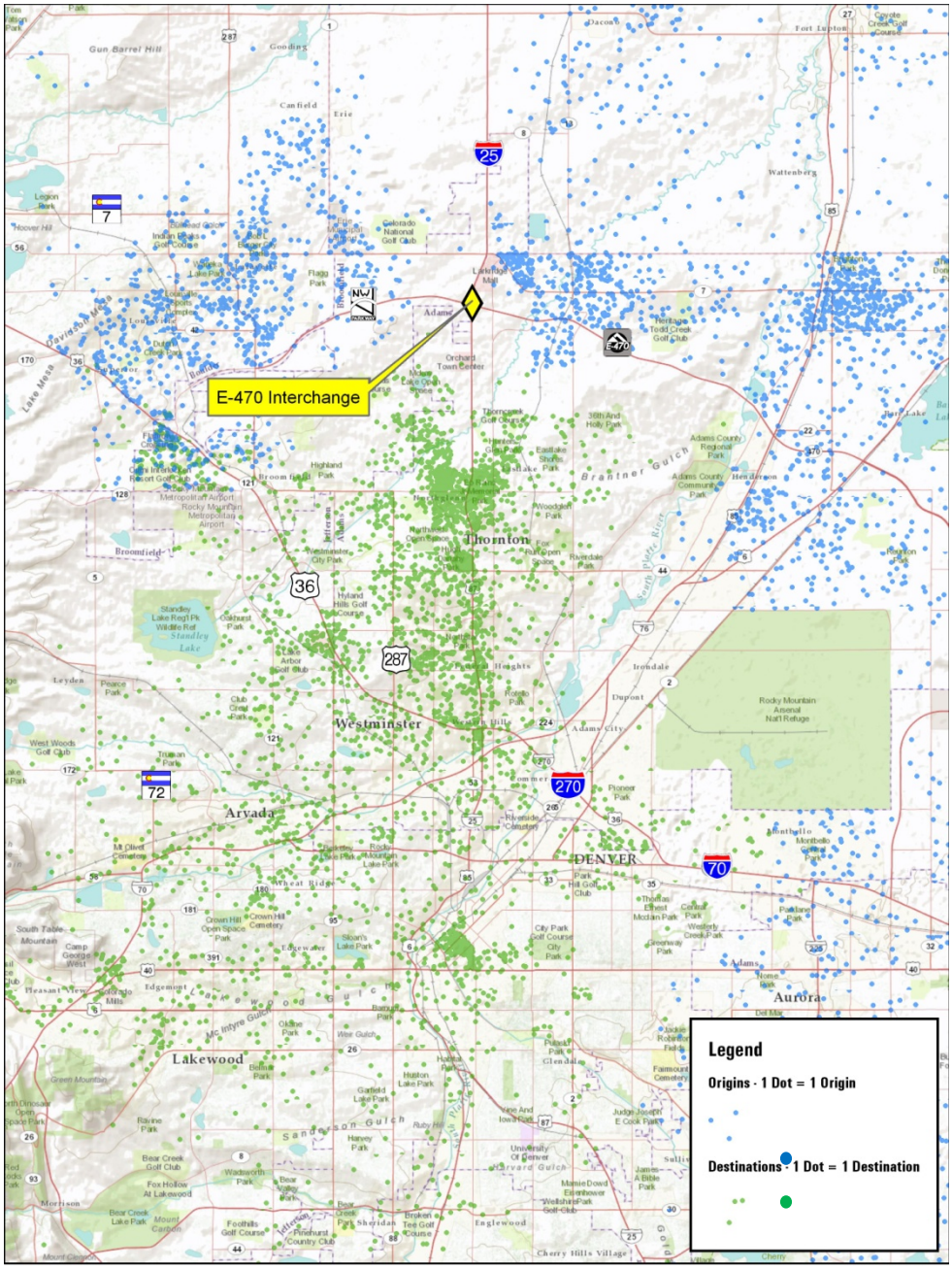
**Figure 4.2-4 2035 Origins and Destinations for Trips on Southbound 120th Avenue to I-25 Ramp**




**Observations:**

- Origins for trips in 2035 that enter I-25 southbound at 120th Avenue are concentrated mostly north of 120th Avenue and near the interstate.
- Destinations dispersed throughout the region but some concentrations are seen along I-25 north of US 36 and in or near Downtown Denver.
- A large portion of the trips are destined to locations within 5 miles of the interchange.

**Figure 4.2-5 2035 Origins and Destinations for Trips on E-470 to Southbound I-25 Ramps**




Observations:

- Origins for trips in 2035 that enter I-25 SB at E-470 are concentrated mostly north of E-470, but are also spread throughout the region.
- 2035 Destinations for these trips are concentrated in the corridor.

### 4.2.4 Dynamic Traffic Assignment Analysis

#### 4.2.4.1 Methodology

The project team has conducted simulation-based Dynamic Traffic Assignment (DTA) modeling of the study area roadways using the software tool DynusT. This modeling tool is capable of evaluating system-wide traffic flow conditions resulting from individual drivers seeking the best routes to their destinations in response to changing network conditions. DynusT DTA capabilities are ideal for modeling the North I-25 PEL study area, particularly with the presence of the new managed lane to be constructed along I-25 between the existing reversible tolled express lanes south of US 36 and 120th Avenue. This new managed lane was incorporated into the 2035 No Action model.

The project team followed these steps to develop a Year 2035 No Action DynusT model of the I-25 study area:

1. Convert a regional Year 2035 DynusT model from the DRCOG regional travel demand model, incorporating regional growth in land use and population.

2. Extract a subarea was from the regional DynusT model to capture the I-25 corridor between US 36 and State Highway 7 and key roadway links outside of the immediate study area.

3. Refine the subarea model by incorporating calibration adjustments based on a calibration process completed for a Year 2010 DynusT model of the same subarea.

4. Run the Year 2035 DynusT model and extract measures of effectiveness to characterize future traffic conditions along I-25 through the PEL study area and compare with current conditions to identify new areas of congestion or future improvement.

#### 4.2.4.2 Findings

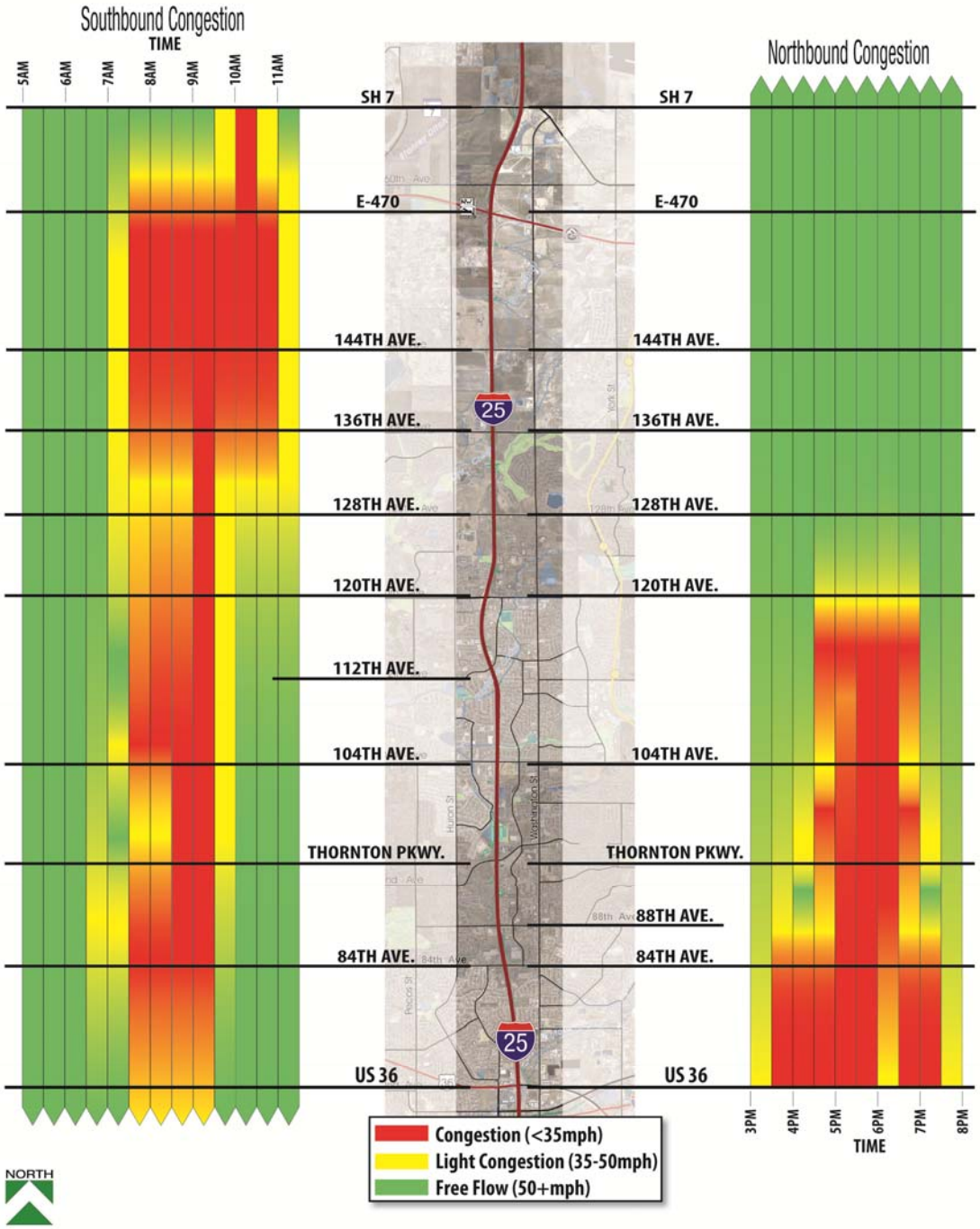
**Figure 4.2-6** depicts the results of the Year 2035 No Action DynusT model run in the form of a time-space speed diagram for both southbound and northbound directions. Traffic congestion through the corridor is directional, showing poorest operations southbound in the weekday morning and northbound in the weekday evening. Results are described as follows:

**Southbound I-25, morning peak** – Year 2035 results indicate that the time duration of morning congestion will be similar to current conditions at approximately 3.5 to 4 hours. The congestion is less extensive south of 120th Avenue, reflecting the influence of the new managed lane. Congested conditions are apparent in the north portion of the study area, particularly between 128th Avenue and E-470, which is currently uncongested during a typical morning peak period.

**Northbound I-25, evening peak** – Year 2035 results indicate that future growth will worsen congestion at the south end of the corridor, where speed reductions are expected to be sustained for nearly five hours. Speed reductions are also shown just south of 120th Avenue, where the new managed lane terminates and travelers shift into the three I-25 general purpose lanes.

In summary, Year 2035 No Action DTA modeling indicates increased congestion farther north along the corridor, both southbound in the morning and northbound in the evening.

**Figure 4.2-6 2035 No Action – DynusT Findings**



# 5.0 SUMMARY OF CORRIDOR CONDITIONS

Sections 1 through 4 of this report summarize current corridor conditions related to traffic operations, pedestrian and bicycle accommodations, transit and traffic safety. Current key findings of the evaluation are provided as follows:

- A high percentage of I-25 trips are trips that both enter and exit I-25 within the Study Area.
- A high percentage of I-25 trips are repeated commuter trips
- The safety review indicated higher occurrence of rear-end and sideswipe-type collisions at sections between 84th Avenue and US 36 and near the 120th Avenue interchange.
- Downtown Denver trips represent about 10-15 percent of I-25 traffic through the Study Area
- Washington Street carries more traffic as a parallel arterial than Huron Street
- Bottlenecks exist on I-25 in both directions between the US 36 interchange and Thornton Parkway
- Non-recurring congestion has a significant impact on the Study Area. Likelihood of a crash occurring on a given day in I-25 between US 36 and SH 7 is 81 percent.
- RTD park-n-Ride lots in the Study Area are overburdened
- Year 2035 No Action traffic modeling indicates increased congestion farther north along the corridor, both southbound in the morning and northbound in the evening.

**NOTE:** Additional conclusions will be added to this summary as feedback from reviewers is compiled.

# 6.0 ENVIRONMENTAL RESOURCES

This report presents existing information about the I-25 Corridor from US 36 to SH 7. The environmental resource information presented in this section is similar, but less detailed, to what is typically developed in Existing Conditions sections in National Environmental Policy Act (NEPA) documents. A PEL occurs before construction funding is available for a specific project and therefore detailed information about a project and impacts from that project are not available. Therefore, the level of detail for environmental resources in a PEL is typically less than what is presented in NEPA documentation. Additional detail regarding the environmental resources presented in this report will occur in subsequent NEPA documentation for projects that are recommended in the PEL.

The resources analyzed in this report were selected based upon regulatory requirements to consider avoidance or minimization early in the project development process, the importance of the resource in the Study Area which could affect decision making, or those specifically identified in Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) to be considered in the planning process. Additionally, the resources analyzed in this report were determined to be sensitive or red-flag resources in the North I-25 EIS.

The entire Study Area for this PEL is within the Study Area for North I-25 FEIS, which was finalized in 2011. Because of the applicability and timeliness of the North I-25 FEIS data, the information presented in the North I-25 FEIS served as the primary source for data collection in the PEL. In some cases, additional information was collected to supplement or validate the North I-25 FEIS data and to ensure that the latest readily-available data was utilized.

Environmental information presented in this section may be displayed and discussed in terms of the PEL Study Area or a Resource-specific Study Area. In general, the term “Study Area” refers to the PEL Study Area, but if resources are presented in a different context, it will be identified as such. Generally, the focus of resource information is along mainline I-25 because most of the likely improvements will be along the mainline.

## *6.1 Air Quality*

Passage of the Clean Air Act led to the establishment by the U.S. Environmental Protection Agency (EPA) of the National Ambient Air Quality Standards (NAAQS) for the criteria air pollutants: carbon monoxide (CO), sulfur dioxide, ozone (O3), particulate matter less than 10 microns in diameter ($PM_{10}$), nitrogen dioxide and lead. Over time, NAAQS have been modified or added to create the current NAAQS list (**Table 6.1-1**).

**Table 6.1-1 National Ambient Air Quality Standards**

| Pollutant | Averaging Time | Primary Standard |
|---|---|---|
| Carbon Monoxide | 8 hours | 9 ppm |
| | 1 hour | 35 ppm |
| Sulfur Dioxide | 1-hour | 0.075 ppm |
| Ozone | 8 hours | 0.075 ppm |
| Particulate Matter <10 µm | 24 hours | 150 µg/m$^3$ |
| Particulate Matter <2.5 µm | Annual | 15 µg/m$^3$ |
| | 24 hours | 35 µg/m$^3$ |
| Nitrogen Dioxide | Annual | 0.053 ppm |
| | 1-hour | 0.1 ppm |
| Lead | 3-month average | 0.15 µg/m$^3$ |

SOURCE: EPA, 2012
Note: ppm = parts per million
µg/m$^3$ = micrograms per cubic meter
µm = micrometers

Motor vehicles are important emission sources for CO, O3, nitrogen dioxide and particulate matter, so these NAAQS pollutants are of greatest importance to this project. Most of the NAAQS pollutants are emitted directly from their sources; however, O3 is not emitted directly but is formed through the reaction of the precursor pollutants of oxides of nitrogen and volatile organic compounds in sunlight.

### 6.1.1 Methodology

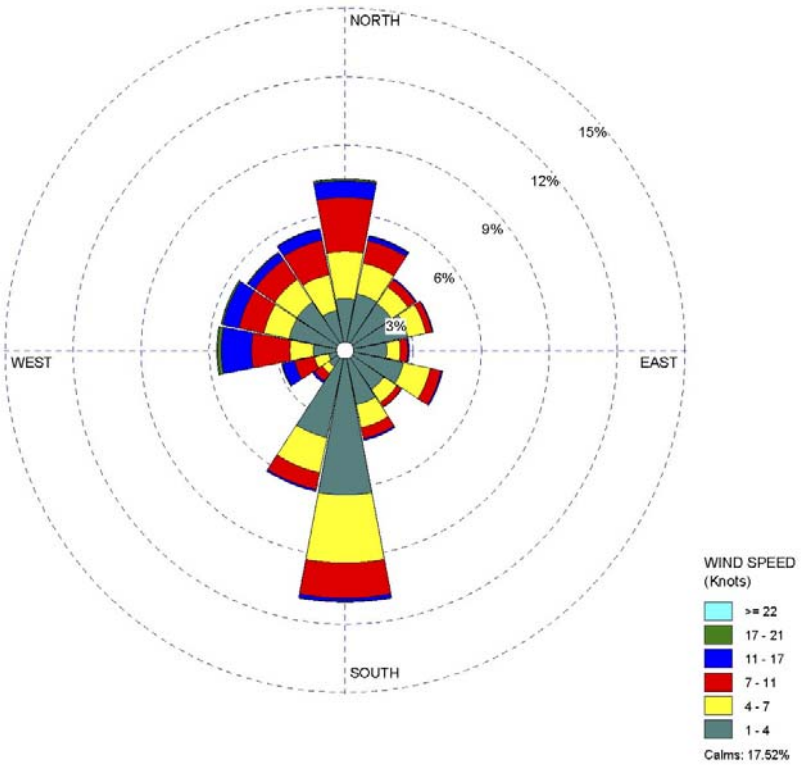
Existing air quality conditions for the PEL Study Area were developed by reviewing the information previously gathered for the area for the North I-25 FEIS and updating this information for any substantive air quality changes that had occurred since the FEIS was prepared. The main air quality consideration is the regulatory status of the Study Area relative to the NAAQS, which primarily determines the needs and requirements for air quality for regional planning.

### 6.1.2 Results

The greater Denver metropolitan area (including Northglenn, Thornton, Westminster, Broomfield and western Adams County) currently is an attainment/maintenance area for CO and $PM_{10}$ and is a nonattainment area for O3. Note that the PEL Study Area includes portions of the cities of Northglenn, Thornton, Westminster and Broomfield, plus unincorporated Adams County.

To the west of the PEL Study Area is the much higher Front Range of the Rocky Mountains while to the east and lower in elevation is the Great Plains. The coldest month for the area usually is January, with an average daily temperature range of 20-48 degrees Fahrenheit. The warmest month usually is July, with an average daily temperature range of 55-90 degrees Fahrenheit. Thermal inversions can occur in the Study Area during times of low winds, which can be important in O3 formation. The Study Area generally receives 10-19 inches of precipitation annually, with the wettest months generally May and April. Prevailing winds in the Study Area tend to be from the south (**Figure 6.1-1**).

**Figure 6.1-1 Wind Speeds and Directions, Thornton**




Air quality monitoring data from the Denver area over the past several years has shown the following trends in criteria pollutants concentrations. CO concentrations have continued to decline across the area and are well below the NAAQS. Nitrogen dioxide levels have remained relatively flat in spite of increased vehicle miles traveled. O3 concentrations have not shown a consistent trend but remain above the NAAQS. PM10 concentrations have remained flat and below the NAAQS over the past 10 years.

Transportation conformity applies to federally funded or approved transportation plans, transportation improvement programs, and highway and transit projects within NAAQS maintenance and nonattainment areas. Conformity requires that the improvements be included in a fiscally constrained, air-quality-conforming transportation plan and transportation improvement program. This ensures that the proposed improvements would not cause new violations of a NAAQS, worsen existing exceedences of a NAAQS or delay timely attainment of the NAAQS.

### 6.1.3 Conclusions

Portions of the Study Area have been included in the long range plan for future CDOT projects; however, no portion of the project has yet been included within the fiscally constrained statewide Transportation Improvement Program or Regional Transportation Plan, so no formal regional conformity findings have been made for any of the potential project actions. This regional and local transportation conformity will need to be demonstrated before improvements from this project could be built.

## 6.2 Environmental Justice

Environmental justice was first articulated as a national policy in 1994 when President Clinton signed Executive Order 12898 (E.O. 12898), *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. Environmental justice is a public policy goal of promoting the fair treatment and meaningful involvement of all people in the decision-making for transportation. Satisfying this goal means ensuring that minority and low-income communities receive an equitable distribution of the benefits of transportation activities without suffering disproportionately high and adverse effects. Achieving environmental justice requires both analytical techniques, as well as the full and fair participation by all potentially affected communities in the transportation decision-making process.

### 6.2.1 Methodology

To identify minority and/or low income populations in the Study Area, US Census data were evaluated consistent with guidance in the Colorado Department of Transportation's *Title VI and Environmental Justice for NEPA Projects – Rev 3*. Census 2010 data at the block level was used to identify minority populations. Low income populations were determined using U.S. Department of Housing and Urban Development (HUD) income thresholds and income parameters from the American Community Survey (2006 – 2010).

### 6.2.2 Results

The results of the analysis to identify minority and low-income populations in the Study Area are presented in the following sections and on **Figure 6.2-1.**

#### 6.2.2.1 Minority Populations

Minority populations are comprised of ethnic and/or racial minorities. As defined in FHWA Order 6640.23, a minority is a person who is Black, Hispanic, Asian American, or American Indian or Alaskan Native. **Table 6.2-1** shows the percentage of minority persons in each county. These percentages serve as the thresholds by which Study Area Census blocks are compared.

## Figure 6.2-1 Environmental Justice Populations

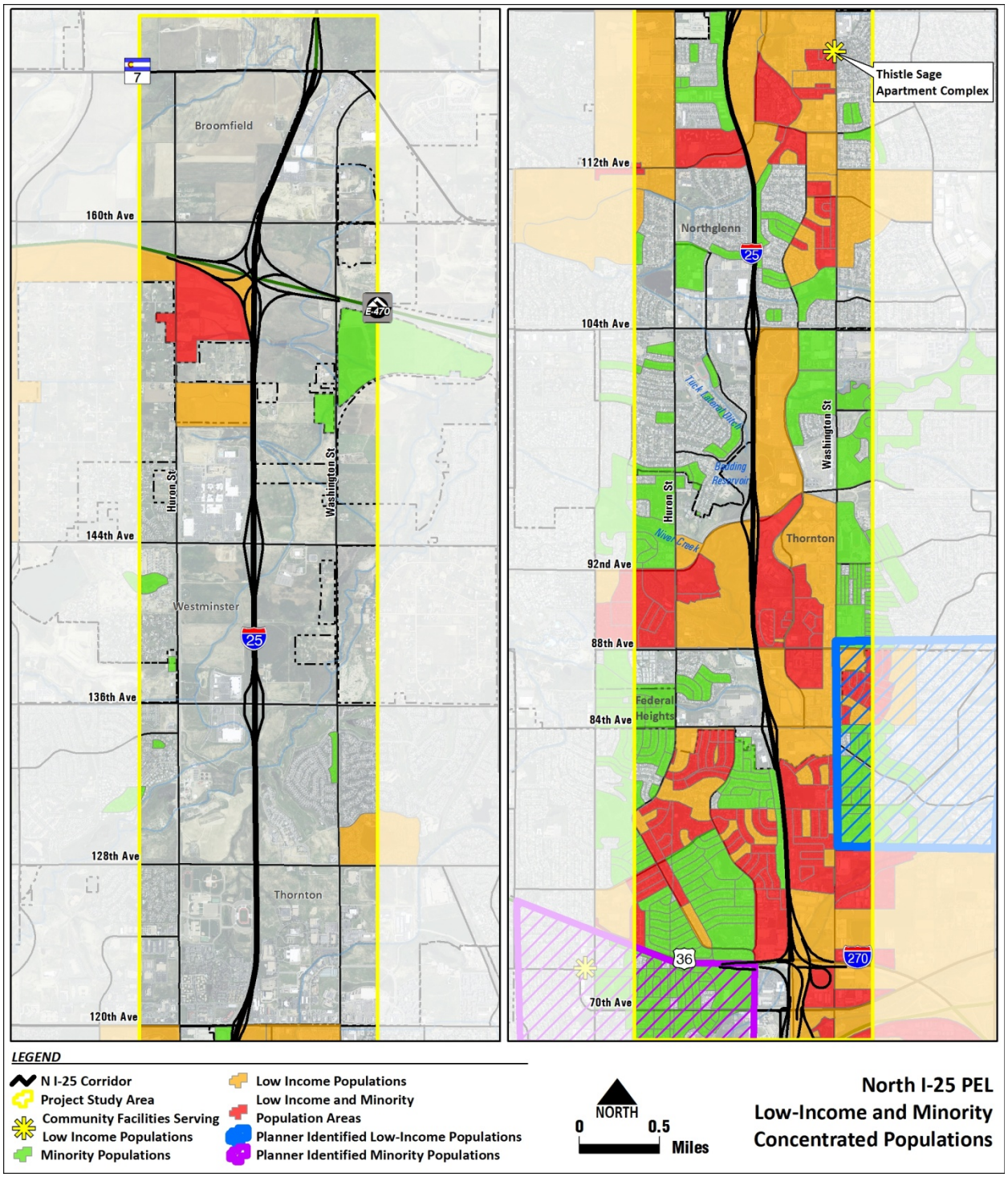


**Table 6.2-1 County Minority Populations**

| County | Population | Minority | Percent Minority |
|---|---|---|---|
| Adams | 441,603 | 206,633 | 46.79% |
| Broomfield | 5,029,196 | 469,716 | 11.77% |

Source: US Census Bureau 2010

As part of future NEPA studies, Census blocks with a higher percentage of minorities than the respective county would be evaluated for disproportionately high and adverse effects and selected for outreach. Within the Study Area, these blocks are not generally located directly adjacent to I-25 (see **Figure 6.2-1**). Five areas of minority populations directly adjacent to I-25 were identified and include:

- Southwest quadrant of the E-470 and I-25 interchange
- West of I-25 between 120th Avenue and 112th Avenue
- East of I-25 between 112th Avenue and 104th Avenue (with one small area on the west side of I-25)
- East of I-25 between Thornton Parkway and 88th Avenue
- Between 84th Avenue and the I-25 and US 36 interchange

When compared with the Environmental Justice documentation prepared for the North I-25 FEIS, which used 2000 Census data, the southwest quadrant of the E-470 and I-25 interchange appears to be a newly identified area of minority populations. The change is due to the fact that this area was part of Adams County in 2000 and has since become part of Broomfield County, which has a lower percentage of minority persons and thus a lower threshold for consideration in environmental justice analysis. Along I-25 between 120th Avenue and 112th Avenue, the number of Census blocks identified is slightly less than the North I-25 FEIS. Changes in the US 36 interchange area are negligible.

#### 6.2.2.2 Low-income Populations in the Study Area

FHWA Order 6640.23 defines low-income as "…a household income at or below the U.S. Department of Health and Human Services (HHS) poverty guidelines." A different threshold (e.g., US Census Bureau poverty threshold or U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) income thresholds) may be used as long as it is not selectively implemented and is inclusive of all persons at or below the HHS poverty guidelines. CDOT's recommended approach in determining low-income populations is to derive the low income threshold from a combination of census average household size data and the income thresholds set annually by HUD for the distribution and allocations of CDBG funds. **Table 6.2-2** shows the percentage of low-income households in each county. These percentages serve as the thresholds by which Study Area Census block groups are compared.

**Table 6.2-2 County Low-Income Populations**

| County | Low-Income Threshold | Number of Households | Number of Low-Income Households | Percent Low-Income |
|---|---|---|---|---|
| Adams | $21,018 | 147,951 | 29,516 | 19.95% |
| Broomfield | $20,874 | 20,116 | 2,483 | 12.34% |

Source: HUD, Federal Year 2012 Income Limits; 2006-2010 ACS[1]

As part of future NEPA studies, potentially affected Census block groups with an average household income below that of the respective county would be evaluated for disproportionately high and adverse effects and selected for outreach. Within the Study Area, these block groups are adjacent to I-25 almost continuously from 120th Avenue to south of the US 36 interchange (see **Figure 6.2-1**). There are also low-income block groups south and west of the I-25 and E-470 interchange.

When compared with the Environmental Justice documentation prepared for the North I-25 FEIS, which used 2000 Census data, the southwest quadrant of the E-470 and I-25 interchange appears to be a newly identified area of low-income populations. The change is due to the fact that this area was part of Adams County in 2000 and has since become part of Broomfield County, which has a lower percentage of low-income and thus a lower threshold for consideration in environmental justice analysis. Changes south of 128th Avenue are minor with more identified low-income blocks in some areas and less in others.

#### 6.2.2.3 Additional Data Sources

During the North I-25 FEIS process, additional efforts were made to identify minority and low-income populations and services within the regional study area (CDOT 2011). These efforts included contacting local planners, non-profit organizations, health and human services, chambers of commerce, and housing authorities. Locations of minority and low-income populations and services identified by these contacts are shown on **Figure 6.2-1**.

### 6.2.3 Conclusions

As part of future NEPA studies, potentially affected Census blocks or Census block groups with identified environmental justice populations would be evaluated for disproportionately high and adverse effects and selected for outreach. Within the Study Area, these areas are generally located south of 120th Avenue. Environmental justice populations were also identified south and west of the I-25 and E-470 interchange.

[1] The American Community Survey (ACS) is a nationwide survey sampling nearly 3 million addresses per year and is designed to provide communities with reliable and timely demographic, social, economic, and housing data. Beginning in 2010, the ACS replaced the decennial census long form questionnaire, which included income information.

## 6.3 Floodways/Floodplains

This section provides a summary of major drainageways and associated floodplains in the Study Area. These floodplains are in counties and/or municipalities that administer Federal Emergency Management Agency (FEMA) policy, and are responsible for regulating the development in FEMA designated floodplains.

### 6.3.1 Methodology

The drainageways identified in this section through reviewing two main sources, the North I-25 FEIS and the Federal Emergency and Management Agency (FEMA) designated floodplains. If a discrepancy was noted between the two sources, the latest information was used. No floodplain modeling was conducted as part of the effort in this PEL.

### 6.3.2 Results

There are 12 drainageways that have FEMA designated floodplains in zones “AE”, “A”, or “X” which define boundaries of floodplains by varying degrees of detail (**Table 6.3-1**). A description of each zone is provided below:

- Zone “AE” is part of the FEMA 100-year flood hazard area where base flood elevations have been determined.
- Zone “A” is part of the FEMA 100-year flood hazard area where base flood elevations have not been determined but a shaded, generalized floodplain is shown on the FEMA Flood Insurance Rate Maps (FIRM). The 100-year flood is FEMA’s base flood.
- Zone X is part of the FEMA 500-year flood area, 100-year flood area with average depths of less than 1 foot, or with drainage areas less than 1 square mile.

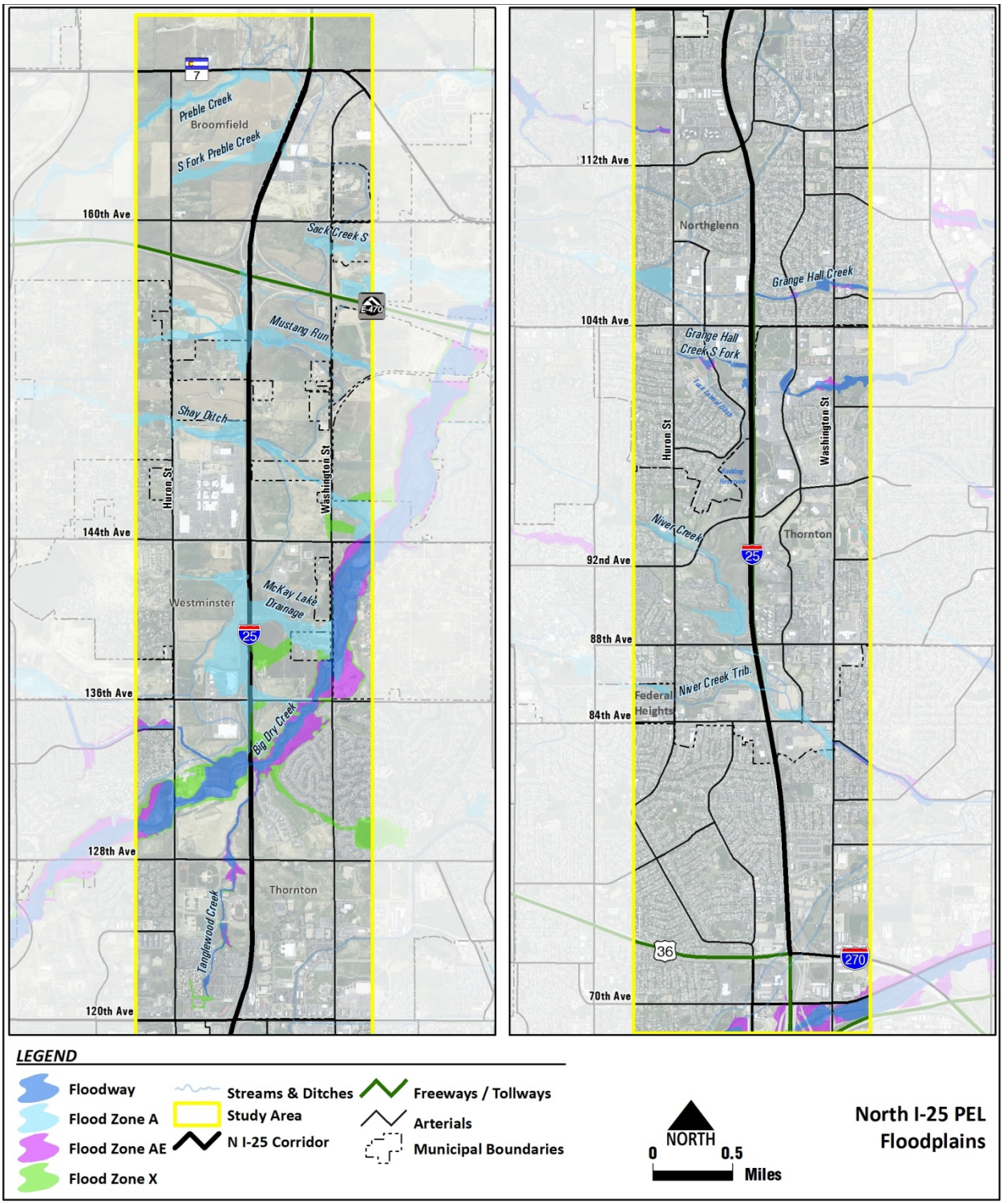
Of these 12 drainageways, 4 are designated as Zone “AE” floodplains and 7 are designated as Zone “A’ floodplains. There are also four drainageways that have floodways delineated in addition to the Zone “AE” floodplains, and one is designated as a Zone “X” floodplain. The four drainageways that have Zone “AE” floodplains also have a floodway delineated (**Figure 6.3-1**) A floodway is an area of the floodplain that has been defined to be “reserved in order to discharge the base flood without cumulatively increas*ing the water surface elevation more than a designated height*.” Usually this is accomplished by prohibiting the placement of fill in the floodway. If fill is proposed in a floodway, it must be shown that this will not adversely impact surrounding property.

**Table 6.3-1 Drainageway Floodplain Summary**

| Mile Point | Name | Area (sq. mile) | Q100 (cfs) | Existing Structure | FEMA Zone | Comments |
|---|---|---|---|---|---|---|
| 228.546 | S. Fork Preble Creek | 0.6 | 1,139 | 16'x6' CBC | A | Not Adequate |
| 227.733 | Sack Creek S. | 0.3 | 658 | 54" RCP | A | Not Adequate |
| 227.335 | Mustang Run | 1.1 | 1,284 | 18" CMP | A | Not Adequate |
| 226.729 | Shay Ditch | 1.0 | 1,183 | 48" RCP | A | Not Adequate |
| 225.646 | McKay Lake Drainageway | 2.1 | 1,600 | None | A | Not Adequate |
| 224.675 | Big Dry Creek | 61 | 8,839 | 2-span Bridge | AE / Floodway | Adequate |
| 224.470 | Tanglewood Creek | 0.7 | 910 | 50" RCP | AE / Floodway | Not Adequate |
| 221.434 | Un-named Trib. to Grange Hall Creek | 0.35 | 796 | 60" RCP | X | Not Adequate |
| 221.228 | Grange Hall Creek | 0.5 | 941 | 24" RCP | AE / Floodway | Not Adequate |
| 220.762 | Grange Hall Creek, S. Fork | 0.6 | 830 | 48" RCP | AE / Floodway | Not Adequate |
| 218.943 | Niver Creek | 2.8 | 890 | 8'X4' CBC | A | Not Adequate |
| 218.731 | Niver Creek Tributary "L" | 1.6 | 1,048 | 8'X8' CBC | A | Not Adequate |

The comment of a draiangeway crossing under I-25 being "Adequate" or "Not Adequate" was determined during the North I-25 FEIS and is based on the structure passing the 100-year flow without overtopping I-25. This information is based on the fully developed flows for the drainageway passing through the existing structure under I-25; however, there are planning documents that recommend channel improvements and regional detention ponds that may affect the adequacy and efficacy of these structures (Wright Water Engineers Inc, 2007; Olsson Associates, 2005; Kiowa Engineering, 2001; CH2M Hill, 2000). These proposed channel improvements and regional detention ponds apply to Shay Ditch, Mustang Run, Sack Creek, Sack Creek South, and the South Fork of Preble Creek.

## Figure 6.3-1 Floodplains/Floodways in the PEL Study Area



The four drainageways that have zone “AE” floodplains and floodways delineated are the most sensitive to any changes in the floodplain because impacts to the floodway and base flood elevations are held to strict criteria and will almost certainly require a Conditional Letter of Map Revision/Letter of Map Revision (CLOMR/LOMR) process, if any changes are proposed. The FEMA base flood elevations can sometimes be based on studies that are several years old and may not accurately reflect the existing channel conditions. Proposed changes in the floodplain may not be within the required limit of the established base flood elevations and to adhere to FEMA’s floodplain policy a CLOMR/LOMR process may be required during project design.

The seven drainageways that have a zone “A” floodplain are sensitive to changes made in the floodplain, but some relatively small changes may be incorporated without triggering a CLOMR/LOMR process because base flood elevations have not been established and proposed changes only need to be compared to existing conditions. Floodplain modeling will still be required to assess the existing and proposed conditions and significant changes in the floodplain will most likely require a CLOMR/LOMR process.

The one draiangeway that has a zone “X” floodplain is the least sensitive to changes made in the floodplain. Floodplain modeling will be needed to assess impacts but unless there is a significant change in the floodplain, a CLOMR/LOMR process would probably not be needed.

### 6.3.3 Conclusions

Improvements in the project area could impact several FEMA regulated floodplains. A base level of modeling to determine these impacts will be required, and depending on the magnitude of the impact, the CLOMR/LOMR process could be triggered. The four zone “AE” floodplains with floodways are the most sensitive to changes in the floodplain and have the most potential to require a CLOMR/LOMR process. The seven zone “A” floodplains have some sensitivity to impacts but have slightly less potential to require a CLOMR/LOMR process. The zone “X” floodplain is the least sensitive to impacts and has the least potential to require the CLOMR/LOMR process.

## 6.4 Hazardous Materials

This section provides a summary of properties with potential or known hazardous materials issues located within the Study Area.

### 6.4.1 Methodology

The methodology used to identify sites with potential or known hazardous materials issues included the following steps:

- Review of North I-25 FEIS hazardous materials data and Modified Environmental Site Assessment (MESA)
- Identification of sites with recognized or potential environmental conditions

For this hazardous materials assessment summary, sites within the Resource-specific Study Area (within 500 feet of I-25 mainline) were identified as having known (current and historic) soil or groundwater contamination and are distinguished in this report as sites with recognized environmental conditions. Recognized environmental conditions, include sites *with “the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a*

*release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property"* (ASTM 2005).

Sites with the potential for soil and/or groundwater contamination that could not be confirmed without additional inspection or investigation are distinguished as sites with potential environmental conditions.

### 6.4.2 Results

A total of 13 sites with recognized and potential environmental conditions were identified within 500 feet of the I-25 mainline (**Table 6.4-1** and **Figure 6.4-1**).

**Table 6.4-1 Sites with Potential and Recognized Environmental Conditions within the Study Area**

| Site Address/Name | Distance from I-25 Centerline | Site Type | Site Description |
|---|---|---|---|
| 12299 Grant St., Thornton | Within 500 feet | Recognized Environmental Condition (REC) | Closed Leaking Underground Storage Tank (LUST) site. Residual soil and/or groundwater contamination could be present. |
| 12121 Grant St., Thornton | Within 500 feet | REC | Closed LUST, Resource Conservation and Recovery Act (RCRA) Small Quantity Generator (no reported violations), aboveground storage tank (AST) site. Three underground storage tanks (USTs) containing diesel fuel are currently in use (two 15,000-gallon and one 1,000-gallon). Residual soil and/or groundwater contamination could be present. |
| 45 E. 120th Ave., Thornton | Within 500 feet | REC | Closed LUST. Residual soil and/or groundwater contamination could be present. |
| 11450 Cherokee St., Northglenn | Within 500 feet | Potential Environmental Condition (PEC) | RCRA SQG (No Reported Violations). Unknown paint/chemical storage, handling, and disposal practices. |
| 333 E. 76th Ave., Denver | Within 500 feet | PEC | Automotive service with unknown chemical and material handling, storage, and disposal practices. |
| 7320 N. Broadway, Denver | Within 500 feet | PEC | Automotive dealership and service center with unknown chemical and material handling, storage, and disposal practices. One operating used oil tank (1,000-gallon). |
| 301 E. 120th Ave., Northglenn | > 500 feet | PEC | Operating gasoline station. No reported leaks. |
| 20 E. 120th Ave., Northglenn | > 500 feet | REC | Closed LUST. Residual soil and/or groundwater contamination could be present. |
| 500 W. 120th Ave., Northglenn, | > 500 feet | REC | Closed LUST. Residual soil and/or groundwater contamination could be present. |

| Site Address/Name | Distance from I-25 Centerline | Site Type | Site Description |
|---|---|---|---|
| 400 W. 104th Ave., Northglenn | > 500 feet | REC | RCRA SQG (No Reported Violations). Closed LUST. Residual soil and/or groundwater contamination could be present. |
| 550 E. 76th Ave., Denver | > 500 feet | REC | RCRA SQG (Violations Reported). Unknown chemical and material handling, storage, and disposal practices. |
| CDOT Northern Maintenance Facility | Within 500 feet | PEC | Uncertain past chemical and material handling, storage, and disposal practices. |
| CDOT Southern Maintenance Facility | Within 500 feet | PEC | Uncertain past chemical and material handling, storage, and disposal practices. |

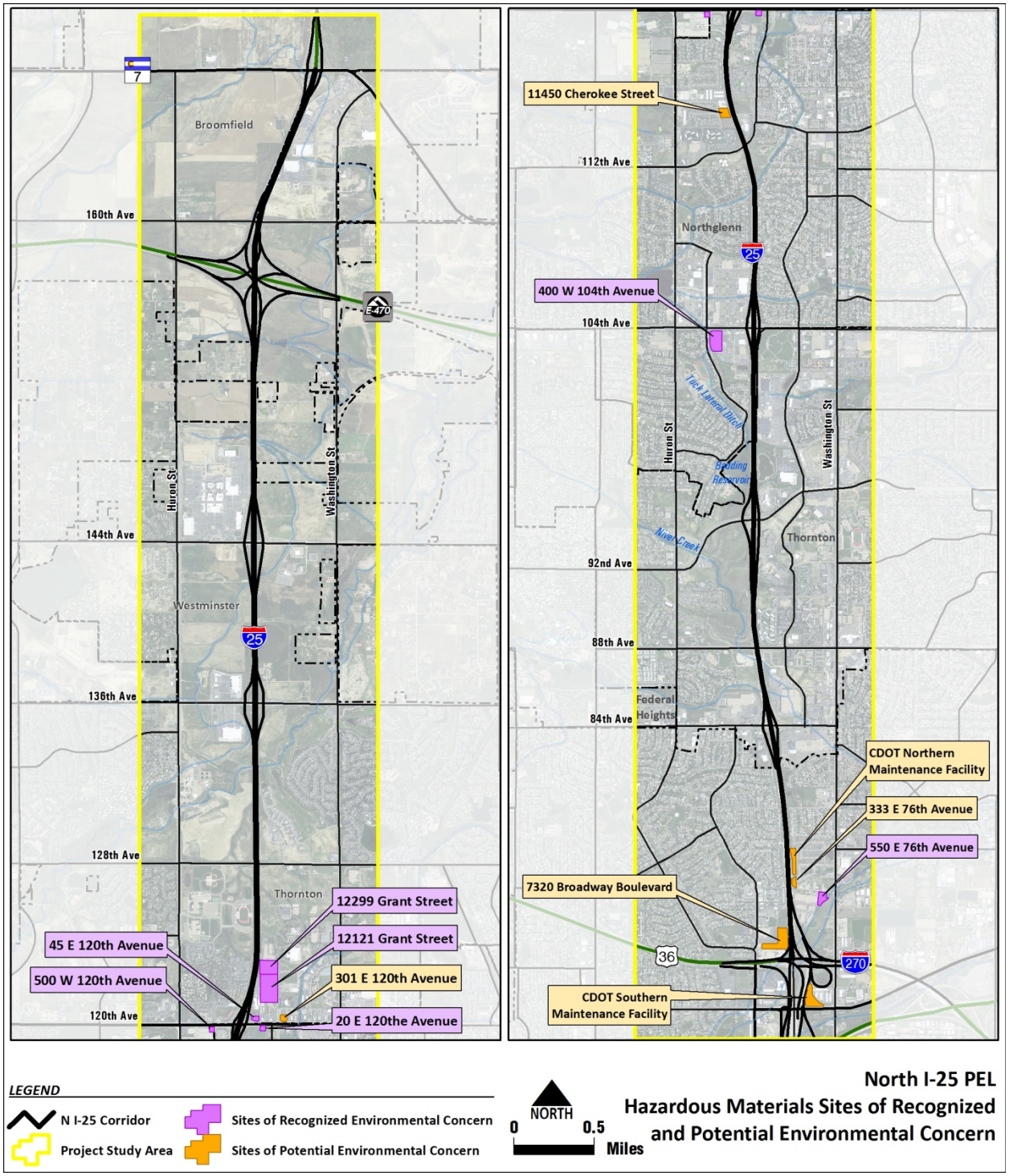
Highway corridors, such as I-25, generally consist of areas where light industrial and commercial businesses historically or currently operate. These types of businesses, such as gasoline service stations, automotive repair facilities, and larger truck stop establishments, typically use underground storage tanks (UST) or aboveground storage tanks (AST) to store petroleum products, waste oils, and/or other hazardous materials. Such facilities are also often regulated based on their current hazardous waste generation management activities. Consequently, areas with light industrial and commercial use present a risk of having the presence of soil and groundwater contamination, as the result of past spills or releases of hazardous substances, including petroleum products.

There are six closed leaking underground storage tank (LUST) sites adjacent to the Study Area. The Colorado Department of Labor and Employment, Division of Oil and Public Safety (OPS) defines a LUST site as closed/clean-up complete when "*the owner and/or operator has not necessarily removed all contamination, but instead actions taken have met the criteria that the State uses for determining adequate clean up*." As a result, residual surficial and subsurface soil contamination and/or groundwater contamination may be present at closed sites and could be encountered on-site or downgradient of these closed sites during subsurface construction activities.

### 6.4.3 Conclusions

Hazardous materials are most likely to be encountered during ground-disturbing activities near sites with recognized environmental conditions. The most fundamental management for hazardous materials is the avoidance of contaminated sites, when feasible. Wherever possible, known hazardous materials issues at properties targeted for right-of-way acquisition should be investigated further prior to acquisition/construction. Knowing what hazardous materials issues exist prior to construction is critical because proper management during construction requires special materials management, handling, disposal, and worker health and safety practices. The types of sites described in this section appear to be those that are normally encountered by CDOT.

**Figure 6.4-1 Sites with Potential and Recognized Environmental Conditions within the Study Area**



## 6.5 Historic Resources

This section includes information on historic resources/properties adjacent to the I-25 mainline corridor from US 36 to SH 7.

### 6.5.1 Methodology

Information on previously identified historic properties and potential historic properties is presented. This information was collected from a variety of sources including the following:

- Lists of properties on the National Register of Historic Places (NRHP)
- Lists of properties on the Colorado State Register of Historic Properties
- Lists of local landmarks from communities and counties with local historic landmark programs
- A file search at the Colorado Historical Society for all properties which had previously been surveyed and officially designated as properties eligible for inclusion on the NRHP
- A file search at the Colorado Historical Society for all properties which had previously been surveyed and had been field assessed as properties eligible for inclusion on the NRHP
- A field assessment to identify properties with architectural character and integrity that may be potential historic resources
- Sites that were identified and analyzed in the North I-25 FEIS

### 6.5.2 Results

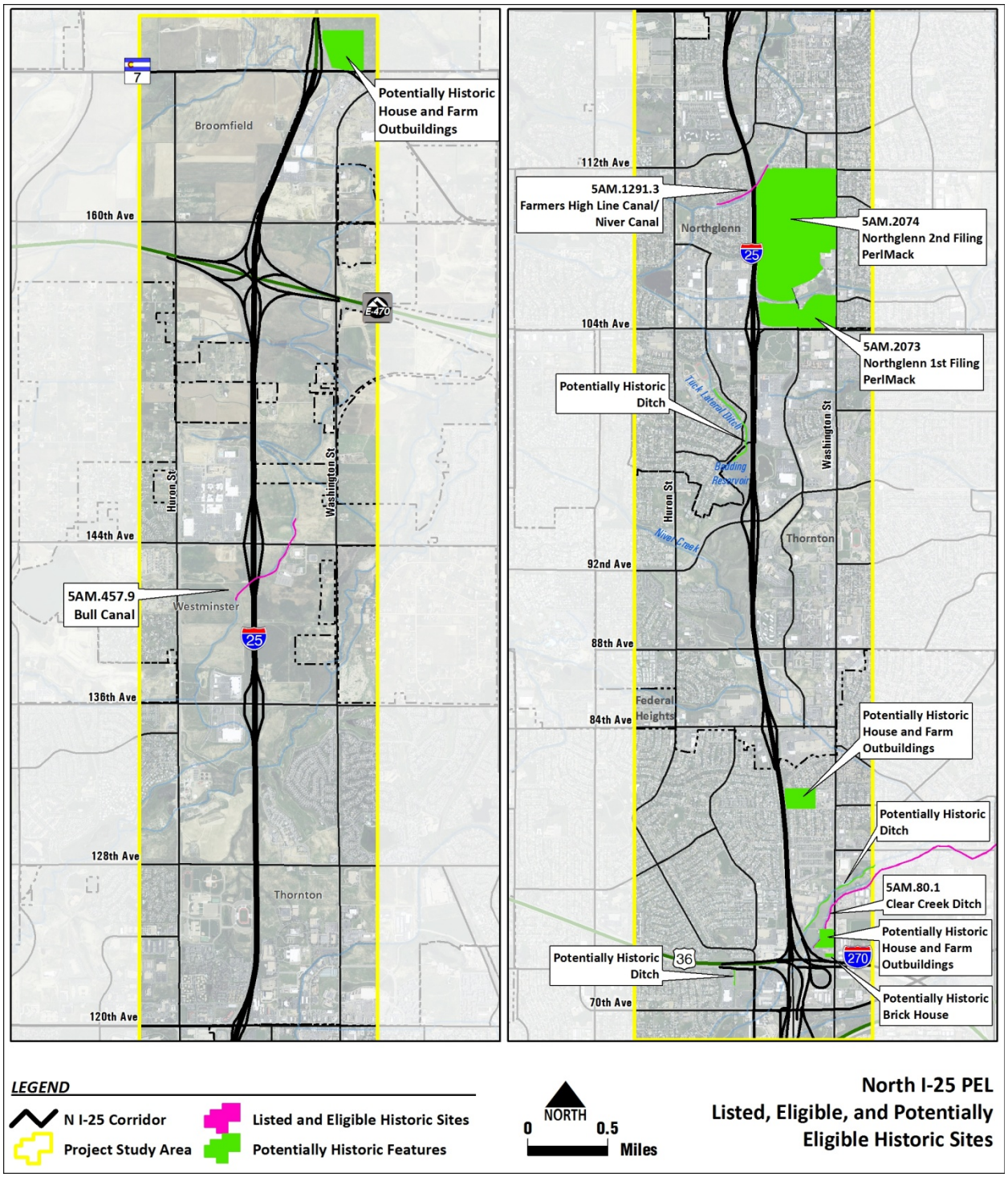
#### 6.5.2.1 Previously Identified Historic Sites

For purposes of this study, only properties on the NRHP or officially eligible for the NRHP are listed as previously identified historic sites. There are no properties within the study corridor for this project that are listed on either the NRHP or the SRHP. There are three officially eligible existing historic properties within the I-25 corridor between US 36 and SH 7. These three eligible properties are all ditches and are described in the following table that lists the previously identified historic sites in the corridor (**Table 6.5-1**). The Listed and Eligible Historic Sites Map shows the location of the known historic sites (**Figure 6.5-1**).

**Table 6.5-1 Previously Identified Historic Sites (Listed from North to South)**

| Site # | Name | Address | Description | Status |
|---|---|---|---|---|
| 5AM.457.9 | Bull Canal | Crosses I-25 approximately .2 mile south of 144th Ave. T1S/R68W, N ½ Sec. 22 | Historic Irrigation Canal | Segment was determined officially eligible for the NRHP on 8/9/2007 |
| 5AM.1291.3 | Farmers' High Line Canal/ Niver Canal | Crosses I-25 approximately .8 mile north of 104th Ave. T2S/R68W, N ½ Sec. 10 | Historic Irrigation Canal | Segment was determined officially eligible for the NRHP on 8/9/2007 |
| 5AM.80.1 | Clear Creek Ditch | Extends northwest from the east side of I-25 at US 36 | Historic Irrigation Ditch | Segment was determined officially eligible for the NRHP on 3/5/2009 |

**Figure 6.5-1 Listed, Eligible, and Potential Historic Sites in the PEL Study Area**



#### 6.5.2.2 Potential Historic Sites

Because not all historic sites within this large corridor have been previously surveyed, it is important to identify potential historic sites. Potential historic sites include:

- Properties that have been previously surveyed and field assessed as eligible or as needing more data
- Properties that have been previously surveyed many years ago and assessed as not eligible, but with the passage of time may now be potentially assessed as historic.
- Local historic landmarks
- Properties over 50 years of age that have not yet been surveyed but based on a visual reconnaissance, appear to possess architectural qualities that may make them eligible for the NRHP under Criterion C – Architecture.

All of the properties in this list will need additional research to determine whether or not they are eligible for the NRHP. **Table 6.5-2** lists the potential historic properties in the corridor. This list includes subdivisions, residences, farms, irrigation ditches, and a highway.

**Table 6.5-2 Potential Historic Sites (Listed from North to South)**

| Site # | Name | Address | Description | Status |
|---|---|---|---|---|
| | House | 4185 WCR 2 | House | |
| 5AM.2074 | Northglenn Second Filing - PerlMack | | Early Subdivision in Northglenn | Officially Needs Data 1/4/2008 |
| 5AM.2073 | Northglenn First Filing - PerlMack | | Early Subdivision in Northglenn | Officially Needs Data 1/2/2008 |
| | Ditch | Ditch crosses Melody Dr. at Belford Dr. on the west side of I-25 approximately midway between 104th Ave. and Thornton Parkway | Ditch | Not Surveyed; Needs Data |
| | House and farm outbuildings | 501 E. 80th Ave. | House and farm outbuildings | Not Surveyed; Needs Data |
| | Ditch just north of Clear Creek Ditch | Crosses I-25 near Southbound ramp for US 36 | Ditch | Not Surveyed; Needs Data |
| | Ditch | Ditch goes under I-25 at 74th Ave. on east side. | Ditch | Not Surveyed; Needs Data |
| | House and farm outbuildings | 7381 Washington St. | House and farm outbuildings | Not Surveyed; Needs Data |
| | House | 7261 Washington St. | Brick House | Not Surveyed; Needs Data |
| 5AM.1760.1 | Denver-Boulder Turnpike US 36 | | Early toll highway | Officially Not Eligible 10/17/2006 |

### 6.5.3 Conclusions

The Study Area contains three ditch sites listed on or eligible to be listed the National Register for Historic Places (Bull Canal, Farmers Highline Canal, and Clear Creek Ditch). These segments of the ditches cross or are adjacent to I-25 and any potential impacts to these resources will need to comply with the Programmatic Section 106 Process with the SHPO identified in the North I-25 FEIS. There are 10 sites that have potential to be listed on the National Register for Historic Places, but require more information to determine their eligibility for listing. These sites are individual homes, buildings, developments, and ditches. Coordination with SHPO is required if any project has the potential to impact these resources.

## *6.6 Land Use*

This section outlines the framework for land use planning in the Study Area and provides a description of existing land use conditions as well as trends and anticipated future land use conditions. Land use planning in the Study Area is primarily undertaken by local municipalities and county governments. In addition, DRCOG is the regional planning agency responsible for transportation planning in the Study Area.

### 6.6.1 Methodology

Existing and future land use in the Study Area was generally identified using municipal and county comprehensive plans and GIS data developed for the North I-25 FEIS. Land uses across all jurisdictions in the Study Area have been generally categorized into agricultural, residential, commercial (including retail, industrial, office, etc), and open space/parks. Specific land uses along the I-25 corridor were identified based on information from the North I-25 FEIS and a review of 2011 aerial imagery from Google Earth.

### 6.6.2 Results

#### 6.6.2.1 Land Use Planning in the Study Area

Land use planning for unincorporated lands in the Study Area is the responsibility of two counties: Adams and Broomfield. Broomfield is a combined city/county government. Municipalities along the I-25 corridor from north to south include Broomfield, Thornton, Westminster, Northglenn, and Federal Heights. Municipalities have designated growth areas in their comprehensive plans, with the exception of Northglenn and Federal Heights because they are completely surrounded by developed municipalities. The plans have identified the I-25 corridor as being the biggest area of change.

The Study Area falls within the DRCOG transportation planning region. Land use projections from local governments are used by DRCOG for regional planning purposes. Local land use projections, such as the location and timing of residential and commercial (employment) development, are incorporated into long-range regional and statewide transportation plans. DRCOG's 2035 Metro Vision Regional Transportation Plan (MVRTP) defines a regional growth boundary that identifies where urban development will take place in the region over the next 25 years. The boundary contains 750 square miles of urban development, which is intended to achieve a 10 percent increase in the region's overall density between 2000 and 2035.

#### 6.6.2.2 Existing Land Use

The predominant land uses in the Study Area are residential (36 percent), commercial (23 percent), and agricultural (23 percent) as shown in **Figure 6.6-1**. Land use in the Study Area generally transitions from agricultural and undeveloped land in the northern portion of the Study Area to commercial and residential land uses south of 128th Avenue.

Land Use along the I-25 Corridor

Between SH 7 and 136th Avenue, existing land use along I-25 is predominantly agricultural and vacant land. There are, however, three centers of commercial development, east of I-25 between SH 7 and 160th Avenue, west of I-25 and north of 144th Avenue, and west of I-25 at 136th Avenue.

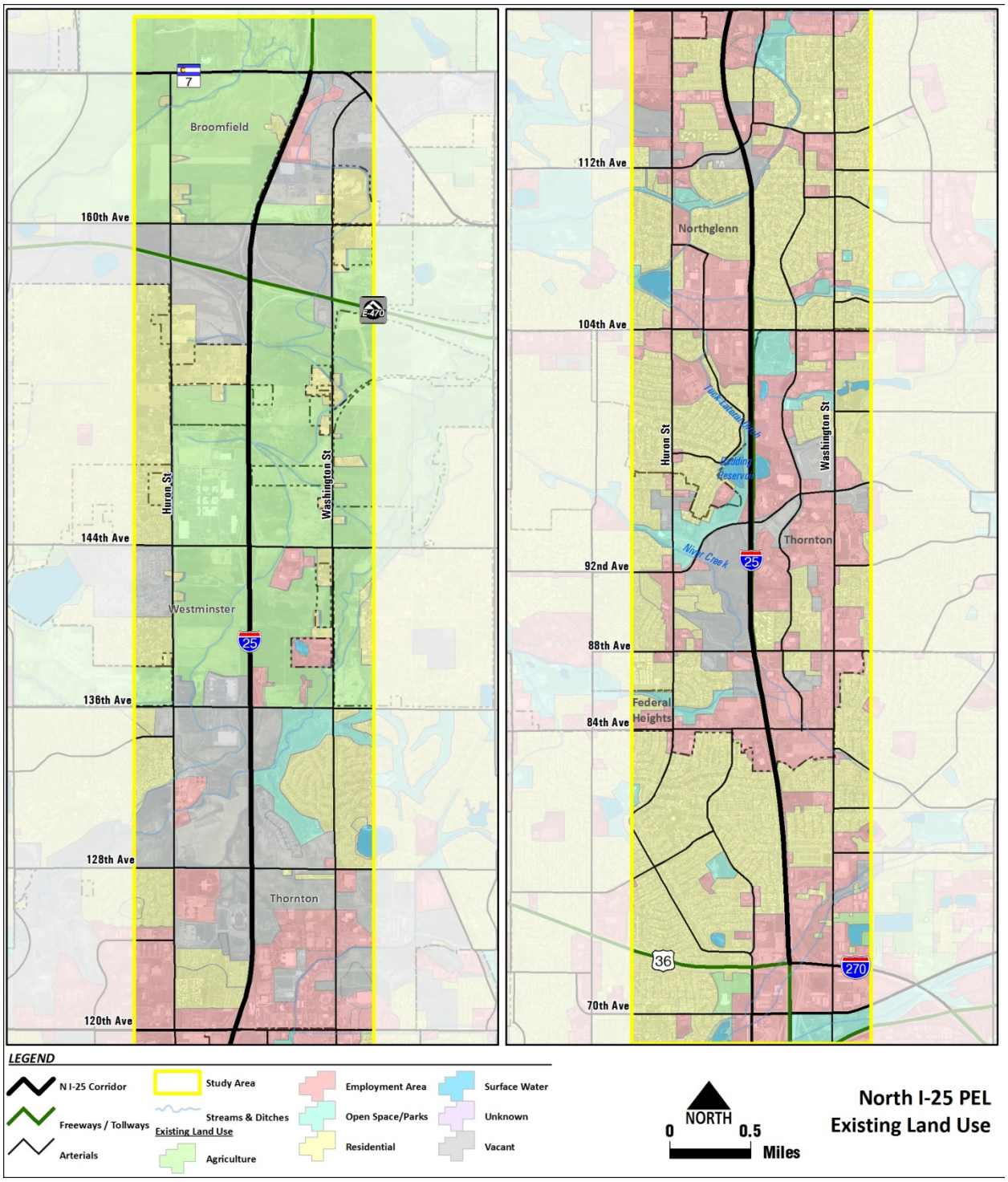
South of 136th Avenue, a more suburban character is evident with residential subdivisions, a golf course, schools, parks and open space, and increasing commercial development. Near the I-25 and 120th Avenue interchange, hotels are located in the northwest quadrant, municipal facilities and hotels in the northeast quadrant, a large RTD p-n-R facility (Wagon Road p-n-R) in the southwest quadrant, and a medical complex in the southeast quadrant.

South of 120th Avenue to the southern project terminus of US 36, the land is almost entirely built-out with commercial, retail, and residential properties interspersed with parks and open space and school. At the I-25 and 104th Avenue interchange, large commercial and business properties dominate the west side, residential uses to the northeast, and a large cemetery to the southeast. South of 104th Avenue, residential properties abut the western side of I-25 and commercial properties abut the eastern side of the corridor. Further south, there is a larger area of undeveloped lands in the southwest quadrant of the I-25 and Thornton Parkway interchange.

Land Use at Proposed I-25 and SH 7 Express Bus Station

The North I-25 FEIS (CDOT 2011) identified a site for an express bus station within the North I-25 PEL Study Area. The proposed station site, located on the southwest corner of the I-25 and SH 7 interchange, is located on agricultural land in the City and County of Broomfield. The surrounding area consists mostly of agricultural land. A small mobile home park with about 50 units is located farther east. The station is bound by SH 7 and agricultural land to the north, agricultural land to the south, and agricultural land and a rural/estate residential neighborhood to the west. The City and County of Broomfield zoning for the proposed station site and surrounding areas is Planned Unit Development.

## Figure 6.6-1 Existing Land Uses in the PEL Study Area

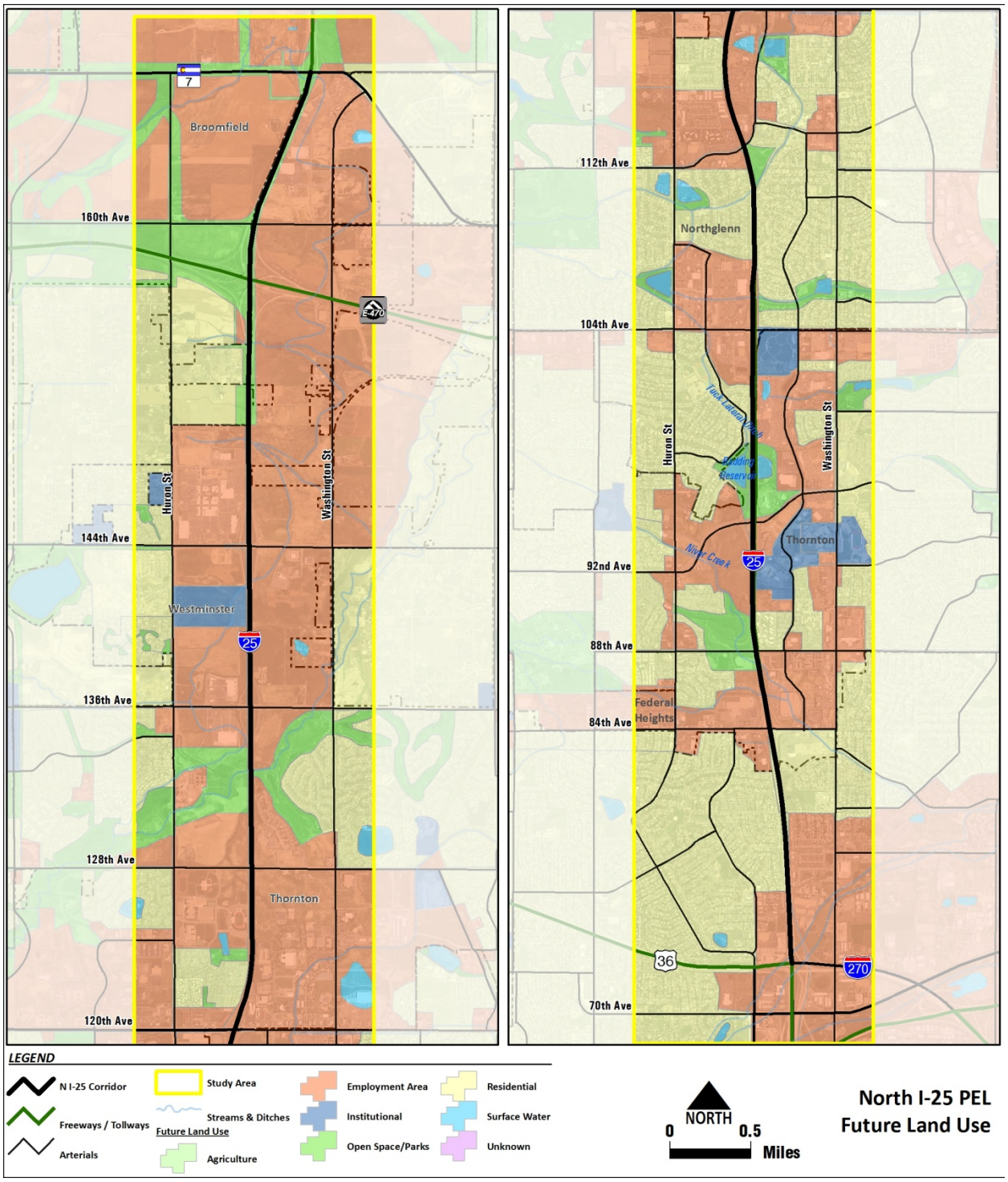


#### 6.6.2.3 Future or Planned Land Uses

Local plans, as referenced below, call for a dramatic shift in land use in the northern portion of the Study Area with agriculture and vacant land converted primarily to commercial land along I-25 and residential use primarily west of Huron Street and east of Washington Street. The percentage of commercial land use in the Study Area is projected to increase from 23 percent to more than 50 percent as local planning objectives are implemented. South of 120th Avenue, very little land use change is anticipated because the area is predominantly built out. A summary of future land use plans for municipalities in the Study Area is described below and depicted in **Figure 6.6-2**.

**City/County of Broomfield –** As documented in the *City and County of Broomfield Comprehensive Plan* (2005), the largest areas of anticipated change are located along the I-25 corridor, north of the I-25 and E-470 interchange. Broomfield plans to focus commercial and retail uses within its City/County limits along the I-25 corridor.

## Figure 6.6-2 Future Land Uses in the PEL Study Area



## 6.7 Noise

A general concern with transportation facilities is the potential for noise impacts from vehicles to the receptors (i.e., properties) near the facilities. Thresholds for determining noise impacts have been established by state and federal transportation agencies (e.g., CDOT or FHWA) to guide these conclusions. When impacts are identified from an improvement, mitigation actions for the impacted receptors are typically considered for the project design. This is an important consideration for this project because properties are along the I-25 mainline may be impacted by noise.

### 6.7.1 Methodology

Existing transportation noise conditions for the PEL area were developed by reviewing the information previously gathered for the area for the North I-25 FEIS and updating this information for the I-25 mainline and up to 500 feet from and any substantive changes in terms of traffic noise receptors that occurred since the North I-25 FEIS was prepared.

The main change in noise methodology is that new guidance has been implemented for noise impacts and abatement for highways since the North I-25 FEIS. On July 13, 2010, FHWA issued a new final traffic noise rule that affects Federal and Federal-aid projects (23 CFR 772). In response, CDOT developed new noise analysis and abatement guidance (CDOT, 2011) to comply with the new rule. Therefore, the determination of impacts and the evaluation of abatement actions going forward must follow the 2011 CDOT guidance and may reach different conclusions than those presented in the North I-25 FEIS. However, it is important to understand that the noise impact thresholds for the most sensitive common noise receptor (residences) did not change under the new guidance, so the impact findings from the new guidance should not be dramatically different. It should be noted that the North I-25 ROD was prepared after this change took effect and followed the 2011 CDOT guidance.

The current CDOT Noise Abatement Criteria (NAC) are presented in **Table 6.7-1**. If the noise level at a receptor is found to equal or exceed the relevant NAC, the receptor is impacted. For proposed improvements, if the noise level in the future design year at a receptor is calculated to increase by 10 decibels (dB) or more over existing conditions, that is also a noise impact.

**Table 6.7-1 CDOT Noise Abatement Criteria**

| Land Use Category | CDOT NAC (Leq dB) | Description of Land Use Category |
|---|---|---|
| A | 56 Exterior | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B | 66 Exterior | Residential |
| C | 66 Exterior | Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings. |

| Land Use Category | CDOT NAC (Leq dB) | Description of Land Use Category |
|---|---|---|
| D | 51 Interior | Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios. |
| E | 71 Exterior | Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F. |
| F | Not Applicable | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, ship yards, utilities (water resources, water treatment, electrical), and warehousing. |
| G | Not Applicable | Undeveloped lands that are not permitted for development. |

### 6.7.2 Results

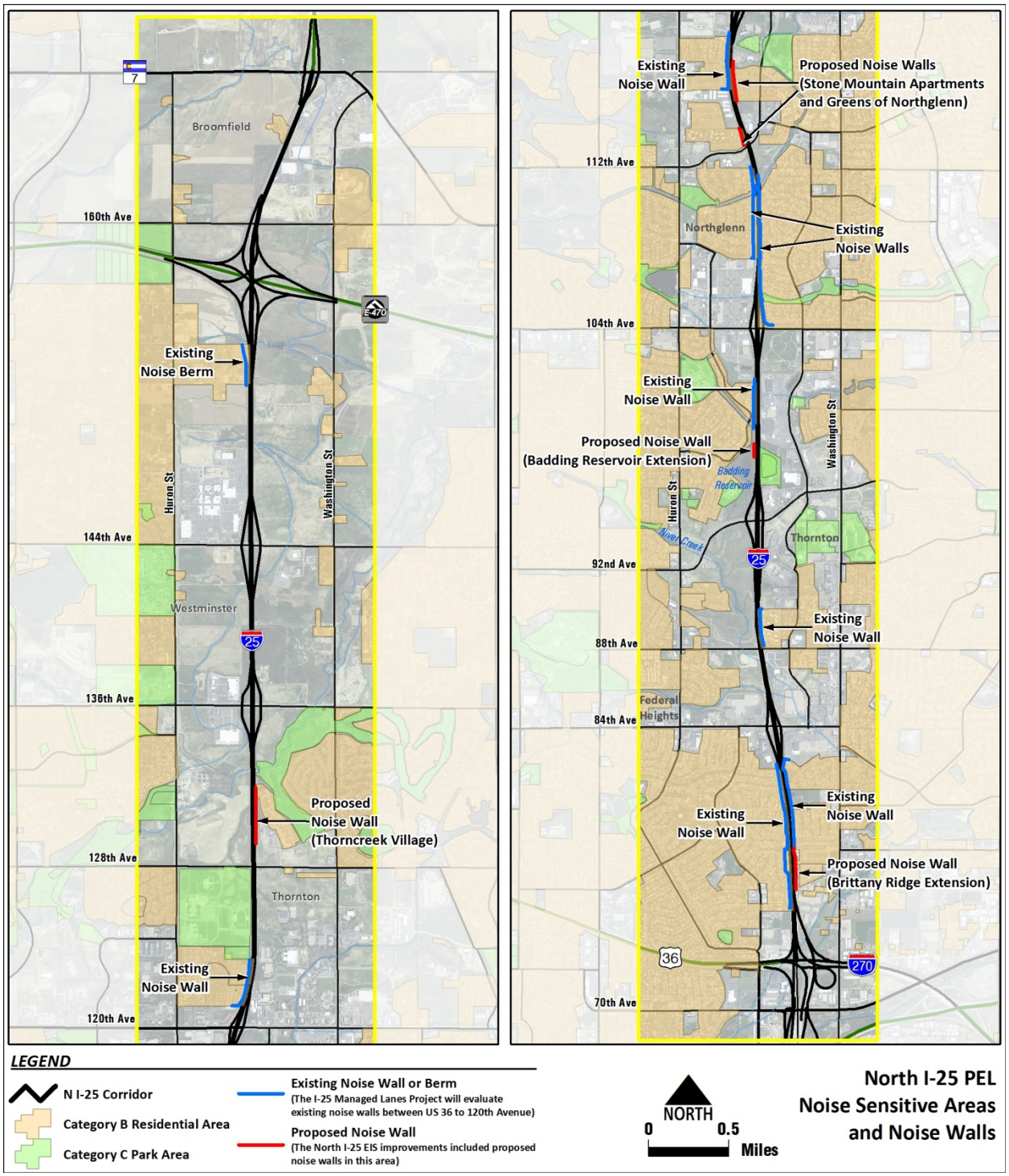
Numerous residential neighborhoods (NAC Category B) can be found in the Study Area between US 36 and SH 7 (**Figure 6.7-1**). Likewise, a number of Category C areas (parks, schools, etc.) are also spread throughout the Study Area. When developing potential transportation improvements for the Study Area, it will be important (in noise terms) to avoid or minimize noise levels and impacts in these areas.

A finding from the North I-25 FEIS was that a number of Category B areas along I-25 in the Study Area were impacted by traffic noise under existing conditions. I-25 traffic noise is the reason that a number of noise abatement actions, in the form of noise barriers, have already been built along I-25 (**Figure 6.7-1**). There are several existing noise barriers between US 36 and SH 7 that were constructed previously by other projects to abate I-25 traffic noise. These barriers provide noise-reduction benefits to the nearby homes and directly affect the number of noise-related impacts in the Study Area.

### 6.7.3 Conclusions

The North I-25 FEIS recommended several new noise barriers along I-25 in the Study Area (**Figure 6.7-1**). These barriers are planned for full build-out of Phase 1 of the North I-25 FEIS Preferred Alternative. The North I-25 FEIS also includes plans to replace the old existing wooden barriers along I-25 when the full build-out of Phase 1is implemented in this area. The interim project of constructing tolled express lanes on the existing infrastructure will construct new noise walls and will evaluate which walls need rehabilitation. Any future projects identified in this PEL will require additional noise analysis that complies with the latest CDOT noise analysis and mitigation guidance to determine the need for and reasonableness for noise mitigation.

## Figure 6.7-1 Proposed Noise Barriers in the Study Area



## 6.8 Parks, Recreation, and Trails

Parks and recreational resources are important community facilities that warrant consideration during federally funded projects. These resources include parks, trails, and open space areas which offer opportunities for recreation, including both passive and active activities. The Resource-specific Study Area for parks and recreational resources includes a 500-foot corridor centered on the I-25 mainline plus a 100-foot corridor centered on the connecting routes between Huron Street and Washington Street.

### 6.8.1 Methodology

Existing parks and recreational resources in the Resource-specific Study Area were identified through review of GIS data; review of current land use, parks, and recreation master plans; review of information in the North I-25 FEIS, and review of 2011 aerial imagery from Google Earth. The following plans were consulted:

- Broomfield *Open Space, Parks, Recreation and Trails Master Plan (2005)*
- Northglenn *Open Space Management Plan (2010)*
- Thornton *Parks and Open Space Master Plan (approved in 2010)*
- Westminster *Parks and Recreation Master Plan 2010 to 2014 (2009)*

### 6.8.2 Results

#### 6.8.2.1 Existing Park, Trail and Open Space Resources

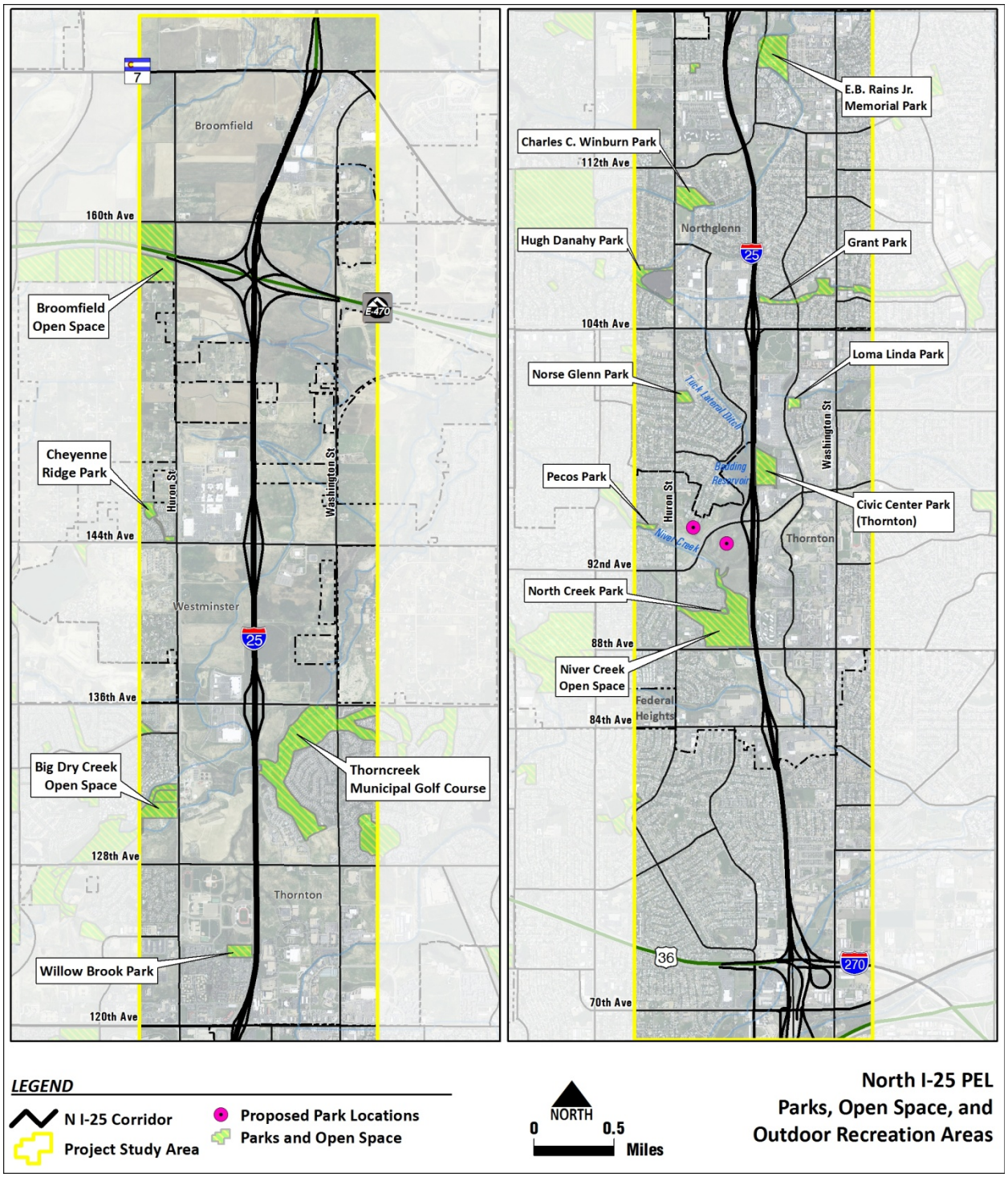
There are relatively few parks within the Study Area, but there are numerous trails. Six of the trails cross the I-25 corridor via grade-separated trail crossings. Four additional trails cross I-25 along roadways with grade-separated crossings. Details and characteristics of the park, open space, and trail resources in the Study Area are presented below in **Table 6.8-1** and depicted in **Figure 6.8-1** for parks and open space and **Figure 6.8-2** for trails. The information has not been confirmed with the jurisdictions and may change as the project progresses through the planning phases.

**Table 6.8-1 Existing Park, Trail, and Open Space Resources**

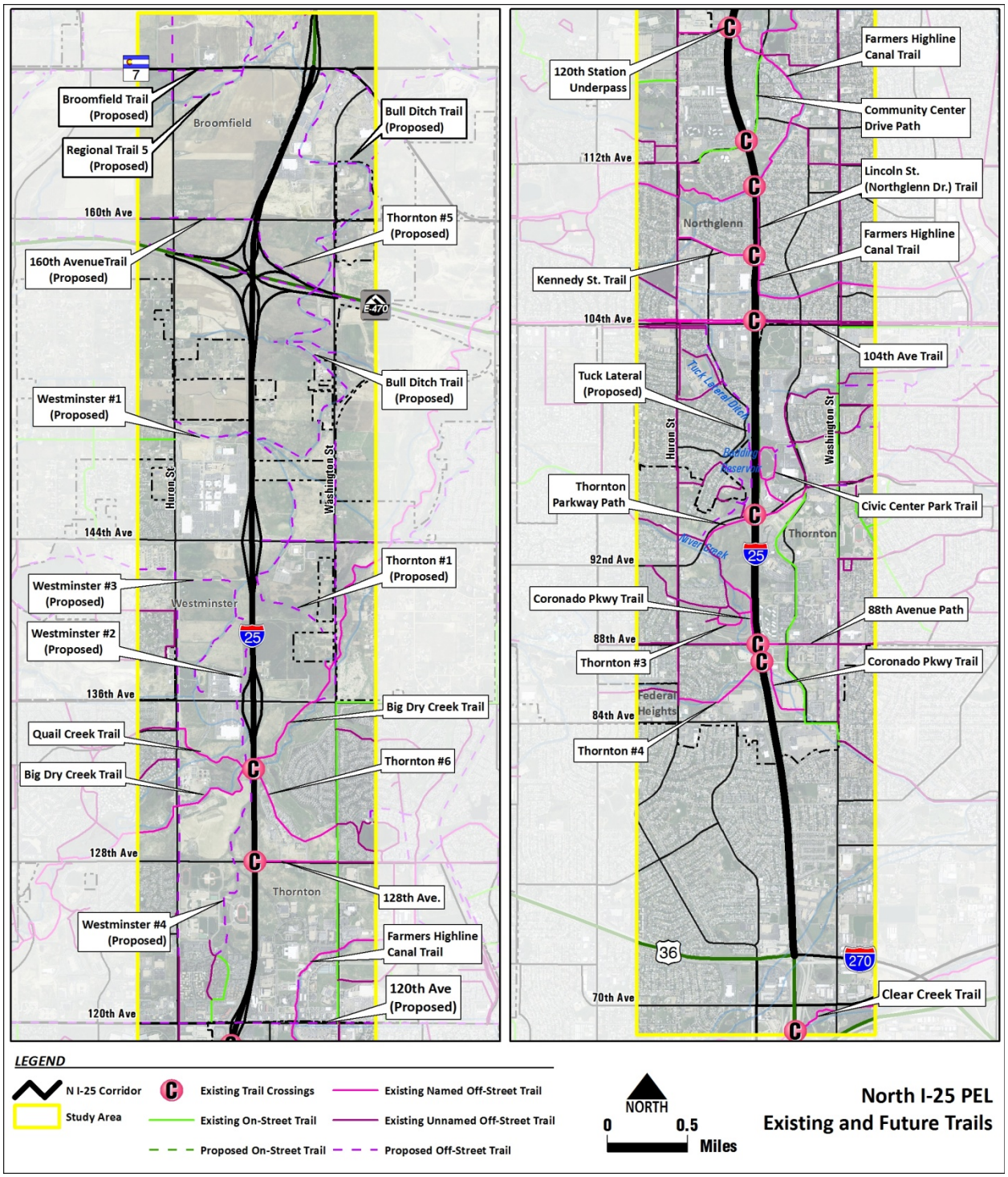
| Resource Name | Size/Location | Resource Type/ description | Managed by |
|---|---|---|---|
| Big Dry Creek Trail | Crosses 136th Ave. west of Washington and crosses I-25 south of 136th Ave. | Regional off-street bike trail with trail underpass of I-25 | City of Thornton |
| Quail Creek Trail | West of I-25 between 136th Ave. and 128th Ave. | Local multi-use path | City of Westminster |
| Thornton #6 Trail | East of I-25 between 136th Ave. and 128th Ave. | Local bike trail | City of Thornton |
| Thorncreek Municipal Golf Course | East of I-25 between 136th Avenue and 128th Avenue | Community park and recreation facility with driving range, miniature and regulation golf course | City of Thornton |
| 128th Avenue | East of I-25 along | Local, off-street, multi-use path | City of |

| Resource Name | Size/Location | Resource Type/ description | Managed by |
|---|---|---|---|
| Multi-use Path | 128th Ave. | | Thornton |
| Farmers Highline Canal Trail | Crosses 120th Ave. east of I-25. Crosses I-25 near 112th Ave. | Regional, off-street multi-use path with trail underpass of I-25 | City of Thornton |
| 120th Station Underpass | Crosses I-25 south of 120th Ave. | Local, off-street multi-use path with trail underpass of I-25 | City of Northglenn |
| Willow Brook Park | 8 acres: west of I-25 at 120th Ave., Westminster | Neighborhood park and recreation facility with pavilion, picnic tables, BBQ grills, stream, playground, trail | City of Westminster |
| Community Center Drive Multi-use Path | Crosses I-25 along Community Center Drive | Multi-use path | City of Northglenn |
| Lincoln Street Trail | East of I-25 between 112th Ave. and 104th Ave. | Regional off-street trail | City of Northglenn |
| Grant Park | 14 acres: adjacent to I-25, north of 104th Ave., Northglenn | Neighborhood park and recreation facility with trail, picnic area soccer, basketball, playground, and picnic shelter | City of Northglenn |
| Kennedy Street Multi-use Path | Crosses I-25 north along Kennedy Street north of 104th Ave. | Local, off-street multi-use path with trail overpass of I-25 | City of Northglenn |
| 104th Avenue Multi-use Path | Crosses I-25 at 104th Ave. | Local, off-street, multi-use path | City of Northglenn |
| Civic Center Park | 17 acres: adjacent to east side of I-25 north of Thornton Parkway | Community park and recreation facility with pond, trails, and picnic area | City of Thornton |
| Civic Center Park Trail | East of I-25 and north of Thornton Parkway | Local, off-street trail | City of Thornton |
| Thornton Parkway Multi-use Path | Crosses I-25 at Thornton Parkway | Regional, off-street, multi-use path | City of Thornton |
| Niver Creek Open Space | West of I-25, North of 88th Ave, Thornton | Open space and detention area with trails | City of Thornton |
| 88th Avenue Multi-use Path | Crosses I-25 along 88th Ave. | Local, off-street, multi-use path | City of Thornton |
| Coronado Parkway Trail | West of I-25 north and south of 88th Ave. Crosses I-25 south of 88th Ave. | Local, off-street trail with trail underpass of I-25 | City of Thornton |
| Thornton #3 Trail | In Niver Creek Open Space west of I-25 and north of 88th Ave. | Local, unpaved, trail | City of Thornton |
| Thornton #4 Trail | East of I-25 south of 88th Ave. | Local trail | City of Thornton |
| Clear Creek Trail | Crosses I-25 south of US 36 | Regional, off-street bike trail with trail underpass of I-25 | City of Wheat Ridge |

## Figure 6.8-1 Existing Parks and Open Space Areas in the Study Area



## Figure 6.8-2 Existing Trails in the Study Area



### 6.8.2.2 Future or Planned Recreation Resources

Each of the municipalities has master plans established for future trails, parks, and open space areas within the Study Area. Some of these resources span jurisdictional boundaries and follow linear features within the Study Area. The proposed trail alignments are conceptual and boundaries for the proposed park/open space areas have not been identified. Ongoing coordination with the local jurisdictions is needed throughout the project as plans for these recreational resources develop. Planned recreational resources identified in the Study Area are listed in **Table 6.8-2**. This list should not be considered exhaustive as master plans may be updated while this project is progressing. However, efforts should be made to not preclude previous planning efforts made by local jurisdictions.

**Table 6.8-2 Future Master Planned Recreation Resources**

| Name | Description & Location | Owner |
|---|---|---|
| Region 5 Trail | Local, off-street trail west of I-25 and north of SH 7 | Broomfield |
| 160th Avenue | Regional trail proposed to cross I-25 along the160th Ave. overpass | Broomfield |
| Thornton #5 Trail | Regional trail east of I-25 and north of Northwest Parkway | City of Thornton |
| Bull Ditch Trail | Local, off-street trail east of I-25 between SH 7 and 144th Ave. | City of Thornton |
| Westminster #1 | Local, unpaved, off-street bike trail proposed to cross I-25 between Northwest Parkway and 144th Ave. Would require a new grade-separated crossing. | City of Westminster |
| Westminster #2 | Local, off-street, bike trail west of I-25 north and south of 136th Ave. | City of Westminster |
| Westminster #3 | Local, off-street, bike trail west of I-25 and between 136th Ave. and 144th Ave. | City of Westminster |
| Westminster #4 | Local, off-street bike trail west of I-25 north and south of 128th Ave. | City of Westminster |
| Tuck Lateral | Off-street trail west of I-25between 104th Ave. and Thornton Parkway | Thornton/ Northglenn |
| Proposed park/open space | North of Thornton Parkway and west of I-25 between Conifer Road and I-25 | City of Thornton |
| Proposed park/open space | South of Thornton Parkway and west of I-25 between the north and south forks of Niver Creek | City of Thornton |

### 6.8.2.3 Section 4(f) Properties

Some of the recreation properties presented within the Study Area may be afforded protection under Section 4(f) as defined in 23 Code of Federal Regulations 774. A Section 4(f) property is one that functions or is designated as a significant publicly-owned park, recreation area, wildlife or waterfowl refuge, or historic site. A number of the recreation properties in the Study Area likely meet the criteria for protection under Section 4(f).

Historic resources are discussed in **Section 6.5** and show that there are 3 sites listed on or eligible to be listed the National Register for Historic Places (Bull Canal, Farmers Highline

Canal, and Clear Creek Ditch) and 10 sites that have potential to be listed on the National Register for Historic Places. These sites are considered Section 4(f) resources.

If one of these properties is impacted as part of the proposed action, then a Section 4(f) evaluation may be required for that particular resource.

#### 6.8.2.4 Section 6(f) Properties

Section 6(f) of the Land and Water Conservation Fund Act (36 Code of Federal Regulations 59) protects recreational lands planned, acquired, or developed with Land and Water Conservation Funds (L&WCF). Once an area has been funded with Land and Water Conservation Fund assistance, it is continually maintained in public recreation use unless the National Park Service approves substitution property. Importantly, Section 6(f) applies to all transportation projects involving possible conversions of the property, whether or not federal funding is being used for the project.

The North I-25 FEIS, completed in August 2011, identified one property within the Study Area that was developed with L&WCF grant assistance; Grant Park, located directly east of I-25 in Northglenn. Colorado State Parks was contacted in March 2012 to verify if any additional recreational resources within the Study Area received grant assistance from the L&WCF. No additional resources were identified.

### 6.8.3 Conclusions

There are relatively few parks within the Study Area. Resources directly adjacent to I-25 include Niver Creek Open Space, Civic Center Park, Willow Brook Park, and Thorncreek Municipal Golf Course. There are numerous recreational trails in the study area with six crossing the I-25 corridor via grade-separated trail crossings and four crossing I-25 along roadways with grade-separated crossings. Planned trails directly adjacent or across I-25 have been identified north of Thornton Parkway, at 120th Avenue, between 128th Avenue and 144th Avenue, at E-470, and at 160th Avenue. Some of these recreation properties may be afforded protection under Section 4(f) and Grant Park, located directly east of I-25 in Northglenn, has been identified as a Section 6(f) resource.

## *6.9 Threatened and Endangered Species / Wildlife Corridors*

Wildlife is an important public resource that warrants consideration during federally funded projects and is documented during transportation project development. Various federal laws have been established to protect wildlife, including: the Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGPA), and provisions of SAFETEA-LU.

### 6.9.1 Methodology

Details and characteristics of wildlife resources in the Study Area were identified using existing geographic information system (GIS) data (see **Table 6.9-1** and **Figure 6.9-1**). Additional inventory details about the resources, such as protection status and presence of species were obtained from accessing the Colorado Parks & Wildlife (CPW) Natural Diversity Information Source (NDIS), the Colorado Natural Heritage Program (CNHP), and the US Fish & Wildlife Service (USFWS) websites in March 2012. Research centered on utilizing the most current

version of information available online. Data from the North I-25 FEIS was also utilized because the two study areas general overlap (CDOT 2011).

The wildlife resources that were identified during the review can be categorized into one of the following categories:

**Threatened & Endangered (T & E) Species** – State and federal listed threatened & endangered species that are listed or are candidates for listing on the ESA. Habitat and range maps were collected from the above resources.

**Protected Species –** Species or their habitat readily available from the above resources. They included species that are protected by the MBTA and BGPA.

**Wildlife Corridors –** Identified corridors for wildlife to move through the landscape freely. Wildlife Corridors and wildlife crossings are identified, as part of SAFETEA-LU, as a source for safety risks to the general public. Identifying and planning for best management practices for wildlife crossings is also identified in SAFETEA-LU. Wildlife corridors were obtained from the North I-25 FEIS.

### 6.9.2 Results

Generally, the Study Area is in a flat to rolling plains region of Colorado which consists of an urban/built-up environment in most of the Study Area, along with agricultural fields and individual farms in the northern part of the Study Area. These agricultural fields and individual farms are now experiencing an increase in both residential and commercial development. There are numerous drainages throughout the Study Area, including 10 ditches and canals and 1 creek. **Table 6.9-1** and **Figure 6.9-1** depict the existing wildlife habitat, protected nests, and wildlife corridors in the Study Area.

#### 6.9.2.1 T & E Species

Location of potential protected T & E species habitat were identified, based on available GIS data. This includes habitat for such plants as the Colorado butterfly plant (*Gaura neomexicana coloradensis*) and the Ute ladies'-tresses orchid (*Spiranthes divulialis*). Other species that were identified that may have habitat present in the Study Area include the common shiner (*Notropis cornutus*) and the Preble's meadow jumping mouse (*Zapus hudsonius preblei*). The primary drainage that was identified from available information which contained suitable habitat for these species is Big Dry Creek. A detailed survey of this drainage is recommended for the species listed above to identify the presence or absence of these species in the Study Area.

#### 6.9.2.2 Migratory Birds

During the data review, any nests that were within the Study Area, including migratory birds, raptors, and eagles were identified through available GIS data and field review. Multiple reported raptor nests, including red-tailed hawk (*Buteo jamaicensis*), great-horned owl (*Bubo virginianus*), Swainson's hawk (*Buteo swainsoni*), and bald eagle (*Haliaeetus leucocephalus*) nests are located in the northern part of the Study Area. Other migratory birds such as cliff swallows (*Petrochelidon pyrrhonota*) potentially have nests located on bridge and culverts over drainages throughout the Study Area. CPW has recommended buffers for raptor nests to limit disturbance due to human encroachment and are between ¼ and ½ a mile radius from active nests (CDOW 2008).

Impacts to migratory birds (e.g., song birds, herons, other raptors, and bald eagles) may occur from design alternatives if construction occurs during the normal nesting season of these species. The normal nesting season is between February 15th and August 31st.

#### 6.9.2.3 Wildlife Corridors

Existing land use in the Study Area is primarily residential and commercial, except for in the north. The northern portion of the Study Area is primarily agricultural and undeveloped lands. However, land is being converted into residential and commercial development at a steady pace. Where wildlife had free movement through fields and along drainages in the past, their movements are now becoming more constricted and their habitat is more fragmented due to this development. Wildlife can also be a road safety hazard, causing millions of dollars annually in repairs and medical costs due to animal-vehicle collisions (AVCs). These AVCs also result in a loss to wildlife populations and wildlife diversity.

Currently, the only area identified as a movement corridor for wildlife between protected tracts of land within or adjacent to the Study Area is along Big Dry Creek. This drainage was identified in the North I-25 FEIS Wildlife Technical Report (ERO 2008). The parks and open space that are protected along Big Dry Creek include: ThornCreek Municipal Golf Course, Big Dry Creek Open Space, and Bull Reservoir Open Space. The construction of wildlife-friendly structures over this drainage will provide an avenue for wildlife to move through the Study Area while keeping the general public safe.

### 6.9.3 Conclusions

Based on the information available during the PEL, there is potential habitat for the Colorado butterfly plant, Ute ladies-tresses orchid, Preble's meadow jumping mouse, and the common shiner in the Study Area. As projects are identified from this PEL, more detailed analysis of potential habitat and potential presence/absence survey may be warranted.

Numerous active and inactive raptor nests were identified in the corridor and CPW buffer recommendations for activities within ¼ and ½ miles from an active nest should be considered. A qualified biologist should determine the actual use of these nests during anticipated construction timing.

If projects are developed in the Big Dry Creek area that requires the manipulation of the box culvert, then it is recommended that the resulting structure be designed to accommodate wildlife movements, as much as possible.

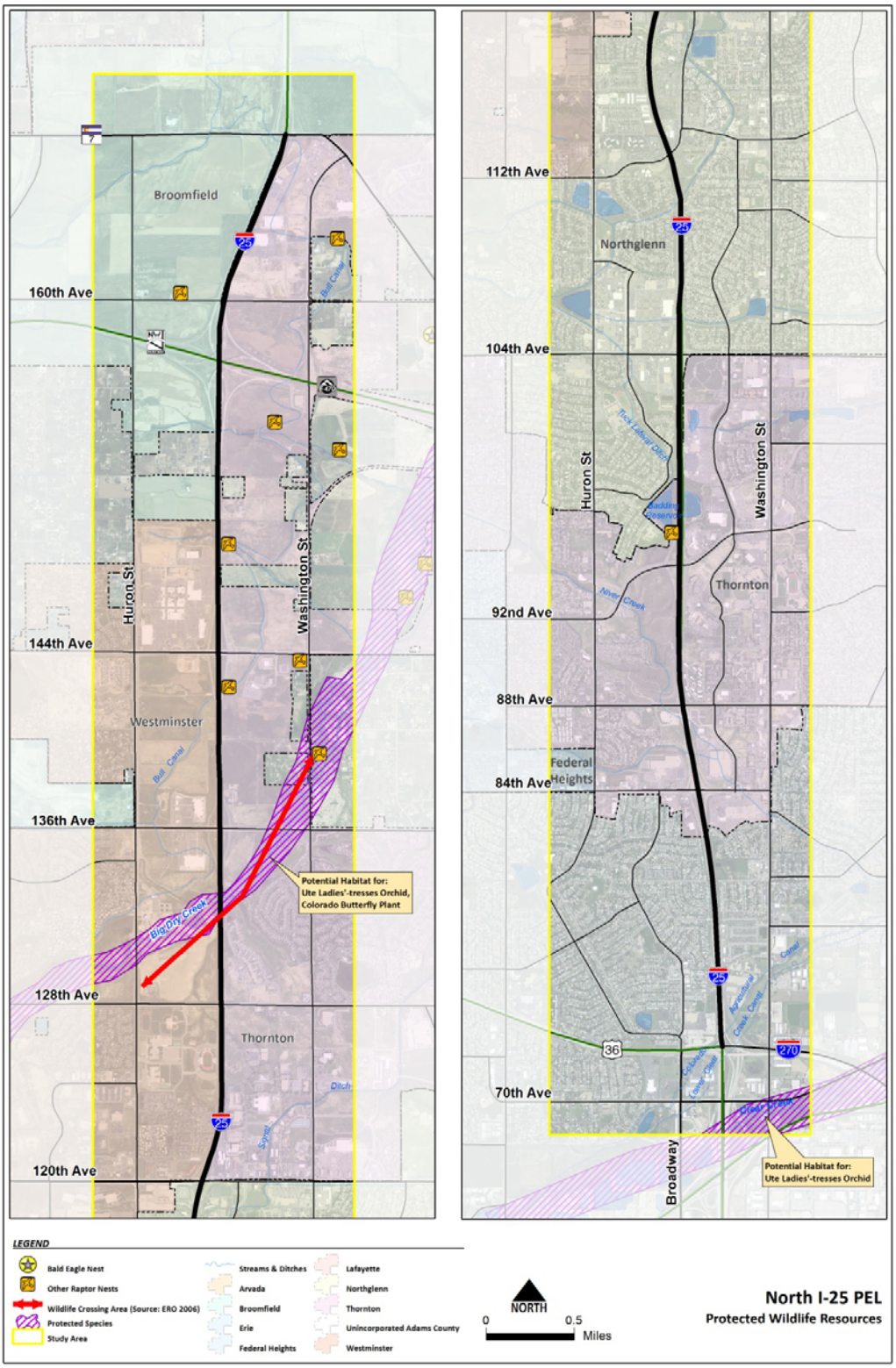
**Table 6.9-1 Existing Wildlife Resources**

| Resource Name | Protection Type | Habitat | Habitat Present? | Observed in Field? |
|---|---|---|---|---|
| *Bald Eagle (Haliaeetus leucocephalus)* | BGPA | Reservoirs and rivers. In winter they may also occur locally in semideserts and grasslands, especially near prairie dog towns. | Yes, multiple areas with cottonwoods and creeks/rivers in Study Area. | Yes, three potential nests, one with bald eagle present |
| Cliff Swallows (*Petrochelidon pyrrhonota)* | MBTA | Streams and creeks with readily available access to insects and locations for building nests. | Yes, multiple locations where structures can be used to build nests. | Yes – mud nests present on bridge structures |
| Colorado Butterfly Plant (*Gaura neomexicana coloradensis*) | Federally Threatened Species - ESA | An early successional plant (although probably not a pioneer) adapted to use meandering stream channel sites that are periodically disturbed. It occurs on subirrigated, alluvial (stream deposited) soils on level or slightly sloping floodplains and drainage bottoms, does not occur in Adams County (USFWS 2011). | Yes, Coal Creek, Community Ditch, Big Dry Creek, and the South Platte River. | No Survey Conducted |
| Common Shiner (*Notropis cornutus*) | State Threatened Species - ESA | Typically occurs in small and medium-sized streams with clear, cool water, and a moderate current. Streams usually with unvegetated gravel to rubble bottom. Prefer pools adjacent to rapids/cascades. | Yes, Coal Creek. | No Survey Conducted |
| Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*) | Federally Threatened Species - ESA | Inhabits riparian areas near standing or running water in lowland areas that are dominated by forested wetlands, shrub dominated wetlands, and grass/forb dominated wetlands between 4,000 and 8,000 ft in elevation. | Yes.<br>*Note: A block clearance zone for this species exists south of the Weld County/Adams County line. | No Survey Conducted |
| Red-tailed Hawk (*Buteo* | MBTA | Nests in large trees (typically plains cottonwood [*Populus* | Yes, multiple drainages and | Yes, several nests |

| Resource Name | Protection Type | Habitat | Habitat Present? | Observed in Field? |
|---|---|---|---|---|
| *jamaicensis*) | | *deltoides*]) in or near riparian areas, areas with abundant prey. | several nests which have been used in the past by red-tailed hawks are present. | identified |
| Swainson's Hawk (*Buteo swainsoi*) | MBTA | Nests in large trees (typically plains cottonwood [*Populus deltoides*]) in or near riparian areas, areas with abundant prey. | Yes, multiple drainages and several nests which have been used in the past by red-tailed hawks are present | Yes, several nests identified |
| Ute Ladies'-Tresses Orchid (*Spiranthes diluvialis*) | Federally Threatened Species - ESA | Occurs along riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. | Yes, Coal Creek, Community Ditch, and Big Dry Creek. *Note: A block clearance zone for this species exists south of the Weld County/Adams County line for the South Platte River. | No Survey Conducted |
| Western Prairie Fringed Orchid (*Platanthera praeclara*) | Federally Threatened Species - ESA | Occurs most often in mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches. | No habitat present. | No Survey Conducted |
| Wildlife Corridors | SAFETEA-LU | Identified corridors/crossing locations for wildlife, typically along drainages, streams, and rivers. | Yes, numerous ditch and stream crossings are located throughout the Study Area. | Yes |

**Notes**: 1 All habitat information taken from CDOW-NDIS 2011 and USFWS 2011, unless otherwise noted.

**Figure 6.9-1 Existing T&E, Protected Nests, and Wildlife Corridors in the Study Area**



## 6.10 Wetlands

In recognition of the importance of clean water and the ecological value of wetlands, in 1977 the U.S. Congress passed the Clean Water Act (CWA) to protect the physical, biological, and chemical quality of waters of the U.S., including adjacent wetlands. Section 404 of the CWA defines waters of the U.S. as all traditional navigable waters and their tributaries, all interstate waters and their tributaries, all wetlands adjacent to these waters, and all impoundments of these waters. The US Army Corps of Engineers (USACE) Regulatory Program administers and the Environmental Protection Agency (EPA) enforces Section 404 of the CWA.

This section discusses wetlands and other waters within the Resource-specific Study Area. The wetlands-specific Study Area was identified as 200 feet from the edge of pavement and exit ramps and interchanges on I-25. This analysis builds on the results of prior environmental studies completed, including the North I-25 FEIS. The wetlands identified in the North I-25 FEIS were utilized as a basis for this study. In addition, a preliminary desktop study was conducted to determine additional wetland and other waters within the Study Area.

### 6.10.1 Methodology

The majority of wetlands within the Study Area were delineated in support of the North I-25 FEIS. Additional wetland identification presented in this section was based on a desktop review of current wetland and water boundaries. The desktop review determined the extent of wetlands within the Study Area and consisted of reviewing National Wetland Inventory (NWI) Maps, aerial photography, Google Earth, and topographical maps. New potential wetland areas identified during the desktop review were digitized using GIS and acreages were determined for each wetland. Additional field surveys are required to gather more detailed information regarding the extent and additional characteristics of wetland areas.

### 6.10.2 Results

The majority of wetlands identified within the Resource-specific Study Area are palustrine emergent and palustrine scrub/shrub wetlands that generally occur along streams, roadside ditches, irrigation ditches and canals, and at pond margins. **Table 6.10-1** lists a summary of the delineated wetlands within the Resource-specific Study Area. **Figure 6.3-1** presents the locations of the wetlands identified in the Resource-specific Study Area.

Wetland systems vegetated with trees, shrubs, or persistent emergent plant species are classified as palustrine (Cowardin, et al., 1979). The palustrine system includes all non-tidal wetlands dominated by trees, shrubs, vascular plants, and non-vascular plants. Palustrine wetland classes in the Resource-specific Study Area include emergent (grass, sedge, and forb dominated) and scrub-shrub (small tree or shrub dominated). Common wetland species include cattail (*Typha sp.*), reed canarygrass (*Phalaris arundinacea*), sedges (*Carex sp.*), rushes (*Juncus sp.*), and sandbar willow (*Salix exigua*).

**Table 6.10-1 Summary of Identified Wetlands**

| Wetland Type | Total Acres within the Resources-specific Study Area |
|---|---|
| Palustrine Scrub/Shrub | **11.05** |
| Palustrine Emergent | **16.56** |
| Waters | **5.22** |

#### 6.10.2.1 Palustrine Scrub/Shrub Wetlands

Typical vegetation occurring in scrub-shrub wetlands in the Resource-specific Study Area include various mixes of emergent wetland vegetation in the understory and an overstory primarily dominated in part or combination of sandbar willow (*Salix exigua*), boxelder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), crack willow (*Salix fragilis*), and plains cottonwood saplings (*Populus deltoides ssp. monilifera*).

The majority of scrub/shrub wetlands within the Resource-specific Study Area occur along the banks and floodplains of established perennial and intermittent waterways and along the outer margins of ponds or large bodies of standing water. A lesser occurrence of this wetland type was identified along man-made irrigation ditches and roadside drainages. Wetlands occurring along the banks of waterways typically have a higher ground water table due to proximity of the stream or river way and receive periods of temporary flooding and inundation from stream and river over flows during storm and snowmelt periods throughout the year. Other common hydrologic indicators identified within these areas include drift lines, sediment deposits, drainage patterns in wetlands, and some areas with water stained leaves.

#### 6.10.2.2 Palustrine Emergent Wetlands

Typical wetland vegetation occurring in emergent wetlands in the Resource-specific Study Area include cattail species (*Typha sp.*), common threesquare (*Schoenoplectus pungens*), arctic rush (*Juncus arcticus*), reed canarygrass (*Phalaris arundinaea*), Emory's sedge (*Carex emoryi*), smooth horsetail (*Equisetum laevigatum*), bluejoint (*Calamagrostis canadensis*), clustered field sedge (*Carex praegracilis*), foxtail barley (*Hordeum jubatum*), and curly dock (*Rumex crispus*).

The majority of emergent wetlands identified in this portion of the Resource-specific Study Area occur along man-made irrigation and roadway ditches, edges of pond margins, seeps, and within the floodplains of various perennial and intermittent waterways. Primary hydrology for this wetland type is provided by unidirectional flows of water including surface runoff, waterway over flows, and shallow sub-surface ground water flows. Other common hydrologic indictors observed in these areas include a saturated upper 12 inches of soil during the growing season, areas of inundation, water-stained leaves, sediment deposits, and drainage patterns common in wetlands.

#### 6.10.2.3 Other Waters

A mix of perennial intermittent waterways, ditches and ponds exists throughout the Resource-specific Study Area. Major waterways, from south to north, include:

- Clear Creek – Perennial Stream
- Colorado Agricultural Canal
- Croke Lake
- Farmers Highline Canal
- Big Dry Creek – Intermittent stream
- Bull Canal

### 6.10.3 Conclusions

The Resource-specific Study Area contained 27.61 acres of Palustrine wetlands and 5.22 acres of Other Waters. The results of this Wetland Overview confirmed the presence of wetlands and other waters within the Study Area and also utilized existing data from previous studies to examine present conditions. This report illustrates and describes current wetland conditions and provides information for the purposes of the North I-25 PEL Environmental Overview.

# 7.0 REFERENCES

CH2MHill. January 2000. Niver Creek Tributary L Project Final Design Report.

City and County of Broomfield. 2005. *City and County of Broomfield Comprehensive Plan*.

City and County of Broomfield. 2005. *Open Space, Parks, Recreation and Trails Master Plan*.

City of Northglenn. 2010. *Open Space Management Plan*.

City of Northglenn. 2010. *The Northglenn Comprehensive Plan*.

City of Thornton, 2007. *City of Thornton Comprehensive Plan*.

City of Thornton. 2009. *Thornton Parks and Open space Master Plan*. (approved in 2010).

City of Westminster. 2001. *Trails Master Plan Map*.

City of Westminster. 2008. *City of Westminster Comprehensive Plan*.

City of Westminster. 2009. *Parks and Recreation Master Plan 2010 to 2014*.

Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA). 2011. North I-25 EIS Record of Decision (ROD).

Colorado Department of Transportation. 2005. *CDOT's Title VI and Environmental Justice Guidelines for NEPA Projects – Rev.3*. May 27.

Colorado Department of Transportation. 2011. Noise Analysis and Abatement Guidelines, March.

Colorado Department of Transportation. 2011. *North I-25 Environmental Impact Statement*.

Colorado Division of Wildlife (CDOW). 2008. CDOW Raptor Guidelines. February.

Colorado State Parks. 2012. email correspondence from Melanie Gose dated March, 13 2012.

Cowardin, L.M., et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. United States Fish and Wildlife Service. Biological Services Program; FWS/OBS-79/31.

ERO Resources. 2008. North I-25 EIS: Wildlife Technical Report.

Jacobs. 2008. North I-25 Wetland Technical Report. Prepared for the North I-25 EIS.

Jacobs. 2011. *Technical Memorandum: Environmental Justice*. Prepared for the North I-25 EIS.

Jacobs. 2011. *Technical Memorandum: Land Use Conditions and Impacts*. Prepared for the

Kiowa Engineering Corporation. October 2001. McKay Lake and Quail Creek Outfall Systems Planning Study Preliminary Design Report.

Natural Diversity Information Source (NDIS). 2011. Website: http://ndis.nrel.colostate.edu/conservationcnty.asp?cnty=031 .

Olsson Associates. August 2005. Design Report for Rehabilitation Maintenance of Grange Hall Creek I-25 to Grant Drive.

United States Fish & Wildlife Service (USFWS). 2011. Information, Planning, and Conservation System (IPaC) internet mapping tool website: http://ecos.fws.gov/ipac/wizard/trustResourceList!prepare.action

US Environmental Protection Agency. 2012. National Ambient Air Quality Standards. Available at: www.epa.gov/air/criteria.html/ (accessed February 2012).

Wright Water Engineers Inc. March 2007. Outfall Systems Planning Update of Big Dry Creek Northern Tributaries: Conceptual Preliminary Design Report.