



**COLORADO**  
Department of  
Transportation



# Planning and Environmental Linkages (PEL) Report For Interstate Highway 225 (I-225)

September 2014

**Prepared for:  
Colorado Department of Transportation  
Region 1  
2000 South Holly Street  
Denver, CO 80222**



**PLANNING AND ENVIRONMENTAL LINKAGES (PEL) REPORT  
FOR  
INTERSTATE HIGHWAY 225 (I-225)**

**CDOT Project No. STA 2254-085 (19187)**

***Prepared for:***

**Colorado Department of Transportation  
Region 1  
2000 South Holly Street  
Denver, CO 80222**

***Prepared by:***

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**SEPTEMBER 2014**

**FHU Reference No. 112200-01**

**Agency Support**

The public agencies that were engaged in the preparation of this Planning and Environmental Linkages (PEL) study for southbound Interstate Highway 225 (I-225) between Yosemite Street and Interstate Highway 25 (I-25) have expressed their support of this plan, as defined in this report, dated September 2014.

- The Federal Highway Administration (FHWA) and Colorado Department of Transportation (CDOT) agree that this study fits the criteria for the FHWA PEL process. Through this process, the evaluation and findings of the PEL study can be more readily applied to subsequent National Environmental Policy Act (NEPA) documentation. Resource agencies with jurisdiction in the interchange area have expressed support for the process and a willingness to work cooperatively on future NEPA processes for individual interchange improvements.
- CDOT, with the support of the local agencies, will work to complete the NEPA requirements for specific improvements for southbound I-225 between Yosemite Street and I-25. Subsequent to future NEPA approval, the local agencies will work cooperatively with CDOT to support receipt of funding for and implementation of the interchange area improvements.
- The local agencies will develop collaborative transportation partnerships to support the interchange recommendations through the Denver Regional Council of Governments (DRCOG) planning process to facilitate improvements to this area.

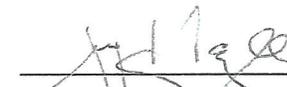
Written letters of support from the local agencies represented on the I-225 PEL from Yosemite Street to I-25 study Technical Working Group have been requested and will be compiled by CDOT as they are received. The Technical Working Group supports the recommendations of this study as indicated by those letters.

  
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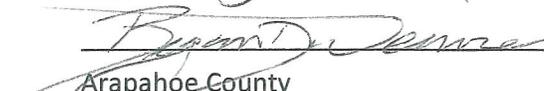
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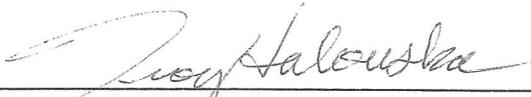
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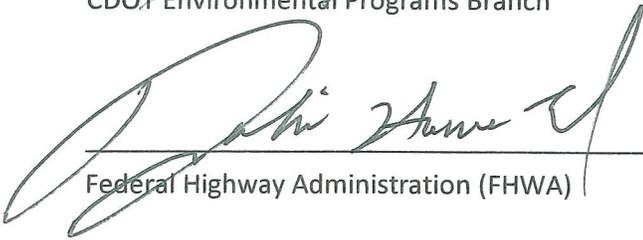
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Appendix B	FHWA Colorado Division Planning/Environmental Linkages Questionnaire
Appendix C	Concepts 16, 17, 18, 19 and 21 Exhibits and Tier 1, 2, and 3 Screening Tables
Appendix D	Traffic Conditions Report
Appendix E	Recommended Alternative Conceptual Typical Sections, Engineering Plans, and Renderings
Appendix F	Agency Coordination
Appendix G	Public Involvement

## LIST OF ACRONYMS AND ABBREVIATIONS

AM	morning
APCD	CDPHE Air Pollution Control Division
ATM	Active Traffic Management
BMPs	Best Management Practices
C-D	Collector-Distributor road
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CE	Construction Engineering
CLOMR	Conditional Letter of Map Revision
CM/GC	Construction Management/General Contractor
CPW	Colorado Division of Parks and Wildlife
DB	Design-Build
DBB	Design-Bid-Build
DDI	Diverging Diamond Interchange
DRCOG	Denver Regional Council of Governments
DTC	Denver Technological Center
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FAT	Fatality
FEMA	Federal Emergency Management Agency
FHU	Felsburg Holt & Ullevig
FHWA	Federal Highway Administration
FIR	Field Inspection Review
FOR	Final Office Review
GMP	Guaranteed Maximum Price
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
I-25	Interstate Highway 25
I-70	Interstate Highway 70
I-225	Interstate Highway 225
IGA	Intergovernmental Agreement
IAR	Interstate Access Request
INJ	Injury
ITS	Intelligent Transportation Systems
LOMR	Letter of Map Revision
LOS	level of service
LRT	light rail transit
LUS	Lane Use Signals
MIMR	Minor Interstate Modification Request
MP	milepost
mph	miles per hour
MS4	Municipal Separate Storm Sewer System
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
pc/mi/ln	passenger cars per mile per lane
PE	Preliminary Engineering
PEL	Planning and Environmental Linkages
PM	evening
PMT	Project Management Team

PDO	Property Damage Only
RAMP	Responsible Acceleration of Maintenance and Partnerships
ROW	right-of-way
RTD	Regional Transportation District
RTP	Regional Transportation Plan
SB	Southbound
SB 40	Senate Bill 40
SH 83	State Highway 83
SHPO	State Historic Preservation Officer
TDM	Travel Demand Management
TIP	Transportation Improvement Program
T-REX	TRansportation EXpansion Project
TWG	Technical Working Group
UDFCD	Urban Drainage Flood Control District
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Department of Interior Fish and Wildlife Service
VMS	Variable Message Sign
vpd	vehicles per day
WQCD	Water Quality Control Division

## 1.0 INTRODUCTION AND PURPOSE AND NEED

This report documents the results of a Planning and Environmental Linkages (PEL) study for southbound Interstate Highway 225 (I-225) between Yosemite Street and Interstate Highway 25 (I-25) in the City and County of Denver, Colorado. The Colorado Department of Transportation (CDOT) initiated the I-225 PEL (Yosemite Street to I-25) to develop and evaluate transportation improvements to reduce congestion and enhance the safety of southbound I-225 within the transportation analysis area (**Figure 1.1**). CDOT, in cooperation with the Federal Highway Administration (FHWA) and local agencies, prepared this PEL study in accordance with FHWA and CDOT PEL guidance for improving and streamlining the environmental process for transportation projects by conducting planning activities before the start of the National Environmental Policy Act (NEPA) process (CDOT, 2012).

CDOT conducted this PEL study to establish existing conditions, to identify future transportation challenges (using the year 2035 as a planning horizon), to evaluate alternatives that address the transportation needs of this segment of southbound I-225, and to develop a Recommended Alternative Concept for southbound I-225 between Yosemite Street and I-25. This report has used information from many sources, including 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 integrated during the PEL study process.

*An Environmental Analysis and Existing Conditions Assessment Report (Appendix A)* documents current and anticipated future conditions of the interchange in regard to land use, the transportation system, and environmental resources. The information presented in this report will be the basis for developing and evaluating possible transportation improvements along this highway segment.

### 1.1 Study Location and Description

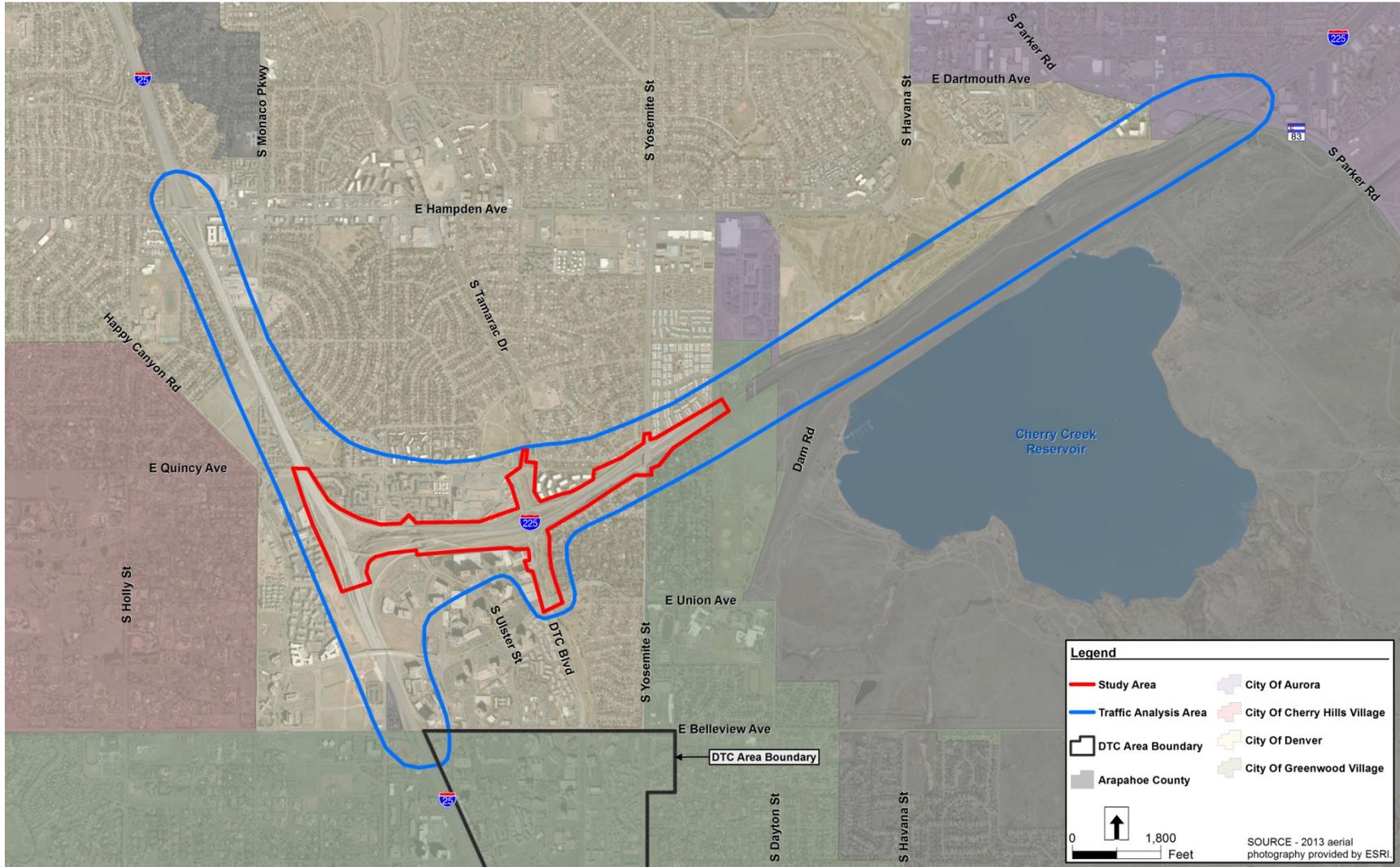
I-225 is a north-south freeway that spans approximately 13 miles between Interstate Highway 70 (I-70) to the north and I-25 to the south. The interstate provides major access to Denver, Adams, and Arapahoe counties. The study area extends less than two miles along I-225 between the I-225/Yosemite Street interchange on the east to the I-225/I-25 interchange on the west (**Figure 1.1**). The traffic analysis area is along I-225 between I-25 and Parker Road and along I-25 between Bellevue Avenue and Hampden Avenue and is shown in **Figure 1.1**.

FHWA defines PEL as a voluntary approach to transportation decision-making that considers environmental, community, and economic goals early in the planning stage and carries them through project development, design, and construction (FHWA, 2008). The PEL process can lead to a better decision-making process that minimizes duplication of effort, promotes environmental stewardship, and reduces delays in project delivery (CDOT, 2013).

Since this project does not have identified construction funding, NEPA cannot be completed at this time. The FHWA PEL Questionnaire summarizes the PEL process and is used to transition from the PEL study to a NEPA analysis. **Appendix B** includes the PEL Questionnaire for this study.

NEPA establishes a mandate for federal agencies to consider the potential environmental consequences of their proposed action, to document the analysis, and to make the information available to the public for comment before implementation.

**Figure 1.1 Study Area and Traffic Analysis Area**



## Interstate 225

As noted above, I-225 provides regional connectivity throughout the Denver Metropolitan Area. Initial construction for I-225 began in 1964 and was completed in 1976. With the development of the Denver Technological Center (DTC) and growth of local communities, the TRansportation EXpansion (T-REX) project expanded I-225 to a three-lane interstate northbound and two-lane interstate southbound from the I-25 interchange to Parker Road in 2003. T-REX constructed the current I-25/I-225/DTC Boulevard/Yosemite Street interchange complex, including the tunnel from southbound I-225 to southbound I-25. Other improvements have occurred along the 12-mile stretch, with funding from CDOT, local municipalities, and county governments.

## Interstate 25

Spanning 299 miles from Wyoming to New Mexico, I-25 is Colorado's primary north-south interstate route. Construction for I-25 began in 1958, and the full length was completed south of Walsenburg, Colorado, in 1969. The portion of I-25 affected by this PEL study is the interchange area with I-225 in Denver, Colorado.

## Denver Technological Center

Established in 1970, DTC is a business technology center in the Denver Metropolitan Area. DTC is located in or near the City of Greenwood Village, the City of Centennial, the City and County of Denver, and Arapahoe County. With over 100 companies located in this 850-acre development, DTC is a hub of employment for the Denver Metropolitan Area.

### 1.2 Planning Context

Many transportation plans have been developed that relate to the study area, including the following:

- ▶ Arapahoe County, *2035 Transportation Plan* (2010)
- ▶ City of Aurora, *2009 Comprehensive Plan* (2009)
- ▶ City of Aurora, *2012 Nine Mile Station Area Plan* (2012)
- ▶ City of Greenwood Village, *Comprehensive Plan* (2004, as amended)
- ▶ City and County of Denver, *Strategic Transportation Plan* (2008)
- ▶ City and County of Denver, *Denver Moves* (2011)
- ▶ CDOT, *Denver Metro Area Active Traffic Management Feasibility Study* (2011)
- ▶ Denver Regional Council of Governments (DRCOG), *2035 Metro Vision Regional Transportation Plan* (DRCOG, 2011)
- ▶ DRCOG, *Freeway Bottleneck Locations in the Denver Region* (2009)

The following briefly summarizes the relevant aspects of each plan.

#### Arapahoe County, 2035 Transportation Plan

Arapahoe County completed a *2035 Transportation Plan* in November 2010. The *2035 Transportation Plan* evaluates future road needs based on land use projection, population growth, daily traffic volumes, and commuting destinations. Only 11 percent of county residents commute to work within Arapahoe County, and nearly 50 percent work within the Denver Metropolitan Area, as defined by DRCOG. The plan identified that I-25 and I-225 are the heaviest traveled facilities in the west end of the County serving approximately 220,000 and 130,000 vehicles per day (vpd), respectively. Busy arterials in the vicinity of the study area include Parker Road (south of I-225), which services between 70,000 and

80,000 vpd (Arapahoe County et al., 2010). These roads, I-25, I-225, and Parker Road have projected growth generally in the range of 50 percent to 100 percent.

The plan identifies the need for transportation improvements in the vicinity of the study area:

- ▶ Transit priority, route improvements, and stop enhancements along Parker Road,
- ▶ Extension Light Rail Transit (LRT) along I-225 from Parker Road to Colfax Avenue,
- ▶ Classification of Parker Road from Quincy Avenue to I-225 as an Urban Expressway with eight proposed through lanes, and
- ▶ Recommendation for bikeway improvement access to the Cherry Creek Trail.

Since the study area is not located within Arapahoe County, improvements along southbound I-225 from I-25 to Yosemite Street were not identified in the Arapahoe County 2035 Transportation Plan.

### **City of Aurora, 2009 Comprehensive Plan**

The City of Aurora updated its comprehensive plan in 2009. The *Comprehensive Plan* contains sections devoted to major transportation corridors and interchanges. I-225 is identified as Aurora's geographic center and connects several distinct neighborhoods. Communities along I-225 have access to commercial developments, recreational areas to the south, and many multi-family housing units. I-225 allows access to the Nine Mile and Dayton LRT stations, the Fitzsimons Life Science District, the Town Center at Aurora, and the Aurora Municipal Center. The study area is located southwest of the City of Aurora, while the traffic analysis area includes a portion of the City of Aurora near the I-225/Parker Road interchange and the Nine Mile LRT station.

### **City of Aurora, 2012 Nine Mile Station Area Plan**

The Nine Mile LRT Station is located along the I-225 LRT Rail Line at the intersection of I-225 and Parker Road. The City of Aurora has begun planning for a Transit-Oriented Development project at this elevated station. Nine Mile Station is currently an end of line transit station providing more than 1,200 commuter parking spaces and multiple bus line connections. The Nine Mile Station is accessible from I-225 via Parker Road or by vehicle and bus on Peoria Street.

### **City of Greenwood Village, Comprehensive Plan**

The Greenwood Village City Council adopted its *Comprehensive Plan* in December 2004 and has made subsequent amendments, with the last being in 2012. The City of Greenwood Village boundary crosses the study area between Yosemite Street and the Cherry Creek Reservoir. The *Comprehensive Plan* recognizes the I-25/I-225 interchange as a key area of potential intermodal transportation improvements.

The *Comprehensive Plan* stated the following:

- ▶ Plan to strengthen working relationships with adjacent municipalities to address mutual traffic issues
- ▶ Improve safety and access for cyclists and pedestrians across busy roadways and to the LRT stations
- ▶ Highlight the importance of the I-25/I-225 complex adjacent to the municipality as a hub of employment and transit opportunities

Specific transportation improvements were not identified in this plan.

## City and County of Denver, Strategic Transportation Plan

The *Strategic Transportation Plan* provided multimodal recommendations for travel in the City and County of Denver based on a series of travel sheds. The travel shed boundaries were based on areas that share similar characteristics, such as trips, that finish in the same area and on geographic features that create barriers to travel movement. The use of travel sheds allows an analysis of the effectiveness of the layout of streets, including the grid and arterial system, transit routes, bike routes, and pedestrian throughways, as well as how they connect and how well people move through the system.

The I-225 study area was not included in a travel shed except for the portion of the study area at the I-25/Hampden Avenue interchange, which is in the Hampden Travel Shed. The Hampden Travel Shed focused on east-west connectivity along the Hampden Avenue corridor.

## City and County of Denver, Denver Moves

The *Denver Moves* plan built on the previous City and County of Denver bicycle, pedestrian, and recreational planning efforts and the investment made in bicycle and walking infrastructure. Due to the barrier of I-225, bicycle traffic is funneled to the Ulster Street and Yosemite Street corridors. Pedestrian traffic also is provided along these corridors, as well as DTC Boulevard.

## CDOT, Denver Metro Area Active Traffic Management Feasibility Study

The feasibility study provided information on the various active traffic management (ATM) treatments in use throughout the U.S. and the world and assesses their feasibility for the Denver Metropolitan Area. An ATM is a method of using new technology based on predicted traffic conditions to improve congestion, increase peak capacity, and smooth traffic flows on busy highways without major reconstruction. The study results can be used to prioritize the implementation of ATM treatments and help to coordinate the installation of the needed equipment with other construction and highway resurfacing projects. Based on the report findings, several ATM treatments should continue to be used or considered for use in the Denver Metropolitan Area. Existing treatments that are very effective and could be expanded system-wide, where appropriate, included:

- ▶ Traveler information – Using a combination of real-time and historical data to predict upcoming travel conditions and convey information to the traveler through a variety of technological devices.
- ▶ Ramp metering – Providing traffic signals at on ramps to control the rate vehicles enter a freeway facility.
- ▶ Incident response – Providing a Courtesy Patrol along the freeway facility to quickly respond to incidents (crashes, etc.) and remove them from the flow of traffic along the facility.
- ▶ Dynamic pricing – Using tolls that change in amount based on congestion using real-time information.
- ▶ Managed lanes – Providing high-occupancy (HOV) and/or high-occupancy toll (HOT) lanes on a highway for exclusive use by motorists carpooling or willing to pay a toll during peak travel times to relieve congestion.

Treatments not currently in use that were found to be feasible for the Denver Metropolitan Area included the following, with only the latter two treatments determined to be feasible for the I-225 corridor from I-25 to Parker Road:

- ▶ Hard shoulder running – Using a shoulder lane as a temporary travel lane during peak periods based on congestion.
- ▶ Speed harmonization – Using technology to monitor congestion and employing speed limit signs to adjust speeds to ease congestion.
- ▶ Queue warning – Providing real-time displays of warning messages along a roadway to alert motorists that significant slowdowns are ahead.

### **DRCOG 2035 Metro Vision Regional Transportation Plan (RTP)**

The DRCOG *2035 Metro Vision RTP* identified the needs, corridor strategies, and projects anticipated to be constructed over the next twenty-plus years, and the RTP consisted of both fiscally-constrained and fiscally-unconstrained vision components (DRCOG, 2011). In the *2035 Metro Vision Regional Transportation Plan*, the key fiscally constrained roadway improvements included:

- ▶ Two lane additions from Parker Road to Mississippi Avenue along I-225, which is currently under construction and is to be completed in 2014
- ▶ A 9.4-mile LRT extension from the Nine Mile Station to the Peoria Station along I-225, which is currently under construction and is to be completed in 2016

Improvements along I-225 from I-25 to Parker Road are not included in the fiscally-constrained *2035 Metro Vision RTP*. The fiscally-unconstrained vision for I-225 between Parker Road and DTC Boulevard is a six-lane freeway, and an eight-lane freeway between DTC Boulevard and I-25 (DRCOG, 2011).

### **DRCOG, Freeway Bottleneck Locations in the Denver Region**

The purpose of this report was to present information on 18 previously identified bottleneck locations on Denver Metropolitan Area freeways, including southbound I-225 from Yosemite Street to I-25, and to identify possible actions to improve conditions. The key reasons for the bottleneck from southbound I-225 from Yosemite Street to I-25 included:

- ▶ Convergence point of two major regional freeways
- ▶ Numerous vehicles weaving between DTC Boulevard/Tamarac Parkway and ramps to I-25
- ▶ Congested traffic on I-25 causing ramp backups
- ▶ Lane drop from four lanes north of Yosemite Street to two lanes at Tamarac Parkway

Possible roadway mitigation strategies that were identified included:

- ▶ Improve directional/guidance signage along I-225
- ▶ Construct an additional through lane from DTC Boulevard/Tamarac Parkway to I-25
- ▶ Braid ramps from DTC Boulevard/Tamarac Parkway to northbound and southbound I-25

### 1.3 Other Transportation Projects in the Vicinity

In addition to the interchange-specific, city-wide, and metropolitan area plans that included the study area, the following identifies a series of transportation studies for projects within the study area vicinity that have been planned, that are under construction, or for which construction has been completed:

- ▶ CDOT and Regional Transportation District (RTD), *Southeast Corridor Multi-Modal Project Final Environmental Impact Statement (EIS)* (1999)
- ▶ RTD *I-225 Light Rail Transit Environmental Evaluation* (RTD, 2009)
- ▶ *Parker Corridor Study* (Arapahoe County, 2009)

#### **CDOT and RTD, T-REX and Southeast Corridor EIS**

The Southeast Corridor LRT line is 19 miles long and runs along the west side of I-25 and within the median of I-225 to Parker Road. This corridor connects two major employment centers for the Denver Metropolitan Area: DTC and Downtown Denver. The EIS led to the widening of I-25 and I-225 and the construction of the light rail lines along these interstates.

#### **RTD I-225 LRT Environmental Evaluation**

Construction has begun for the I-225 LRT extension from the Nine Mile Station at the interchange of Parker Road and I-225 to the Peoria Station at I-70. Construction is expected to be completed and operational in 2016 (RTD, 2009).

#### **Parker Corridor Study, Arapahoe County**

Arapahoe County conducted a corridor study of State Highway 83 (SH 83), Parker Road, south of I-225. Study recommendations included the following:

- ▶ Re-stripe and provide overhead signage for southbound and northbound Parker Road traffic to/from I-225
- ▶ Add a new park-n-Ride at the intersection of Parker Road and Arapahoe Road to supplement parking utilization at Nine Mile Station
- ▶ Add a pedestrian underpass between Belleview Avenue and Quincy Avenue
- ▶ Add a multi-use path along Cherry Creek State Park and Parker Road

## 1.4 Purpose

The purpose of the transportation improvements along southbound I-225 between Yosemite Street and I-25 is to reduce existing and future traffic congestion and travel time for southbound I-225.

## 1.5 Need

The proposed transportation improvements are needed to improve:

- ▶ Traffic operations
- ▶ Traffic congestion
- ▶ Safety

### Traffic Operations

Traffic operation improvements needed for this project involve removing the bottleneck, addressing the weave section, and considering the intersection functions at the interchanges on southbound I-225. Several traffic operational components are in play when assessing the DTC Boulevard area. Most notably includes the two-lane section of the southbound I-225 mainline as it crosses over DTC Boulevard. This two-lane section is currently a bottleneck, particularly during the morning peak commuter hours of travel. This is more thoroughly discussed in the **Traffic Congestion** subsection.

Just downstream of the two-lane bottleneck is a 1500-foot long traffic weave section; ideally, the weave distance between a system interchange (freeway to freeway like I-25/I-225) and service interchange (freeway to arterial like I-225/DTC Boulevard) should be a minimum of 2000 feet. This southbound I-225 weave extends from the DTC Boulevard on ramp to the I-25 junction “split.” This segment experiences relatively heavy traffic in which pronounced traffic “streams” need to cross (hence the term “weave”) as drivers are positioning themselves to exit, traveling to either northbound or southbound I-25. The two-lane bottleneck and the signalized ramp metering on the DTC Boulevard on ramp, being just upstream of this weave, aids in the weave’s functionality today. However, “opening up” southbound I-225 to a wider cross-section (such as three lanes) in the interest of addressing freeway congestion will overwhelm the weave’s traffic capacity, thereby rendering this weave section a bottleneck instead of the two-lane section.

The traffic operations also include the functionality of the I-225 interchange intersections at DTC Boulevard and at Yosemite Street. While these intersections have not been problematic today, their functionality into the future needs to be considered when addressing various interchange types.

The following NEPA process principles were followed for this PEL:

- ▶ Prepare a purpose and need statement
- ▶ Screen alternative concepts and identify a Recommended Alternative Concept
- ▶ Evaluate potential environmental impacts and conceptual mitigation strategies for the Recommended Alternative Concept project
- ▶ Coordinate with federal, state, and local agencies
- ▶ Provide the public with an opportunity to comment on the project

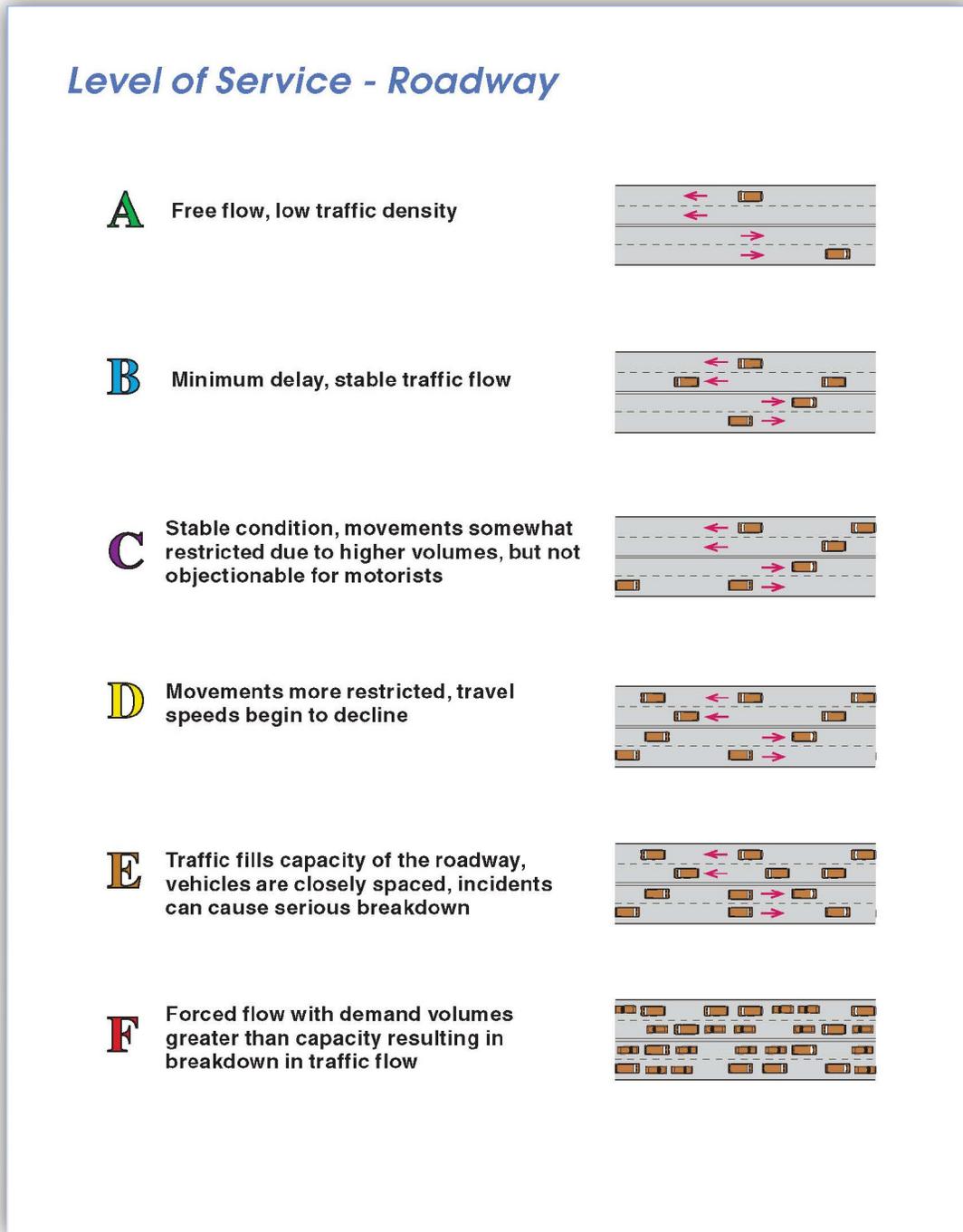
## Traffic Congestion

The traffic congestion improvements needed for this project include improving the level of service (LOS) and travel time along southbound I-225. The most notable traffic issue along southbound I-225 is the mainline congestion caused by the constraining two-lane section spanning DTC Boulevard. The limiting capacity of the two through-lanes functions at a LOS F (**Figure 1.2** provides an explanation of LOS for a roadway) during the AM peak hours, which can typically extend to three hours per day when considering the “recovery” time from the queues that form.

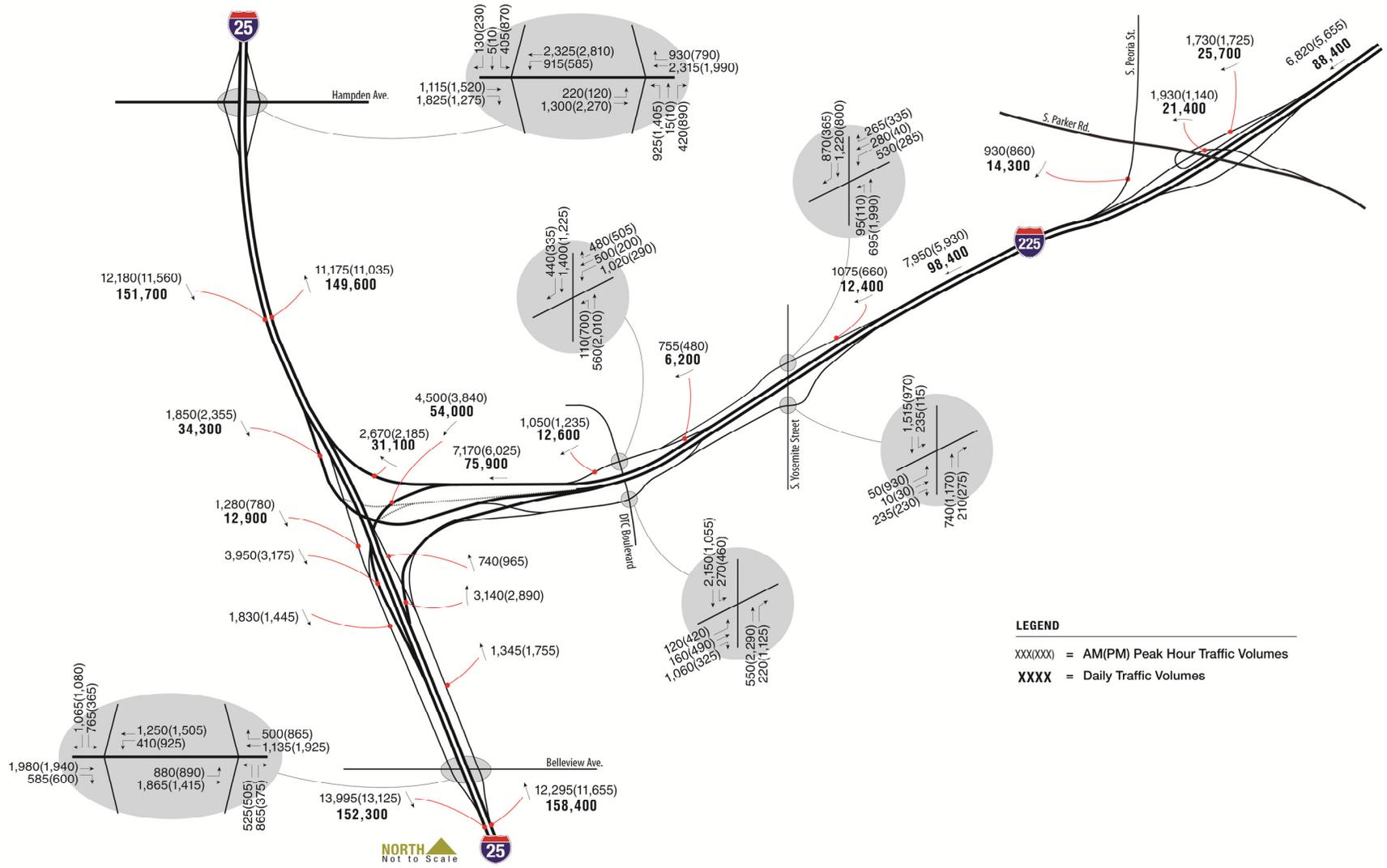
This congestion and associated low travel speeds result from heavy traffic entering the system at the Parker Road interchange, where six lanes are provided, narrowing down to just two lanes at the DTC Boulevard bridge. This directly translates into poor LOS's, extended queues (often two to three miles), and lengthy travel times along the corridor during the AM peak period. This queue can sometimes stack back onto the flyover ramp from northbound Parker Road to southbound I-225. The combination of heavy demand and lack of southbound lane continuity all contribute toward this congestion. The issue is not as prevalent for southbound during the PM peak period.

The congestion is expected to worsen by 2035 with increases in traffic and due to the limited capacity of the two-lane section of southbound I-225. **Figure 1.3** shows the 2035 No Action traffic volume forecasts. The No Action condition would essentially leave southbound I-225 as it is until 2035 and is used as a baseline to compare alternative concepts for screening and environmental analysis purposes. The existing daily traffic volume along southbound I-225 is more than 70,000 vpd (one direction only), and traffic levels along I-225 are projected to increase by 20 to 30 percent by 2035. This growth will cause congestion to occur throughout the day. Estimates are that a LOS F could be experienced for 8 to 12 hours per day in 2035 (**Figure 1.4**) as a result of the two-lane bottleneck, and there is a strong possibility that drivers will opt to use alternative routes if the two lane bottleneck remains. Some congestion along the corridor may be tolerable, but heavy and continuous congestion, along with associated lengthy travel times, is not acceptable to the traveling public.

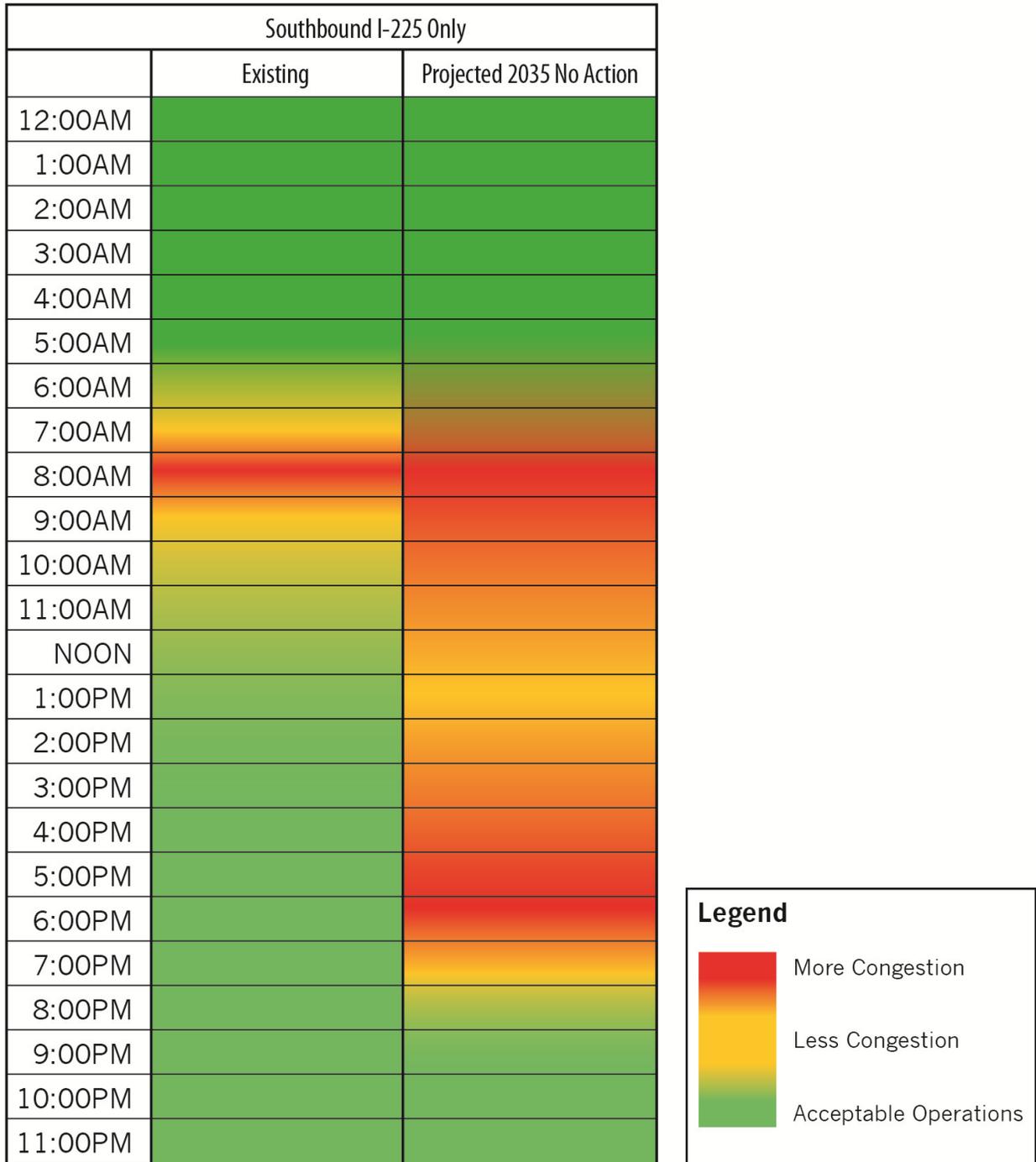
Figure 1.2 Level of Service – Roadway



**Figure 1.3 2035 No Action Traffic Volumes**



**Figure 1.4 Projected 2035 Congestion**



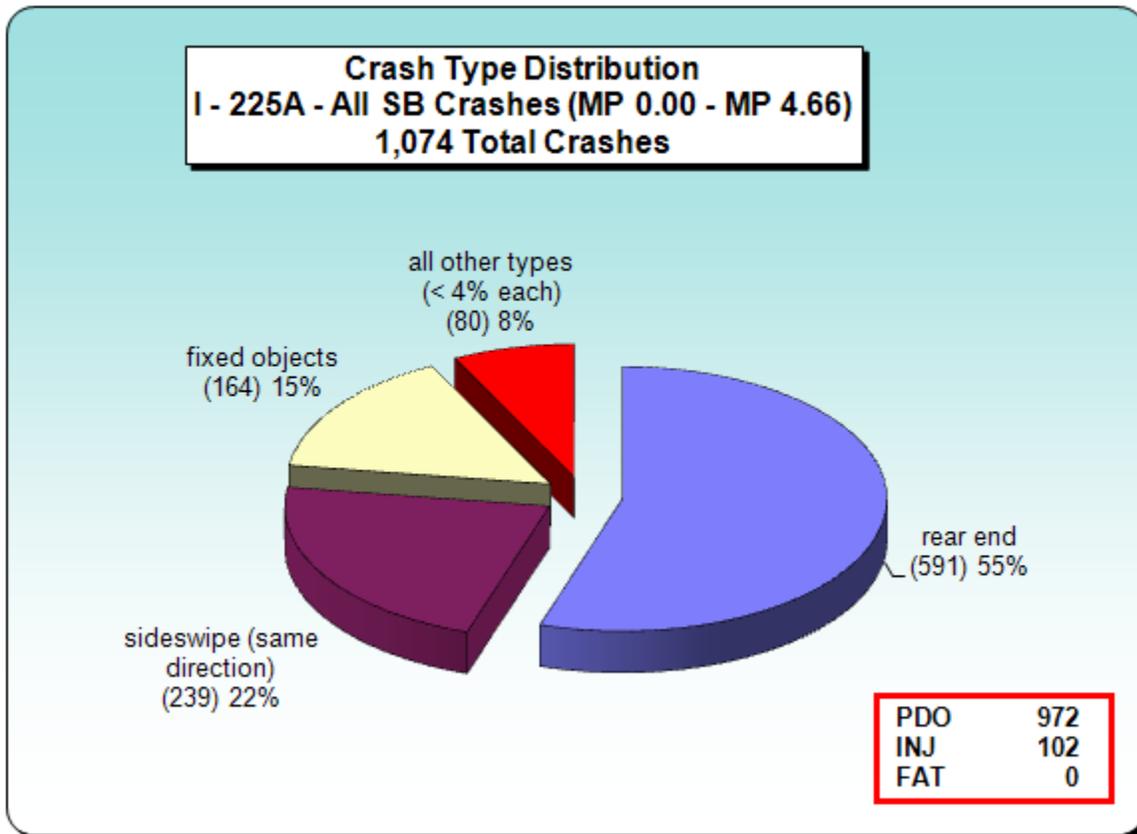


### Safety

Much of the crash experience along southbound I-225 has been associated with congestion along the corridor (**Figure 1.5**). While this section of I-225 as a whole has an above average safety record when compared to similar facilities, concentrations of rear-end and sideswipe (same direction) collision-types and their location suggest that there is room for improvement. Enhancements that reduce the magnitude and duration of congestion can help to reduce crashes along the corridor. This

will become increasingly important as traffic volume levels along the corridor increase, resulting in an even greater amount of congestion and associated crashes.

**Figure 1.5 Total Crashes in Study Area for 2009–2012**



Note: MP - milepost, SB - southbound, PDO – Property Damage Only, INJ – Injury, FAT – Fatality

## 1.6 Project Goals

The DRCOG transportation vision for the Denver Metropolitan Area is of a balanced, sustainable multimodal transportation system that includes a regional roadway system, local streets, bicycle and pedestrian facilities, and a regional bus and rail transit system. The goals of the I-225 PEL study are based on the local goals identified in the *2035 Metro Vision Regional Transportation Plan* (DRCOG, 2011), on the national goals established for the Federal highway programs, and on the goals of the local agencies through the Project Management Team (PMT), the Technical Working Group (TWG), and the public. Based on these goals, specific criteria were established to evaluate the alternative concepts developed for the project.

The goals of the transportation improvements for the I-225 PEL study are to:

- ▶ Reduce congestion and travel time/improve traffic operations,
- ▶ Improve traffic safety by reducing congestion,
- ▶ Improve accessibility and connectivity,
- ▶ Avoid/minimize community impacts,
- ▶ Avoid/minimize environmental and cultural resource impacts,
- ▶ Ensure implementability, and
- ▶ Address multimodal considerations.

## 2.0 ALTERNATIVE CONCEPT DEVELOPMENT AND SCREENING

**Chapter 2.0** documents the process, including screening criteria, and presents the No Action Alternative and screening results.

Agency coordination and public involvement played a major role in this process, as summarized in **Chapter 6.0**. Agency involvement activities included regular progress committee meetings with agency participants and resource agency scoping. To ensure the needs and concerns of affected entities and groups would be heard and considered in the alternative concept development and screening process, a TWG was formed. The TWG, as further described in **Section 6.1**, was involved at each step of the screening process, as well as during the development of concepts and concept refinement.

### 2.1 *No Action Alternative*

The No Action Alternative would essentially leave southbound I-225 as it is and would not provide any major capacity improvements; however, the No Action Alternative would include safety and maintenance activities such as pavement resurfacing or reconstruction, signing improvements, and guardrail improvements that would be required to sustain an operational transportation system. The No Action Alternative does not meet the purpose and need but is used as a baseline to compare alternative concepts for screening and environmental analysis purposes.

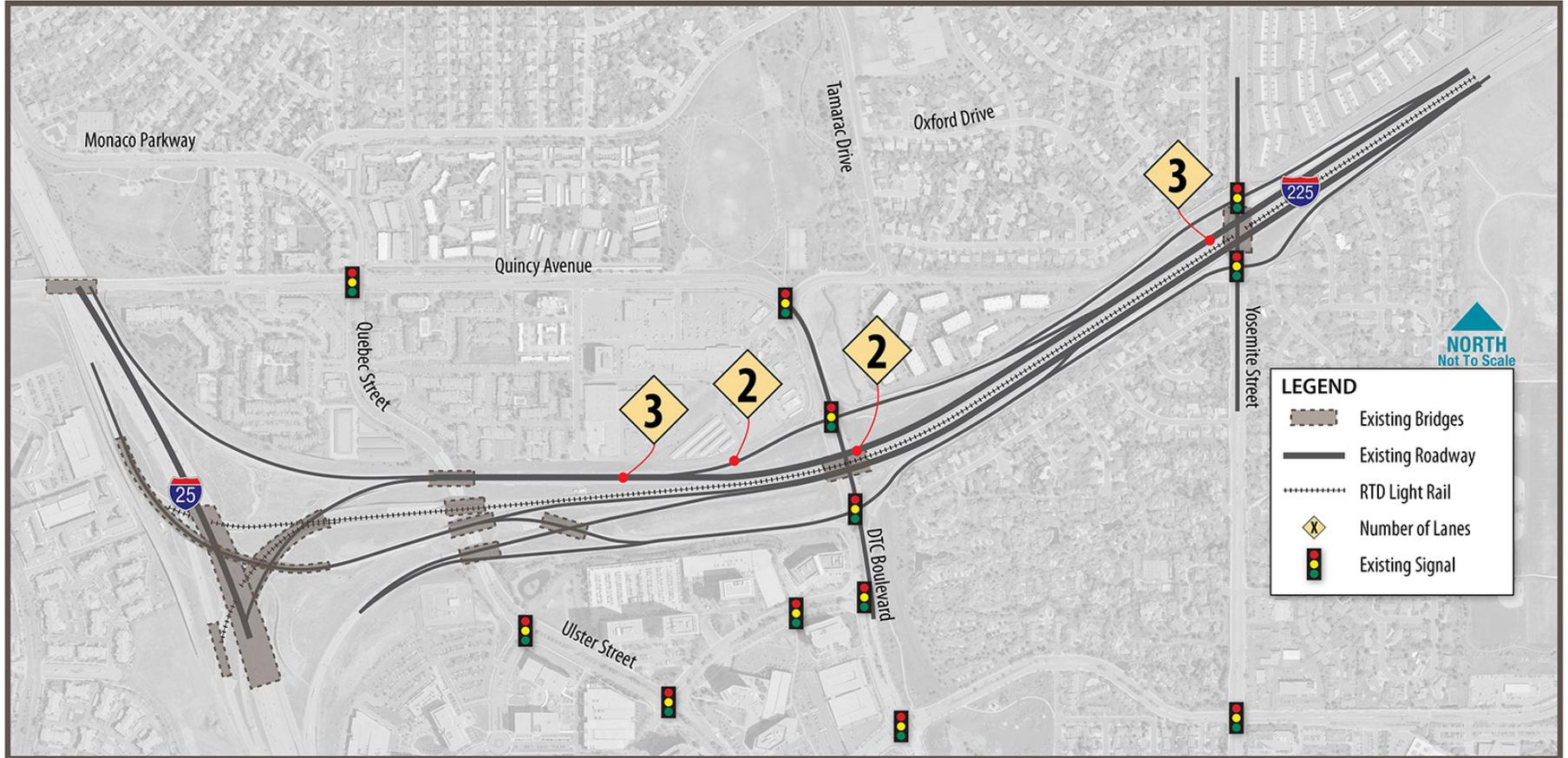
**Figure 2.1** displays the No Action Alternative. This alternative maintains existing roadways and bridges on southbound I-225 through 2035 without any major improvements. The existing number of lanes on southbound I-225 would remain as they are today. The No Action Alternative was carried through all three tiers of screening for comparison and analysis of existing and future conditions.

### 2.2 *Alternative Concept Development*

The alternative concept development and screening process consisted of a three-tier iterative process. The fundamental philosophy in the screening process was to systematically identify the notable positive and negative characteristics and tradeoffs among concepts, and to evaluate concepts, one by one, as the determinations were made.

The alternative concept development and screening process began with the identification of 21 concepts. These concepts included a broad range of ideas and improvements focusing on managed lanes, travel demand strategies, additional travel lanes, speed harmonization, queue warning, rerouting local traffic onto southbound I-225, full or partial on ramp closures, and transportation system management. In **Table 2.1**, the 21 concepts are defined and, when applicable, a graphic representation is included. **Appendix C** includes displays of the following alternative concepts: Concepts 16, 17, 18, 19, and 21 for reference.

Figure 2.1 No Action Alternative



**Table 2.1 All Evaluated Concepts**

Concept	Title	Description
<p><b>1</b> No figure required</p>	<p>Managed Lanes</p>	<p>Concept 1 consists of Bus-only and Bus/High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) Lanes.</p>
<p><b>2</b> No figure required</p>	<p>Transit</p>	<p>Concept 2 provides additional transit improvements, such as additional LRT and/or bus routes.</p>
<p><b>3</b> No figure required</p>	<p>Intelligent Transportation Systems (ITS)/Travel Demand Management (TDM) Only</p>	<p>Concept 3 uses information technologies, such as ITS including traffic control through ramp metering with TDM strategies, such as rideshare programs.</p>
<p><b>4</b></p> 	<p>Hard Shoulder Running Only</p>	<p>Concept 4 involves using the existing shoulder as a third travel lane along southbound I-225 during peak traffic congestion periods.</p>
<p><b>5</b> No figure required</p>	<p>Speed Harmonization Only</p>	<p>Concept 5 consists of speed harmonization with over-lane speed signs and lane control signs to dynamically and automatically reduce speed limits in areas of congestion to maintain traffic flow and reduce collision risks due to speed differentials related to queuing and congestion.</p>
<p><b>6</b> No figure required</p>	<p>Queue Warning Only</p>	<p>Concept 6 consists of queue warning to warn motorists of downstream congestion and slowed or stopped vehicles using electronic signs to allow drivers to adjust to the downstream travel conditions.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>7</b></p>	<p>Third Lane Only</p>	<p>Concept 7 involves constructing an additional third lane along southbound I-225 and widening the bridges to accommodate three lanes and shoulders.</p>
<p style="text-align: center;"><b>8</b></p>	<p>DTC Boulevard On Ramp to Northbound I-25 Only</p>	<p>Concept 8 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to southbound I-25 traffic, and rerouting traffic on the Yosemite Street interchange. The rerouted traffic would be directed to use the existing west shoulder over the Yosemite Street bridge to access the Collector-Distributor (C-D) road to the north and merge onto southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be removed.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>9</b></p>	<p>Texas U-Turn with DTC Boulevard On Ramp to Northbound I-25 Only</p>	<p>Concept 9 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to southbound I-25 traffic, and rerouting traffic to a Texas U-turn bridge over I-225 near Yosemite Street. The rerouted traffic would be directed to the C-D road to the north and merge onto southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be removed.</p>
<p style="text-align: center;"><b>10</b></p>	<p>Diverging Diamond Interchange (DDI) with Braided Ramp and DTC Boulevard On Ramp to Northbound I-25 Only</p>	<p>Concept 10 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to southbound I-25 traffic, and rerouting traffic to the Yosemite Street interchange. The Yosemite Street interchange would be converted to a DDI to access the C-D road to the north and merge onto southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be replaced with a braided ramp with the new Yosemite Street on ramp.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>11</b></p>	<p>Reroute DTC Boulevard Ramp to Yosemite Street</p>	<p>Concept 11 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to both northbound and southbound I-25 traffic, and rerouting traffic to the Yosemite Street interchange. The rerouted traffic would be directed to use the existing Yosemite Street ramp intersections to access the C-D road to the north and merge onto southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be removed.</p>
<p style="text-align: center;"><b>12</b></p>	<p>Braided Ramps between Yosemite Street and DTC Boulevard</p>	<p>Concept 12 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to both northbound and southbound I-25 traffic, and rerouting traffic to the Yosemite Street interchange. The rerouted traffic would be directed to use the existing Yosemite Street ramp intersections to access the C-D road to the north and merge onto southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be replaced with a braided ramp with the new Yosemite Street on ramp.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>13</b></p>	<p>Combine Interchanges with U-Turn Bridge</p>	<p>Concept 13 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to both northbound and southbound I-25 traffic, and rerouting traffic to a U-turn bridge grade crossing halfway to Yosemite Street. The rerouted traffic would be directed to use the grade crossing to access the C-D road to the north and merge on southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be removed.</p>
<p style="text-align: center;"><b>14</b></p>	<p>Texas U-Turn</p>	<p>Concept 14 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to both northbound and southbound I-25 traffic, and rerouting traffic to a Texas U-turn bridge over I-225 near Yosemite Street. The rerouted traffic would be directed to the C-D road to the north and merge onto southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be removed.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>15</b></p>	<p>Two DDI's - Yosemite Street and DTC Boulevard</p>	<p>Concept 15 involves constructing a third lane along southbound I-225, closing the DTC Boulevard on ramp to both northbound and southbound I-25 traffic, and rerouting traffic to the Yosemite Street interchange. The DTC Boulevard and Yosemite Street interchanges would be converted to DDIs. Traffic would be directed to access the C-D road to the north and merge onto southbound I-225 with an on ramp. The off ramp to DTC Boulevard from southbound I-225 would be replaced with a braided ramp with the new Yosemite Street on ramp.</p>
<p style="text-align: center;"><b>16</b></p>	<p>Braid Ramps West of DTC Boulevard</p>	<p>Concept 16 involves constructing a third lane along southbound I-225. The DTC Boulevard on ramp to southbound I-25 would cross under southbound I-225 with a new bridge on southbound I-225 and then merge onto southbound I-225 from the left side of the highway. The DTC Boulevard on ramp to northbound I-25 would continue to use a dedicated lane to the exit ramp at I-25. <b>Appendix C</b> contains a larger version of the concept exhibit.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>17</b></p> <p>The map for Concept 17 shows I-225 from Yosemite Street to the west. Lane counts are indicated by yellow diamonds: 2 lanes from Yosemite Street to Ulster Street, 1 lane from Ulster Street to Quincy Avenue, 1 lane from Quincy Avenue to Quebec Street, 2 lanes from Quebec Street to Tamarac Drive, 2 lanes from Tamarac Drive to Oxford Drive, and 3 lanes from Oxford Drive to Yosemite Street. A legend identifies existing bridges, roadways, improvements, and signals.</p>	<p><b>Divide I-225, Remove DTC Boulevard Off Ramp and Braid Ramps West of DTC Boulevard</b></p>	<p>Concept 17 involves dividing southbound I-225 just west of Yosemite Street into two, two-lane freeway segments directed to either northbound I-25 or southbound I-25. The DTC Boulevard on ramp would cross under southbound I-225 with a new bridge and then merge onto the highway to southbound I-25 from the right side. The DTC Boulevard on ramp to northbound I-25 would continue to use a dedicated lane to the exit ramp to I-25. The off ramp to DTC Boulevard from southbound I-225 would be removed and traffic would be redirected to the Yosemite Street off ramp and through the ramp intersection to reach DTC Boulevard. <b>Appendix C</b> contains a larger version of the concept exhibit.</p>
<p style="text-align: center;"><b>18</b></p> <p>The map for Concept 18 shows I-225 from Yosemite Street to the west. Lane counts are indicated by yellow diamonds: 2 lanes from Yosemite Street to Ulster Street, 4 lanes from Ulster Street to Quincy Avenue, 1 lane from Quincy Avenue to Quebec Street, 1 lane from Quebec Street to Tamarac Drive, 3 lanes from Tamarac Drive to Oxford Drive, 2 lanes from Oxford Drive to Yosemite Street, and 3 lanes from Yosemite Street to the east. A legend identifies existing bridges, roadways, improvements, and signals.</p>	<p><b>Add Loop Ramp and Braid Ramps East and West of DTC Boulevard</b></p>	<p>Concept 18 involves constructing a third lane along southbound I-225. The northbound DTC Boulevard traffic heading to southbound I-225 would use a loop ramp; whereas the southbound Tamarac Parkway traffic would use a new slip ramp. The DTC Boulevard on ramps merge to access the northbound and southbound I-25 ramps. The DTC Boulevard to southbound I-25 on ramp would cross underneath southbound I-225 with a new bridge and then merge onto southbound I-225 from the left side of the highway. The off ramp to DTC Boulevard from southbound I-225 would be replaced with a braided ramp with the new Yosemite Street on ramp. <b>Appendix C</b> contains a larger version of the concept exhibit.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>19</b></p>	<p>Divide I-225, Maintain DTC Boulevard Off Ramp and Braid Ramps West of DTC Boulevard</p>	<p>Concept 19 involves dividing southbound I-225 just west of Yosemite Street into two, two-lane freeway segments directed to either northbound I-25 or southbound I-25. The DTC Boulevard on ramp would cross under southbound I-225 with a new bridge and then merge onto the highway to southbound I-25 from the right side. The DTC Boulevard on ramp to northbound I-25 would continue to use a dedicated lane to the exit ramp to I-25. The off ramp to DTC Boulevard from southbound I-225 would remain. This concept is the same as Concept 17, except that it maintains the DTC Boulevard off ramp from southbound I-225. <b>Appendix C</b> contains a larger version of the concept exhibit.</p>
<p style="text-align: center;"><b>20</b></p>	<p>Divide I-225 East of DTC Boulevard and Add Roundabouts at the DTC Boulevard Interchange</p>	<p>Concept 20 involves dividing southbound I-225 just west of Yosemite Street into two, two-lane freeway segments directed either to northbound I-25 or southbound I-25. The DTC Boulevard on ramp would cross under southbound I-225 with a new bridge and then merge onto the highway to southbound I-25 from the right side. The DTC Boulevard on ramp to northbound I-25 would continue to use a dedicated lane to the exit ramp to I-25. The signalized intersections at the DTC Boulevard interchange off and on ramps would be converted to roundabouts.</p>

**Table 2.1. All Evaluated Concepts (Continued)**

Concept	Title	Description
<p style="text-align: center;"><b>21</b></p>	<p><b>Braid Ramps East and West of DTC Boulevard</b></p>	<p>Concept 21 involves dividing southbound I-225 just west of Yosemite Street into two, two-lane freeway segments directed to either northbound I-25 or southbound I-25. The DTC Boulevard on ramp would cross under southbound I-225 with a new bridge and then merge onto the highway to southbound I-25 from the right side. The DTC Boulevard on ramp to northbound I-25 would continue to use a dedicated lane to the exit ramp to I-25. The off ramp to DTC Boulevard from southbound I-225 would be braided with a new Yosemite Street on ramp to southbound I-225 before the freeway segment division. This concept is the same as Concept 19, except that the existing DTC Boulevard off ramp from the southbound I-225 ramp is braided with a new Yosemite Street on ramp to southbound I-225. <b>Appendix C</b> contains a larger version of the concept exhibit.</p>

1

## 2.3 Screening Criteria

Criteria for developing and screening alternative concepts were established in part through a public process that was responsive to the purpose and need of the project, project goals, potential for transportation benefits, and environmental resources within the study area. Evaluation of alternative concepts involved a list of screening criteria based on input from the PMT and TWG. For each tier of the alternative concept screening process, the study team established categories and prepared screening measures for each criterion.

**Appendix C** includes these criteria and measures, along with the summary screening tables for each tier. The evaluation of each alternative concept to the criteria determined whether or not the alternative concept was retained for further screening, not recommended at this time, or eliminated from further consideration.

## 2.4 Screening Results

The following sections describe the screening criteria and measures, and the results of each tier of screening.

### Tier 1 Screening – Purpose and Need

The Tier 1 screening is based solely on each alternative concept meeting the purpose and need statement. The following question was used to evaluate the alternative concepts:

- ▶ Can the concept reduce existing and future (2035) delay and travel time due to traffic congestion along southbound I-225 between Yosemite Street and I-25?

**Table 2.2** summarizes the Tier 1 screening results. Of the 21 alternative concepts developed, five alternative concepts were eliminated from further consideration as stand-alone concepts because they did not address the purpose and need to reduce existing and future (2035) traffic congestion. Sixteen alternative concepts were retained for further consideration in Tier 2 screening. **Appendix C** documents the Tier 1 screening process for the alternative concepts and provides details about the reasons why a particular alternative was retained, eliminated, or not recommended.

The screening criteria focused on eight categories:

- ▶ Reduce congestion/travel time
- ▶ Improve traffic operations
- ▶ Improve safety by reducing congestion
- ▶ Improve safety through design
- ▶ Improve accessibility and connectivity
- ▶ Avoid/minimize community impacts
- ▶ Avoid/minimize environmental and cultural resource impacts
- ▶ Address multimodal considerations

**Table 2.2 Tier 1 Screening Results**

Alternative Concept	Title	Results
1	Managed Lanes	<b>Eliminated</b> in Tier 1 screening because this concept would not address purpose and need to reduce existing and future (2035) traffic congestion because it would only minimally improve congestion or reduce travel time along southbound I-225.
2	Transit	<b>Eliminated</b> in Tier 1 screening because this concept would not address purpose and need to reduce existing and future (2035) traffic congestion because it would not improve congestion or reduce travel time to the extent required along southbound I-225 with additional transit service alone.
3	ITS/TDM Only	<b>Eliminated</b> in Tier 1 screening because this concept would not address purpose and need to reduce existing and future (2035) traffic congestion because it would only minimally improve congestion or reduce travel time along southbound I-225.
4	Hard Shoulder Running Only	<b>Retained</b>
5	Speed Harmonization Only	<b>Eliminated</b> in Tier 1 screening because this concept would not address purpose and need to reduce existing and future (2035) traffic congestion because it would only minimally improve congestion or reduce travel time along southbound I-225.
6	Queue Warning Only	<b>Eliminated</b> in Tier 1 screening because this concept would not address purpose and need to reduce existing and future (2035) traffic congestion because it would only minimally improve congestion or reduce travel time along southbound I-225.
7	Third Lane Only	<b>Retained</b>
8	DTC Boulevard On Ramp to Northbound I-25 Only	<b>Retained</b>
9	Texas U-Turn with DTC Boulevard On Ramp to Northbound I-25 Only	<b>Retained</b>
10	DDI with Braided Ramp and DTC Boulevard On Ramp to Northbound I-25 Only	<b>Retained</b>
11	Reroute DTC Boulevard Ramp to Yosemite Street	<b>Retained</b>
12	Braided Ramps between Yosemite Street and DTC Boulevard	<b>Retained</b>
13	Combine Interchanges with U-Turn Bridge	<b>Retained</b>
14	Texas U-Turn	<b>Retained</b>
15	Two DDI's - Yosemite Street and DTC Boulevard	<b>Retained</b>
16	Braid Ramps West of DTC Boulevard	<b>Retained</b>
17	Divide I-225, Remove DTC Boulevard Off Ramp and Braid Ramps West of DTC Boulevard	<b>Retained</b>

**Table 2.2 Tier 1 Screening Results (Continued)**

Alternative Concept	Title	Results
18	Add Loop Ramp and Braid Ramps East and West of DTC Boulevard	Retained
19	Divide I-225, Maintain DTC Boulevard Off Ramp and Braid Ramps West of DTC Boulevard	Retained
20	Divide I-225 East of DTC Boulevard and Add Roundabouts at the DTC Boulevard Interchange Intersections	Retained
21	Braid Ramps East and West of DTC Boulevard	Retained

In accordance with the CDOT Managed Lanes Policy (CDOT, 2012), managed lanes (Bus-only lanes and Bus/HOV/HOT Lanes) (Alternative Concept 1) were evaluated for the I-225 project (Yosemite Street to I-25). The managed lanes alternative concept was eliminated in Tier 1 screening because it did not address purpose and need because it only minimally improved congestion or reduced travel time along southbound I-225. The elimination of managed lanes for the I-225 project (Yosemite Street to I-25) does not preclude the evaluation of managed lanes along the I-225 corridor from I-70 to I-25 or as a comprehensive managed lanes system in the Denver Metropolitan Area. A corridor study or comprehensive managed lanes study would be necessary to evaluate managed lanes along I-225, as well as how the various corridors will function together.

### Tier 2 Screening – Project Goals

Tier 2 screening is based on each remaining alternative concept's ability to qualitatively address the purpose and need, screening criteria, and screening measures. The following criteria and measures, based on the project goals developed, were used to screen the alternative concepts during the Tier 2 screening. The metric used is shown in parentheses for each screening criterion.

#### **Purpose and Need Screening Criteria**

- ▶ Reduce Congestion and Travel Time/Improve Traffic Operations
  - Improve traffic operations along southbound I-225 between Yosemite Street and I-25 by restricting LOS F freeway flow to less than two hours per day but by no more than three hours given 2035 traffic demands. See **Section 3.1, Traffic Operations**, for the more detailed explanation. *(Measure using Highway Capacity Software [HCS] analysis on duration of LOS F for each concept)*
    - Maintain or improve future traffic operations with respect to the No Action Alternative at the I-225/Yosemite Street and I-225/DTC Boulevard interchange intersections. Further, traffic queues should not stack between successive intersections. *(Measure using LOS, delay, and queuing)*
- ▶ Improve Safety due to Congestion
  - Maintain existing or improve future traffic operations with respect to existing conditions for weave areas along southbound I-225 with regard to distance of weave and number of lane changes. *(Measure at this level includes the relative distance of weave and number of lane changes for each concept compared to existing conditions)*

- Maintain or improve safety at the DTC Boulevard and Yosemite Street ramp intersections compared to the No Action Alternative. *(Evaluate traffic demands and shifts thereof; the greater the traffic, the greater the potential crash occurrence)*
- Maintain or improve traffic safety on the adjacent local street network compared to the No Action Alternative. *(Evaluate DRCOG Model traffic demands and shifts thereof; the greater the traffic, the greater the potential crash occurrence)*
- ▶ Improve Safety through Design
  - Satisfy engineering design standards and criteria. *(Evaluate alternatives based on potential fatal flaws related to engineering design standards and criteria)*

#### Other Screening Criteria

- ▶ Improve Accessibility and Connectivity
  - Meet driver's expectations. *(Assessment of each concept relative to its "standardization" that drivers are used to considering the existing I-225/Yosemite Street/DTC Boulevard interchange complex operations and relative to other interchanges in Colorado)*
  - Preserve system interchange access. *(The system consists of the existing I-225/Yosemite Street/DTC Boulevard interchange complex. Evaluate if current access is removed from the system interchange complex based on each concept)*
  - Minimize out-of-direction travel to access I-225 and the I-225/Yosemite Street and I-225/DTC Boulevard interchanges. *(Measure distance of out-of-direction travel)*
- ▶ Avoid Community Impacts
  - Avoid direct and indirect property and business impacts. *(Measure impacted properties and any access modifications)*
  - Avoid business and resident displacements. *(Measure impacted buildings and required displacement of occupants)*
  - Evaluate compatibility with existing local land use. *(Measure affected existing local land use access and circulation, and current impacted operations of transportation systems in the community)*
- ▶ Avoid Environmental and Cultural Resource Impacts
  - Avoid impacts to environmental and cultural resources based on direct impacts on: *(Measure impacted areas on these resources)*
    - Parks, open space, and trails
    - Floodplains
    - Wetlands and waters of the U.S.
    - Sensitive species

Alternatives were **eliminated** that did not meet purpose and need or due to the magnitude of a combination of negative (quantified) impacts on community and environmental and cultural resources when there was another alternative that met purpose and need and avoided or minimized these impacts.

Alternatives were **not recommended** due to the magnitude of a combination of negative (not quantified) impacts on community and environmental and cultural resources or when there was another alternative that met purpose and need and avoided or minimized these impacts. Alternative concepts that are not recommended are still carried forward for further evaluation in NEPA.

- ▶ Address Multimodal Considerations
  - Maintain or improve north-south bicycle or pedestrian connectivity under I-225 along Yosemite Street and DTC Boulevard with respect to existing conditions. *(Measure as ability for bicycle/pedestrian crossing of I-225 north-south along Yosemite Street and DTC Boulevard as compared to existing conditions)*

## Tier 2 Screening Results

**Table 2.3** summarizes Tier 2 screening results. Of the 16 retained alternative concepts from Tier 1, 11 alternative concepts were eliminated from further consideration because they did not address the criteria established. Five alternative concepts were retained for further consideration in the Tier 3 screening. Alternative Concept 18 was not recommended in the Tier 2 screening but was retained for further quantitative analysis as part of the Tier 3 screening. **Appendix C** documents the Tier 2 screening process for the alternative concepts and provides details about the reasons why a particular alternative was retained, eliminated, or not recommended.

**Table 2.3 Tier 2 Screening Results**

Concept	Title	Results
4	Hard Shoulder Running Only	<b>Eliminated</b> in Tier 2 screening because Concept 4 would not address purpose and need to reduce existing and future (2035) traffic congestion and improve safety due to congestion. This concept would experience congestion (LOS F) four to five hours per day in 2035 and would require a greater number of lane changes than the existing lane geometry; therefore, Concept 4 does not maintain existing operations.
7	Third Lane Only	<b>Eliminated</b> in Tier 2 screening because Concept 7 would not address purpose and need to reduce existing and future (2035) traffic congestion and improve safety due to congestion. This concept would experience congestion (LOS F) four to five hours per day in 2035 and would require a greater number of lane changes than the existing lane geometry; therefore, Concept 7 does not maintain existing operations.
8	DTC Boulevard On Ramp to Northbound I-25 Only	<b>Eliminated</b> in Tier 2 screening because Concept 8 would not address purpose and need to reduce future (2035) traffic congestion. Concept 8 does not maintain the I-225/DTC Boulevard interchange intersection operations. The I-225/DTC Boulevard southern intersection will degrade in 2035 from a LOS C to a LOS D in the AM peak hour and from LOS C to LOS F for the evening (PM) peak hour.
9	Texas U-Turn with DTC Boulevard On Ramp to Northbound I-25 Only	<b>Eliminated</b> in Tier 2 screening because Concept 9 would not address purpose and need to reduce future (2035) traffic congestion. Concept 9 does not maintain the I-225/DTC Boulevard interchange intersection operations. The I-225/DTC Boulevard southern intersection will degrade in 2035 from a LOS C to a LOS D in the AM peak hour and from LOS C to LOS F for the PM peak hour.

**Table 2.3 Tier 2 Screening Results (Continued)**

Concept	Title	Results
<b>10</b>	DDI with Braided Ramp and DTC Boulevard On Ramp to Northbound I-25 Only	<b>Eliminated</b> in Tier 2 screening because Concept 10 would not address purpose and need to reduce future (2035) traffic congestion. Concept 10 does not maintain the I-225/Yosemite Street and I-225/DTC Boulevard interchange intersection operations. The I-225/Yosemite Street southern intersection will degrade in 2035 from a LOS D to a LOS F for the PM peak hour. The I-225/DTC Boulevard southern intersection will degrade in 2035 from a LOS C to LOS F for the PM peak hour.
<b>11</b>	Reroute DTC Boulevard Ramp to Yosemite Street	<b>Eliminated</b> in Tier 2 screening because Concept 11 would not address purpose and need to reduce future (2035) traffic congestion. Concept 11 would experience congestion (LOS F) four to five hours per day in 2035 on southbound I-225. This concept does not maintain the I-225/Yosemite Street and I-225/DTC Boulevard interchange intersection operations. The I-225/Yosemite Street northern intersection will degrade in 2035 from a LOS E to a LOS F for the AM peak hour and from a LOS B to a LOS D for the PM peak hour. The southern intersection will degrade in 2035 from a LOS C to a LOS F for the PM peak hour. The I-225/DTC Boulevard southern intersection will degrade in 2035 from a LOS C to LOS F for the PM peak hour.
<b>12</b>	Braided Ramps between Yosemite Street and DTC Boulevard	<b>Eliminated</b> in Tier 2 screening because Concept 12 would not address purpose and need to reduce future (2035) traffic congestion. This concept would experience congestion (LOS F) four to five hours per day in 2035 on southbound I-225. Concept 12 does not maintain the I-225/Yosemite Street and I-225/DTC Boulevard interchange intersection operations. The I-225/Yosemite Street northern intersection will degrade in 2035 from a LOS E to a LOS F for the AM peak hour and from a LOS B to a LOS F for the PM peak hour. The southern intersection will degrade in 2035 from a LOS C to a LOS F for the PM peak hour. The I-225/DTC Boulevard southern intersection will degrade in 2035 from a LOS C to LOS E for the PM peak hour.
<b>13</b>	Combine Interchanges with U-Turn Bridge	<b>Eliminated</b> in Tier 2 screening because Concept 13 would not address purpose and need to reduce future (2035) traffic congestion. This concept would experience congestion (LOS F) four to five hours per day in 2035 on southbound I-225. Concept 13 does not maintain the I-225/DTC Boulevard interchange intersection operations. The I-225/DTC Boulevard southern intersection will degrade substantially in 2035 from a LOS C to LOS F for the PM peak hour. In addition, queues from the U-turn bridge would operate at LOS F in both peak hours and would back into the I-225/DTC Boulevard interchange intersection.

**Table 2.3 Tier 2 Screening Results (Continued)**

Concept	Title	Results
14	Texas U-Turn	<b>Eliminated</b> in Tier 2 screening because Concept 14 would not address purpose and need to reduce future (2035) traffic congestion. This concept would experience congestion (LOS F) four to five hours per day in 2035 on southbound I-225.
15	Two DDI's - Yosemite Street and DTC Boulevard	<b>Eliminated</b> in Tier 2 screening because Concept 15 would not address purpose and need to reduce future (2035) traffic congestion. Concept 15 would experience congestion (LOS F) four to five hours per day in 2035 on southbound I-225. This concept does not maintain the I-225/DTC Boulevard interchange intersection operations. The I-225/DTC Boulevard northern and southern intersections will degrade in 2035 from LOS C to LOS F for the PM peak hour.
16	Braid Ramps West of DTC Boulevard	<b>Retained</b>
17	Divide I-225, Remove DTC Boulevard Off Ramp and Braid Ramps West of DTC Boulevard	<b>Retained</b>
18	Add Loop Ramp and Braid Ramps East and West of DTC Boulevard	<b>Not Recommended</b> in Tier 2 screening but retained for Tier 3 screening for further quantitative analysis. Concept 18 would have impacts to the Goldsmith Gulch open space, floodplains, wetlands, and require partial acquisition of the Summit Ridge Luxury Apartment Homes complex with multiple residential displacements.
19	Divide I-225, Maintain DTC Boulevard Off Ramp and Braid Ramps, West of DTC Boulevard	<b>Retained</b>
20	Divide I-225 East of DTC Boulevard and Add Roundabouts at the DTC Boulevard Interchange Intersections	<b>Eliminated</b> in Tier 2 screening because Concept 20 would not address purpose and need to reduce future (2035) traffic congestion. Concept 20 does not maintain the I-225/DTC Boulevard interchange intersection operations. The I-225/DTC Boulevard northern and southern intersections will degrade in 2035 from LOS C to LOS F for the PM peak hour. During the PM peak hour, queues between the two roundabouts will spill between the two roundabouts, as well as into the intersections at Tamarac Parkway/Quincy Avenue and DTC Boulevard/Tufts Avenue.
21	Braid Ramps East and West of DTC Boulevard	<b>Retained</b>

### Tier 3 Screening – Quantitative Goals

Tier 3 screening is based on each remaining alternative concept's ability to quantitatively address the purpose and need, screening criteria, and screening measures. The following criteria and measures, based on the project goals developed, were used to screen the alternative concepts during the Tier 3 screening. The metric used is shown in parentheses for each screening criterion.

### **Purpose and Need Screening Criteria**

- ▶ Reduce Congestion and Travel Time/Improve Traffic Operations
  - Improve traffic operations along southbound I-225 between Yosemite Street and I-25 by restricting LOS F freeway flow to two hours per day or less given 2035 traffic demands. *(Measure using HCS analysis on duration of LOS F for each concept)*
  - Avoid traffic queuing between successive intersections. *(Measure using queues)*
  - Maintain or improve future traffic operations with respect to the No Action Alternative at the I-225/Yosemite Street and I-225/DTC Boulevard interchange intersections. *(Measure using LOS and delay)*
  - Maintain or improve traffic operations on the adjacent local street network compared to the No Action Alternative. *(DRCOG models were used to determine the effects of the concepts on the local street network)*
  - Do not preclude a fourth general purpose or managed lane in the future. *(Ability to accommodate a future lane with each concept as compared with other concepts)*
- ▶ Improve Safety due to Congestion
  - Reduce weaves along southbound I-225. Weaves are less desirable than a merge or diverge due to the traffic streams crossing each other in a short distance. *(Concepts were evaluated for the removal of weaves between DTC Boulevard and I-25)*
  - Maintain or reduce merge/diverges along southbound I-225. Merges and diverges are conflict points along I-225. Maintaining or reducing conflict points will generally improve I-225 traffic flow and maintain/improve safety. *(Concepts were evaluated for the number of merges and diverges in respect to the No Action Alternative)*
  - Maintain or improve safety at the DTC Boulevard and Yosemite Street ramp intersections compared to the No Action Alternative. *(Measure using LOS)*
  - Maintain or improve traffic safety on the adjacent local street network compared to the No Action Alternative. *(DRCOG models were used to determine the effects of the concepts on the local street network)*
- ▶ Improve Safety through Design
  - Satisfy engineering design standards and criteria. *(Evaluate concepts based on meeting established engineering design standards and criteria)*

### **Other Screening Criteria**

- ▶ Improve Accessibility and Connectivity
  - Meet driver's expectations. *(Assessment of each alternative relative to its "standardization" that drivers are used to considering the existing I-225/Yosemite Street/DTC Boulevard interchange complex operations and relative to other interchanges in Colorado).*
  - Preserve system interchange access. *(The system consists of the existing I-225/Yosemite Street/DTC Boulevard interchange complex. Evaluate if current access is removed from the system interchange complex based on each concept)*
- ▶ Avoid/Minimize Community Impacts
  - Avoid/minimize direct and indirect business and resident impacts. *(Measure impacted property, business or resident, and identify any easement requirements).*
  - Avoid/minimize business and resident displacements. *(Measure impacted buildings)*

- Evaluate compatibility with existing local land use. (*Measure affected existing local land use access and circulation, and current impacted operations of transportation systems in the community*).
- ▶ Avoid/Minimize Environmental and Cultural Resource Impacts
  - Avoid/Minimize impacts to environmental and cultural resources based on direct impacts on: (*Measure impacted areas on these resources*):
    - Parks, open space, and trails
    - Noise walls
    - Floodplains
    - Wetlands and waters of the U.S.
    - Sensitive species
    - Sites with hazardous material concerns
    - Viewsheds
- ▶ Address Multimodal Considerations
  - Maintain or improve north-south bicycle or pedestrian connectivity under I-225 along Yosemite Street and DTC Boulevard with respect to existing conditions. (*Measure ability for bicycle/pedestrian crossing of I-225 north-south along Yosemite Street and DTC Boulevard as compared to existing conditions*)
  - Minimize impacts to existing bus services using the I-225/Yosemite Street/DTC Boulevard interchange complex. (*Measure ability of bus service to use the I-225/Yosemite Street/DTC Boulevard interchange complex with each concept as compared to existing conditions*)

### Tier 3 Screening Results

**Table 2.4** summarizes the Tier 3 screening results. Of the five retained alternative concepts from Tier 2 screening, three alternative concepts were eliminated from further consideration because they did not address purpose and need, and one alternative was not recommended. Alternative Concept 19 was identified as the Recommended Alternative Concept. **Appendix C** documents the Tier 3 screening process for the alternative concepts, and provides details about the reasons why a particular alternative was retained, eliminated, or not recommended.

Both Concepts 17 and 19 have the same interchange configuration, except for removal of the southbound I-225 off ramp to DTC Boulevard. Concept 17 was not recommended because of the removal of the southbound I-225 off ramp to DTC Boulevard, which is not supported by the local agencies. Based on Tier 3 screening, Concept 19 was the Recommended Alternative Concept. It best met the purpose and need for the project while minimizing community and environmental impacts and should be analyzed further during the NEPA process. As part of the NEPA process, both Concepts 17 and 19 will be studied further to determine a proposed action.

**Table 2.4 Tier 3 Screening Results**

Concepts	Title	Results
16	Braid Ramps West of DTC Boulevard	<b>Eliminated</b> in Tier 3 screening because Concept 16 would not address purpose and need to improve safety. The left-hand on ramp from DTC Boulevard to I-225 is contrary to driver expectations, and studies indicate that crashes may be reduced as much as 25 to 70 percent with the use of right-hand on and off ramps compared to left-hand ramps. Traffic speeds are typically faster in the left-most lanes of the highway; therefore, speed differentials between entering and existing traffic and through traffic is usually greater with left-hand ramps. Of the FHWA recommended mitigation measures for left-hand on ramps, only supplemental advanced signing to advise drivers of upcoming left-hand ramp entrance in advance of merge can be provided. Extending the auxiliary lanes to reduce speed differential conflicts, providing full decision sight distance in advance of the left-side on ramp, or providing ramp geometry near the point of physical merge that accommodates a high speed design cannot be accomplished without shortening the weave distance, creating steeper grades requiring design variance, or relocating the LRT substation.
17	Divide I-225, Remove DTC Boulevard Off Ramp and Braid Ramps West of DTC Boulevard	<b>Not Recommended</b> in Tier 3 screening because the system interchange access is not preserved. Direct access from southbound I-225 to DTC Boulevard would be removed. Removal of this access is not supported by the local agencies of the City of Greenwood Village, the City and County of Denver, and Arapahoe County.
18	Add Loop Ramp and Braid Ramps East and West of DTC Boulevard	<b>Eliminated</b> in Tier 3 screening because Concept 18 would not address purpose and need to reduce future (2035) traffic congestion. During the AM peak hour, the southbound through movement at the I-225/DTC Boulevard interchange southern intersection would queue into the northern I-225/DTC Boulevard interchange intersection affecting the operations of this intersection. In addition, Concept 18 would have negative impacts on the community. This concept would require partial acquisition of the Summit Ridge Apartment Homes parcel, requiring the displacement of 108 residences.
19	Divide I-225, Maintain DTC Boulevard Off Ramp and Braid Ramps West of DTC Boulevard	<b>Recommended</b>
21	Braid Ramps East and West of DTC Boulevard	<b>Eliminated</b> in Tier 3 screening because Concept 21 would not address purpose and need to reduce future (2035) traffic congestion. This concept would experience congestion (LOS F) two to three hours per day in 2035 on southbound I-225.

## 2.5 Identification of the Recommended Alternative Concept

The Recommended Alternative Concept that resulted from the thorough screening analysis, input from key agencies involved in the project, and based on public opinion was Concept 19. This concept best met the purpose and need for the project while minimizing impacts to community and environmental impacts. Concept 17 was not recommended as the Recommended Alternative from this PEL study.

## 2.6 Implementability

Potential construction and right-of-way (ROW) costs for each concept were prepared for reference but were not included in screening. **Table 2.5** summarizes the costs for each concept.

**Table 2.5 Cost for Implementation of Each Concept**

Concept	ROW Cost	Total Cost (Includes PE, CE, and ROW)
16	\$0	\$34.3 M
17	\$100,000	\$41.4 M
18	\$21.6 M	\$74.5 M
19	\$100,000	\$42.3 M
21	\$15.0 M	\$69.3 M

PE – Preliminary Engineering, CE – Construction Engineering, ROW – right-of-way

## 3.0 TRANSPORTATION ANALYSIS

**Chapter 3.0** documents the transportation-related analytical methods and data used to evaluate the alternative concepts described in **Chapter 2.0**. A *Traffic Conditions Report* was prepared for the PEL study and is provided in **Appendix D** for reference.

### 3.1 Traffic Operations

#### Congestion along I-225

The southbound segment of I-225 is projected to cause LOS F for 8 to 12 hours a day by 2035. As part of the alternative concepts analysis, traffic congestion along I-225 was evaluated relative to the frequency of hours that the southbound direction would function at LOS F given 2035 traffic volumes. Concepts were analyzed to identify whether LOS F occurs for more than two hours per day, chosen as a condition that would be an improvement over existing conditions. None of the concepts were found to completely eliminate the LOS F operations during the morning peak hour. Thus, it is recognized that the freeway system will operate at LOS F in 2035 during one peak hour, and the subsequent hour represents a recovery period to climb out of LOS F; hence, no more than two hours in LOS F is the goal specifically caused by the segment between DTC Boulevard and I-225. Other non-peak hour conditions should operate better, barring incidents that might impact the facilities capacity.

Typically we analyze traffic to meet LOS D to accommodate the design year peak hour traffic. However, because the downstream traffic conditions on I-25 will negatively impact this segment of southbound I-225, this typical LOS D measure cannot be achieved and, therefore, is not appropriate for the traffic analysis of this study. For analysis purposes, the goal was to at least match the duration of LOS F on southbound I-225 today in the design year of 2035 to reduce congestion at the existing bottleneck. So, the primary measure in this analysis with respect to the freeway operations is not the specific peak hour operations, but rather the duration of LOS F operations allowed, measured in hours, during the course of a typical weekday.

Both the existing two-lane section crossing DTC Boulevard and the weave segment just downstream of these two lanes were analyzed. The weave segment becomes the critical constraint once the two-lane bridge is widened to three lanes. This weave analysis incorporates three components based on the applicability to the alternative concepts:

- ▶ The mainline traffic entering the study area from upstream
- ▶ Traffic entering from the DTC Boulevard on ramp oriented to just southbound I-25
- ▶ All the on ramp traffic entering from DTC Boulevard sensitive to its directionality (either to northbound I-25 or to southbound I-25)

Each alternative was analyzed using the Highway Capacity Manual (HCM) methodology and applying the HCS for freeway capacities to determine how often (number of hours) a LOS F was caused specifically by this segment, given 2035 traffic volumes. This number was compared among concepts for screening. Those concepts that did perform better than the No Action Alternative were discarded.

**Figure 3.1** displays the No Action Alternative and the retained concepts from Tier 3 screening. With no improvements, southbound I-225 would experience LOS F for approximately 8 to 12 hours per day. Concept 17 and Concept 19 will operate at LOS F for no more than one to two hours per day.

## Intersection Operations

An evaluation of the interchange intersections at DTC Boulevard and Yosemite Street was completed for all the concepts in Tier 2 and Tier 3 in comparison to the No Action Alternative. HCM techniques for intersections was applied using the Synchro software package. This allowed analysis of the intersections for LOS and queue stacking between intersections.

- ▶ **LOS:** Evaluated to remain the same or better than No Action with 2035 traffic volumes.
- ▶ **Queue Stacking:** Evaluated to ensure that each concept does not have traffic from one intersection stacking into an adjacent intersection.

### 3.2 *Local Street Network*

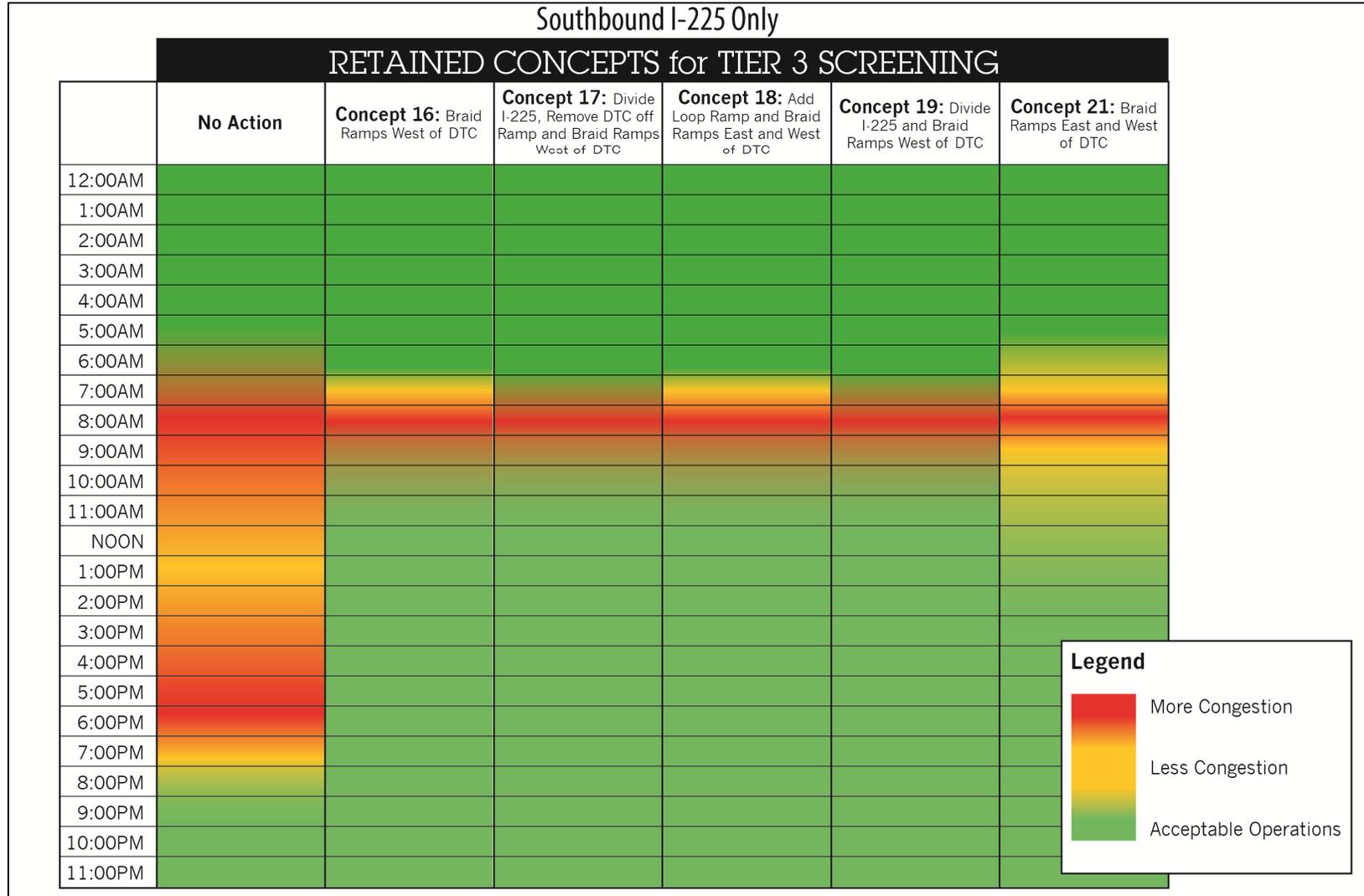
The adjacent local street network was reviewed in relation to impacts from the proposed Tier 3 concepts in maintaining and improving traffic and safety. Specifically, the evaluation assessed potential traffic diversions onto the local street network.

The DRCOG travel demand modeling tool for year 2035 traffic forecasts, which includes a third through lane along I-225, was used to evaluate each Tier 3 concept. Modeling traffic assignment results were then compared with the No Action Alternative using the same 2035 traffic demands. While the traffic forecasts for this project incorporated three through lanes along southbound I-225, this specific local street system analysis included a model “run” that incorporated only two southbound lanes (as exists today across DTC Boulevard) to determine residual impacts on the local road system. Each of the final Tier 3 concepts was then analyzed via a special model run in which the subject alternative was specifically coded into the DRCOG travel demand model.

The comparison results from this approach show very little difference in the final traffic assignment along the local roadways. In comparing the raw traffic model assignment results, it was discovered that none of the concepts would create undue traffic diversions onto the adjacent local street network. Fluctuations in traffic volumes on the local network for each Tier 3 concept carried no more than a 2 percent cumulative difference when compared to the local network traffic assignment results associated with the two-lane No Action Alternative. These shifts in traffic are within normal day-to-day fluctuations and demonstrate that all five Tier 3 concepts would not have a negative impact on the local roadway network. Many trips along southbound I-225 have an origin and a destination well outside the study area, and the model did not “see” the local street system as being advantageous in serving these trips. **Detailed results of the analysis can be found in Section 4.2, Local Street Network, of the Traffic Conditions Report in Appendix D.**

Additionally, due to the conclusion that the Tier 3 concepts would not impact traffic volumes negatively along the local street network, safety would remain similar to that of the No Action since no improvements are inherent in the local street network as part of this PEL.

**Figure 3.1 Congestion Along I-225 for Retained Tier 3 Concepts in 2035**



The City and County of Denver, the City of Greenwood Village, and Arapahoe County have expressed that they would like to see more detail on the impact of the improvements on the local roadway network in regard to added delay and degradation of the levels of service, perhaps using a more sophisticated analysis tool than was used in the regional model. This quote from the City and County of Denver letter dated July 25, 2014, states, "...We want to add that in our opinion the removal of the DTC Boulevard slip ramp, as shown in Alternate 17, will add delay and impacts to the local roadway network and reduce access into the Denver Tech Center for both resident and business trips. We feel removal of the slip ramp would also have an indirect impact on businesses by eliminating the direct access from I-225."

From a technical standpoint, the model used for the PEL study was sufficient for the large scale traffic analysis required for comparing the alternatives evaluated in the study, but it is not suited to analyze specific impacts to the local network. This level of analysis could be included in NEPA during the next steps, if there is any need to further explore Alternative 17.

### 3.3 Safety

As part of the PEL, safety was reviewed to evaluate the concepts to reduce crashes along the corridor (**Appendix A**). As traffic levels along the corridor increase, there is an even greater amount of congestion and associated crashes. The information that follows describes the safety analysis that was completed for Tier 2 and Tier 3 criteria for safety related to each concept configuration.

***Tier 2: Maintain existing or improve traffic operations with respect to existing conditions for weave areas along southbound I-225 with regard to distance of weave and number of lane changes.***

The current weave length between the DTC Boulevard on ramp and the I-25 ramps is only approximately 1,500 feet. This criterion examined if a concept would still contain a weave and if the length of a weave would be equal or longer than the existing length. A concept would be able to reduce rear-end type crashes along I-225 if the weave distance is longer. A longer distance will increase the time for vehicles to get situated in correct exiting lanes to I-25 and reduce drivers having to accept shorter gaps in traffic to maneuver from one lane to another. If a concept's weave distance is equal to the existing, then it will at least maintain the level of safety instead of making it worse.

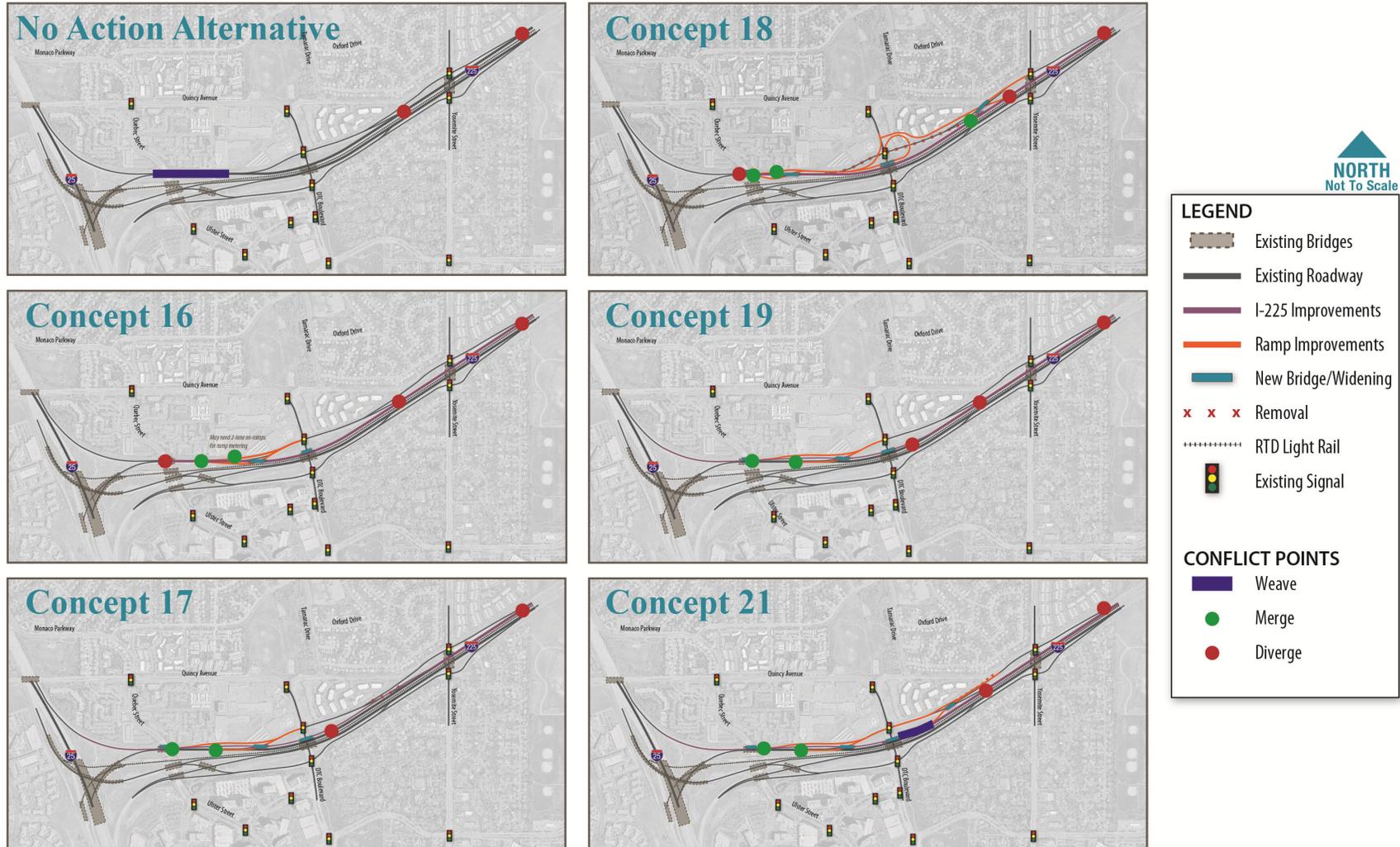
***Tier 3: Reduce weaves along southbound I-225. Weaves are less desirable than a merge or diverge due to the traffic streams crossing each other in a short distance.***

Each Tier 3 concept was evaluated to determine whether weave movements could be removed entirely with each proposed concept. Generally, weaves increase conflict points by having traffic cross from both sides of the freeway to get to the correct destination lane. In a weave, sideswipe crashes can be more common.

***Tier 3: Maintain or reduce merges/diverges along southbound I-225. Merges and diverges are conflict points along I-225. Maintaining or reducing conflict points will generally improve I-225 traffic flow and maintain/improve safety.***

Each concept was inventoried for maintaining or reducing merges/diverges. Additional conflict areas could potentially increase the number of crashes along I-225, specifically rear-end and sideswipe crashes. **Figure 3.2** displays the locations of the merges, diverges, and weaves for each of the Tier 3 concepts.

Figure 3.2 Safety Assessment Conflict Points – Tier 3 Alternatives



### ***Tier 3: Maintain or improve safety at the DTC Boulevard and Yosemite Street ramp intersections compared to the No Action Alternative.***

Each interchange intersection was evaluated for an increase in traffic volumes due to traffic patterns shifting. An increase in traffic volumes can correlate to an increase in intersection crashes, such as broadside, approach turn, and rear-end type crashes.

Results of the safety analysis are presented in screening matrices (**Appendix C**) and detailed in the Traffic Conditions Report (**Appendix D**).

## ***3.4 I-25 2035 Growth and Resulting Operations***

As part of the 2035 No Action conditions evaluation of the study area, I-25 mainline operations were evaluated and found to be poor, such that, southbound I-225 traffic cannot easily merge onto southbound I-25. This condition is prevalent in both AM and PM peak hours, and it results in traffic queues occurring along the entrance ramps (from southbound I-225).

By 2035, southbound I-25 mainline traffic will operate at LOS F at the merge with I-225 and LOS F between Hampden and I-225, without improvements to I-25. This congestion will create a traffic backup along the ramps and potentially spill back onto I-225, thereby adding to the existing congestion issue on southbound I-225.

The existing northbound traffic along I-25 is already operating at LOS F and the southbound merge from I-225 operates at LOS E during the AM peak hour. Evaluations show the merge point will degrade to LOS F by 2020 and continue to degrade southbound traffic to a LOS F north of the merge by 2035.

In essence, the extreme congestion that I-25 will experience has the potential to create queues along southbound I-225 as this traffic will be attempting to merge into gridlock conditions.

## ***3.5 Alternative Concepts' Impacts to I-25 – Tier 3***

Each of the five Tier 3 concepts was reviewed with respect to impacts to I-25 operations. All the concepts remove the bottleneck on southbound I-225, allowing I-225 traffic to flow more smoothly to I-25. Analysis was conducted to determine the impacts to I-25 with this changed condition because the bottleneck served as traffic metering onto I-25.

The VISSIM microsimulation software tool was used to evaluate LOS, density, and average speed along I-25 at the northbound and southbound I-25 merge points from I-225. VISSIM allows the assessment of transportation operations in more detail as the software simulates, tracks, and records every vehicle entered into the system. The software assesses the interaction between drivers and spill-back effects of nearby bottlenecks. By 2035, peak traffic conditions along I-25 will be poor such that the mainline will operate at LOS F. Assessing LOS F conditions will not provide meaningful comparisons as simulation results will show poor operations throughout the system during the peak hour. Analysis focused on the existing AM peak hour traffic volumes (worst-case scenario) as variations in operations are more likely, thereby allowing a more direct comparison. **Table 3.1** compares the No Action Alternative to the five Tier 3 concepts.

**Table 3.1 I-25 Comparison of Tier 3 Concepts – Existing AM Peak Hour Traffic\*\***

		No Action	Concept 16	Concept 17	Concept 18	Concept 19	Concept 21
I-25 Northbound Merge (from I-225)	LOS/Density (pc/mi/ln)*	F (64.1)	F(50.4)	F (54.4)	F (46.2)	F (52.1)	F (49.9)
	Avg. Speed (mph)	24.8	31.0	29.1	35.4	29.9	31.1
I-25 Southbound Merge (from I-225)	LOS/Density (pc/mi/ln)*	E (43.0)	E (39.0)	E (42.5)	E (40.6)	E (42.9)	E (41.7)
	Avg. Speed (mph)	37.1	41.2	37.1	39.1	37.0	37.9

\* *pc/mi/ln* = passenger cars per mile per lane. LOS is based on this density measure.

\*\* See the Traffic Conditions Report in **Appendix D** for more detail.

One can see that each concept does not impact I-25 negatively. Even though, the bottleneck at the DTC Boulevard interchange is removed in each concept, other capacity constraints restrain traffic from entering I-25 mainline. The VISSIM simulation shows that the on ramps to I-25 (from I-225) are capacity-constrained due to traffic conditions along I-25. Therefore, the peak period operations cause these on ramps to be saturated at peak times, causing queues to form. Removing the two-lane bottleneck along southbound I-225 will result in these queues growing longer at the peak times, but the nature of merging onto I-25 will not change as the absorption of traffic from the on ramp is fixed due to congestion along I-25. As such, very little change is seen at the merging areas relative to LOS and density.

This information was not used in Tier 3 screening because it does not provide a differentiation among the concepts. However, it is helpful in that this analysis shows that removing the metering effect of the bottleneck does not negatively impact I-25, it just extends queues entering I-25.

## 4.0 Recommended Alternative Concept

**Chapter 4.0** describes the Recommended Alternative Concept (Concept 19) resulting from the alternative evaluation and development and screening process conducted in this PEL study. Both Concepts 17 and 19 have the same interchange configuration, except for removal of the southbound I-225 off ramp to DTC Boulevard. Concept 17 was not recommended due to the lack of support for removal of the southbound I-225 off ramp to DTC Boulevard by the local agencies. As part of the NEPA process, both Concepts 17 and 19 will be studied further to determine a proposed action. **Appendix E** includes the conceptual typical engineering plans, sections, and renderings for the Recommended Alternative Concept.

### 4.1 *Divide I-225 and Braid Ramps West of DTC Boulevard*

The Recommended Alternative Concept involves dividing southbound I-225 just west of the Yosemite Street bridge west of the DTC slip ramp into two, two-lane freeway segments to connect southbound I-225 to the designated I-25 on ramp; the south two lanes go to southbound I-25 and the north two lanes go to northbound I-25 (**Figure 4.1** and **Appendix E**).

The DTC Boulevard on ramp would cross under southbound I-225 with a new bridge crossing and merge onto the highway to southbound I-25 from the right side, meeting driver expectations for a typical on ramp. The DTC Boulevard on ramp to northbound I-25 would continue to use a dedicated lane to the exit ramp to I-25. The off ramp from southbound I-225 to DTC Boulevard would remain with the Recommended Alternative Concept to maintain existing access for the area. Renderings for the Recommended Alternative Concept have been developed and are illustrated in **Figures 4.2, 4.3, and 4.4**.

The Recommended Alternative Concept was developed to meet CDOT design criteria and standards. This concept was developed to an approximate 15 percent level of design for review of potential impacts, construction and ROW costs, and meeting the design criteria and standards.

In accordance with the Managed Lanes Policy Directive 1603.0, managed lanes were considered for this study area. However, considering the short 2-mile extent in one direction only along southbound I-225 and terminating at I-25 on the west end, providing managed lanes was not practical. Managed lanes are not precluded with the Recommended Alternative Concept for future managed lane improvements along the 12-mile I-225 corridor. The elimination of managed lanes for the I-225 project (Yosemite Street to I-25) does not preclude the evaluation of managed lanes along the I-225 corridor from I-70 to I-25 or as a comprehensive managed lanes system in the Denver Metropolitan Area. A corridor study or comprehensive managed lanes study would be necessary to evaluate managed lanes along I-225, as well as how the various corridors will function together.

Figure 4.1 Recommended Alternative Concept – Plan View

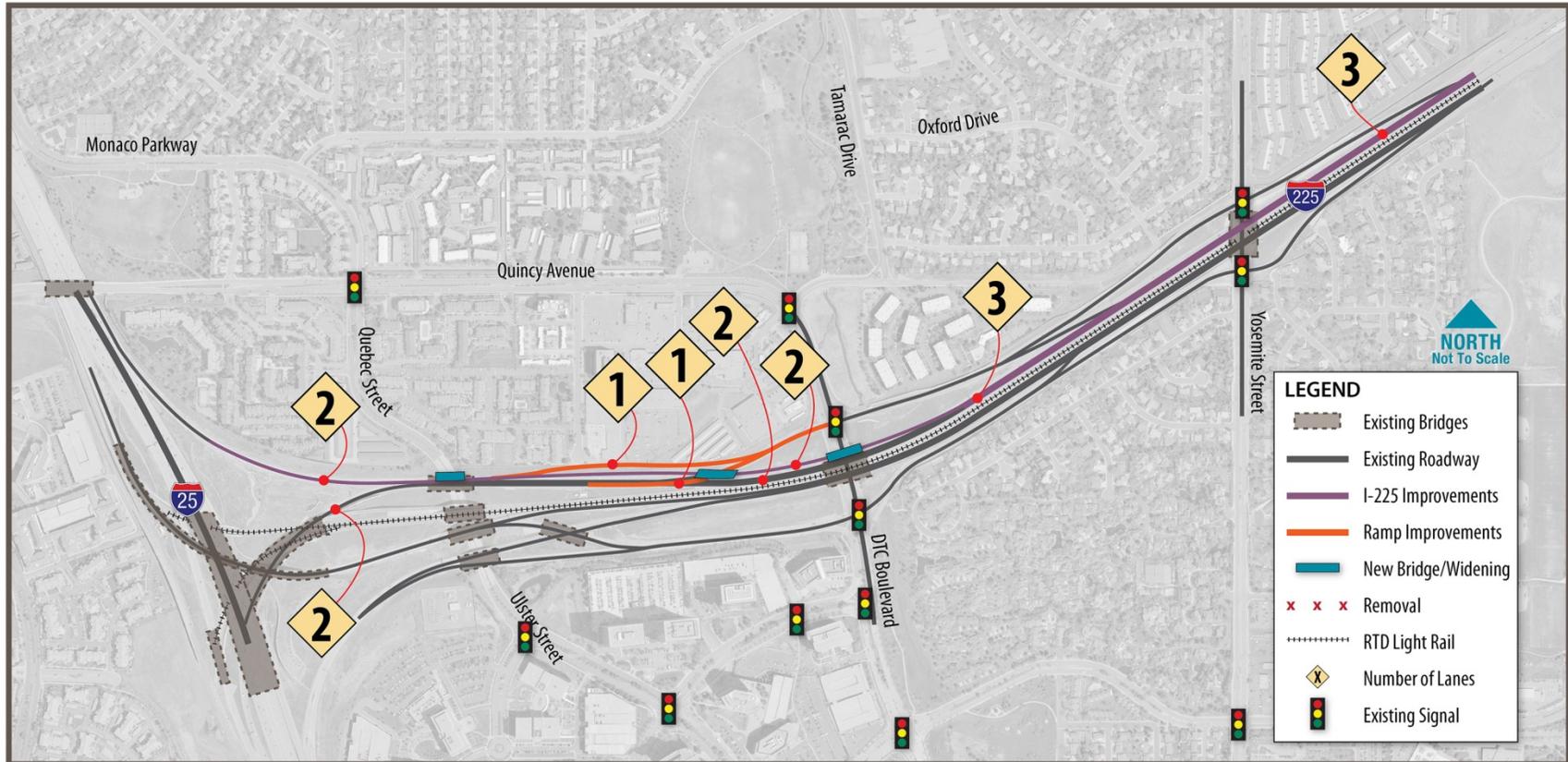
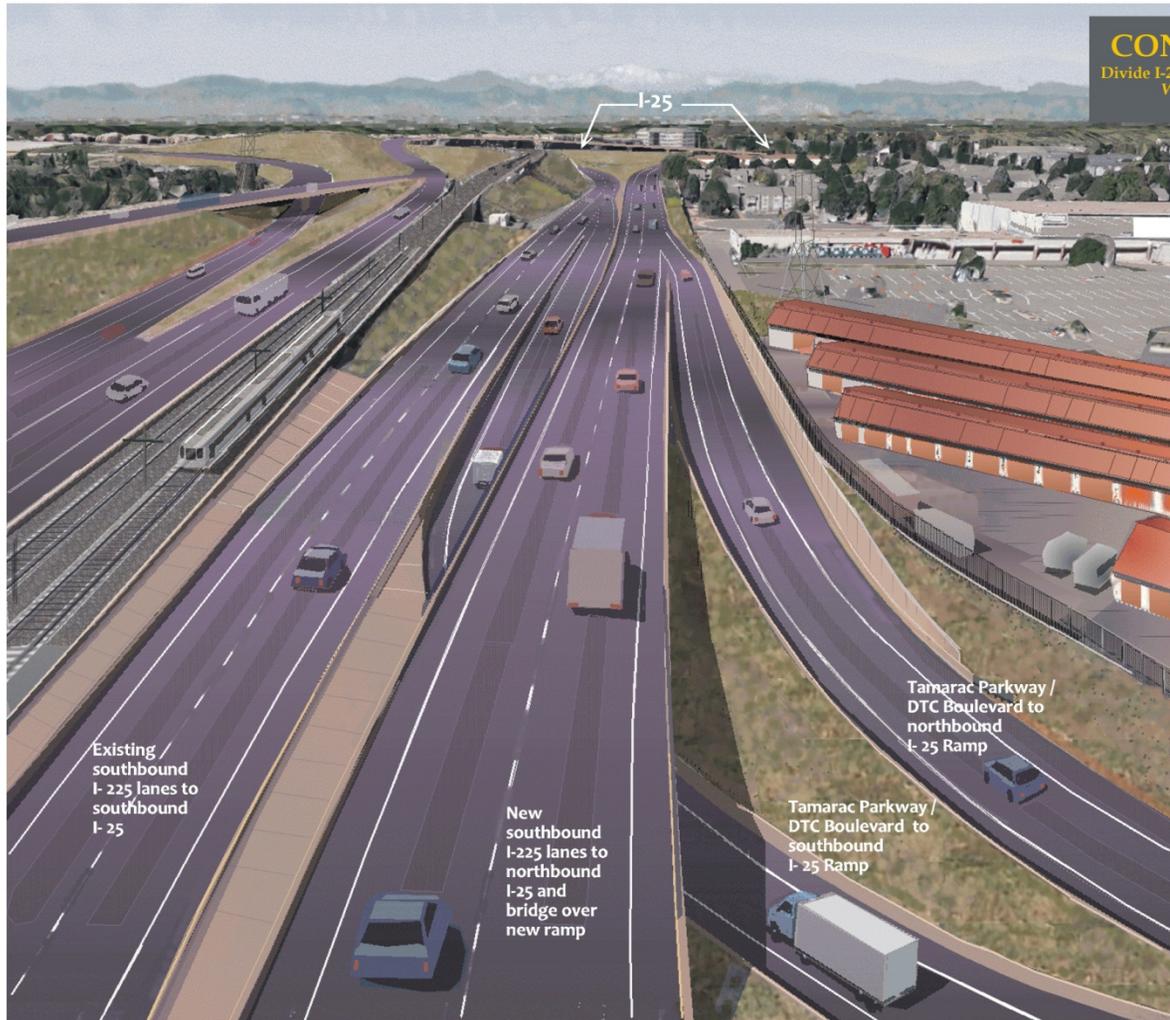


Figure 4.2 Recommended Alternative Concept - Illustrative View of I-225 Looking West near DTC Boulevard



**CONCEPT 19**  
Divide I-225 and Braid Ramps  
West of DTC

**I-225 Planning and Environmental Linkages Study**

Yosemite Street to I-25



**RECOMMENDED ALTERNATIVE CONCEPT (CONCEPT 19)**

Bird's eye view to the west, just west of Tamarac Parkway / DTC Boulevard. I-225 splits to form two lanes to southbound I-25 and two lanes to northbound I-25. I-225 will be expanded to accommodate the lanes to northbound I-25 and will require a new bridge over the Tamarac Parkway / DTC Boulevard.

ARTWORK BY  
Frank Miltenberger  
Landscape Architect

FM 8 25 14

Split for southbound and northbound I-25 ramps from Tamarac Parkway / DTC Boulevard

**Figure 4.3 Recommended Alternative Concept - Illustrative View to the West from I-225 Southbound On Ramp from DTC Boulevard**



**EXISTING CONDITIONS**  
Southbound I-225 on ramp from Tamarac Parkway / DTC Boulevard. View to the west.

**CONCEPT 19**  
Divide I-225 and Braid Ramps  
West of DTC

**RECOMMENDED ALTERNATIVE CONCEPT (CONCEPT 19)**  
Showing new ramp configuration just west of Tamarac Parkway/ DTC Boulevard. The southbound I-25 ramp profile passes below the new southbound I-225 bridge structure.

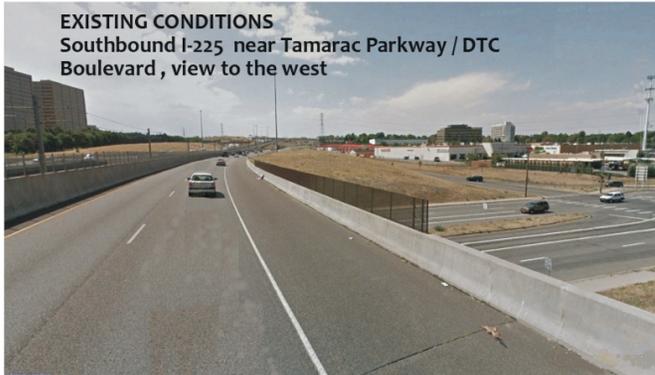
**I-225 Planning and Environmental Linkages Study**

Yosemite Street to I-25



ARTWORK BY  
Frank Miltenberger  
Landscape Architect  
FM 8 24 14

Figure 4.4 Recommended Alternative Concept - Illustrative View of I-225 Looking West over DTC Boulevard



**CONCEPT 19**  
Divide I-225 and Braid Ramps  
West of DTC

I-225 Planning and  
Environmental Linkages  
Study

Yosemite Street to I-25

RECOMMENDED ALTERNATIVE CONCEPT  
(CONCEPT 19)  
A new lane for northbound I-25 will require a new  
bridge over Tamarac Parkway / DTC Boulevard.



ARTWORK BY  
Frank Miltenberger  
Landscape Architect  
FM 7 10 14

## 4.2 Active Traffic Management Strategies

Potential ATM and ITS elements could provide additional traffic operational and safety benefits in coordination with the Recommended Alternative Concept when constructed. Not all these strategies may be practical or effective if focused only on the traffic analysis area of this project involving less than 2 miles of interstate in one direction of an overall 12-mile corridor.

The ATM approach to congestion mitigation consists of using a combination of operational strategies and infrastructure that, when implemented successfully, takes advantage of the existing networks and provides measureable benefits to the traveling public. Various ATM techniques have been, or are planned to be, implemented in the Denver Metropolitan Area, as well as around the country. Of those, the following may be appropriate for the southbound I-225 corridor in the I-225 PEL study area:

- ▶ **Speed Harmonization:** Speed harmonization involves installing gantries spanning the roadway with lane use signs over each lane and spaced at regular intervals. When conditions reach a congestion threshold, the lane use signs automatically reduce speed limits across all lanes to maintain good traffic flow and eliminate speed differentials that can cause congestion to develop. This helps to reduce initial collision risks from queuing as well as secondary accidents.
- ▶ **Queue Warning:** Queue warning uses similar physical infrastructure as speed harmonization, overhead gantries with electronic lane use signs, and additional side-mount displays. An algorithm is applied using real-time data to automatically alert drivers of downstream congestion or blocked lanes and to reduce speed limits in approach of the queue. The area upstream of the congestion and queues that develop along southbound I-225 in approach of the Yosemite Street and DTC Boulevard interchanges could benefit from an application of queue warning.
- ▶ **Ramp Metering:** Ramp metering controls the flow of traffic at on ramps based on current freeway conditions. It helps merging efficiency, reduces collisions, and has been in widespread use throughout the Denver Metropolitan Area for the past 30 years. Ramp metering uses sensors in the roadway that measure and report the real-time volume, occupancy, and speed back to CDOT's central software. An algorithm processes these data, and the on ramp traffic red hold times are adjusted to meter the traffic entering the roadway according to the level of mainline congestion and ramp queues. In the study area, ramp metering is currently in use at the on ramps at northbound and southbound DTC Boulevard, northbound Yosemite Street, and northbound and southbound Parker Road. The current Recommended Alternative Concept may benefit from ramp meter installation on each braided ramp from DTC Boulevard to southbound I-225; however, the acceleration length requirement and the limited storage length available may limit the use of this element.
- ▶ **Traveler Information and Dynamic Rerouting:** Traveler information and dynamic rerouting displays travel time information and other relevant information to drivers to help them make more informed decisions. Dynamic rerouting uses the traveler information data to direct drivers to alternate routes based on downstream conditions, or for lane utilization to mitigate conditions such as is currently present on the ramp to southbound I-25. To be effective, the dynamic rerouting would need to take place at upstream junctions where alternative routes to southbound I-225 are available. For example, users along Parker Road could be diverted to Dam Road or Havana Street/Hampden Avenue if the congestion along southbound I-225 is severe. As a result, this infrastructure would need to be implemented outside the study area.

- ▶ **Incident Response:** Incident response continuously monitors the roadway for incidents to provide timely and efficient responses, which results in reduced congestion and reduced secondary collisions. This can be incorporated with other ATM elements, such as the queue warning data collection, to aid in monitoring and notification. This is already in place in the study area in the form of Incident Control Plans and Courtesy Patrol. Courtesy Patrol could be considered to cover the area of congestion and ensure that incidents are cleared as quickly as possible.

Implementation of the previously discussed ATM treatments could provide the following benefits:

- ▶ Decrease in both primary and secondary incidents
- ▶ Decrease in incident severity
- ▶ More uniform speeds and driver expectation
- ▶ Increased trip reliability
- ▶ Reduction in traffic noise, emissions, and fuel consumption

### 4.3 *Intelligent Transportation Systems Elements*

To support the I-225 ATM system described above, the following ITS components would need to be installed on the roadway:

- ▶ **Lane Use Signals (LUS):** These electronic message signs would be located above each lane and installed on all of the ATM gantries. They would be full-color, full-matrix to display advisory speeds, lane closures, restrictions, or merge conditions.
- ▶ **Side Mount Variable Message Signs (VMS):** These electronic signs could also be full-color, full-matrix, and would be attached to the side of the road to provide supplemental messages to the users. They are larger than the LUS but smaller than a full overhead VMS.
- ▶ **Variable Message Signs:** Full overhead VMS will also be used to supplement the LUS. They would be used to display longer messages.
- ▶ **Closed Circuit Television Cameras:** Cameras would be installed to provide full, or additional, visual coverage of the length of the corridor. This will support the ATM system by providing visual confirmation of the sign displays and verification of incidents when the ATM algorithm is activated.
- ▶ **Microwave Vehicle Radar Detectors:** These detectors will be used to measure point volume, speed, occupancy, and classification data. The ATM algorithm would use these data to detect queuing, reduced speeds, and incidents.



- ▶ **Travel Time Indicators:** Travel time indicator antennas and readers within the study limits would be used to collect travel time information that would be posted on CoTrip and VMS.



Figure 4.5 shows a system that includes LUS over each lane and a full overhead VMS for additional messaging.

**Figure 4.5 Sample Active Traffic Management Structure**



## 4.4 Additional Considerations

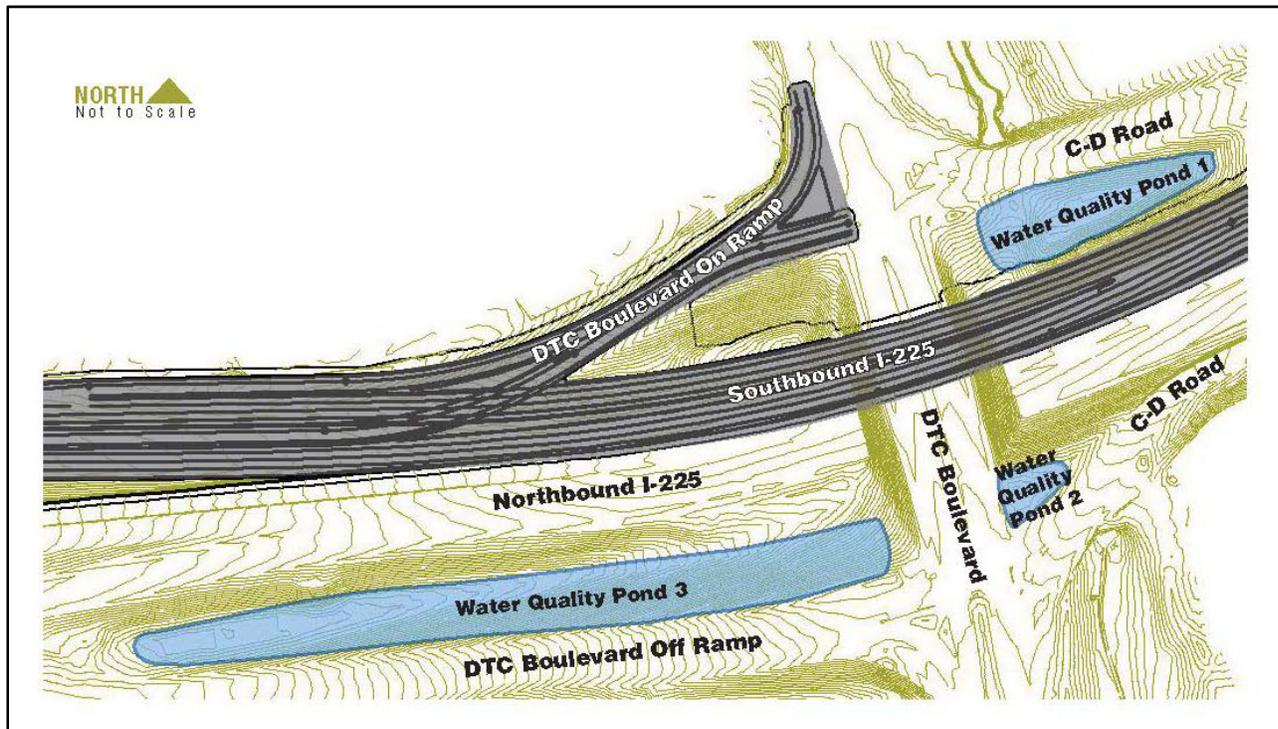
### Permanent Water Quality Features

CDOT has a Phase I Municipal Separate Storm Sewer System (MS4) permit from the Colorado Department of Public Health and Environment (CDPHE), and the City and County of Denver has a Phase I MS 4 permit from CDPHE, as well. The I-225 PEL study area is located within both the CDOT and City and County of Denver Phase I MS4 permits area. A Phase I MS4 permit requires providing permanent water quality facilities for new development or redevelopment where there will be 1 acre or greater of new paved areas, as well as temporary best management practices (BMPs) for disturbed areas during construction.

If the CDOT Phase I MS4 requirements are followed, a variance letter from the City and County of Denver for both permanent water quality facility requirements and temporary BMPs during construction may be required due to the overlapping CDOT and City and County of Denver Phase I MS4 permit areas. CDOT is currently operating under an Interim New Development/Re-Development (NDRD) Program associated with its CDPHE MS4 Permit. Under the Interim NDRD Program, projects that are designated Priority projects will require permanent water quality best management practices (BMPs). Under this program, this project is designated as a Non-Priority project, which means new permanent water quality BMPs are not required. As the project moves further through design and NEPA processes, the need for such BMPs will continue to be monitored, and MS4 permit requirements, in general, will be coordinated with appropriate local agencies. If, at some point, water quality BMPs or other stormwater detention facilities are determined to be necessary for this project, several sites within the project limits may be

suitable. **Figure 4.6** provides possible locations of permanent water quality features in the I-225/DTC Boulevard interchange.

**Figure 4.6 Possible Permanent Water Quality Features - I-225/DTC Boulevard Interchange**



### Bicycle Connectivity

The City and County of Denver's bike plan, *Denver Moves – Making Bicycle and Multi-Use Connections*, identifies a few bicycle improvements for the study area. It lists bike lanes along Ulster Street/Quebec Street/Eastmoor Drive from Princeton Avenue to the south (2011). It also identifies future bike lanes for Quincy Avenue from the western boundary of the study area to the northern segment of Tamarac Parkway, and along Yosemite Street for its entirety within the study area. A "shared parking/bike lane" is installed on Princeton Avenue from Eastmoor Drive to the northern boundary of the study area, which involves onstreet parking that is wide enough and often void of parked vehicles so that it typically operates like a de-facto bike lane. No bicycle facilities currently exist or are planned along DTC Boulevard, although bicycle facilities along DTC Boulevard are likely to be a topic in the upcoming enhanced bikeway planning efforts.

The Recommended Alternative Concept will not preclude inclusion of bicycle facilities along DTC Boulevard at a later date. The proposed bike lanes along Ulster Street/Quebec Street/Eastmoor Drive and the bike lanes along Yosemite Street will not be directly affected by the Recommended Alternative Concept because no improvements are included in the Recommended Alternative Concept for these north-south roadways. The bike lanes along Ulster Street/Quebec Street/Eastmoor Drive and Yosemite Street will be temporarily affected during construction to widen the I-225 bridge over Ulster Street/Quebec Street and to build improvements to the I-225/Yosemite Street off and on ramp intersections.

## Pedestrian Connectivity

Existing sidewalks in DTC are frequently detached, as are sidewalks along Quincy Avenue between Eastmoor Drive and Tamarac Parkway. However, most sidewalks in the remainder of the study area are attached. Many paths exist along and within the three parks that fall within this area. Sidewalks south of I-225 are typically newer and wider, while those north of the highway are older and narrower.

Pedestrian facilities at intersections in the study area vary per intersection. This is primarily to suit the uniqueness of each intersection environment. Most intersections in the study area are well programmed for pedestrians, but some common amenities that improve use for pedestrians (including the Americans with Disabilities Act [ADA] programming) are lacking in some instances.

The Recommended Alternative Concept will maintain and improve pedestrian bicycle facilities where they are affected by the project, specifically at the I-225 on ramp/DTC Boulevard intersection and the southbound I-225 on and off ramp/Yosemite Street intersection.

## 4.5 Traffic Conditions Analysis

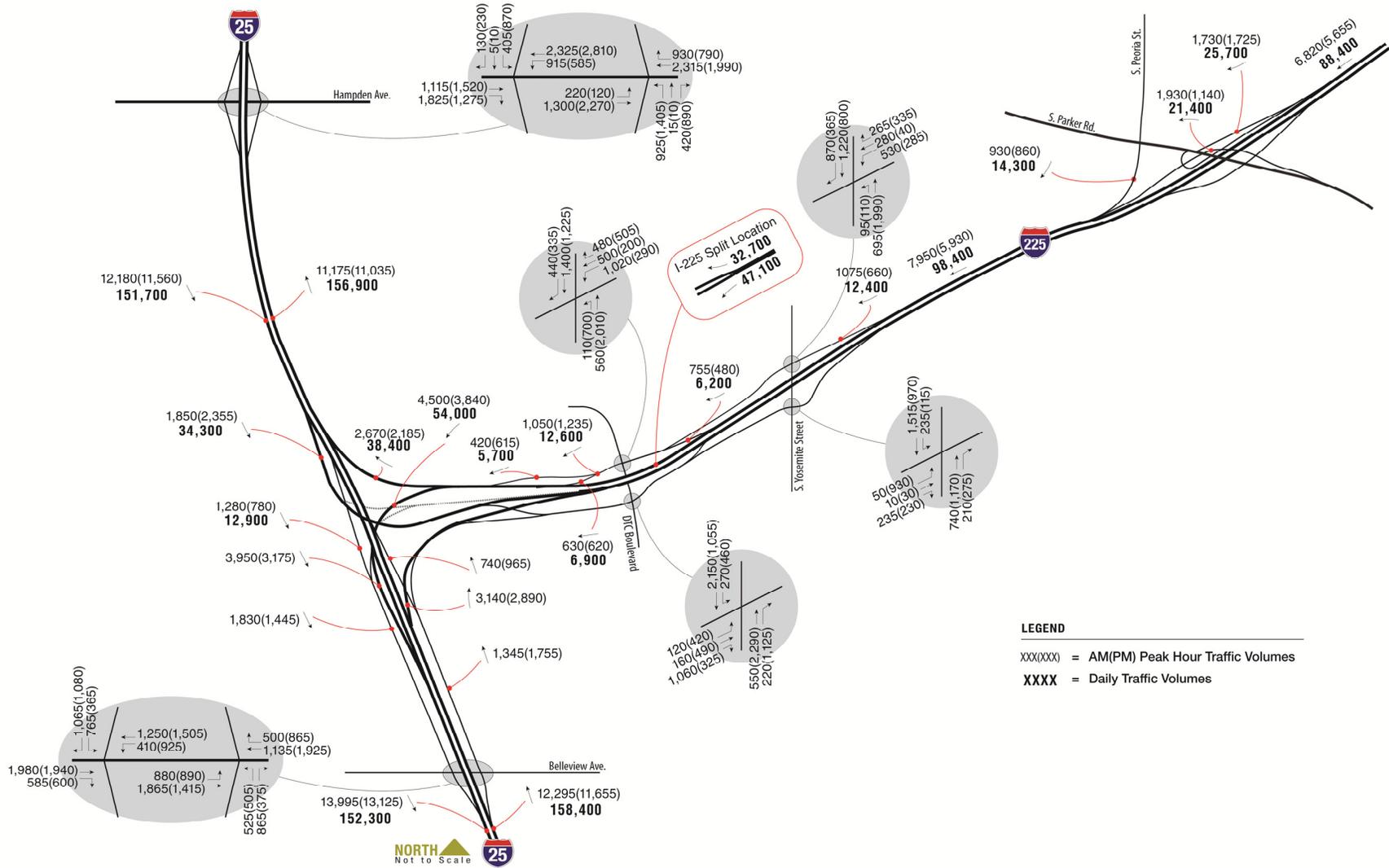
The Recommended Alternative Concept was evaluated in more detail with respect to traffic operations. This was conducted to fully address any traffic operation refinements and to compare the more detailed operational measures with those of a No Action scenario. The analysis used 2035 traffic forecasts (**Figure 4.7**).

### Freeway and Intersections Operations

**Table 4.1** displays the projected freeway conditions along I-225 for Concept 19 and the No Action Alternative in year 2035. North of the DTC Boulevard interchange, I-225 would continue to operate at LOS F during the AM peak hour in the southbound direction; however, density will be similar to that of the No Action Alternative. The exception to the LOS F condition is the merge to northbound I-25 from the DTC Boulevard on ramp with a LOS A. This condition is present due to the upstream congestion creating gaps for the merging of DTC Boulevard traffic to enter the southbound I-225/northbound I-25 traffic stream. The poor operations during the AM peak hour are expected along the freeway system in this area, and traffic queues will form at many locations and negatively impact other elements of the freeway system as traffic queues build. This phenomenon is evident in **Table 4.1**, which focuses on the AM peak hour.

Concept 19 removes one of the constraining components on the system, the two-lane I-225 cross section across DTC Boulevard. Leaving this at two lanes will cause congestion throughout the entire day. Congestion will still occur during the peak hours, but Concept 19 will help limit the duration of congestion along I-225 outside the peak hours. For Concept 19, the widening of I-225 as it spans DTC Boulevard will cause congestion only two hours per day, whereas the No Action scenario's cross section could produce 8 to 12 hours of LOS F conditions each day as shown in **Figure 4.8**. Reducing the duration of the congestion queue translates into less driver delay over the course of the day, fewer crashes related to congestion, and potentially less impact on the local roadway system. Further, the southbound traffic weave will be eliminated as part of Concept 19, and the DTC Boulevard merging traffic operations will improve and be safer.

Figure 4.7 2035 Concept 19 Traffic Volumes



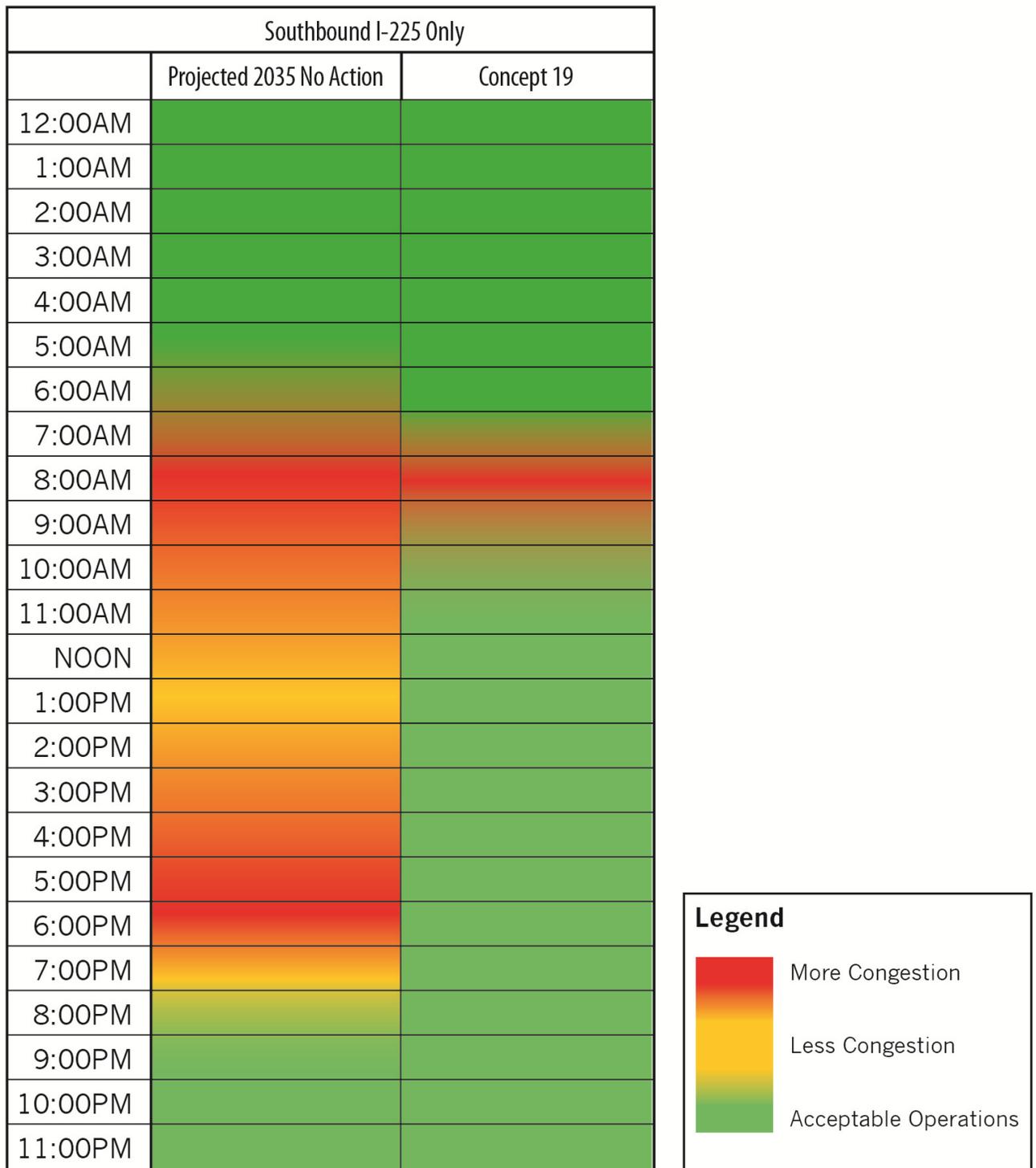
**Table 4.1 Concept 19 (2035) and No Action (2035) Freeway Operations Comparison\*\***

Location	Type	AM Peak Hour		PM Peak Hour	
		LOS	Density*	LOS	Density*
<b>Concept 19 (2035) Southbound I-225</b>					
I-225, North of Parker Interchange	Freeway	F	91.4	D	30.7
Parker Road Off Ramp	Diverge	F	84.6	C	26.3
Parker Road Flyover On Ramp	Merge	F	138.4	F	62.2
Parker Road/Peoria Street On Ramp	Merge	F	92.2	F	49.4
Between Parker & Yosemite Interchanges	Freeway	F	135.7	F	96.0
Yosemite Street Off Ramp	Diverge	F	135.7	F	96.0
DTC Boulevard Street Off Ramp	Diverge	F	109.1	F	92.3
I-25 Bifurcation (Splitting to I-25 North and South)	Diverge	F	143.2	F	124.5
To Northbound I-25 DTC On Ramp	Merge	A	8.2	A	9.4
To Southbound I-25 DTC On Ramp	Merge	F	118.7	F	102.6
<b>No Action (2035) Southbound I-225</b>					
I-225, North of Parker Interchange	Freeway	F	100.9	E	36.6
Parker Road Off Ramp	Diverge	F	95.6	E	42.0
Parker Road Flyover On Ramp	Merge	F	162.5	F	88.8
Parker Road/Peoria Street On Ramp	Merge	F	140.0	F	80.2
Between Parker & Yosemite Interchanges	Freeway	F	126.9	F	100.7
Yosemite Street Off Ramp	Diverge	F	126.9	F	100.7
DTC Boulevard Street Off Ramp	Diverge	F	119.9	F	112.5
Between DTC Boulevard Off Ramp & On Ramp	Freeway	F	124.2	F	122.7
Between DTC Boulevard On Ramp & I-25	Weave	F	111.2	F	104.6

\* Density reported in passenger cars per mile per lane (pc/mi/ln)

\*\*Freeway operations calculated using VISSIM simulation software

**Figure 4.8 Congestion along I-225 for No Action and Concept 19 in 2035**

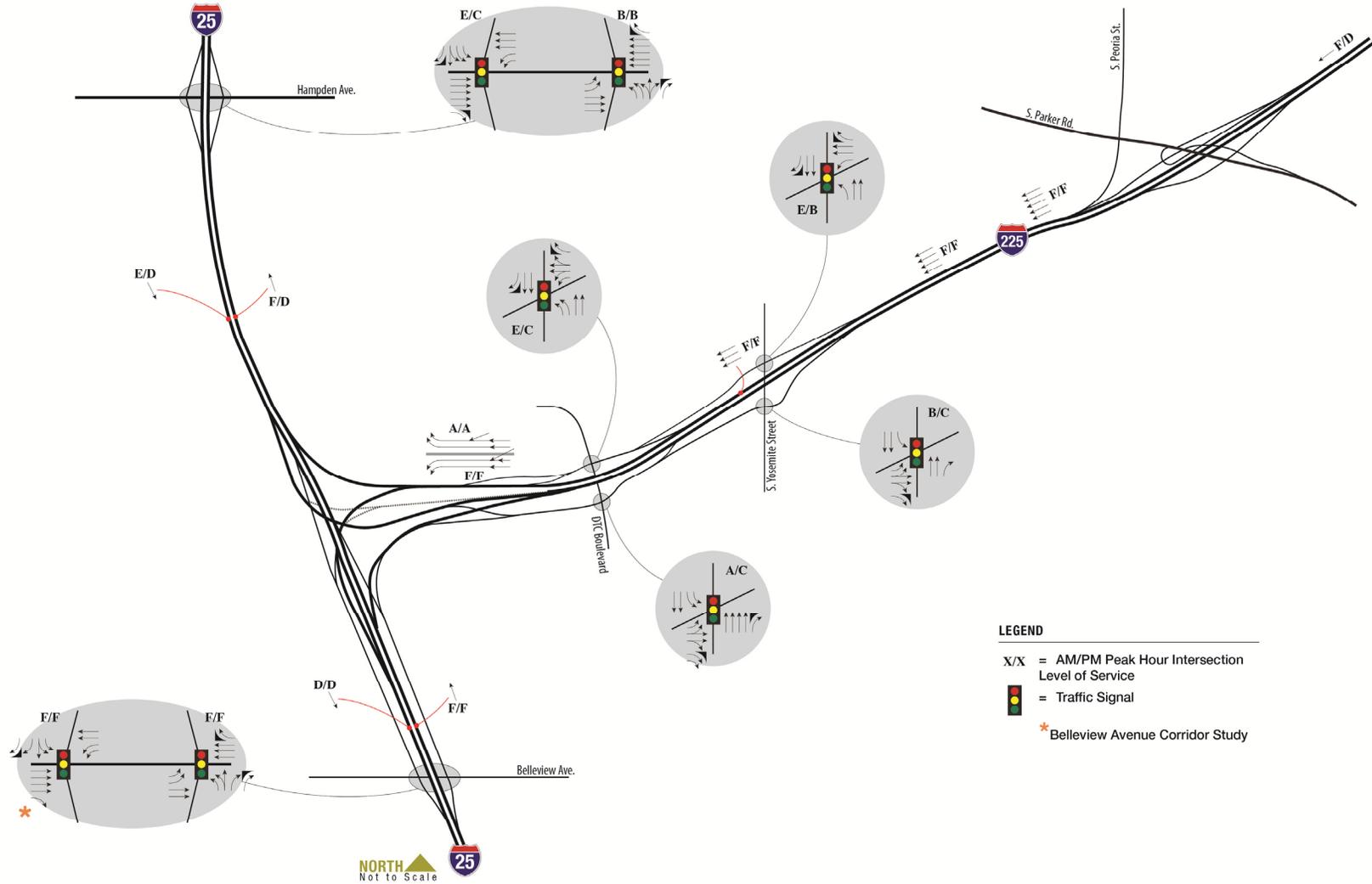


As part of the Recommended Alternative Concept analysis, the LOS for the signalized interchange intersections was determined for the AM and PM peak hours. Because all movements would still be accommodated relative to freeway access with the Recommended Alternative Concept (Concept 19), the intersections at the DTC Boulevard and Yosemite Street LOS are the same as that of the 2035 No Action Alternative. **Figure 4.8** shows the lane configuration at each intersection in the study area and the overall results. **Table 4.2** displays the LOS and average delays for the signalized intersections.

**Table 4.2 Interchange Intersection Level of Service and Average Delay for 2035**

Interchange / Intersection	AM Peak Hour		PM Peak Hour	
	Avg. Delay (seconds)	LOS	Avg. Delay (seconds)	LOS
<b>I-225 / DTC Boulevard Interchange Intersections</b>				
North Ramps	62.5	E	31.8	C
South Ramps	7.1	A	24.4	C
<b>I-225 / Yosemite Street Interchange Intersections</b>				
North Ramps	72.2	E	10.2	B
South Ramps	11.0	B	25.6	C

Figure 4.9 Concept 19 (2035) Lane Geometry and Level of Service



## 5.0 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES AND MITIGATION STRATEGIES

The No Action Alternative, Concept 17 (Not Recommended), and the Recommended Alternative Concept (Concept 19) have been evaluated for impacts to various resources within the study area. **Table 5.1** summarizes impacts to these resources. For more detailed information on the existing conditions of the following resources, see the corresponding documentation in **Appendix A** for the *Environmental Analysis and Existing Conditions Assessment Report*.

**Table 5.1 Overview of the Impacts Associated with the No Action Alternative, the Recommended Alternative Concept, and Concept 17 (Not Recommended)**

Resource	Context	No Action Alternative	Recommended Alternative Concept (Concept 19)	Concept 17 (Not Recommended)
<b>Land Use, Socioeconomics and Community</b>	Properties adjacent to the PEL study area include residential, commercial, and retail uses	<p>Would not affect current land use because no additional ROW would need to be acquired. However, the No Action Alternative would not promote the efficient use of the existing transportation corridors.</p> <p>Would not directly affect population, income, or employment but could result in continued system reliability problems for local and regional trips on I-225 and I-25.</p> <p>Could negatively affect local travel patterns due to increased congestion and system disruptions from the lack of lane continuity and balance on I-225 and encourage frustrated motorists to seek alternative routes to I-225.</p>	<p>Would not affect current land use because no business or residential displacements (full acquisition of properties for ROW) would occur.</p> <p>Would not directly affect population, income, or employment.</p> <p>Would help maintain access and reduce traffic congestion getting to businesses and employment centers in the vicinity of the project and the regional area.</p>	<p>Would not affect current land use because no business or residential displacements (full acquisition of properties for ROW) would occur.</p> <p>Would not directly affect population, income, or employment.</p> <p>Would reduce traffic congestion, although access would be reduced to businesses and employment centers in the vicinity of the project and the regional area with removal of the existing southbound I-225 ramp to DTC Boulevard.</p>

**Table 5.1 Overview of the Impacts Associated with the No Action Alternative and the Recommended Alternative Concept (Continued)**

Resource	Context	No Action Alternative	Recommended Alternative Concept (Concept 19)	Concept 17 (Not Recommended)
<b>Properties Acquired for Right-of-Way</b>	The study area is in a dense urban area with many residential and commercial parcels.	Would not require the acquisition of property for ROW.	Would impact 65,363 square feet of parcels and the partial acquisition of property from Sonic Burger Restaurant and Public Storage Units parcels.	Would impact 65,363 square feet of parcels and the partial acquisition of property from Sonic Burger Restaurant and Public Storage Units parcels.
<b>Residential and Commercial Displacements</b>	Properties in the vicinity of the study area are occupied by a variety of commercial owners, tenants, and residents.	Would not cause any residential and commercial displacements.	Would not cause any residential and commercial displacements.	Would not cause any residential and commercial displacements.
<b>Bicycle/ Pedestrian Facilities</b>	Existing bike lanes along Ulster Street/Quebec Street/Eastmoor Drive and Yosemite Street.  Existing pedestrian facilities along Ulster Street/Quebec Street/Eastmoor Drive, DTC Boulevard, and Yosemite Street.	Would not affect any bicycle and pedestrian facilities.	Would temporarily impact the bike lanes along Ulster Street/Quebec Street/Eastmoor Drive and Yosemite Street during construction to widen the I-225 bridge over Ulster Street/Quebec Street and improvements to the I-225/ Yosemite Street off and on ramp intersections.  Would maintain and improve pedestrian bicycle facilities at the I-225 on ramp/DTC Boulevard intersection and the southbound I-225 on and off ramp/Yosemite Street intersection.	Would temporarily impact the bike lanes along Ulster Street/Quebec Street/Eastmoor Drive and Yosemite Street during construction to widen the I-225 bridge over Ulster Street/ Quebec Street and improvements to the I-225/ Yosemite Street off and on ramp intersections.  Would maintain and improve pedestrian bicycle facilities at the I-225 on ramp/DTC Boulevard intersection and the southbound I-225 on and off ramp/Yosemite Street intersection.

**Table 5.1 Overview of the Impacts Associated with the No Action Alternative and the Recommended Alternative Concept (Continued)**

Resource	Context	No Action Alternative	Recommended Alternative Concept (Concept 19)	Concept 17 (Not Recommended)
<b>Parks and Recreational Resources</b>	Goldsmith Gulch Trail crosses I-225 at the DTC Boulevard intersection.	Would not cause any impacts to Parks and Recreational Resources.	Would not cause any impacts to Parks and Recreational Resources.	Would not cause any impacts to Parks and Recreational Resources.
<b>Air Quality</b>	<p><u>Regional Conformity</u></p> <p>The 2035 RTP and the Transportation Improvement Program (TIP) are the adopted fiscally-constrained air quality-conforming plan and program for DRCOG. Federally funded projects need to be included in the current fiscally-constrained RTP and TIP before a decision document can be signed.</p> <p><u>Local Conformity</u></p> <p>Local conformity is demonstrated by assessing whether future traffic conditions may cause an exceedence of a National Ambient Air Quality Standard (NAAQS) on a smaller basis. The proposed project must not lead to violations of an NAAQS.</p>	Future emissions from vehicles would be minimized through several federal regulations (such as emission standards) and regional controls.	This project would not result in any meaningful changes in traffic volumes, vehicle mix, location of the existing facility, or any other factor that would cause an increase in emissions impacts relative to the No Action Alternative.	This project would not result in any meaningful changes in traffic volumes, vehicle mix, location of the existing facility, or any other factor that would cause an increase in emissions impacts relative to the No Action Alternative.

**Table 5.1 Overview of the Impacts Associated with the No Action Alternative and the Recommended Alternative Concept (Continued)**

Resource	Context	No Action Alternative	Recommended Alternative Concept (Concept 19)	Concept 17 (Not Recommended)
<p><b>Traffic Noise</b></p> <p>A noise analysis study will be required to evaluate prospective future (2035) traffic noise conditions.</p>	Noise walls are currently located on both sides of I-225 due to the proximity of residential, parks and recreational resources.	Would not increase current conditions of traffic noise.	Would impact 295 linear feet of existing noise walls along I-225.	Would impact 295 linear feet of existing noise walls along I-225.
<p><b>Historic Resources</b></p>	Cherry Creek Townhouses, located north of I-225, meet the age requirement for historic resources but are not located in the study area.	Would not cause any impacts to known local historic resources.	Would not cause any impacts to known local historic resources.	Would not cause any impacts to known local historic resources.
<p><b>Floodways, 100-year Floodplains, and Water Quality</b></p>	Goldsmith Gulch, its floodplain, and its floodways are designated Federal Emergency Management Agency (FEMA) Zones AE and Z. The gulch is a tributary of Cherry Creek and is mainly used for natural moderation of floods with limited wildlife usage.	Would not impact any floodways, floodplains, and water quality resources in the study area.	Would impact 13,478 square feet or 0.31 acre in the floodplain area and 2,979 square feet or 0.07 acre in the existing water quality pond area.	Would impact 13,478 square feet or 0.31 acre in the floodplain area and 2,979 square feet or 0.07 acre in the existing water quality pond area.

**Table 5.1 Overview of the Impacts Associated with the No Action Alternative and the Recommended Alternative Concept (Continued)**

Resource	Context	No Action Alternative	Recommended Alternative Concept	Concept 17 (Not Recommended)
<b>Wetlands and Other Waters of the U.S.</b>	Most wetlands identified within the corridor are small palustrine emergent wetlands occurring in a narrow fringe along Goldsmith Gulch.	Would not impact any wetlands or other waters of the U.S. in the study area.	Would impact 128 linear feet of Waters of the U.S. in Goldsmith Gulch. No wetlands would be impacted.	Would impact 128 linear feet of Waters of the U.S. in Goldsmith Gulch. No wetlands would be impacted.
<b>Wildlife/Threatened and Endangered Species</b>	One Black-tailed Prairie Dog colony is located at Goldsmith Gulch North Middle Park, north of I-225 along DTC Boulevard.	Would not impact any wildlife/threatened and endangered species.	Would not impact any wildlife/threatened and endangered species.	Would not impact any wildlife/ threatened and endangered species.
<b>Hazardous Materials</b>	Five historical auto sites, two historical dry cleaning sites, two leaking underground storage tanks, and one underground storage tank are located within the hazardous materials study area.	Would not impact any locations with possible hazardous materials.	Would not impact any locations with possible hazardous materials.	Would not impact any locations with possible hazardous materials.
<b>Viewsheds</b>	The viewshed includes the existing I-225/DTC Boulevard/ Yosemite Street interchange complex.	Would not change the existing viewshed.	Would change the viewshed by raising the new I-225 bridge structure over DTC Boulevard by approximately 5 feet.	Would change the viewshed by raising the new I-225 bridge structure over DTC Boulevard by approximately 5 feet.

## 5.1 *Cumulative Impacts*

During the NEPA process, additional analysis and agency coordination will need to be performed based on the environmental scan that was conducted. Resources that may be cumulatively impacted by future projects when combined with other past, present, and reasonably foreseeable future projects may include noise impacts to local residents, economic impacts to local businesses, and direct/indirect loss of wetlands due to surface disturbance and increased impervious surface area.

## 5.2 *Next Steps and Proposed Mitigation Strategies*

**Table 5.2** discusses the mitigation practices for the impacts from the Recommended Alternative Concept and Concept 17 (Not Recommended). These mitigation practices are proposed commitments and may be amended during the future NEPA process.

**Table 5.2 Next Steps and Proposed Mitigation Strategies**

Mitigation Category	Recommended Alternative Concept and Concept 17 (Not Recommended) Impacts	Proposed Mitigation Strategies
<b>Right-of-Way Displacements</b>	Will impact 65,363 square feet of parcels requiring the partial acquisition of property from Sonic Burger Restaurant and Public Storage Units parcels.	Any partial property acquisition for ROW will conform to the requirements set forth in the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970 (Public Law 91-646 as amended). All impacted property owners will be provided notification of CDOT’s intent to acquire an interest in their property, including a written offer letter of just compensation specifically describing those property interests. A CDOT Right-of-Way Specialist will be assigned to each property owner to assist them with this process.
<b>Bicycle and Pedestrian Facilities</b>	Would temporarily impact the bike lanes and pedestrian facilities along Ulster Street/Quebec Street/Eastmoor Drive and Yosemite Street during construction to widen the I-225 bridge over Ulster Street/Quebec Street and improvements to the I-225/Yosemite Street off and on ramp intersections.  Would temporarily impact pedestrian facilities at the south I-225 on and off ramp/DTC Boulevard intersection.	Provide temporary detours for bicyclists and pedestrians along the Ulster Street/Quebec Street/Eastmoor Drive, Yosemite Street, and DTC Boulevard during construction.
<b>Parks and Recreational Resources</b>	Would not impact parks, trails, or open space.	If parks, trails, or open space are impacted at a later date, evaluations of publicly-owned parks, trails, and open space lands will be conducted to determine if there are any properties that qualify for protection under Section 4(f) and/or are Section 6(f) assisted properties.

**Table 5.2 Next Steps and Proposed Mitigation Strategies (Continued)**

Mitigation Category	Recommended Alternative Concept and Concept 17 (Not Recommended) Impacts	Proposed Mitigation Strategies
<p><b>Air Quality</b></p>	<p>This project would not result in any meaningful changes in traffic volumes, vehicle mix, location of the existing facility, or any other factor that would cause an increase in emissions impacts relative to the No Action Alternative.</p>	<p>Due to past and present air quality issues, infrastructure projects that might exacerbate existing air quality problems must meet certain requirements before they can proceed. In general, projects must be analyzed with respect to their potential impact on air quality at both the regional and local levels. An air quality impact assessment will need to be prepared. This assessment may include a hot spot analysis for carbon monoxide at intersections with a LOS of D, E, or F.</p> <p>Neighboring areas could be exposed to construction-related emissions, and particular attention will be given to minimizing total emissions near sensitive areas such as homes. To address the temporary elevated air emissions that may be experienced during construction, standard construction mitigation strategies should be incorporated into construction contracts. These include following BMPs and relevant CDOT construction specifications, such as:</p> <ul style="list-style-type: none"> <li>▶ Keep engines and exhaust systems on equipment in good working order. Equipment is maintained on a regular basis, and equipment is subject to inspection by the project manager to ensure maintenance.</li> <li>▶ Control fugitive dust systematically through diligent implementation of CDOT’s Standard Specifications for Road and Bridge Construction, particularly Sections 107.24, 209, and 250, and CDPHE Air Pollution Control Division (APCD)’s Air Pollutant Emission Notification requirements.</li> <li>▶ Allow no excessive idling of inactive equipment or vehicles.</li> <li>▶ Use low-sulfur fuel for construction equipment and vehicles to reduce pollutant emissions.</li> <li>▶ Locate stationary equipment as far from sensitive receivers as possible (when conditions allow).</li> <li>▶ Implement more strict dust control measures near schools during school hours.</li> <li>▶ Retrofit older construction vehicles to reduce emissions.</li> </ul>

**Table 5.2 Next Steps and Proposed Mitigation Strategies (Continued)**

Mitigation Category	Recommended Alternative Concept and Concept 17 (Not Recommended) Impacts	Proposed Mitigation Strategies
<b>Traffic Noise</b>	Will impact 295 linear feet of existing noise walls along I-225.	<p>The CDOT <i>Noise Analysis and Abatement Guidelines</i> (CDOT 2011) specify that a noise analysis study is required for all Type I projects if noise sensitive receptors are present within the study area. A Type I project consists of a proposed Federal or Federal-Aid or CDOT-administered highway project for construction of a highway on a new location or the physical alteration of an existing highway that significantly changes either the horizontal or vertical alignment or increases the number of through lanes. Construction of the Recommended Alternative would be a Type I project, and a traffic noise study will need to be prepared to evaluation reconstruction of noise walls affected.</p> <p>Construction noise would be subject to relevant local regulations and ordinances, and any construction activities would be expected to comply with them.</p>
<b>Historic Resources</b>	Would not cause any impacts to known local historic resources.	<p>The transportation improvements have the potential to affect currently unidentified and unevaluated cultural resources in unsurveyed areas; however, additional intensive-level inventory will be required to adequately assess these potential impacts. An intensive survey of cultural resources will be conducted, including preparation of a Cultural Resources Inventory Report, to facilitate official evaluations of NRHP-eligibility and assess specific project impacts as required for National Historic Preservation Act Section 106 review.</p> <p>If any archaeological materials (such as artifacts and faunal remains) or features are encountered or unearthed during construction, work would be immediately halted in the vicinity of the find, and the CDOT archaeologist and State Historic Preservation Officer (SHPO) would be promptly notified. The site of the find would be secured and work would remain halted until a qualified professional archaeologist could evaluate and/or remove the materials. If warranted, additional archaeological testing or data recovery may be necessary before work can be resumed in the vicinity of the find.</p> <p>If bones of potential human origin are encountered during construction, ground-disturbing work would be halted in the vicinity of the discovery, and the CDOT archaeologist would be promptly notified. The CDOT archaeologist would assess the find, and the county coroner would be summoned, if necessary, to determine the relative age and ethnicity of the individual(s) represented. Work should not resume in the vicinity of the find until CDOT grants clearance.</p>

**Table 5.2 Next Steps and Proposed Mitigation Strategies (Continued)**

Mitigation Category	Recommended Alternative Concept and Concept 17 (Not Recommended) Impacts	Proposed Mitigation Strategies
<p><b>Floodways, 100-year Floodplains, and Water Quality</b></p>	<p>Will impact 13,478 square feet or 0.31 acre in the floodplain area and 2,979 square feet or 0.07 acre in the existing water quality pond area.</p>	<p><u>Floodplains</u></p> <p>The Goldsmith Gulch floodplain would be the most sensitive to any changes in the floodplain and would require a Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) from FEMA. Floodplain modeling would be required to assess significant changes. Some relatively small changes may be incorporated in the floodplain without triggering the CLOMR/LOMR process. Floodplain modeling would be required to assess significant changes.</p> <p>Engineering design will take into account the floodplain and floodway issues. The location of abutments, bridges, and bridge piers within the floodplain and floodway will be considered in the engineering design. Structures located within the floodway will require a specialized hydrologic assessment and approval by FEMA and Colorado Water Conservation Board.</p> <p><u>Water Quality</u></p> <p>CDOT has a Phase I MS4 permit from CDPHE, and the City and County of Denver has a Phase I MS 4 permit from CDPHE, as well. The I-225 PEL study area is located within both the CDOT and City and County of Denver Phase MS4 permits area. A Phase MS4 permit requires providing permanent water quality facilities for new development or redevelopment where there will be 1 acre or greater of new paved areas, as well as temporary BMPs during construction. If the CDOT Phase I MS4 requirements are followed, a variance letter from the City and County of Denver for both permanent water quality facility requirements and temporary BMPs during construction will be required. Requirements to the permit should be evaluated during the NEPA process to determine any impacts to the community.</p> <p>During construction, stormwater impacts will be minimized by using the appropriate CDOT standard construction BMPs as appropriate. Potential BMPs would include silt fence, inlet protection, stabilized construction entrances, slope stabilization, concrete washouts, erosion logs, inlet filters, sediment basins (at permanent water quality pond locations), vehicle tracking pads, and other BMPs. Specific temporary and permanent stormwater management strategies will be identified during preliminary/final design as part of a drainage/hydraulics assessment and development of a storm water management plan (SWMP). Construction-related mitigation measures will be outlined in the SWMP and will include a detailed set of erosion control plans as part of the roadway design set.</p>

**Table 5.2 Next Steps and Proposed Mitigation Strategies (Continued)**

Mitigation Category	Recommended Alternative Concept and Concept 17 (Not Recommended) Impacts	Proposed Mitigation Strategies
<p><b>Wetlands and Other Waters of the U.S.</b></p>	<p>Would impact 128 linear feet of Waters of the U.S. in Goldsmith Gulch. No wetlands would be impacted.</p>	<p>A Wetland Delineation Report will be required and submitted to the US Army Corps of Engineers (USACE) for concurrence. A Wetland Findings Report will be prepared based on the Preferred Alternative in the NEPA document. FHWA and CDOT policy requires compensatory mitigation for permanent impacts on both jurisdictional and non-jurisdictional wetlands. Wetland mitigation is typically done on a one-to-one basis; however, a Clean Water Act Section 404 permit, which the USACE will issue, may require higher ratios if unique or high-quality wetlands are affected.</p>
<p><b>Wildlife/Threatened and Endangered Species</b></p>	<p>Would not impact any wildlife/threatened and endangered species.</p>	<p>A biological survey of threatened and endangered species, including aquatic species, will be required. Coordination with the US Department of Interior Fish and Wildlife Service (USFWS) and Colorado Division of Parks and Wildlife (CPW) would be necessary to mitigate potential impacts on special status species habitat. Also, Senate Bill 40 (SB 40) wildlife certification will be required for the crossing of riparian corridors in the project. CPW will determine if Formal or Programmatic certification may be required depending on SB 40 guidelines.</p> <p>If proposed construction is planned to occur during the primary nesting season for migratory birds in eastern Colorado (typically April 1 to August 31, with some species nesting outside this period), a qualified biologist will resurvey the study area to verify if any active nests are present. If no active nests are present, trees can be removed. However, if active migratory bird nests are identified and cannot be avoided by proposed construction activities, the USFWS field office will be contacted to help determine the appropriate mitigation action, which may include removing nests before egg laying begins or ceasing construction until all nestlings have fledged.</p>

**Table 5.2 Next Steps and Proposed Mitigation Strategies (Continued)**

Mitigation Category	Recommended Alternative Concept and Concept 17 (Not Recommended) Impacts	Proposed Mitigation Strategies
<b>Hazardous Materials</b>	Would not impact any locations with possible hazardous materials.	<p>Properties to be acquired will require a site-specific Phase I Environmental Site Assessment or Initial Site Assessment with an updated search of environmental databases as part of the ROW acquisition process.</p> <p>Contamination from hazardous materials is most likely to be encountered during ground-disturbing activities in areas near properties with potential or recognized environmental conditions (hazardous materials). During the design process, the information concerning these properties can be used to identify avoidance options, if possible, and to assist with the development of materials management and worker health and safety plans. An asbestos-containing materials survey is required for all structures to be demolished as part of this project and must be completed as part of the CDPHE demolition permit. Additionally, a lead-based paint survey and regulated materials clearance survey are recommended for all structures to be demolished as part of this project.</p>
<b>Other Resources</b>	<p>The following resources were not evaluated as part of the this PEL:</p> <ul style="list-style-type: none"> <li>▶ Environmental Justice</li> <li>▶ Archaeological Resources</li> <li>▶ Paleontology</li> <li>▶ Noxious Weeds</li> <li>▶ Soils and Geology</li> <li>▶ Energy</li> </ul>	Additional environmental analysis will be required as part of future NEPA analysis and documentation.

## 6.0 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

CDOT has been committed to involving federal, state, and local agencies and the public throughout the I-225 PEL process. Project success hinges on communication and cooperation among FHWA, CDOT, and the local communities.

### 6.1 Agency Coordination

The study team prepared an Agency Coordination and Public Outreach Plan for the PEL study (Felsburg Holt & Ullevig [FHU], 2013) at the outset of the project. The purpose of the agency coordination and public involvement program was to set forth the public involvement process for the I-225 PEL study and to describe how federal, state, and local government officials; regional transportation planning entities; citizen groups; community groups; civic and professional organizations; businesses; citizens; and low-income and minority populations would be involved in the process.

#### Project Management Team

Agency involvement activities included regular progress meetings held with project leaders from CDOT and FHU approximately monthly during the PEL study. Participating agencies and their representatives on the PMT included:

- ▶ Vanessa Henderson, CDOT Environmental Programs Branch
- ▶ Troy Halouska, CDOT Environmental Programs Branch
- ▶ Richard Horstmann, CDOT Region 1 Engineering
- ▶ Jerome Estes, CDOT Region 1 Engineering
- ▶ Carrie DeJacomio, CDOT Region 1 Engineering
- ▶ Leela Rajasekar, CDOT Region 1, Traffic
- ▶ Jordan Rudel, CDOT Region 1, Environmental
- ▶ Jiovanna Toppi, CDOT Region 1, Design
- ▶ Dean Bradley, FHU
- ▶ Chris Fasching, FHU
- ▶ Michelle Stevens, FHU
- ▶ Kevin Maddoux, FHU
- ▶ Gabrielle Renner, FHU

#### Resource Agency Scoping

Resource agencies have specific technical expertise and regulatory oversight on various environmental issues and potential impacts associated with the project. The study invited representatives from the USACE, USFWS, U.S. Environmental Protection Agency (EPA), CPW, CDPHE Water Quality Control Division (CDPHE WQCD), Urban Drainage and Flood Control District (UDFCD), and SHPO to comment on the *Environmental Analysis and Existing Conditions Report* in a letter on April 15, 2014. **Appendix F** includes all Resource Agency letters and correspondence.

## Technical Working Group

CDOT worked closely with other agencies and the corridor’s local communities throughout the study process. Coordination largely occurred through the TWG, which was made up of staff from the corridor’s local governments, FHWA, DRCOG, RTD, and local metropolitan districts. Written letters of support from the local agencies represented on the I-225 PEL from Yosemite Street to I-25 study Technical Working Group have been requested and will be compiled by CDOT as they are received. Letters that have been received are included in **Appendix F**.

The TWG’s primary role was to provide input on a range of issues analyzed in the PEL study. The TWG met with the study team approximately every 6 to 8 weeks from February 2013 through the conclusion of the study to provide input about the analysis of technical data for CDOT’s decision-making purposes. TWG members kept their respective organizations, constituent groups, or elected officials updated and provided outreach to the public through their own communication networks.

The TWG was composed of representatives from the following agencies:

- ▶ CDOT
- ▶ FHWA
- ▶ City of Aurora
- ▶ City and County of Denver
- ▶ City of Greenwood Village
- ▶ Arapahoe County
- ▶ DRCOG
- ▶ RTD
- ▶ Goldsmith Metro District
- ▶ Madre Metro District

The study team met with the TWG throughout the study to discuss the following items to obtain community concurrence on how the study was proceeding. **Table 6.1** lists the TWG meeting schedule and agenda topics.

**Table 6.1 Technical Working Group Meeting Schedule and Agenda Topics**

Meeting Date	Meeting Topics Discussed	
<b>February 20, 2013</b>	<ul style="list-style-type: none"> <li>▶ Project Overview</li> <li>▶ Description of a PEL study</li> <li>▶ Project Goals</li> <li>▶ Team Organization</li> <li>▶ Technical Working Group</li> </ul>	<ul style="list-style-type: none"> <li>▶ Public Involvement Program</li> <li>▶ Agency Coordination</li> <li>▶ Existing Conditions</li> <li>▶ Critical Issues</li> <li>▶ Brainstorming Workshop</li> </ul>
<b>March 20, 2013</b>	<ul style="list-style-type: none"> <li>▶ Brainstorming Workshop Report</li> <li>▶ Purpose and Need</li> </ul>	<ul style="list-style-type: none"> <li>▶ Telephone Town Hall Meeting</li> </ul>
<b>June 19, 2013</b>	<ul style="list-style-type: none"> <li>▶ Telephone Town Hall Meeting Polling Questions</li> <li>▶ Traffic Data and Safety Assessment Status</li> </ul>	<ul style="list-style-type: none"> <li>▶ Draft Purpose and Need</li> <li>▶ Responsible Acceleration of Maintenance and Partnerships (RAMP) Application</li> <li>▶ Schedule</li> </ul>
<b>July 17, 2013</b>	<ul style="list-style-type: none"> <li>▶ Telephone Town Hall Meeting Recap</li> <li>▶ Traffic Analysis Status</li> <li>▶ Safety Assessment Review Status</li> </ul>	<ul style="list-style-type: none"> <li>▶ Draft Purpose and Need</li> <li>▶ Project Goals and Screening</li> <li>▶ Existing Conditions Report Status</li> <li>▶ RAMP Short-List</li> </ul>

**Table 6.1 Technical Working Group Meeting Schedule and Agenda Topics (Continued)**

Meeting Date	Meeting Topics Discussed	
<b>November 20, 2013</b>	<ul style="list-style-type: none"> <li>▶ Traffic Congestion Overview</li> <li>▶ Purpose and Need</li> <li>▶ Concepts Overview</li> </ul>	<ul style="list-style-type: none"> <li>▶ Tier 1 Screenings</li> <li>▶ Confirm Criteria</li> </ul>
<b>January 15, 2014</b>	<ul style="list-style-type: none"> <li>▶ Project Update</li> <li>▶ Tier 2 Screening</li> <li>▶ Project Goals and Supporting Criteria Memo</li> </ul>	<ul style="list-style-type: none"> <li>▶ Traffic Analysis White Paper</li> <li>▶ Second Public Meeting</li> <li>▶ Tier 3 Screening</li> <li>▶ Build Concept Elements</li> </ul>
<b>February 19, 2014</b>	<ul style="list-style-type: none"> <li>▶ Public Open House</li> <li>▶ Outreach Efforts</li> <li>▶ Format</li> </ul>	<ul style="list-style-type: none"> <li>▶ Handouts</li> <li>▶ Presentation Boards</li> <li>▶ Conceptual Design Status</li> </ul>
<b>April 16, 2014</b>	<ul style="list-style-type: none"> <li>▶ Public Open House Summary</li> <li>▶ Traffic Analysis Update</li> <li>▶ Conceptual Design Update</li> </ul>	<ul style="list-style-type: none"> <li>▶ Tier 3 Screening – Tables and Goals Memo</li> <li>▶ Agency Letters</li> <li>▶ Schedule</li> </ul>
<b>June 18, 2014</b>	<ul style="list-style-type: none"> <li>▶ Tier 3 Screening</li> <li>▶ Draft PEL Report Update</li> <li>▶ Conceptual Design Update</li> </ul>	<ul style="list-style-type: none"> <li>▶ Final Newsletter</li> <li>▶ Schedule</li> </ul>
<b>August 20, 2014</b>	<ul style="list-style-type: none"> <li>▶ Draft PEL Report Review</li> <li>▶ Final Newsletter</li> </ul>	<ul style="list-style-type: none"> <li>▶ Schedule</li> </ul>
<b>September 17, 2014</b>	<ul style="list-style-type: none"> <li>▶ Final PEL Report</li> </ul>	

## 6.2 Public Participation

The study team designed and conducted various public outreach activities based on the decisions that needed to be made and the stakeholders who were to be engaged. **Appendix G** includes a table of all outreach meetings that occurred through the study and the related summaries documenting each meeting. The following describes outreach activities.

### Mailing List Development and Mass Mailing

The study team developed a contact database to include individuals who wanted to stay informed about the study. The database incorporated contact lists from an available phone call database, lists provided by CDOT and local agencies, emails received during the telephone town hall, and website contact information submissions. The database allowed the study team to communicate directly with the public, including sending notifications and calling residents for the June 2013 and March 2014 public meetings. Likewise, the study team canvassed local businesses, offices, and housing complexes in and around the study area. This allowed team members to discuss the project with business owners and property managers personally. A press release was also developed and provided to the CDOT Regional Communications Manager for further outreach.

## Public Meetings

Public meetings were held in June 2013 and in March 2014. The first public meeting was a telephone town hall meeting. The second meeting was an open house and was held at the Cherry Creek High School West Cafeteria.

### Telephone Town Hall Meeting

CDOT reached out to more than 11,000 people in the vicinity of the study area. As a result, the telephone town hall meeting had over 1,000 active listeners during the meeting. In this meeting, the PMT representatives discussed the project overview and answered questions from public constituents. The total duration of the telephone town hall meeting was 40 minutes.

Participants were asked a set of polling questions when they joined the meeting. **Table 6.2** includes the questions and responses.

**Table 6.2 Telephone Town Hall Meeting Polling Questions and Responses**

Polling Question	Public Response
How would you like to access information/be contacted about the project in the future?	<ul style="list-style-type: none"> <li>▶ By email 38%</li> <li>▶ By website 20%</li> <li>▶ By phone 24%</li> <li>▶ I do not want to be contacted 18%</li> </ul>
How did you find out about this telephone town hall meeting?	<ul style="list-style-type: none"> <li>▶ CDOT contacted us by telephone 83%</li> <li>▶ Project flyer or email from property manager 7%</li> <li>▶ Website 0%</li> <li>▶ Other 10%</li> </ul>
How many days a week do you travel I-225 southbound between Parker Road and I-25?	<ul style="list-style-type: none"> <li>▶ 1 – 2 times 37%</li> <li>▶ 3 – 5 times 25%</li> <li>▶ More than 5 times 24%</li> <li>▶ I avoid I-225 due to congestion 14%</li> </ul>
What is your primary purpose for driving I-225 southbound from Parker Road to I-25?	<ul style="list-style-type: none"> <li>▶ Commuting to/from work 21%</li> <li>▶ Business related trips 6%</li> <li>▶ Shopping trips 13%</li> <li>▶ Personal trips 60%</li> </ul>
What is your primary concern on I-225 southbound from Parker Road to I-25?	<ul style="list-style-type: none"> <li>▶ Traffic congestion 43%</li> <li>▶ Crashes and safety 22%</li> <li>▶ Lane changes/weaving 14%</li> <li>▶ Last minute merges 20%</li> </ul>
Solving the congestion problem on I-225 southbound from Parker Road to I-25, is a:	<ul style="list-style-type: none"> <li>▶ High priority 52%</li> <li>▶ Moderate priority 38%</li> <li>▶ Low priority 10%</li> </ul>
How valuable has this town hall meeting been to you?	<ul style="list-style-type: none"> <li>▶ Very valuable 52%</li> <li>▶ Somewhat valuable 48%</li> </ul>

### **Public Open House at Cherry Creek High School**

The public open house was held Wednesday, March 19, 2014, at the Cherry Creek High School West Cafeteria. Approximately 60 members of the public attended in addition to a number of elected officials. The public meeting was an open house format with four stations providing general information (purpose of the meeting, purpose and need, etc.). The following items were displayed: Tier 1 and Tier 2 screening process and results, the remaining alternative concepts to be evaluated in Tier 3, and the next steps for the project. A handout was provided soliciting comments on the project and the concepts.

### **Public Open House Comments**

Twenty comments were received at the public meeting, via email after the public open house meeting, and through the project website. A table documenting all of the comments received to-date, prior to and after the public meeting, and responses has been posted to the project website under public involvement with a discussion in the following section. In general, Concept 19 received more positive comments than any other concept. While Concept 17 is very similar to Concept 19, six comments asked that the DTC off ramp not be removed. The majority of the comments were specific to a concept.

Throughout the study, the public had ongoing, accessible, and distinct opportunities to participate and provide input to the study. Over the course of the study, the public submitted approximately 10 comments through the website before the public open house that were reviewed, responded to, and considered.

**Tables 6.3** and **6.4** summarize comments received before, during, and after the public open house at Cherry Creek High School on March 19, 2014. **Appendix G** includes responses to these comments.

**Table 6.3 Email and Website Comments prior to the Public Open House**

Subject	Comments
<b>Third travel lane</b>	<ul style="list-style-type: none"> <li>▶ Three lanes over DTC bridge</li> <li>▶ Widen I-225 to three lanes to I-25 interchange</li> </ul>
<b>Multimodal transportation</b>	<ul style="list-style-type: none"> <li>▶ Please improve bicycle and pedestrian access on DTC/Tamarac and Quebec/Ulster</li> <li>▶ Add a light rail stop at Yosemite/I-225 with RTD services</li> </ul>
<b>Traffic volumes</b>	<ul style="list-style-type: none"> <li>▶ Percentages of vehicular traffic that exits I-225 at Yosemite, at Tamarac, and then splits at I-25</li> <li>▶ Will this project consider and have a positive impact on northbound traffic on I-225 at Parker Road</li> <li>▶ Any plans for reducing congestion in both directions on I-225</li> <li>▶ Provide peak AM traffic count numbers at the critical locations</li> <li>▶ If I-225 southbound congestion is lessened, is I-25 capable of handling the increased load</li> </ul>
<b>Project phasing</b>	<ul style="list-style-type: none"> <li>▶ Since any long-term solutions for your "I-225 Yosemite to I-25 PEL" could take 4 to 6 years to complete (study, design, fund, implement), will CDOT consider short-term interim solutions to the current traffic congestion problems</li> </ul>
<b>Closing on or off ramps</b>	<ul style="list-style-type: none"> <li>▶ Not opposed to closing DTC Parkway and finds the problem with the merge. Suggests a two-lane on ramp at Yosemite that would continue onto I-25</li> <li>▶ Suggestion – A dual option entrance at DTC/Tamarac/Yosemite that allows one lane to enter directly for northbound I-25 and provide a flyover directly for southbound I-25 – no southbound traffic enters I-225 at all</li> </ul>
<b>Driver awareness and expectation</b>	<ul style="list-style-type: none"> <li>▶ Methods to keep drivers alert during slowdowns</li> </ul>

**Table 6.4 Summarized Comments During and After the Public Open House**

Subject	Comment
<b>Planning context</b>	<ul style="list-style-type: none"> <li>▶ Evaluate entire I-225 as context for planning decision so that improvements in one area do not impact future development in another area</li> </ul>
<b>Road conditions</b>	<ul style="list-style-type: none"> <li>▶ Bridge condition at the DTC Boulevard overpass should be taken into consideration</li> <li>▶ Improve lead time for signage</li> </ul>
<b>Local road network</b>	<ul style="list-style-type: none"> <li>▶ Northbound Yosemite off ramp – cars traveling onto southbound Yosemite do not have a controlled signal. Residents southwest of the exit along Yosemite have difficulty turning onto northbound Yosemite. Many accidents have occurred and created a dangerous situation.</li> <li>▶ Proposal - Flyaway at Union, create a Tamarac entrance dedicated to northbound I-25 and southbound I-25 would be rerouted to Union flyaway</li> </ul>
<b>I-25 Impacts</b>	<ul style="list-style-type: none"> <li>▶ After the design and construction are completed, the lanes to southbound I-25 will be backed up because they cannot enter southbound I-25 at PM or AM rush hours</li> </ul>
<b>Multimodal transportation</b>	<ul style="list-style-type: none"> <li>▶ Maintain and improve bicycle routes along Dayton, Quebec, and DTC Boulevard</li> <li>▶ Install video sensor at traffic lights for bikes</li> </ul>
<b>Third travel lane</b>	<ul style="list-style-type: none"> <li>▶ Add third travel lane but direct it under DTC on ramp</li> </ul>
<b>Public communication methods</b>	<ul style="list-style-type: none"> <li>▶ Use Twitter and other methods of social media for future announcements and public meetings</li> </ul>
<b>Noise Levels</b>	<ul style="list-style-type: none"> <li>▶ Noise level and vibration levels need to be provided to local residents</li> <li>▶ No mention of noise mitigation</li> <li>▶ Any new sound walls should be aesthetically pleasing</li> </ul>
<b>Concept development</b>	<ul style="list-style-type: none"> <li>▶ Appears a large number of concepts were considered</li> <li>▶ Glad to know this problem is being studied (2 comments)</li> </ul>
<b>Concept 16</b>	<ul style="list-style-type: none"> <li>▶ Too close between DTC &amp; I-25 to solve the problem</li> <li>▶ Best choice and simple</li> <li>▶ Not best option (5 comments)</li> </ul>
<b>Concept 17</b>	<ul style="list-style-type: none"> <li>▶ Please do not remove DTC off ramp (6 comments)</li> <li>▶ Good option</li> </ul>
<b>Concept 18</b>	<ul style="list-style-type: none"> <li>▶ Unacceptable option (5 comments)</li> <li>▶ Loop ramp would slow traffic but moving the entrance further northeast would be good</li> </ul>
<b>Concept 19</b>	<ul style="list-style-type: none"> <li>▶ Most cost effective and meets need of the study (9 comments)</li> </ul>
<b>Concept 21</b>	<ul style="list-style-type: none"> <li>▶ Addresses the problems – having the northbound or southbound I-25 access go far back as possible is a preferred</li> <li>▶ Second choice</li> <li>▶ Best</li> <li>▶ Requires 4 bridges and is costly (3 comments)</li> <li>▶ Yes, if too expensive, go with Concept 19</li> </ul>
<b>Project funding for design and construction</b>	<ul style="list-style-type: none"> <li>▶ Hope funding is secured for construction</li> </ul>

## 7.0 NEXT STEPS

This PEL is intended to provide the framework for the long-term implementation of the transportation improvements. This section summarizes the next steps related to implementation of these improvements. **Figure 7.1** depicts a flowchart for completion of these next steps.

### 7.1 *Travel Demand Forecast*

The travel demand forecasts for the PEL used year 2035 traffic conditions. DRCOG is currently developing its 2040 travel demand model. Assuming it will be readily available for use; subsequent steps (1601 Process, Interstate Access Report, and future NEPA documentation) in bringing this project to fruition could include a check of the 2040 model results, in essence comparing 2040 traffic assignments with those from the I-225 2035 model.

Relative differences in traffic loadings, along with traffic patterns, should be compared along the freeway and through the interchange intersections. Upon this review, an assessment should be made as to whether differences are significant enough to warrant an updated traffic analysis in comparing the alternatives; this should be done only if the differences appear that they might suggest a different alternative is needed. Also, 2040 traffic projections may be appropriate in support of design, assuming the 2040 results are noticeably different than 2035 results.

### 7.2 *1601 Process*

The CDOT Policy Directive 1601.0 and Procedural Directive 1601.1 *Interchange Approval Process* describe a CDOT process to review requests for interchanges and major improvements to existing interchanges on the state and federal-aid highway system that could affect highway travel (CDOT, 2001; CDOT, 2005a; CDOT, 2005b). The Colorado Transportation Commission established CDOT Policy Directive 1601.0 and Procedural Directive 1601.1 to provide fair and consistent procedures regarding the review and evaluation of requests for new interchanges and major improvements to existing interchanges on the state highway system.

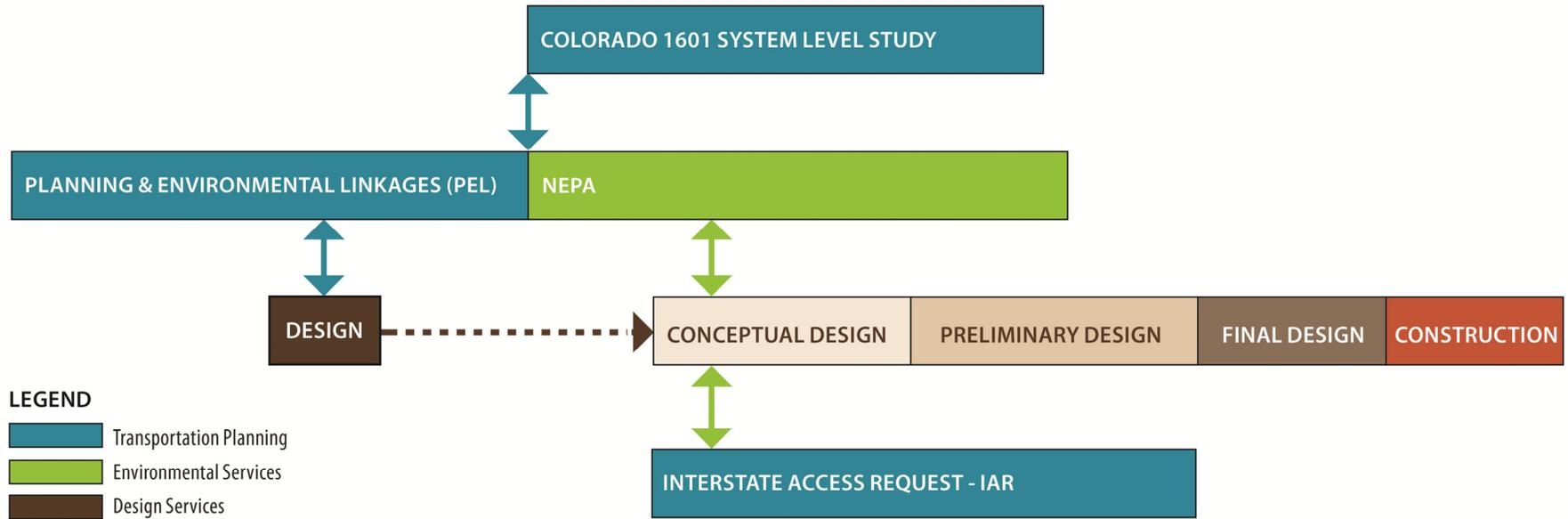
The 1601 process requires, among other things, that the interchange:

- ▶ Be consistent with an approved fiscally-constrained RTP and included in a TIP
- ▶ Be the subject of approved Intergovernmental Agreements (IGAs) that address the funding of the application development and review process, timeline and analytical expectations, and an IGA covering construction, operations, maintenance, and replacement of the interchange
- ▶ Have sufficient environmental, operational, and other studies performed consistent with FHWA interchange approval and NEPA requirements

The scope of the study and the level of detail and effort depend on the improvement type and the complexity of the interchange proposal. The 1601 interchange approval process that would be needed for the Recommended Alternative Concept (Concept 19) is known as Type 2.

Type 2 requests consist of proposals for a new interchange not on the interstate or freeway system and all modifications or reconfigurations to existing interchanges. The Chief Engineer must approve Type 2 requests and elevate these requests to the Transportation Commission for consideration.

Figure 7.1 Next Steps Flowchart



A System Level Study is required for Type 2 proposals and should provide enough information to support the FHWA Interstate Access Request (IAR) or Minor Interstate Modification Request (MIMR).

### 7.3 *Interstate Access Request*

The IAR approval is a two-step process that was developed to help the state manage risk and provide flexibility. The process is intended to identify fatal flaws and to help ensure the investment in environmental documentation is not wasted. The first step is a finding of operational and engineering acceptability. The second step is the final approval. The FHWA approval constitutes a federal action and requires that NEPA procedures are followed. Compliance with the NEPA procedures need not precede the determination of engineering acceptability. However, final approval of access cannot precede the completion of NEPA. Once NEPA has been completed, approval of access is granted as long as no changes were made to the accepted concept.

### 7.4 *General NEPA Requirements*

This PEL study provides a framework for the long-term implementation of the transportation improvements as funding becomes available and is to be used as a resource for future NEPA documentation. This PEL study has identified issues, as presented in **Tables 5.1** and **5.2**, that will require additional evaluation in any future NEPA documentation. According to the Managed Lanes Policy Directive 1603.0, during the NEPA process, managed lanes should be strongly considered for the planning and development of capacity improvements. Although providing managed lanes for the 2-mile study area may not be possible, they should not be precluded from future improvements along the 12-mile stretch of I-225. The elimination of managed lanes for the I-225 project (Yosemite Street to I-25) does not preclude the evaluation of managed lanes along the I-225 corridor from I-70 to I-25 or as a comprehensive managed lanes system in the Denver Metropolitan Area. A corridor study or comprehensive managed lanes study would be necessary to evaluate managed lanes along I-225, as well as how the various corridors will function together.

Funding for the Recommended Alternative Concept has not been identified at this time. However, the identification of a Recommended Alternative Concept for the entire project in this PEL study is consistent with FHWA's objective of analyzing and selecting transportation solutions on a broad enough scale to provide meaningful analysis and avoid segmentation. During the PEL process, phasing the Recommended Alternative Concept was explored at length to develop implementable phases that would reduce congestion and alleviate the bottleneck. However, no specific phases were identified. If partial funding was available, portions of the project could be constructed, but they may not reduce congestion on this segment of southbound I-225. Phased implementation may be detailed during NEPA and final design. Fiscal constraint requirements must be satisfied for FHWA and CDOT to approve further NEPA documentation. Before FHWA and CDOT can sign a final NEPA decision document (Record of Decision, Finding of No Significant Impact, or programmatic or non-programmatic Categorical Exclusion), the proposed project, as defined in the NEPA document, must meet the following specific fiscal-constraint criteria (FHWA, 2011):

- ▶ The proposed project or phases of the proposed project within the time horizon of the RTP must be included in the fiscally-constrained RTP, and other phase(s) of the project and associated costs beyond the RTP horizon must be referenced in the fiscally-unconstrained vision component of the RTP.
- ▶ The project or phase of the project must be in the fiscally-constrained TIP, which includes:

- At least one subsequent project phase, or the description of the next project phase (For project phases that are beyond the TIP years, the project must be in the fiscally-constrained RTP and the estimated total project cost must be described within the financial element of the RTP and/or applicable TIP).
- Federal-aid projects or project phases and state/locally funded, regionally significant projects that require a federal action.
- Full funding is reasonably available for the completion of all project phase(s) within the time period anticipated for completion of the project.

In cases where a project is implemented in more than one phase, care must be taken to ensure that the transportation system operates acceptably at the conclusion of each phase. This is referred to as “independent utility” – the ability of each phase to operate on its own. Additionally, it must be demonstrated that air quality conformity will not be jeopardized. Any mitigation measures needed in response to project impacts must be implemented with the phase in which the impacts occur, rather than deferred to a later phase.

The establishment of phases during NEPA for the Recommended Alternative Concept is required to meet the following criteria:

- ▶ **Independent Utility/Logical Termini:** Each phase should have independent utility and logical termini to the extent that the phase provides a functional transportation system even in the absence of other phases.
- ▶ **Elements of Purpose and Need:** Each phase should contribute to meeting the purpose and need for the entire project.
- ▶ **Environmental Impacts:** Individual phases should avoid the introduction of substantial additional environmental impacts that cannot be mitigated.

Once funding is secured, the environmental planning process can be initiated. The environmental process will build on the environmental work, public outreach, and agency outreach conducted by this PEL study.

To carry out any or all of the recommendations from this PEL, CDOT has committed to applying NEPA. Resources likely impacted include property to be acquired for ROW, Waters of the U.S., floodplains, etc. (**Tables 5.1** and **5.2**). The NEPA processes that would be anticipated could be either an Environmental Assessment (EA) or a Categorical Exclusion (CatEx).

CatExs are the most common NEPA documents and are for actions that do not individually or cumulatively have a significant environmental impact, are excluded from the requirement to prepare an EA or an EIS, and do not have substantial public controversy. CatExs are defined in 23 CFR 771.117 and meet the definition from the Council on Environmental Quality in 40 CFR 1508.4 and are based on the past experience with similar actions of FHWA.

An EA would be prepared and submitted through the successive review processes of CDOT Region 1, CDOT Environmental Programs Branch, and FHWA. The public would have 30 days to review and comment before FHWA makes its final decision. CDOT will consider use of a streamlined EA template for this project to accelerate the timeline for the environmental process, while still allowing for appropriate agency coordination and public involvement. If, at any point in the EA process, FHWA determines that the action would likely have a significant impact on the environment, that EA process would stop and the preparation of an EIS would be required. If FHWA agrees the action would have no significant

impacts on the environment, FHWA would prepare a Finding of No Significant Impact to serve as the decision document for the proposed action.

## 7.5 *Scoping, Preliminary, and Final Engineering Design*

After project funding has been identified and the project is included in the TIP, a planning level estimate is prepared to determine how much funding is needed for each project phase: ROW, Utilities, Environmental, Design and Construction.

A project scoping meeting can be held before or after the selection of a project delivery method to establish the project objectives; to identify the design standards, funding sources and amounts, the required resources necessary to complete the project, and the schedule; and to complete the preliminary survey request.

Once the project goals and constraints are defined, the delivery schedule, complexity, and innovation opportunities can be used to determine the appropriate project delivery method. These methods may include Design-Bid-Build (DBB), Design-Build (DB), and Construction Management/General Contractor (CM/GC). A risk assessment will be conducted given each delivery method's opportunities and obstacles. Once the delivery method is selected, the level of design, contractor selection process, and participation can be initiated.

If the project delivery method is DBB, after the design level survey is received, the preliminary design phase of the project begins. A conceptual level of engineering design (approximately 15 percent) was prepared for the Recommended Alternative Concept (**Appendix C**) for the purposes of this PEL study. A Field Inspection Review (FIR) meeting is held to review the site conditions with 30 percent plans complete. The plans are reviewed with all of the specialty units, the local governments if applicable, and representatives from the utility companies to identify the tasks needed to complete the project. The preliminary cost estimate is developed and compared to the available budget. Once the design is at the stage that the ROW limits can be identified, plans can be prepared and acquisition initiated. Final Design proceeds until the Plans, Specification and Estimate package is 95 percent complete. A Final Office Review (FOR) meeting is then conducted to complete the review process. The project funding is then obligated and authorized once all clearances are obtained and then the project is advertised for construction.

If the project delivery method is DB and if the owners have the capabilities to perform the design effort, the plans are developed to approximately the 30 percent level to be used to select a DB team of designers and contractors to complete the project. An engineering firm may be contracted to develop the 30 percent design plans. The factors used in the selection of the DB team include qualifications, duration, price, and innovation.

Finally, if the project delivery method is CM/GC, the agency contracts separately with a designer and a construction manager. The agency can perform design or contract with an engineering firm to provide a facility design. A contractor is selected to give construction management input during the design process, perform construction management services and construction work. The CM/GC contractor will negotiate with the agency for a mutually agreeable contract amount. If the CM/GC contractor and agency cannot reach a mutually agreeable negotiated contract amount or they choose not to negotiate, the project will be advertised for competitive bid.

## 7.6 *Acquisition of Property for Right-of-Way*

The limits of the existing ROW for the planned improvements will be determined from record information and field surveys. The preferred or final design alternatives will then be overlaid on the ROW base to determine impacts that will require additional ROW fee or easement acquisitions. When acquisitions are necessary, a title report is ordered and used to prepare property descriptions, exhibits, and ROW plans to support the acquisition process. Once these documents clearly define the impact, property appraisal is then ordered to determine the value of the property to be acquired. The acquisition process will commence after all of this information has been compiled. Typically, the timeframe between identification and transfer of ownership takes about 18 months to meet all of the requirements of the Uniform Relocation Act. However, it may be possible to obtain possession earlier based on project needs. In worst cases, if the property is rendered unusable or if it is a total take, relocation services may be necessary.

## 7.7 *Construction*

Construction delivery options include DBB, CM/GC, and DB. CM/GC and DB typically provide shortened delivery times. These two delivery methods usually start the procurement process during the end stages of the environmental planning processes. The three delivery methods have different allocations of risk between the owner and contractor.

In the CM/GC process, CDOT contracts directly with the engineering consultant and, therefore, has more control over the design of the project, but also requires more robust coordination among CDOT and stakeholders, the engineer, and the contractor. In the typical DB process, CDOT releases most of the risk to the contractor in designing the project but also establishes a stricter contracting process, leading to a longer procurement time. In DB, the engineering consultant is a member of the contractor's team.

## 8.0 REFERENCES

- American Society for Testing and Materials. 2005. *ASTM Designation E 1527-05, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*.
- Arapahoe County, City of Aurora, City of Centennial, and Parker Jordan Metro District. 2010. *Cherry Creek Trail at Arapahoe Road Feasibility Study*. Draft prepared by Vision Land Consultants. December.
- Arapahoe County. 2010. *2035 Transportation Plan*.
- Arapahoe County. 2009. *Parker Corridor Study*. Prepared by David Evans and Associates. July.
- Cherry Creek Water Quality Basin Authority. Website accessed May 14, 2013: [www.cherrycreekbasin.org](http://www.cherrycreekbasin.org)
- City of Aurora. 2009. *2009 Comprehensive Plan*.
- City of Aurora. 2012. *Nine Mile Station Area Plan*. December.
- City and County of Denver. 2008. *Denver Strategic Transportation Plan*. October.
- City and County of Denver. 2010. *City and County of Denver Storm Drainage Master Plan*. Prepared by Matrix Design Group.
- City and County of Denver. 2011. *Denver Moves – Making Bicycle and Multi-Use Connections*. Accessed June 2013. [http://www.denvergov.org/Portals/708/documents/FINAL\\_Denver\\_Moves.pdf](http://www.denvergov.org/Portals/708/documents/FINAL_Denver_Moves.pdf)
- City and County of Denver. 2013a. Website accessed May 17, 2013: <http://www.denvernature.net/Documents/DenverParks.html>
- City and County of Denver. 2013b. Website accessed May 20, 2013: [http://www.denvergov.org/Portals/747/documents/parks/trails/regional\\_trails\\_web.pdf](http://www.denvergov.org/Portals/747/documents/parks/trails/regional_trails_web.pdf)
- City of Greenwood Village. 2004. *Comprehensive Plan*.
- City of Greenwood Village. 2013. Website accessed May 2013: <http://www.greenwoodvillage.com/index.aspx?NID=351>
- Colorado Department of Public Health and Environment (CDPHE). 2012. *Cherry Creek Reservoir Control Regulation #72*. Effective November 30.
- Colorado Department of Public Health and Environment (CDPHE). 2013. *Regulation 38 – Classifications and Numeric Standards for South Platte River Basin*. Effective March 1.
- CDOT and RTD. 1999. *Southeast Corridor Multi-Modal Project Final Environmental Impact Statement*. December.
- CDOT. 2005. *Environmental Stewardship Guide*.
- CDOT. 2009. *Black-tailed Prairie Dog Policy*.
- CDOT. 2011a. *Standard Specifications for Road and Bridge Construction*.
- CDOT. 2011b. *Asbestos-Contaminated Soil Management Standard Operating Procedure*. August 2011.
- CDOT. 2012. *Planning and Environmental Linkages (PEL) Handbook*. December.
- CDOT. 2013. *Noise Analysis and Abatement Guidelines*, February.

- Colorado Geological Survey. 2003. *Colorado Geological Survey Groundwater Atlas of Colorado*. Colorado Geological Survey Special Publication 53. Prepared by Ralf Topper, K.L. Spray, W. H. Bellis, J.L. Hamilton, and P.E. Barkmann.
- Colorado Parks and Wildlife. 2013. Natural Diversity Information Source (NDIS). Website accessed May 2013: <http://ndis.nrel.colostate.edu/>
- Cowardin et. al. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*.
- Denver Regional Council of Governments (DRCOG). 2011. *2035 Metro Vision Regional Transportation Plan*.
- Environmental Data Resources, Inc. (EDR). 2013. *Radius Map Report with Geocheck*. Inquiry Number 3583685.1s April 22.
- Environmental Laboratory. 1987. *Corps of Engineers Wetland Delineation Manual*.
- Environmental Laboratory. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0)*.
- Federal Emergency Management Agency (FEMA) FIRM Community Panel, Map revised No. 0800460219G, Map revised November 17, 2005.
- Federal Emergency Management Agency (FEMA). 2005. *Flood Insurance Study of City and County of Denver, Colorado*. November.
- Lichvar, R.W. 2012. *The National Wetland Plant List*. ERDC/CRREL TR-12-11. Hanover, NH: U.S. Army Corps of Engineers (USACE), Cold Regions Research and Engineering Laboratory.
- RTD. 2009. *I-225 Light Rail Transit Environmental Evaluation*. Website accessed June 2013: [http://www.rtd-fastracks.com/i225\\_80](http://www.rtd-fastracks.com/i225_80)
- T-REX. 2007. Southeast Corridor Multi-modal Project As-built Drawings. Prepared by Southeast Corridor Constructors.
- Transportation Research Board. 2010. *Highway Capacity Manual*.
- Urban Drainage Flood Control District (UDFCD), City and County of Denver, the City of Greenwood Village, and Arapahoe County. 1977. Goldsmith Gulch and Tributaries Master Development Plan. Prepared by Gingery & Associates, Inc.
- Urban Drainage Flood Control District (UDFCD). 2013. Website accessed May 17, 2013: [http://www.udfcd.org/downloads/pdf/fhn/fhn90\\_1.pdf](http://www.udfcd.org/downloads/pdf/fhn/fhn90_1.pdf)
- U.S. Department of Transportation (USDOT). 1978. A Preservation of the United States Wetlands.
- U.S. Environmental Protection Agency (EPA). 1977. Executive Order No. 11990: Protection of Wetlands. 42 F.R. 26961
- U.S. Environmental Protection Agency (EPA). 2005. Standards and Practices for All Appropriate Inquiries, Final Rule. *Federal Register* 70 (November 1): 66070 – 66113.
- U.S. Fish and Wildlife Service (USFWS). 2013. Information Planning and Conservation System (IPaC) System. Website accessed May 2013: <http://ecos.fws.gov/ipac/>.
- U.S. Geological Survey (USGS). 2003. "Groundwater Quality Assessment of Shallow Aquifers in the Front Range Urban Corridor, Colorado, 1954-1998." *Water Investigations Report* 02-4247. Prepared by Jennifer L. Flynn.

# **Appendix A**

## **Environmental Analysis and Existing Conditions Assessment Report (CD Only)**

# **Appendix B**

## **FHWA Colorado Division Planning and Environmental Linkages Questionnaire**

# **Appendix C**

## **Concepts 16, 17, 18, 19 and 12 Exhibits and Tier 1, 2, and 3 Screening Tables**

# Appendix D

## Traffic Conditions Report

# **Appendix E**

## **Recommended Alternative Conceptual Typical Sections, Engineering Plans, and Renderings**

# Appendix F

## Agency Coordination

# Appendix G

## Public Involvement