Attachment B

Alternatives Evaluation Technical Report

April 2020

I-25 Central PEL

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List of Acronyms and Abbreviations

ATM	Active Traffic Management
BRT	Bus Rapid Transit
CAV	Connected and Autonomous Vehicle
CDOT	Colorado Department of Transportation
CMCA	Colorado Motor Carrier's Association
CML	Consolidated Main Line
Denver	City and County of Denver
DRCOG	Denver Regional Council of Governments
FHWA	Federal Highway Administration
HOV	High Occupancy Vehicle
I-25	Interstate 25
I-70	Interstate 70
I-76	Interstate 76
I-225	Interstate 225
ITS	Intelligent Transportation Systems
MPH	Miles Per Hour
PEL	Planning and Environmental Linkages
RTD	Regional Transportation District
SFG	Stakeholder Focus Group
TDM	Transportation Demand Management
US 6	U.S. Highway 6
US 85	U.S. Highway 85
VMS	Variable Message Signs

1. Introduction

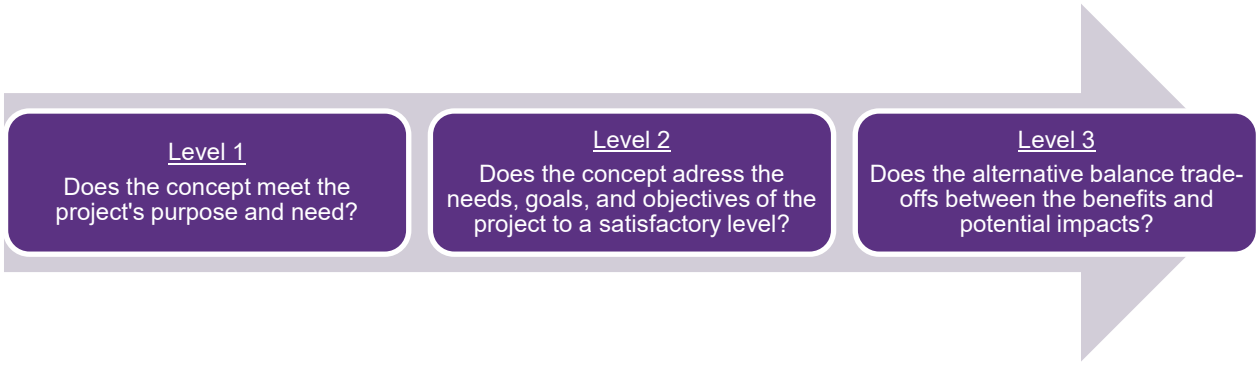
The purpose of this technical report is to document the alternatives evaluation process and outcomes for the Interstate 25 (I-25) Central Planning and Environmental Linkages (PEL) Study. The following chapters define the general development and input that informed the creation of the alternatives; a description of the methodology and summary of results for each level of evaluation; and the outcomes of the evaluation process.

Note that, for the remainder of this report, the terms “alternative” and “concept” are used deliberately. For the first two levels of evaluation, concepts were considered. This term is used because it best reflects the high-level nature of the evaluation process. Concepts are intended to be able to be mixed and matched together to form more-specific and defined alternatives. Conversely, an alternative is considered to be one such combination of concepts. In general, concepts are intended to capture larger, non-location-specific ideas that could be applied anywhere in the corridor whereas alternatives generally apply specific concepts in specific areas to create a potentially implementable solution.

2. Overview of the Evaluation Process

A three-level evaluation process was used to evaluate concepts and alternatives. The first level of evaluation consisted of a high-level review to see if the concepts met the project’s Purpose and Need. The second level of evaluation determined how well the concepts met the project’s goals and objectives. The third level of evaluation packaged individual concepts into more-defined, complete alternatives consisting of corridor-wide improvements and evaluated the trade-offs between the benefits gained from a specific alternative versus the potential impacts of the alternative. Figure 1 summarizes the three-level evaluation process.

Figure 1: Alternatives Evaluation Process



3. Level 1

Level 1 consisted of two phases. The first phase identified/developed the spectrum of concepts to be evaluated. The second phase evaluated the identified concepts to determine if they met the study’s stated Purpose and Need.

3.1. Level 1 Concept Generation

The Level 1 concepts were developed through a series of brainstorming discussions and interviews with key project stakeholders, study team members, and the Stakeholder Focus Group (SFG).

The SFG was made up of experts, advocates, and community members that were charged with providing input on the project's processes and outcomes. At the first SFG Meeting (July 12, 2018), stakeholders discussed the challenges and opportunities along I-25 through the corridor. The raw comments provided by stakeholders are included in the meeting summary from the SFG meeting, which is included in Appendix C, *Meeting Summaries*, of Attachment E, *Agency and Public Coordination Summary*, of the *I-25 Central PEL Study Report*. The bullets below provide a brief summary of the major comments, ideas, concerns, and opportunities generated by the stakeholders. This input directly influenced the development of the Level 1 concepts.

Stakeholders requested that concepts consider:

- Local mobility challenges and access to neighborhoods (pedestrians, bicyclists, cars, freight, etc.), specifically limited east/west connections across I-25 for all modes of travel
- Confusing and short ramps, bridge heights, and challenging weaving movements required to enter and exit the highway
- Environmental and social considerations, including noise, air quality, economic development, affordable housing, etc.
- Impacts to businesses, event venues, freight haulers, employees, visitors, and residents accessing Downtown Denver
- Impacts to surrounding land uses, neighborhoods, and redeveloping areas (River Mile, Water Street/Platte Street area, etc.)
- Congestion during peak periods and on weekends throughout the corridor
- Access to key destinations along Water Street/Platte Street, Auraria Campus, downtown, etc.
- Transit accessibility and transit volumes in the corridor
- Congestion, access, and egress related to special events

Following the SFG meeting, the study team then held a brainstorming workshop (July 20, 2018) with several technical experts from the Colorado Department of Transportation (CDOT), Federal Highway Administration (FHWA), Denver Regional Council of Governments (DRCOG), Colorado Motor Carriers Association (CMCA), and the City and County of Denver (Denver) to build on stakeholders' concerns and develop concepts to address the Purpose and Need, as well as the additional stakeholder issues. These concepts formed the basis of the concepts evaluated in Level 1 (listed below).

- Remove I-25 in the study area and replace with a boulevard, adjacent grade-separated facility, and/or remove the Colfax Avenue viaduct
- Locate the highway underground and construct a boulevard above (at grade level)
- Lower and cover segments of the highway (between 23rd Avenue and 20th Street)
- Consider an elevated viaduct, a tunnel, and/or lowering all (or segments) of the highway
- Consider physically separated express lanes and/or connector/distributor (CD) roads
- Consider the needs of freight traffic with dedicated freight-only ramps, freight-only lanes, and centralized freight transfer areas
- Improve the highway's geometric characteristics, including full shoulder widths and straightening segments of the highway (specifically near Colfax Avenue)
- Reconfigure interchanges and access, including 20th Street, Speer Boulevard, 23rd Avenue, 17th Avenue, 8th Avenue, Colfax Avenue/Auraria Parkway, 8th Avenue, U.S. Highway 6 (US 6)/6th Avenue, Alameda Avenue, and Santa Fe Drive/U.S. Highway 85 (US 85)

- Consider various ramp types, interchange configurations, and combining interchanges (braided ramps, split diamond interchanges, etc.)
- Provide space for emergency vehicles, first responders, and disabled vehicles
- Consider peak period shoulder lanes, fewer travel lanes, and reduced lane width
- Examine adding general-purpose lanes in each direction
- Consider the needs of connected and autonomous vehicles (CAVs)
- Support enhanced connectivity for all modes of travel across and through the corridor (specifically when reconstructing the 23rd Avenue and Speer Boulevard bridges)
- Consider Intelligent Transportation Systems (ITS) improvements, such as ramp metering, automatic traffic management systems, tolling options, etc.
- Influence travel behavior through Transportation Demand Management (TDM) interventions, such as casual carpooling, congestion pricing, incentives, etc.
- Expand transit by considering bus service expansion, light rail, commuter rail, park-n-ride, Hyperloop/Arrive type technologies, etc.
- Address special event access/egress for all modes
- Improve aesthetics and public art

3.2. Level 1 Concepts Considered

The Level 1 concepts were intentionally broad to encompass all ideas and challenges identified by stakeholders. The goal was to provide a comprehensive list of concepts for Level 1 evaluation. Specific improvements that are common to all concepts—such as bicycle, pedestrian, and local connectivity—will be defined and included in the concepts advanced to Level 2 evaluation. Considerations or specific infrastructure elements common to all concepts may include:

- ITS (various options)
- TDM (various options)
- Operations and enforcement improvements
- Local east/west connectivity
- Bicycle connectivity
- Pedestrian connectivity
- Freight considerations
- Special event traffic
- Downtown access

Table 1 summarizes and describes the concepts evaluated in Level 1.

Table 1: Level 1 Concepts Evaluated

Concept	Description	Primary Reason(s) for Consideration
No Action	This concept presents the expected future condition if no action is taken. This includes reasonably planned mobility improvements in the region within the 2040 regional planning horizon as identified in DRCOG's 2040 Fiscally Constrained Regional Transportation Plan (DRCOG, 2015). On I-25 Central, this includes interchange capacity improvements at the I-25 and Broadway interchange. This concept is not the same as the existing conditions. It should be noted that the DRCOG 2040 Fiscally Constrained Regional Transportation Plan (DRCOG, 2015) also includes the addition of one new general-purpose travel lane in each direction on I-25 between Santa Fe Drive/US 85 and US 6/6th Avenue. For the purposes of this study, this improvement was intentionally omitted from the No Action concept. This was done because one of the desired outcomes of this study was to determine if this recommended improvement is still warranted given any additional recommendations made as part of this study.	This concept provides a baseline against which all other concepts are measured.
I-25 Reroute with Urban Boulevard	This concept would include rerouting regional traffic around the urban core of Denver and replacing the existing I-25 freeway with an urban boulevard. Regional traffic would be rerouted east using Interstate 76 (I-76), Interstate 70 (I-70), and Interstate 225 (I-225). A signalized urban boulevard would be created from approximately 20th Street to Santa Fe Drive/US 85 that connects to the existing surface grid.	Removing the highway from the urban core of Denver could allow for better cross connections to be made between neighborhoods and could provide more space adjacent to the South Platte River.
Lane Reductions	This concept proposes removal of travel lanes to provide space within the existing right of way in which a more standard highway cross section could be created.	Improving the highway cross section could improve safety and provide the space needed for first responders to safely access crash sites.
Shoulder Lane Use	This concept would bring the highway shoulders up to standard, or construct new shoulders as needed, to be used as flexible travel lanes during peak periods. Current shoulder width is inconsistent along the existing freeway between 20th Street and Santa Fe Drive/US 85.	Improving and adding shoulders for use as travel lanes during the peak periods could improve congestion and provide space for first responders to safely access crash sites.

Table 1: Level 1 Concepts Evaluated

Concept	Description	Primary Reason(s) for Consideration
I-25 Geometric Refinements	This concept would provide geometric refinements by acquiring needed property (right of way) along the existing alignment. The intent of this concept is to implement a more standard cross section (if achievable) with standard lane widths, shoulders, ramp lengths, etc., while minimizing the amount of new right of way required.	There may be areas along I-25 in which only a small amount of right of way is required to provide major improvements to the highway.
I-25 Geometric Improvements	This concept would provide major alignment alterations, such as implementing a more standard cross section, improved access/egress ramp configurations, straightening curves, etc.	Bringing the geometry of the highway up to current design standards could improve safety, enhance travel time reliability, and reduce congestion.
I-25 Realignment	This concept proposes the substantial realignment of the highway away from the existing right of way constraints including the South Platte River and the BNSF Railway railroad tracks.	Removing the highway from the current constraints of the existing corridor (including the South Platte River, the freight rail lines, etc.) may allow it to be fully reconstructed in a way that meets current and future needs.
Lane Conversion	This concept proposes converting existing general-purpose lanes to managed lanes.	Converting existing lanes into managed lanes may provide I-25 users with a travel option that provides a more reliable travel time without the need to expand the highway.
Additional General-Purpose Lanes	This concept proposes adding travel lanes to the freeway that could be used by any driver or vehicle type.	Providing additional travel lanes may help meet current and future travel demand and reduce congestion.
Added Managed Lanes	This concept proposes adding travel lanes to the highway that could be used by regional (through) traffic or managed for specific users, such as high-occupancy vehicles (HOVs), tolled vehicles, etc.	Adding managed lanes may provide I-25 users with a travel option that provides a more reliable travel time.
Dedicated Transit Lanes	This concept proposes adding travel lanes to the highway that are for transit only (bus, express bus, bus rapid transit (BRT), or other new technology type, etc.).	Adding transit lanes could promote travel mode shift away from single-occupancy vehicles, thus reducing congestion on I-25 and providing a more reliable travel time option through the corridor.

Table 1: Level 1 Concepts Evaluated

Concept	Description	Primary Reason(s) for Consideration
Collector/Distributor Roads	This concept would add a system of roads adjacent to the highway, which could allow for the consolidation of access.	Consolidating access could reduce congestion and improve safety on the highway.
Multi-Level Highway	This concept would involve reconstructing the existing I-25 as a viaduct (elevated), a tunnel, or an open lowered freeway. These improvements may be consistent throughout the corridor or only proposed in specific segments.	Creating multiple levels to the highway could create space for new amenities (such as park space), more standard geometric elements (such as shoulders to provide space for first responders), and/or space for additional travel lanes, all while minimizing the need for additional right of way.
TDM, Operational, and ITS	This concept includes strategies designed to reduce travel demand and improve the use of the current transportation system. TDM programs provide user information, offer incentives, and encourage behavior change to reduce travel demand. ITS improvements may include active traffic management (ATM), variable message signs (VMS), and variable speed limits to help improve traffic flow on the existing transportation system.	TDM strategies and ITS improvements could address traffic congestion by reducing travel demand rather than increasing transportation capacity, thus reducing the need for major capital investment.
Congestion Pricing	This concept proposes a mechanism to reduce peak congestion by shifting trips to off-peak times or reducing trips during peak times by implementing variable charges during the commuter peaks. These charges may apply to specific lanes of a roadway (similar to express toll lanes); variable tolls on an entire roadway; cordon charges that require a toll to enter a congested area of the city; or per-mile charges in a specific congested area.	Charging people to travel during the most congested times of the day may reduce the travel demand for I-25, thus potentially improving safety, congestion, and travel time reliability without the need to expand the highway.
New Transit Facility	This concept involves constructing a high capacity transit facility (rail or other new technology type). The new transit facility may be located adjacent to the I-25 corridor (in new right of way) or follow another corridor in the region depending on the transit corridor's ability to serve similar origins and destinations as I-25.	Adding transit facilities could promote travel mode shift away from single-occupancy vehicles, thus reducing congestion on I-25 and providing a more reliable travel time option through the corridor.

3.3. Level 1 Evaluation Process

The purpose of the Level 1 evaluation process was to determine if concepts have the ability to meet the Purpose and Need of the project. This was done by using a series of qualitative evaluation questions based on the project's Purpose and Need statement. This statement reads:

> *The purpose of the recommended transportation improvements in the I-25 Central Corridor between approximately Santa Fe Drive/US 85 and 20th Street is to reduce congestion and improve safety and travel time reliability for the movement of people and goods. The improvements will also consider access to and from I-25, as well as connectivity across I-25 for bicycles, pedestrians, transit, and local traffic.*

Based on this statement, five key considerations were used during the Level 1 evaluation process: including (1) safety, (2) congestion, (3) travel time reliability, (4) access, and (5) connectivity across I-25. Each of these considerations were further distilled into individual evaluation criteria. These individual criteria for each consideration are described in the following sections.

3.3.1. Safety

To evaluate the safety consideration, the question, "Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals?" was asked of each concept. To answer this question, four criteria were considered.

1. Driver expectations: Driver expectation encompass the idea that safety increases when drivers are familiar and comfortable with the roadway layout. If the roadway fits with driver expectations, then drivers make fewer last-minute maneuvers and behave more predictably.
2. Conflict points: Conflict points are the locations where different users are expected to cross paths, such as at intersections or merging areas. Reducing the number of conflict points reduces the number of chances for users to interact negatively with each other, resulting in improved safety.
3. Congestion: Although this criterion is a key consideration unto itself, congestion also relates directly to safety. As congestion increases, so do the number of crashes. This is a result of that fact that, in congested conditions, vehicles are closer together and often break suddenly and unexpectedly. During congested conditions, the number of crashes typically increases, which has a negative impact on safety.
4. Geometric conditions: Geometric conditions include all physical elements of the roadway, including sight distances, the condition of shoulders, the presence of obstructions, and other geometric elements. Improving geometric conditions can improve safety by ensuring that drivers have the appropriate amount of time to observe and react to sudden changes in speeds ahead of them, that they can remove their vehicles from the active travel way in the event of a breakdown or crash, and that they have adequate clearance underneath structures to ensure they do not hit the top of their vehicles, to name just a few methods.

3.3.2. Congestion

When considering congestion, concepts were evaluated based on their ability to satisfy the following question: "Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals?" The answer to this question was based on two criteria.

1. Roadway capacity: Concepts that increased capacity on I-25 were considered to have the potential to reduce the overall congestion as compared to the existing conditions.
2. Level of demand for I-25: This criterion considered the ability of each concept to shift travel demand from I-25 to other facilities or modes of travel. Reducing the demand for I-25 would reduce the overall congestion on the highway.

3.3.3. Travel Time Reliability

Travel time reliability is based on how consistent travel times are on a given facility. Increasing the consistency of travel times is important because it allows all travelers to more accurately plan their trips. For this consideration, three criteria were considered.

1. Availability of alternate routes: Improving the availability of alternate routes was considered to have the potential to improve travel time reliability because alternate routes can reduce the impact of crashes, special events, or incidents along I-25.
2. Guarantee of a travel time: This guarantee of a travel time could be provided in multiple ways, but to satisfy this criterion, the concept must have the ability to move people from one location to another within a defined time period regardless of external conditions or future growth.
3. Response to and minimization of impacts from crashes, special events, and incidents: Because not every situation impacting travel times can be controlled, a concepts ability to respond and minimize the negative impacts from such things was considered.

3.3.4. Access

Concepts also were evaluated on their potential impacts to access to and from I-25. Access was evaluated using two criteria. The first criterion was the number of accesses to or from I-25. A concept with the ability to increase the number of accesses to the mainline was considered a positive for this criterion. Note that access to I-25 was considered both direct access to the mainline freeway, as well as access to CD roads or other ramp configurations that would facilitate access to or from the mainline.

In addition to the number of accesses to I-25, the access consideration also was evaluated by the quality of access provided. Quality of access includes multiple elements, including both engineering elements, such as a concept's ability to provide full acceleration/deceleration lanes or built-to-standard roadway geometry, as well as considerations for ease of use. Quality of access was included because simply increasing the number of access points to the highway does not necessarily improve access. If access points are overcrowded, are difficult to maneuver to or through, or create hazardous or difficult driving conditions, then they do not meet the intent of interstate access.

3.3.5. Cross Connectivity

The cross-connectivity consideration was based on a concept's ability to satisfy the following question: "Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic?" Evaluation of this consideration was based on two criteria.

1. Number of crossing opportunities: Concepts that have the potential to increase the number of crossings of the highway were considered to be positive for this criterion.
2. Quality of crossings: This was included because the pure number of crossings does not necessarily improve cross connectivity. If crossings were likely to be highly congested and/or have the potential

to have many negative interactions between vehicles, pedestrians, and bicyclists, then the quality of crossings is likely to be poor, which would not encourage use.

3.4. Level 1 Evaluation Outcomes

After evaluating each concept for every Level 1 consideration, each concept was given an overall summary of results. A concept was either carried forward to further levels of evaluation, eliminated as a standalone alternative, or eliminated.

If a concept was eliminated as a standalone alternative, this means that it was removed from consideration, but specific elements of the concept were carried forward for incorporation into other concepts or alternatives during subsequent evaluation levels. If a concept was eliminated, then no elements unique to the concept were carried forward.

Table 2 summarizes the results and recommendations for each Level 1 concept. Additional information about the considerations and evaluation of each criterion for each concept is included in Table 3.

Table 2: Summary of Level 1 Evaluation Results

Concept	Criteria Questions[1]					Summary of Results[2]
	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	
No Action	Neutral	Neutral	Neutral	Neutral	Neutral	Carried Forward
I-25 Reroute with Urban Boulevard	No	No	No	Neutral	Neutral	Eliminated
Lane Reductions	Neutral	No	Yes	Neutral	Neutral	Eliminated
Shoulder Lane Use	No	Yes	Neutral	Neutral	Neutral	Eliminated as a Standalone Alternative
I-25 Geometric Refinements	Yes	Yes	Yes	Yes	Neutral	Carried Forward
I-25 Geometric Improvements	Yes	Yes	Yes	Yes	Neutral	Carried Forward
I-25 Realignment	Yes	Yes	Yes	Neutral	Neutral	Carried Forward
Additional General-Purpose Lanes	Yes	Yes	Yes	Neutral	Neutral	Carried Forward
Lane Conversion	Neutral	Neutral	Yes	Neutral	Neutral	Carried Forward
Add Express Lanes	Neutral	Yes	Yes	Neutral	Neutral	Carried Forward
Collector/Distributor Roads	Yes	Yes	Neutral	Yes	Yes	Carried Forward
Dedicated Transit Lanes	Yes	Yes	Yes	Neutral	Neutral	Carried Forward
New Transit Facility	Yes	Yes	Yes	Neutral	Neutral	Carried Forward
Multi-Level Highway	Yes	Yes	Yes	Yes	Yes	Carried Forward
TDM, Operational, ITS	Yes	Yes	Yes	Neutral	Neutral	Carried Forward
Congestion Pricing	Yes	Yes	Yes	Neutral	Neutral	Carried Forward

1. Criteria Questions

Yes—Concept meets or has the potential to meet the criteria in question

Neutral—Concept likely would not affect the criteria in question

No—Concept likely would negatively affect the criteria in question

2. Summary of Results

Carried Forward—Concept is carried forward to Level 2 evaluation

Eliminated as a Standalone Alternative—Concept is removed from consideration, but elements are carried forward for incorporation into other concepts or alternatives during subsequent evaluation levels

Eliminated—Concept is removed from consideration, no elements unique to the concept are carried forward.

Table 3: Level 1 Evaluation Results

Concept	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	Summary of Results	Comments
	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
No Action This concept presents the expected future condition if no action is taken. This includes reasonably planned mobility improvements in the region within the 2040 regional planning horizon. On I-25 Central, these projects include adding one additional lane on I-25 between Alameda Avenue and Walnut Street and interchange capacity improvements at the I-25 and Broadway interchange. This concept is not the same as the existing condition.	Neutral	Neutral	Neutral	Neutral	Neutral	Carried Forward	

Table 3: Level 1 Evaluation Results

Concept	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	Summary of Results	Comments
	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
I-25 Reroute with Urban Boulevard This concept would include rerouting regional traffic around the urban core of Denver and replacing the existing I-25 with an urban boulevard. Regional traffic would be rerouted east using I-76, I-70, and I-225. A signalized urban boulevard would be created from approximately 20th Street to Santa Fe Drive/US 85 that connects to the existing surface grid.	No A. Rerouting I-25 and providing an at-grade urban boulevard would not change driver expectations. B. Creating an at-grade urban boulevard could create additional intersections between the boulevard and the local roadway network. This increase in intersections could increase the number of conflict points, which could reduce safety. C. An at-grade urban boulevard could have less capacity than a freeway facility. This reduction in capacity could increase congestion, thus reducing safety. D. An at-grade urban boulevard would not change the geometric conditions of the existing alignment. Discussion: Creating an at-grade urban boulevard could create additional intersections and conflict points and could increase congestion. This could have a negative impact to safety.	No A. An at-grade urban boulevard could have less capacity than a grade-separated highway facility and could, therefore, experience greater congestion. B. Providing an alternate regional route could reduce demand for I-25 Central. Discussion: An at-grade urban boulevard could have less capacity than the existing interstate facility. Although providing an alternate route for regional through traffic could reduce the overall demand for I-25 Central, it likely would not offset the reduction in capacity. The alternate route facilities also are unlikely to have the capacity to meet the additional demand. Therefore, this alternative is considered to have an overall negative effect on congestion.	No A. Integrating the at-grade urban boulevard with the existing local network could increase the number of alternate paths available, thus increasing the travel time reliability. B. Rerouting I-25 and providing an at-grade urban boulevard would not provide an option for a guaranteed travel time. C. Crashes and incidents on an at-grade urban boulevard (assumed to be a signalized facility) could have a larger impact than those on an interstate facility. Discussion: Although access to additional alternate routes could be created by integrating the at-grade urban boulevard with the existing local street network, these benefits are likely to be outweighed by the increase in frequency and impact of crashes and incidents. Therefore, the overall travel time reliability likely would be lower on an at-grade urban boulevard than on the existing interstate facility.	Neutral A. An at-grade urban boulevard could allow for more intersections with local streets. B. Increases in congestion, especially at intersections with major local cross streets, could reduce the quality of access to existing destinations. Discussion: An at-grade urban boulevard could provide opportunities for additional access points to and from the I-25 corridor; however, increases in congestion could reduce the quality of access. The potential positive and negative effects of this alternative are considered to be equal; therefore, this alternative is neutral for this consideration.	Neutral A. An at-grade urban boulevard could allow for more intersections with local streets, increasing the number of crossings, and thereby increasing cross connectivity. B. High traffic volumes at intersections could create an uncomfortable crossing environment. Discussion: Although the total number of crossing opportunities could increase with an at-grade urban boulevard, the quality of crossings could be diminished by the high traffic volumes. Therefore, this alternative is considered neutral for this consideration.	Eliminated	<u>Determination Justification:</u> An at-grade urban boulevard could result in increased congestion, reduced safety, and more travel time reliability issues along the corridor even if regional through-traffic is rerouted. Therefore, this concept is removed from consideration because it does not meet the project's Purpose and Need.

Table 3: Level 1 Evaluation Results

Concept	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	Summary of Results	Comments
	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
Lane Reductions This concept proposes removal of travel lanes to implement a more standard cross section (as achievable within the existing right of way).	Neutral A. Reducing the number of lanes on I-25 would not change driver expectations. B. Reducing the number of lanes on I-25 would not change the number of conflict points. C. Reducing the number of lanes on I-25 could reduce the capacity on the freeway and, therefore, increase congestion and reduce safety. D. Improving the geometry of the freeway, such as providing shoulders and improving curvature, could improve safety. Discussion: Although reducing the number of lanes on I-25 could allow for improvements to the highway geometrics, the benefits could be offset by an increase in congestion. These trade-offs to safety are considered to be equal; therefore, this concept is considered neutral for this consideration.	No A. Reducing the number of lanes on I-25 could reduce the capacity of the freeway, thusly increasing congestion. B. Reducing the number of lanes on I-25 would not change the level of demand for I-25. Discussion: Reducing the number of lanes on I-25 could reduce the capacity of the highway and increase congestion.	Yes A. Reducing the number of lanes on I-25 would not change the availability of alternate routes. B. Reducing the number of lanes on I-25 would not provide an option for a guaranteed travel time. C. Providing shoulders by reducing lanes could reduce the delays/impacts from crashes and incidents. Discussion: Reducing the number of lanes on I-25 could allow for improvements to the roadway, such as providing shoulders. These improvements could reduce the impact from crashes and incidents.	Neutral A. Lane reductions would not change the number of accesses to/from I-25. B. Lane reductions would not change the quality of access to/from I-25. Discussion: Lane reductions would not affect access to/from I-25.	Neutral A. Lane reductions would not change the number of crossing opportunities. B. Lane reductions would not change the quality of crossing opportunities. Discussion: Lane reductions would not affect cross connectivity opportunities.	Eliminated	<u>Determination Justification:</u> This concept does not meet the criteria for congestion and is, therefore, removed from consideration.

Table 3: Level 1 Evaluation Results

Concept	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	Summary of Results	Comments
	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
Shoulder Lane Use This concept would bring shoulders up to standard, or construct new shoulders as needed, to be used as flexible travel lanes during peak periods. Current shoulder width is inconsistent along the existing freeway between 20th Street and Santa Fe Drive/US 85.	No A. Using shoulders as travel lanes during peak periods could create driver confusion because the lane use would be variable. B. Using the shoulders as travel lanes would not change the number of conflict points. C. Using the shoulders as travel lanes during peak periods could reduce congestion and, therefore, improve safety. D. To use shoulders as travel lanes, existing geometric conditions would need to be improved, such as providing full shoulders throughout the corridor. These improvements could improve safety. Discussion: Improving the geometry of the roadway and providing shoulders likely would have a positive effect on safety. However, using the shoulders as travel lanes also could increase driver confusion and lead to additional crashes. Furthermore, when the shoulders are being used as travel lanes, there would be no shoulders. Although there are potential benefits to safety, the trade-offs are considered greater. Therefore, this alternative is considered to have an overall negative impact to safety.	Yes A. Allowing use of the shoulders could increase the capacity of the highway and, therefore, reduce congestion. B. Using the shoulders as travel lanes would not affect the level of demand on I-25 Discussion: Allowing use of the shoulders as travel lanes could increase the capacity of the freeway and, therefore, reduce congestion.	Neutral A. Using the shoulders as travel lanes would not change the availability of alternate routes. B. Using the shoulders as travel lanes would not provide a guaranteed travel time. C. Providing shoulders could reduce the impact of crashes and other incidents. However, a crash or incident occurring when the shoulders are being used as travel lanes would require the closure of the shoulders to travel, which would negatively impact travel times. Discussion: Although providing shoulders could reduce the travel time impacts from crashes and incidents, their use as travel lanes during some periods of the day could result in an increased impact from crashes/incidents if the shoulders are required to be closed. The possibility for positive and negative consequences is considered equal; therefore, this alternative is considered neutral for the travel time reliability consideration.	Neutral A. Allowing travelers to use the shoulder would not change the number of accesses to/from I-25. B. Using the shoulders as travel lanes during peak periods would not change the quality of access to/from I-25. Discussion: Using the shoulders as travel lanes during the peak periods would not affect access to/from I-25.	Neutral A. Using the shoulders as travel lanes during peak periods would not change the number of crossing opportunities. B. Using the shoulders as travel lanes during the peak periods would not change the quality of crossing opportunities. Discussion: Using the shoulders as travel lanes during peak periods would not affect cross connectivity opportunities.	Eliminated as a Standalone Alternative	<u>Determination Justification:</u> Although this concept could provide benefits to some of the needs of the corridor, it does not meet the criteria for safety and, therefore, is not carried forward as a standalone concept. However, the concept of using the shoulders as travel lanes during the peak periods could be considered in the future if the negative impacts to safety can be addressed.

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I-25 Geometric Refinements This concept would provide geometric refinements along the existing alignment. The intent of this concept is to implement a more standard cross section (if achievable) with standard lane widths, shoulders, ramp lengths, etc., to the greatest extent possible within the existing right of way, or with minimal additional right of way.	Yes A. Geometric refinements (straightening curves, providing standard lane widths, etc.) would not change driver expectations. B. Geometric refinements would not change the number of conflict points. C. Refining the geometry of the roadway could improve traffic flow, thus reducing congestion and improving safety. D. Refining the geometry of the roadway could improve sightlines, provide recovery space, etc. This would improve safety. Discussion: Providing geometric refinements could improve congestion and improve geometric conditions without affecting driver expectations or the number of conflict points. Therefore, this alternative could improve overall safety.	Yes A. Refining the geometry of the roadway could improve overall traffic flow, thereby increasing the capacity of the roadway. B. Geometric refinements would not change the level of demand for I-25. Discussion: Providing geometric refinements could improve the overall traffic flow of the highway, thus increasing its capacity and decreasing congestion.	Yes A. Geometric refinements would not change the number of alternate routes available. B. Geometric refinements would not provide an option for a guaranteed travel time. C. Adding standard shoulders as a geometric refinement could reduce the impact of crashes and incidents, thus improving travel time reliability. Discussion: Providing geometric refinements could reduce the impacts of crashes and incidents, thereby improving travel time reliability.	Yes A. Geometric refinements would not affect the number of accesses. B. Geometric refinements could allow for improvements to accesses (full acceleration/deceleration lanes, smaller ramp departure angles, etc.), thus improving the quality of access to/from I-25. Discussion: Providing geometric refinements could allow for improvements to access locations, thus increasing the quality of access to/from I-25.	Neutral A. Geometric refinements would not change the number of crossing opportunities. B. Geometric refinements would not change the quality of crossings. Discussion: Providing geometric refinements would not affect cross connectivity.	Carried Forward	

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I-25 Geometric Improvements This concept would provide major alignment alterations, such as implementing a more standard cross section, improved access/egress ramp configurations, straightening curves, etc. Additional right of way would be acquired where necessary to achieve a standard cross section.	Yes A. Geometric improvements would not change driver expectations. B. Geometric improvements would not change the number of conflict points. C. Improving the geometry of the roadway (straightening curves, providing standard lane widths, etc.) could improve traffic flow thus reducing congestion and improving safety. D. Improving the geometry of the roadway could improve sightlines, provide recovery space, etc. This could improve safety. Discussion: Providing geometric improvements could improve congestion and standardize geometric conditions without affecting driver expectations or the number of conflict points. Therefore, this alternative could improve overall safety.	Yes A. Improving the geometry of the roadway could improve overall traffic flow, thereby increasing the capacity of the roadway and decreasing congestion. B. Geometric improvements would not change the level of demand for I-25. Discussion: Providing geometric improvements could improve the overall traffic flow of the highway, thus increasing its capacity and decreasing congestion.	Yes A. Geometric improvements would not change the number of alternate routes available. B. Geometric improvements would not provide an option for a guaranteed travel time. C. Adding standard shoulders as a geometric improvement could reduce the impact of crashes and incidents, thus improving travel time reliability. Discussion: Providing geometric improvements could reduce the impacts of crashes and incidents, thereby improving travel time reliability.	Yes A. Geometric improvements would not affect the number of accesses. B. Geometric improvements could allow for improvements to accesses (full acceleration/deceleration lanes, smaller ramp departure angles, etc.), thus improving the quality of access to/from I-25. Discussion: Providing geometric improvements could allow for improvements to access locations, thus increasing the quality of access to/from I-25.	Neutral A. Geometric improvements would not change the number of crossing opportunities B. Geometric improvements would not change the quality of crossings. Discussion: Providing geometric improvements would not affect cross connectivity.	Carried Forward	

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	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
I-25 Realignment The concept proposes the substantial realignment of the highway (new right of way) using the Consolidated Main Line (CML) or another corridor that may serve I-25 traffic.	Yes A. Realigning I-25 would not change driver expectations. B. Realigning I-25 would not change the number of conflict points. C. Realigning I-25 could provide the opportunity to improve the geometry of the roadway, which could improve traffic flow, thus reducing congestion and improving safety. D. Realigning I-25 could provide the opportunity to improve the geometry of the roadway (straightening curves, providing standard lane widths, etc.) which could improve sightlines, provide recovery space, etc. This would improve safety. Discussion: Realigning I-25 could improve geometric conditions, which could improve safety.	Yes A. Realigning I-25 could provide the opportunity to improve the geometry of the roadway, which could improve overall traffic flow, thereby increasing the capacity of the roadway and decreasing congestion. B. Realigning I-25 would not change the level of demand for I-25. Discussion: Realigning I-25 could improve the geometry of the roadway, which could improve the overall traffic flow of the highway, thus increasing its capacity and decreasing congestion.	Yes A. Realigning I-25 would not change the number of alternate routes available. B. Realigning I-25 would not necessarily provide an option for a guaranteed travel time. C. Realigning I-25 could provide the opportunity to improve the geometry of the roadway, which could reduce the impact of crashes and incidents, thus improving travel time reliability. Discussion: Realigning I-25 could allow for geometric improvements to be made that could reduce the impacts of crashes and incidents, thereby improving travel time reliability.	Neutral A. The exact number of access locations to/from I-25 for this alternative is not known at this level of detail. However, this alternative would not dramatically alter the number of access locations to/from I-25. It is assumed that access would be provided to/from the same cross streets where access exists today. For this criterion, the number of access points is considered to be unchanged from existing conditions. B. Realigning I-25 could allow interchanges to be built to current standards. This could improve the quality of access as compared to the sub-standard geometry of the existing accesses. However, moving interstate access locations, even if still along the same cross street, could reduce the convenience of access to destinations currently adjacent to the highway (for example, Empower Field at Mile High Stadium). This could have an overall negative effect on the quality of access. Discussion: Moving I-25 from its current alignment could change the overall quality of access to the interstate. This has the potential to be both positive (by creating the opportunity to improve the geometrics of the access locations) and negative (by changing the convenience of access to adjacent destinations). Because these potential impacts are considered equal, this alternative is neutral for this consideration.	Neutral A. Moving I-25 to a different alignment could allow for additional crossing opportunities throughout the existing I-25 corridor. At the same time, it could reduce the cross connectivity within the new corridor. For example, if the highway is moved to a corridor that has a dense local street network, it is unlikely that every street within the local network would have a connection over the new I-25. Although the total number of crossing of I-25 may remain unchanged from existing conditions, there is a chance that the overall cross connectivity within the new corridor could be reduced. B. Moving I-25 to a different alignment would not change the quality of crossings provided. Discussion: Moving I-25 from its existing alignment could increase cross connectivity opportunities along the current I-25 corridor, but also could reduce them within the new corridor. These trade-offs are considered equal and, therefore, this alternative is considered neutral for this consideration.	Carried Forward	

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Lane Conversion This concept proposes converting existing general-purpose lanes to express lanes.	Neutral A. Converting existing general-purpose lanes to express lanes would not change driver expectations. B. Converting existing general-purpose lanes to express lanes could create additional conflict points (merging and weaving areas) near express lane ingress and egress locations. C. Converting existing general-purpose lanes to express lanes could increase the capacity of the highway, thus reducing congestion and improving safety. D. Converting existing general-purpose lanes to express lanes would not affect the geometric conditions of the highway. Discussion: Converting existing general-purpose lanes to express lanes could create additional conflict points near express lane ingress and egress locations; however, it also could improve overall safety by reducing congestion. The possibility for positive and negative consequences is considered equal and, therefore, this alternative is considered neutral for the safety consideration.	Neutral A. Converting existing general-purpose lanes to express lanes would not change the capacity of the highway. B. Converting existing general-purpose lanes to express lanes would not change the level of demand for I-25. Discussion: Converting existing general-purpose lanes to express lanes would not change the capacity of or the demand for I-25; therefore, this alternative is considered neutral for this consideration.	Yes A. Converting existing general-purpose lanes to express lanes would not change the availability of alternate routes. B. Converting existing general-purpose lanes could provide the option of a guaranteed travel time (for example, if the express lanes are managed through tolls or vehicle restrictions). C. The configuration of the express lanes (buffer separated versus barrier separated) could affect the level of impact from crashes and incidents. For example, if the lanes are barrier separated, crashes may have a larger impact on the express lane operations because vehicles may not be able to reroute. This kind of detail is not available at this time; therefore, it is assumed that this consideration is neutral at this time. Discussion: Express lanes would create the opportunity to provide a guaranteed travel time; therefore, this alternative is considered to improve travel time reliability.	Neutral A. Converting existing general-purpose lanes to express lanes could create the opportunity to provide direct connections between local roadways and the express lanes, which could increase the number of accesses to I-25. At this level of detail, it is not known if direct connections would be provided. Therefore, this criterion is neutral at this time. B. Converting existing general-purpose lanes to express lanes could create the opportunity to provide direct connections between local roadways and the express lanes, which could provide an improved quality of access for express lane users by reducing their need to merge and weave on I-25. At this level of detail, it is not known if direct connections would be provided. Therefore, this consideration is neutral at this time. Discussion: Converting existing general-purpose lanes to express lanes could create opportunities to affect access; however, at this level of detail, these opportunities are uncertain. Therefore, this alternative is considered neutral for this consideration.	Neutral A. Converting existing general-purpose lanes to express lanes would not change the number of crossing opportunities. B. Converting existing general-purpose lanes to express lanes would not change the quality of crossing opportunities. Discussion: Converting existing general-purpose lanes to express lanes would not affect cross connectivity opportunities.	Carried Forward	

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Additional General-Purpose Lanes This concept proposes adding travel lanes to the freeway that could be used by any driver or vehicle type.	Yes A. Adding general-purpose lanes would not change driver expectations. B. Adding general-purpose lanes would not change the number of conflict points. C. Adding general-purpose lanes could reduce congestion, thereby improving safety. D. Adding general-purpose lanes would not change the existing geometric conditions. Discussion: Adding additional general-purpose lanes could reduce congestion, which could improve safety.	Yes A. Adding general-purpose lanes could increase capacity on I-25, thereby reducing congestion. B. Adding general-purpose lanes would not change the level of demand on I-25. Discussion: Adding additional general-purpose lanes could increase the capacity of I-25 and, therefore, reduce congestion.	Yes A. Adding general-purpose lanes would not change the number of alternate routes available. B. Adding general-purpose lanes would not provide an option for a guaranteed travel time. C. Adding general-purpose lanes could provide additional space to navigate around a crash/ incident, thereby improving travel time reliability. Discussion: Adding general-purpose lanes could provide additional space for drivers to maneuver around a crash or incident, which could improve travel time reliability.	Neutral A. Adding general-purpose lanes would not change the number of accesses to/from I-25. B. Adding general-purpose lanes would not change the quality of access to/from I-25. Discussion: Adding general-purpose lanes would not affect access to/from I-25.	Neutral A. Adding general-purpose lanes would not change the number of crossing opportunities. B. Adding general-purpose lanes would not impact the quality of crossing opportunities. Discussion: Adding general-purpose lanes would change the cross connectivity of I-25.	Carried Forward	

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Add Express Lanes This concept proposes adding travel lanes to the highway that could be used by regional (through) traffic or managed for specific users, such as HOVs, tolled vehicles, etc.	Neutral A. Express lanes would not change driver expectations. B. Express lanes could create additional conflict points (merging and weaving areas) near express lane ingress and egress locations. C. Express lanes could increase the capacity of the highway, thus reducing congestion and improving safety. D. Express lanes would not affect the geometric conditions of the highway. Discussion: Express lanes could create additional conflict points near express lane ingress and egress locations; however, they also could improve overall safety by reducing congestion. The possibility for positive and negative consequences is considered equal and, therefore, this alternative is considered neutral for the safety consideration.	Yes A. Express lanes could add capacity to the highway and thereby reduce congestion. B. Express lanes would not change the level of demand for I-25. Discussion: Express lanes could increase the capacity of the highway and, therefore, have the potential to reduce congestion.	Yes A. Express lanes would not change the availability of alternate routes. B. Adding express lanes could provide the option of a guaranteed travel time (for example, if the express lanes are managed through tolls or vehicle restrictions). C. The configuration of the express lanes (buffer separated versus barrier separated) could affect the level of impact from crashes and incidents. For example, if the lanes are barrier separated, crashes may have a larger impact on the express lane operations because vehicles may not be able to reroute. This kind of detail is not available at this time; therefore, it is assumed that this criterion is neutral at this time. Discussion: Express lanes could create the opportunity to provide a guaranteed travel time; therefore, this alternative is considered to improve travel time reliability.	Neutral A. Constructing express lanes could create the opportunity to provide direct connections between local roadways and the express lanes, which could increase the number of accesses to I-25. At this level of detail, it is not known if direct connections would be provided. Therefore, this criterion is neutral at this time. B. Constructing express lanes could create the opportunity to provide direct connections between local roadways and the express lanes, which could improve the quality of access for express lane users by reducing their need to merge and weave on I-25. At this level of detail, it is not known if direct connections would be provided. Therefore, this criterion is neutral at this time. Discussion: Express lanes could create opportunities to affect access; however, at this level of detail these opportunities are uncertain. Therefore, this alternative is considered neutral for this consideration.	Neutral A. Adding express lanes would not change the number of crossing opportunities. B. Adding express lanes would not change the quality of crossing opportunities. Discussion: Adding express lanes would not affect cross connectivity opportunities.	Carried Forward	

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Dedicated Transit Lanes This concept proposes adding travel lanes to the highway that are for transit only (bus, express bus, BRT, or other new technology type, etc.).	Yes A. Adding dedicated transit lanes would not change driver expectations. B. Adding dedicated transit lanes would not change the number of conflict points. C. Adding dedicated transit lanes could encourage people to take transit instead of driving, which could reduce congestion on I-25, thus reducing the number of crashes. D. Adding dedicated transit lanes would not change the geometric conditions on the highway. Discussion: Adding dedicated transit lanes could reduce congestion on I-25 and thereby improve safety.	Yes A. Adding dedicated transit lanes would not change the capacity of the highway. B. Adding dedicated transit lanes could reduce the level of demand for I-25 by shifting more people to transit instead of driving. Discussion: Adding dedicated transit lanes could reduce the demand for I-25 and, therefore, reduce congestion.	Yes A. Adding dedicated transit lanes would not change the availability of alternate routes. B. Adding dedicated transit lanes could provide the option for a guaranteed travel time. D. Adding dedicated transit lanes would not change the impacts from crashes/events/incidents. Discussion: Adding dedicated transit lanes could provide the option of a guaranteed travel time and improve travel time reliability.	Neutral A. Adding dedicated transit lanes would not change the number of accesses to/from I-25. B. Adding dedicated transit lanes would not change the quality of access to/from I-25. Discussion: Adding dedicated transit lanes would not affect access to/from I-25.	Neutral A. Adding dedicated transit lanes could create the opportunity to provide additional crossing of I-25, such as near on-highway transit stations. At this level of detail, it is not known if on-highway transit stations would be provided or if additional crossing would be available. Therefore, this criterion is neutral at this time. B. Adding dedicated transit lanes would not change the quality of crossing opportunities. Discussion: Adding dedicated transit lanes would not affect cross connectivity opportunities.	Carried Forward	

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Collector/Distributor Roads This concept would add a system of roads adjacent to the highway that could allow for the consolidation of access.	Yes A. Adding CD roads would not change driver expectations. B. Adding CD roads could reduce the number of conflict points along the mainline freeway. However, it also could increase the number of intersections where local roadways meet the CD roads, thereby adding conflict points. C. CD roads could allow for the consolidation of access points to the mainline freeway, thereby reducing turbulence on the freeway, reducing congestion, and improving safety. D. Adding CD roads could allow for geometric improvements to access, such as reducing the curves on ramps and providing full acceleration lanes. Discussion: Although additional conflict points could be created through new intersections along the CD roads, this could be offset by the benefits gained through a reduction in sub-standard merging and weaving areas, which currently exist along the corridor. Therefore, this alternative is considered to have the potential to provide an overall improvement to safety.	Yes A. Adding CD roads could reduce the turbulence on the mainline and, therefore, improve traffic flow. However, combining the volume from multiple ramps onto CD roads could cause congestion at CD road intersections and I-25 ramp terminals. B. CD roads would not change the level of demand for I-25. Discussion: Because the CD roads would be new facilities, they likely would be designed to accommodate the required traffic volumes to ensure they operate in an acceptable fashion. Therefore, CD roads likely would provide an overall benefit to congestion on the corridor.	Neutral A. CD roads could reduce the number of access points to and from the mainline freeway, which could reduce a driver's opportunities to reroute in response to delays. B. CD roads would not provide for a guaranteed travel time. C. CD roads could allow for better control of traffic into and out of event venues, which could reduce the impact of events on I-25 travel times. Discussion: CD roads could both improve and reduce travel time reliability. These opportunities are considered balanced; therefore, this alternative is considered neutral for this consideration.	Yes A. CD roads could reduce the number of access locations to the I-25 mainline by consolidating multiple access points together. However, CD roads also could provide connections to remaining access locations, which could maintain the same level of access to existing destinations. B. CD roads could allow for a consolidation of access, which could allow the remaining access points to be improved, such as through longer acceleration/deceleration lanes. This could improve the overall quality of access. Discussion: CD roads could reduce the total number of access points to the I-25 mainline; however, they also could provide connections between existing destinations and the remaining access locations. Additionally, the remaining access locations could be of better quality because there could be opportunities to improve the geometrics of the ramps. Therefore, this alternative is considered to have an overall benefit to this consideration.	Yes A. CD roads would not change the number of crossing opportunities. B. CD roads could include sidewalks and/or bicycle lanes, which could provide more direct connections to crossings of I-25 compared to what exists today. Discussion: CD roads could provide better connections to crossings of I-25, thereby improving the quality of crossing opportunities.	Carried Forward	

Table 3: Level 1 Evaluation Results

Concept	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	Summary of Results	Comments
	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
Multi-Level Highway This concept would include reconstruction of the existing I-25 as a viaduct (elevated), tunnel, or an open lowered freeway. These improvements may be consistent throughout the corridor or only proposed in specific segments.	Yes A. A multi-level highway would not change driver expectations. B. A multi-level highway would not change the number of conflict points. C. Constructing a multi-level highway could provide the opportunity to improve the geometry of the roadway (straightening curves, providing standard lane widths, etc.), which could improve traffic flow, thus reducing congestion and improving safety. D. Constructing a multi-level highway could provide the opportunity to improve the geometry of the roadway (straightening curves, providing standard lane widths, etc.), which could improve sightlines, provide recovery space, etc. This could improve safety. Discussion: Constructing I-25 as a multi-level highway could improve geometric conditions, which could improve safety.	Yes A. Constructing I-25 as a multi-level highway could provide the opportunity to improve the geometry of the roadway, which could improve overall traffic flow, thereby increasing the capacity of the roadway and decreasing congestion. B. Constructing I-25 as a multi-level highway would not change the level of demand for I-25. Discussion: Constructing I-25 as a multi-level highway could improve the geometry of the roadway, which could improve the overall traffic flow of the highway, thus increasing its capacity and decreasing congestion.	Yes A. Constructing I-25 as a multi-level highway would not change the number of alternate routes available. B. Constructing I-25 as a multi-level highway would not provide an option for a guaranteed travel time. C. Constructing I-25 as a multi-level highway could provide the opportunity to improve the geometry of the roadway, such as adding standard shoulders. These improvements could reduce the impact of crashes and incidents, thus improving travel time reliability. Discussion: Constructing I-25 as a multi-level highway could allow for geometric improvements to be made that could reduce the impacts of crashes and incidents, thereby improving travel time reliability.	Yes A. Constructing I-25 as a multi-level highway would not affect the number of accesses. B. Constructing I-25 as a multi-level highway could allow for improvements to accesses (full acceleration/ deceleration lanes, smaller ramp departure angles, etc.), thus improving the quality of access to/from I-25. Discussion: Constructing I-25 as a multi-level highway could allow for improvements to access locations, thus increasing the quality of access to/from I-25.	Yes A. A multi-level highway configuration could allow for new cross connections to be made above or below the highway. B. Constructing I-25 as a multi-level highway could improve the quality of crossings by creating visual and auditory barriers between the crossings and the freeways (for example, by providing a cover over the highway). Discussion: Constructing I-25 as a multi-level highway could allow for both a greater number of crossings and an overall more comfortable crossing experience. Therefore, this alternative could improve the cross connectivity of I-25.	Carried Forward	

Table 3: Level 1 Evaluation Results

Concept	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	Summary of Results	Comments
	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
TDM, Operational, and ITS This concept includes strategies designed to reduce travel demand and improve the use of the current transportation system, while reducing the need for major capital investments. TDM strategies would address traffic congestion by reducing travel demand rather than increasing transportation capacity. TDM programs provide user information, offer incentives, and encourage behavior change to reduce travel demand. ITS improvements may include ATM, VMS, and variable speed limits to help improve traffic flow on the existing transportation system.	Yes A. ITS devices could align driver expectations with real-time conditions. B. TDM strategies and ITS devices would not change the number of conflict points. C. TDM strategies could reduce congestion, thus improving safety conditions. D. TDM strategies and ITS devices would not change the geometric conditions of the highway. Discussion: ITS devices could help alert drivers to real-time travel conditions and TDM strategies could reduce congestion. Both could provide a benefit to safety.	Yes A. TDM strategies and ITS devices would not change the capacity of the highway. B. TDM strategies could reduce the number of vehicles on the road, which could reduce congestion. Discussion: TDM strategies could reduce the demand for I-25 and thus improve congestion.	Yes A. TDM strategies and ITS devices would not change the availability of alternate routes. B. TDM strategies and ITS devices could provide a guaranteed travel time. C. ITS devices can reduce the impact of incidents and events along the corridor by alerting drivers, which could reduce the chances of follow-on crashes and incidents and/or allow drivers to reroute. Discussion: By altering drivers to crashes, incidents, and/or events, ITS devices could reduce the impact of these actions on I-25 travel times.	Neutral A. TDM strategies and ITS devices would not change the number of accesses to/from I-25. B. TDM strategies and ITS devices would not change the quality of access to/from I-25. Discussion: TDM strategies and ITS devices would not affect access to/from I-25.	Neutral A. TDM strategies and ITS devices would not change the number of crossing opportunities. B. TDM strategies and ITS devices would not change the quality of crossing opportunities. Discussion: TDM strategies and ITS devices would not affect cross connectivity opportunities.	Carried Forward	

Table 3: Level 1 Evaluation Results

Concept	Safety	Congestion	Travel Time Reliability	Access	Cross Connectivity	Summary of Results	Comments
	Does the concept improve safety on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) driver expectations, (B) conflict points, (C) congestion, (D) geometric conditions*	Does the concept reduce congestion on the I-25 mainline, on the I-25 on- or off-ramps, and/or at the I-25 ramp terminals? *Criteria: (A) capacity, (B) level of demand*	Does the concept improve travel time reliability on the I-25 mainline? *Criteria: (A) availability of alternate routes, (B) guarantee of travel time, (C) impacts from crashes/special events/incidents*	Does the concept improve access to and/or from I-25? **Note: This criterion does not consider access to express lanes.* *Considerations: (A) number of accesses to I-25 (including I-25 CD roads), (B) quality of access*	Does the concept improve connectivity across I-25 for bicyclists, pedestrians, transit, and/or local traffic? *Considerations: (A) number of crossing opportunities, (B) quality of crossing experience*		
Congestion Pricing These charges may apply to specific lanes of a roadway (similar to express toll lanes); variable tolls on an entire roadway; cordon charges that require a toll to enter a congested area of the city; or per-mile charges in a specific congested area.	Yes A. Congestion pricing would not change driver expectations. B. Congestion pricing would not change the number of conflict points. C. Congestion pricing could reduce the demand for I-25, thus reducing congestion and improving safety. D. Congestion pricing would not change the geometric conditions of the highway. Discussion: Congestion pricing could reduce the demand for I-25, thus reducing congestion and improving safety.	Yes A. Congestion pricing would not change the capacity of I-25. B. Congestion pricing could reduce the demand for I-25, thus reducing congestion. Discussion: Congestion pricing could reduce the demand for I-25, thus reducing congestion.	Yes A. Congestion pricing would not change the availability of alternate routes. B. Congestion pricing could be used to manage travel demand during peak periods, thus guaranteeing a reliable travel time. C. Congestion pricing would not change the impacts from crashes, events, and/or incidents. Discussion: Congestion pricing could provide a guaranteed travel time along I-25, thus improving travel time reliability.	Neutral A. Congestion pricing would not change the number of accesses to/from I-25. B. Congestion pricing would not change the quality of access to/from I-25. Discussion: Congestion pricing would not affect access to/from I-25.	Neutral A. Congestion pricing would not change the number of crossing opportunities. B. Congestion pricing would not change the quality of crossing opportunities. Discussion: Congestion pricing would not affect cross connectivity opportunities.	Carried Forward	
New Transit Facility This concept includes the construction of a high capacity transit facility (rail or other new technology type). The new transit facility may be located adjacent to the I-25 corridor (in new right of way) or follow another corridor in the region, depending on the transit corridor's ability to serve similar origins and destinations as I-25.	Yes A. A new transit facility would not change driver expectations. B. A new transit facility would not change the number of conflict points. C. A new transit facility could reduce the demand for I-25, thus reducing congestion and improving safety. D. A new transit facility would not change the geometric conditions of the highway. Discussion: A new transit facility could reduce congestion on I-25 and, therefore, improve safety.	Yes A. Adding a new transit facility would not change the capacity of I-25. B. Adding a new transit facility could reduce the demand for the freeway, thus reducing congestion. Discussion: A new transit facility could reduce the demand for I-25, thus improving congestion.	Yes A. Adding a new transit facility would not change the availability of alternate routes. B. Adding a new transit facility could provide the option for a guaranteed travel time. C. Adding a new transit facility would not change the impacts from crashes, events, and/or incidents. Discussion: A new transit facility could provide a guaranteed travel time, thus improving travel time reliability.	Neutral A. Adding a new transit facility would not change the number of accesses to/from I-25. B. Adding a new transit facility would not change the quality of access to/from I-25. Discussion: Adding a new transit facility would not affect access to/from I-25.	Neutral A. Adding a new transit facility could create the opportunity to provide additional crossing of I-25, such as near on-highway transit stations. At this level of detail, it is not known if on-highway transit stations would be provided or if additional crossings would be available. Therefore, this criterion is neutral at this time. B. Adding a new transit facility would not change the quality of crossing opportunities. Discussion: Adding a new transit facility would not affect cross connectivity opportunities.	Carried Forward	

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3.4.1. Eliminated Concepts

Two Level 1 concepts were eliminated following the Level 1 evaluation process. These included the I-25 Reroute with Urban Boulevard concept and the Lane Reductions concept. Additionally, the Shoulder Lane Use concept was eliminated as a standalone alternative. Since the Level 1 concepts were evaluated on whether they met the project's Purpose and Need by evaluating the considerations of safety, congestion, travel time reliability, access, and cross connectivity, discussion about why these concepts were either eliminated or eliminated as a standalone alternative with regard to these elements follows.

3.4.1.1. I-25 Reroute with Urban Boulevard

This concept would include rerouting regional traffic around the urban core of Denver and replacing the existing I-25 with an urban boulevard. Regional traffic would be rerouted east using I-76, I-70, and I-225. A signalized urban boulevard that connects to the existing surface street grid would be created from approximately 20th Street to Santa Fe Drive/US 85.

This concept was eliminated for three reasons:

Safety:

- Creating an at-grade urban boulevard could create additional intersections between the boulevard and the local roadway network. This increase in intersections could increase the number of conflict points, which could reduce safety.
- An at-grade urban boulevard would have less capacity than a freeway facility. This reduction in capacity could increase congestion, thus reducing safety.

Congestion:

- An at-grade urban boulevard would have less capacity than a grade-separated highway facility and could, therefore, experience greater congestion.
- Although a regional re-route could reduce some of the demand for I-25 Central, only about 20 percent of travelers on I-25 pass all the way through I-25 Central from approximately Downing Street to north of I-70. The remaining 80 percent of travelers enter or exit I-25 between these two locations. Therefore, a regional reroute likely would not be able to reduce the demand for I-25 to such a level that a grade-separated facility still would not be needed.

Travel Time Reliability

- Crashes and incidents on an at-grade urban boulevard (assumed to be a signalized facility) could have a larger impact than those on an interstate facility.

3.4.1.2. Lane Reductions

This concept proposes removal of travel lanes to implement a more standard cross section (as achievable within the existing right of way). It was eliminated because reducing the number of lanes on I-25 would reduce the highway's capacity and, thus, increase congestion.

3.4.1.3. Shoulder Lane Use

This concept would bring shoulders up to standard, or construct new shoulders as needed, to be used as flexible travel lanes during peak periods. Current shoulder width is inconsistent along the existing freeway between 20th Street and Santa Fe Drive/US 85.

This concept was eliminated as a standalone because of its inability to meet the safety consideration of this study's Purpose and Need. The primary safety concerns include:

- Using shoulders as travel lanes during peak periods could create driver confusion because the lane use would be variable.
- During the peak periods, when crashes are most likely to occur, there would be no shoulder to move a crash out of the travel lanes. This would increase the impact of crashes and increase the risk to first responders, who would have to work within the active travel way. Furthermore, not removing a crash from the travel way increases the chance of a secondary crash occurring.

Although eliminated as a standalone, it is possible that utilizing the shoulder as a travel lane for certain uses (e.g., bus on shoulder operation) or during certain periods (e.g. peak period shoulder usage) still could be considered as an element of another concept or alternative if it is able to address the safety concerns discussed above. Therefore, this concept was eliminated as a standalone concept, but not fully removed from consideration.

4. Level 2

4.1. Level 2 Concept Generation

Level 2 concepts were created based on the outcomes of the Level 1 evaluation. Using these concepts, a series of workshops were held to further refine these concepts for the Level 2 evaluation process. This refinement resulted in some Level 1 concepts being combined to create a single Level 2 concept, some Level 1 concepts being split into multiple Level 2 concepts, and some Level 1 concepts being carried forward as-is into Level 2. In general, combining, splitting, or carrying concepts forward as-is was done to maximize their potential to best meet the project's goals and objectives.

4.2. Level 2 Concepts Considered

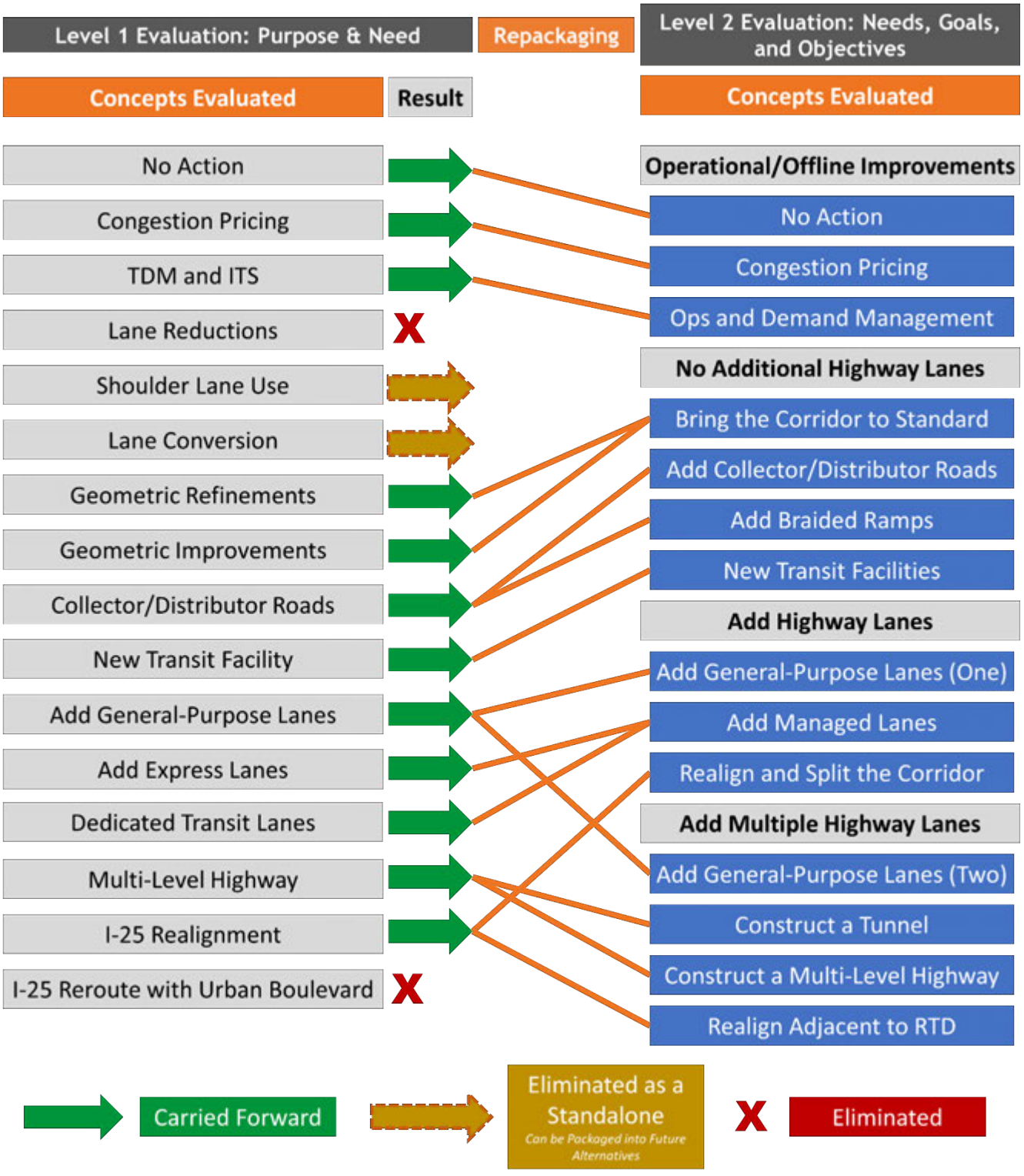
Figure 2 summarizes how Level 1 concepts were carried forward into Level 2. Additional descriptions of each Level 2 concept are provided below.

Note that the "Lane Conversion" concept carried forward from Level 1 was reconsidered at the beginning of the Level 2 process and the project team determined that it should not be independently evaluated as a concept in Level 2 since it only had the potential to improve conditions for one of the core considerations, travel time reliability. Although eliminated as a standalone, it is possible the concept of converting an existing travel lane to a managed lane or another use still could be considered as an element of another concept or alternative, so that is how it is shown in Table 2.

4.2.1. No Action

The No Action concept was carried forward as-is from the Level 1 evaluation and provided the baseline against which other concepts were compared.

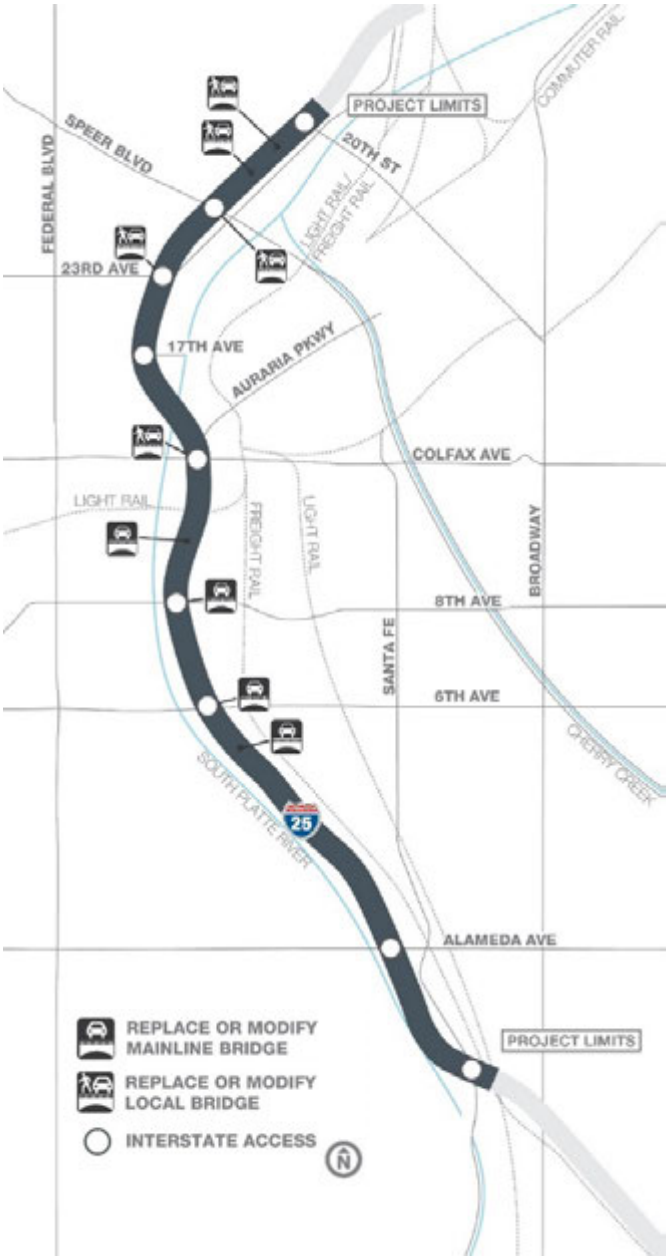
Figure 2: Level 1 to Level 2 Alternative Concept Progression



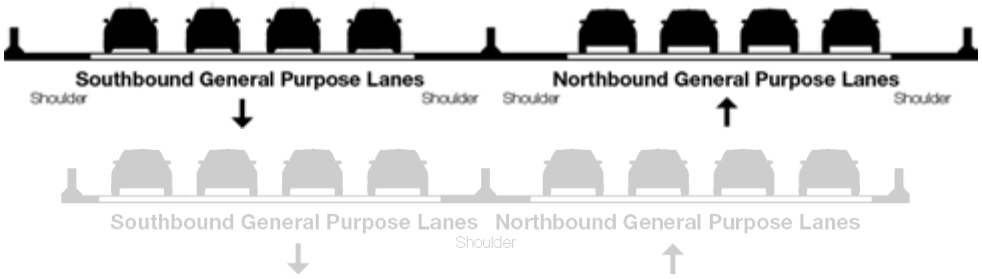
4.2.2. Bring the Corridor to Standard

The Bring the Corridor to Standard concept combined the I-25 Geometric Refinements and the I-25 Geometric Improvements concepts into one single concept for Level 2 evaluation. These two concepts were combined into one because, upon additional high-level analysis, it was recognized that there were not enough minor improvements that could be done within existing right of way which would result in meaningful benefits to the highway. The Bring the Corridor to Standard concept was created to provide all necessary geometric improvements to the highway to meet current engineering design standards. Figure 3 shows the general alignment and cross section for this concept.

Figure 3: Bring the Corridor to Standard



Proposed Cross Section

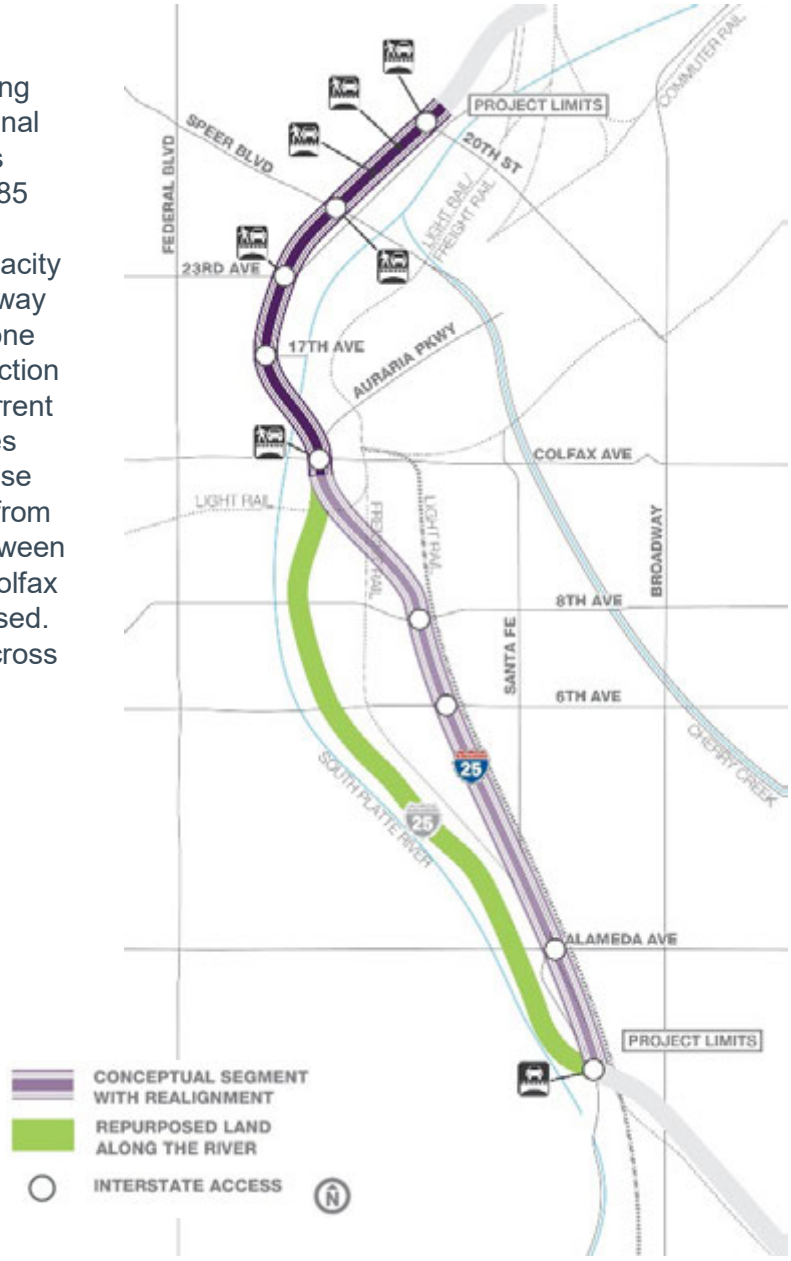


Existing Cross Section

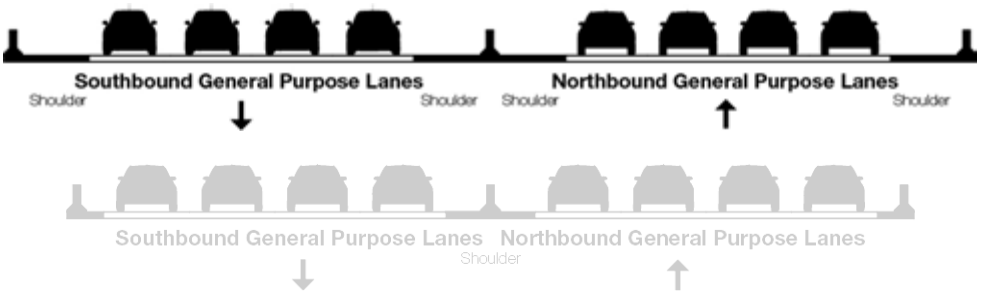
4.2.3. Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines

This concept comes from the Level 1 I-25 Realignment concept and proposes realigning the highway to be next to the existing Regional Transportation District (RTD) light rail tracks between approximately Santa Fe Drive/US 85 and Colfax Avenue. This would allow the highway to be reconstructed to improve capacity and geometry. It is assumed that if the highway were to be completely reconstructed, then one additional lane would be added in each direction and the highway would be brought up to current design standards. This concept also includes space for new RTD light rail tracks to increase transit capacity and removes the interstate from the east side of the South Platte River—between approximately Santa Fe Drive/US 85 and Colfax Avenue—allowing that space to be repurposed. Figure 4 shows the general alignment and cross section for this concept.

Figure 4: Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines



Proposed Cross Section

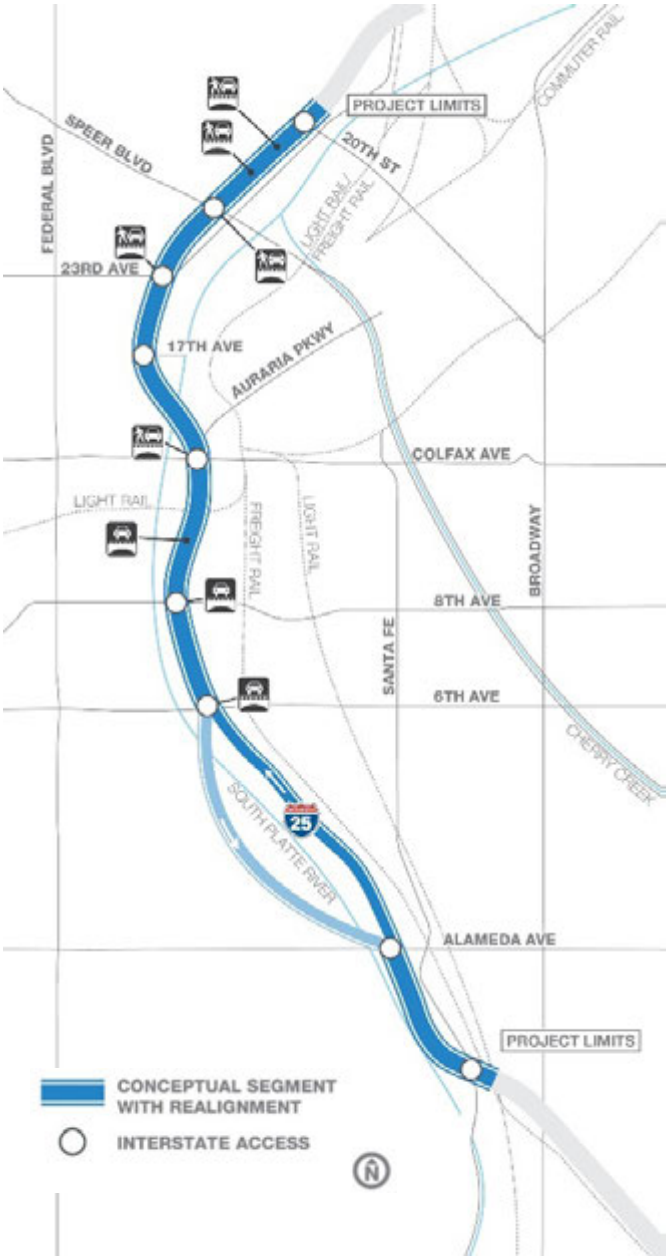


Existing Cross Section

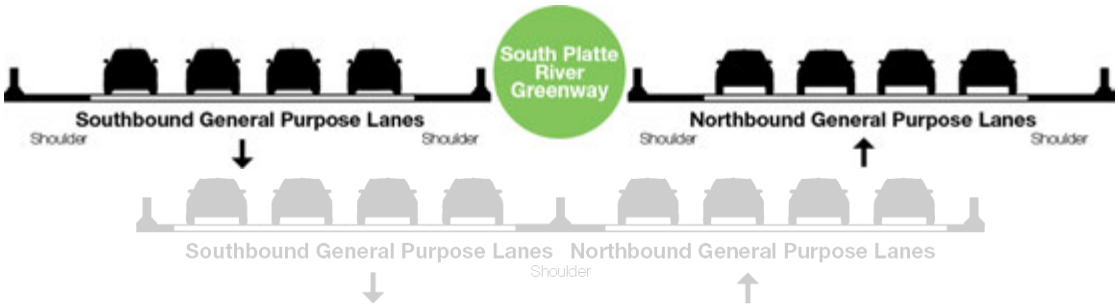
4.2.4. Realign and Split the Corridor

This concept comes from the Level 1 I-25 Realignment concept and proposes moving the southbound lanes of I-25 to the west side of the South Platte River between Alameda Avenue and US 6/6th Avenue. The existing I-25 alignment would only serve northbound traffic, and its footprint could be narrowed to provide more space to the South Platte River greenway or additional space to the adjacent freight railroad corridor. It is assumed that if the highway were to be reconstructed, then one additional lane would be added in each direction and the entire highway would be brought up to current engineering standards. Figure 5 shows the general alignment and cross section for this concept.

Figure 5: Realign and Split the Corridor



Proposed Cross Section

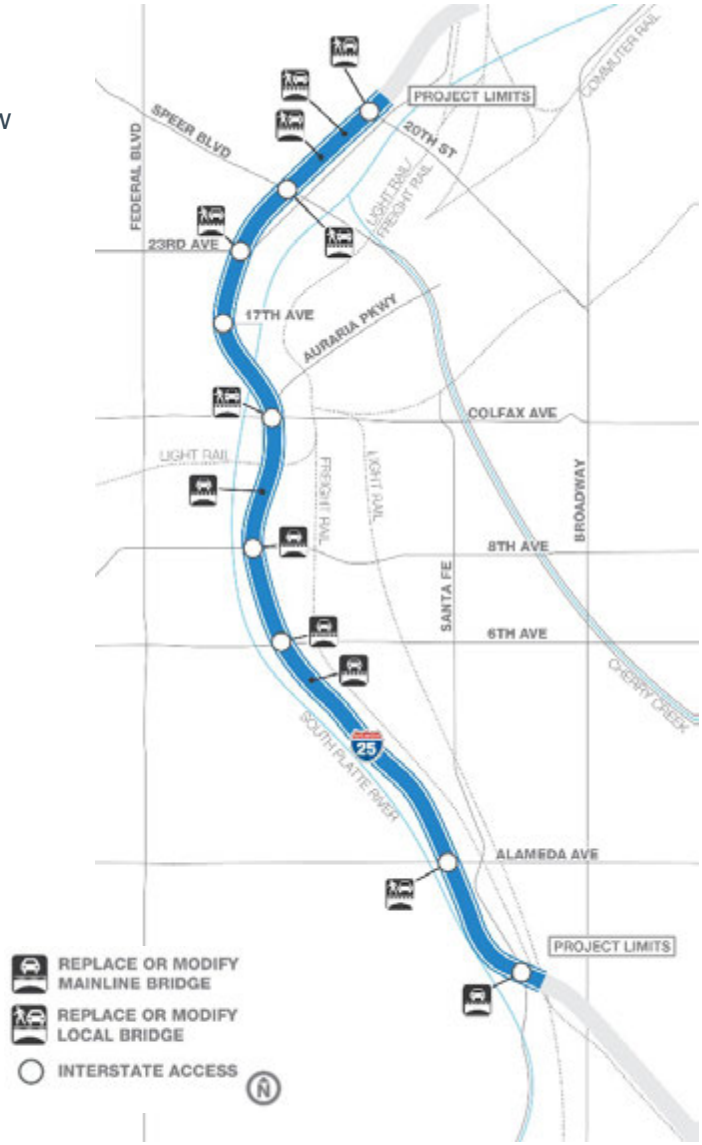


Existing Cross Section

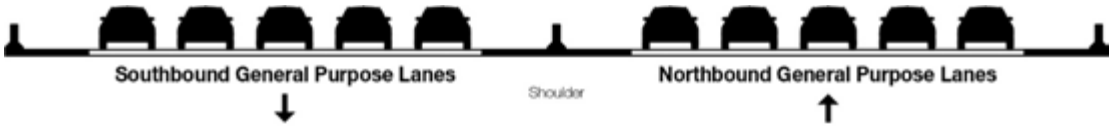
4.2.5. Add General-Purpose Lanes (One)

This concept was carried forward as-is from the Level 1 evaluation and proposes to add one new general-purpose lane to I-25 in each direction. When adding these new lanes, it is assumed that the entire highway also is brought up to current engineering standards. Figure 6 shows the general alignment and cross section for this concept.

Figure 6: Add General-Purpose Lanes (One)



Proposed Cross Section



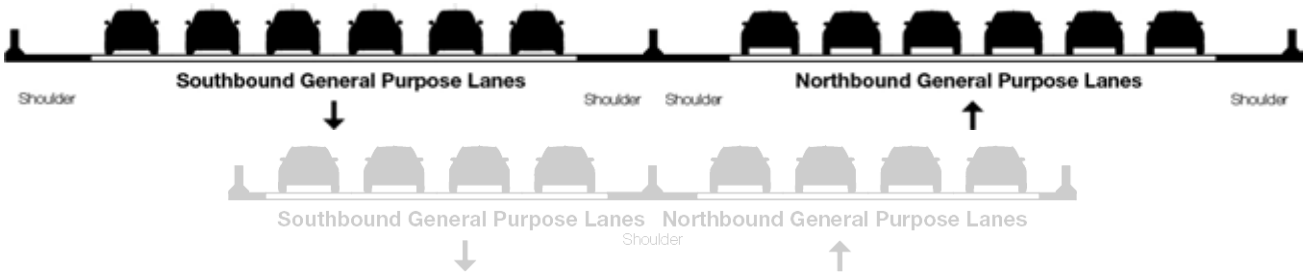
Existing Cross Section

4.2.7. Add General-Purpose Lanes (Two)

This concept was carried forward as-is from the Level 1 evaluation and proposes to add two new general-purpose lanes to I-25 in each direction. When adding these new lanes, it is assumed that the entire highway also is brought up to current engineering standards. Figure 7 shows the general alignment and cross section for this concept.

Figure 7: Add General-Purpose Lanes (Two)

Proposed Cross Section

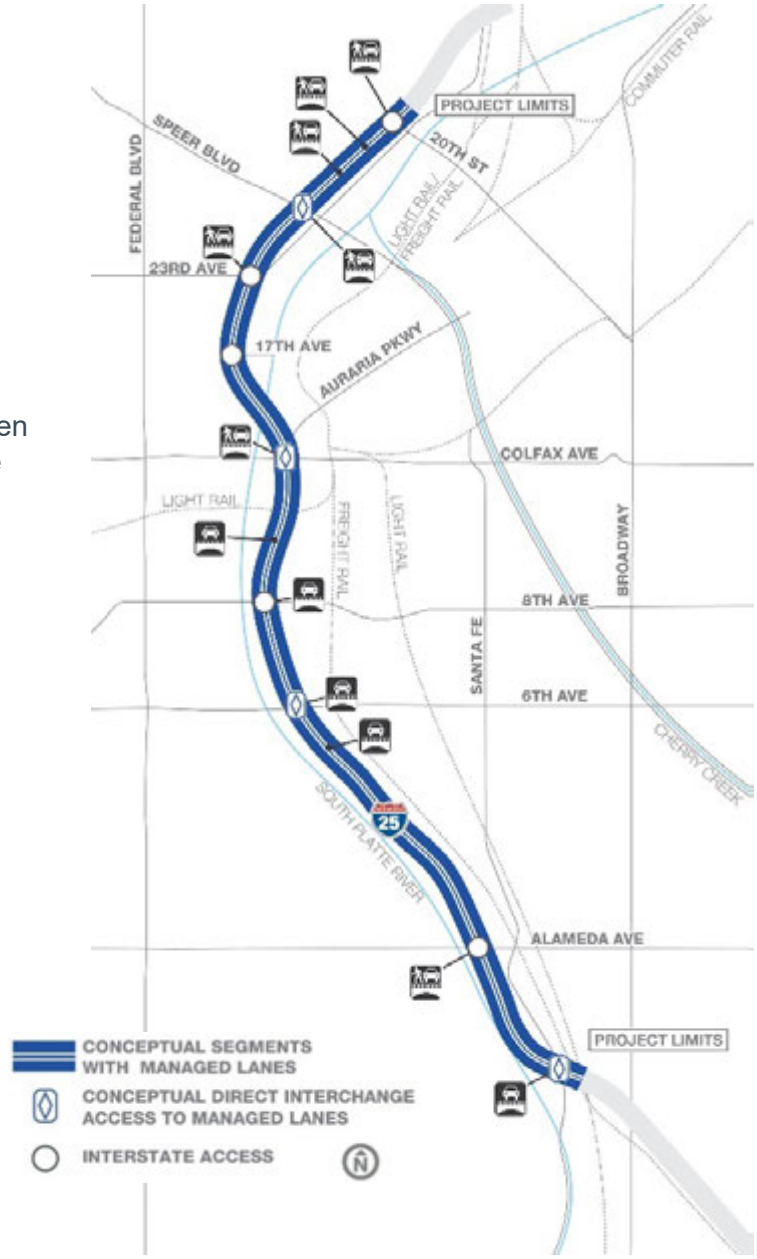


Existing Cross Section

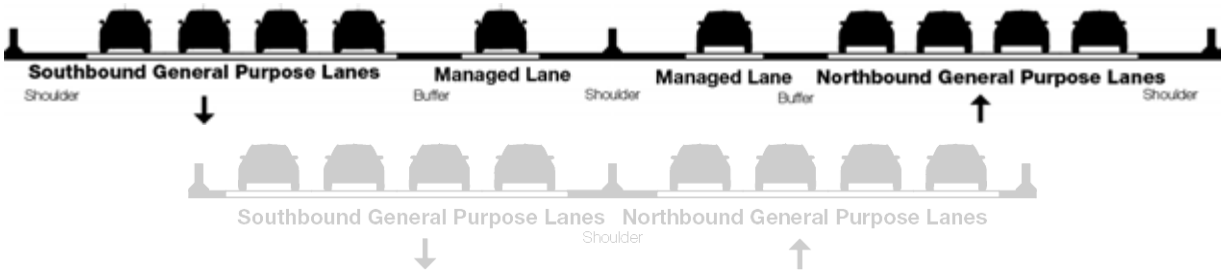
4.2.8. Add Managed Lanes

This concept is a combination of the Add Express Lanes and Dedicated Transit Lanes concepts evaluated in Level 1. It proposes adding one or more managed lanes to I-25 in each direction, extending from Santa Fe Drive/US 85 to 20th Street. These lanes could be managed in many ways, including as tolled lanes, lanes restricted to HOVs, bypass only lanes (lanes that can be used by any vehicle, but have limited ingress/egress locations), etc. Additionally, it is assumed that the managed lanes could accommodate transit (buses). When adding these new lanes, it is assumed that the entire highway also is brought up to current engineering standards. Figure 8 shows the general alignment and cross section for this concept.

Figure 8: Add Managed Lanes



Proposed Cross Section

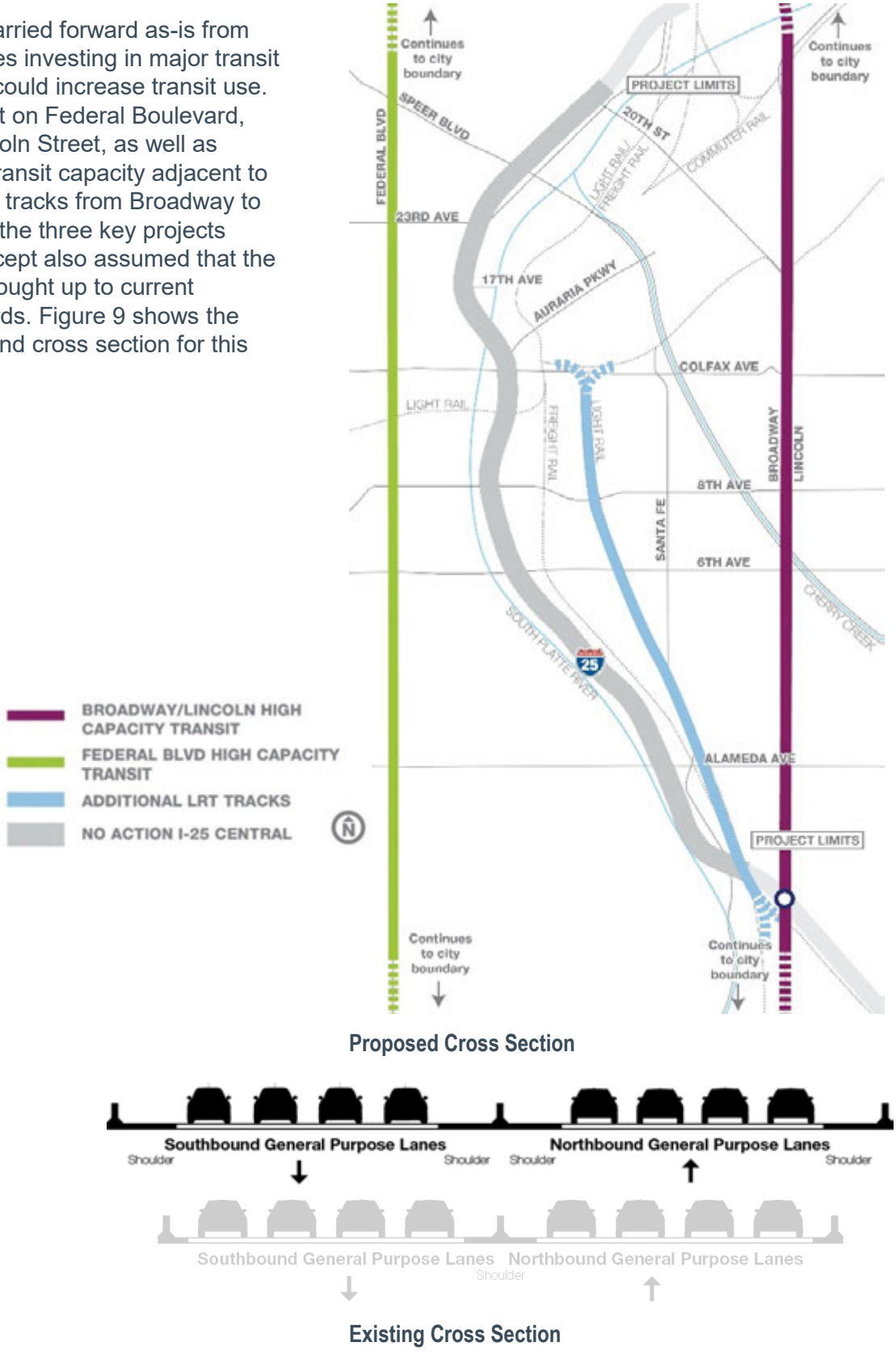


Existing Cross Section

4.2.9. New Transit Facilities

This concept was carried forward as-is from Level 1 and proposes investing in major transit improvements that could increase transit use. High-capacity transit on Federal Boulevard, Broadway, and Lincoln Street, as well as additional light rail transit capacity adjacent to the existing light rail tracks from Broadway to Colfax Avenue, are the three key projects proposed. This concept also assumed that the entire highway is brought up to current engineering standards. Figure 9 shows the general alignment and cross section for this concept.

Figure 9: New Transit Facilities



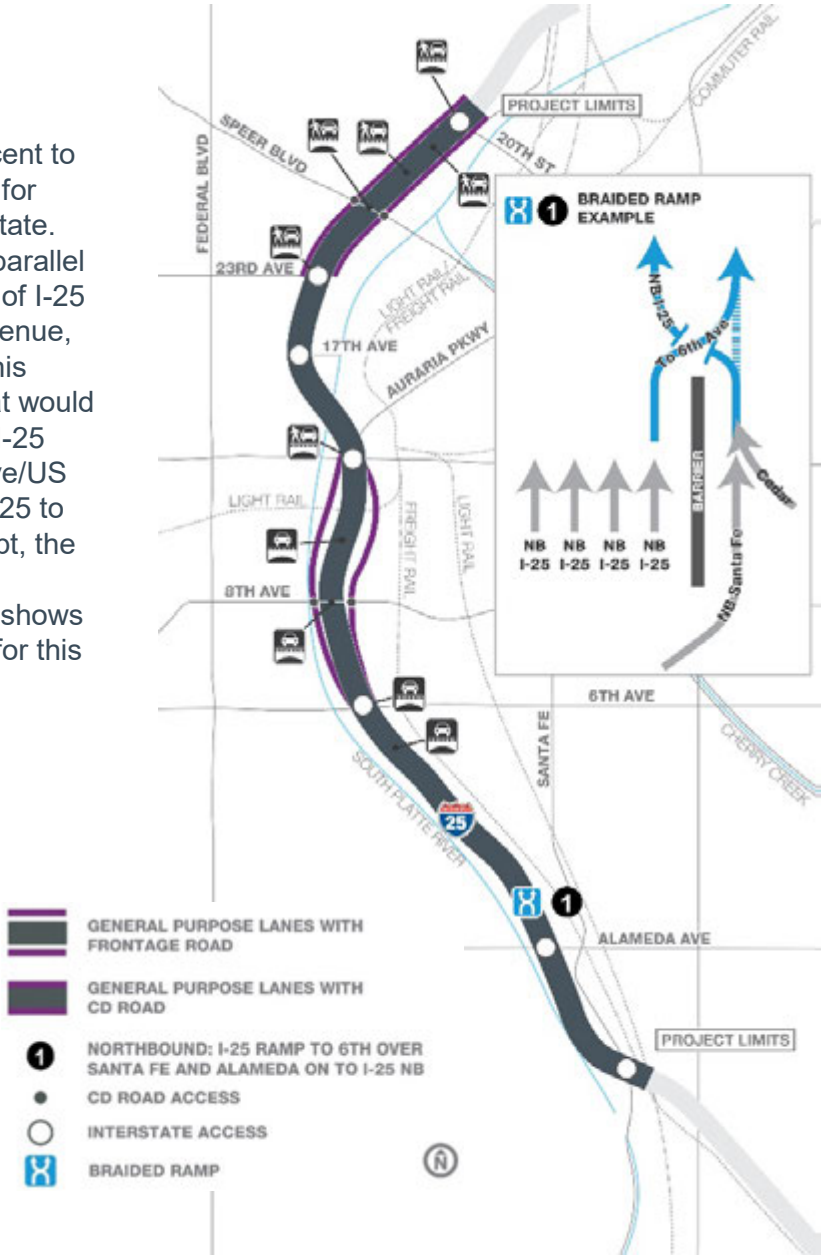
Proposed Cross Section

Existing Cross Section

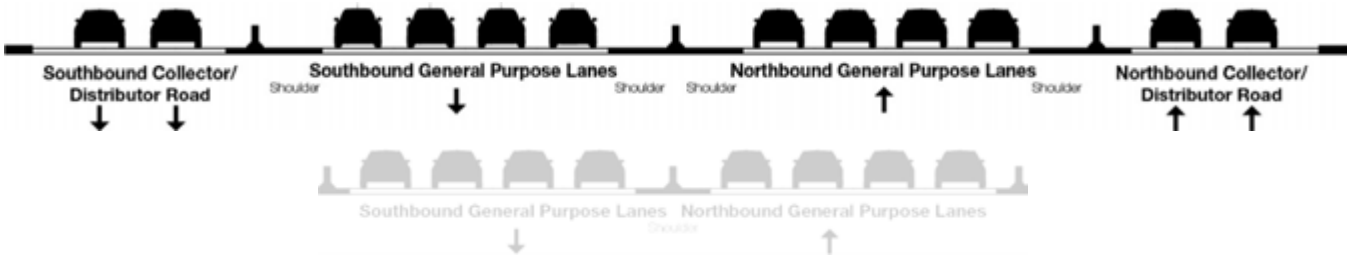
4.2.10. Add Collector/Distributor Roads

This concept stems from the Collector/ Distributor Roads concept in Level 1 and proposes adding a system of roads adjacent to the I-25 Central corridor that would allow for management of access to/from the interstate. The CD and/or frontage roads would be parallel to the northbound and southbound lanes of I-25 between US 6/6th Avenue and Colfax Avenue, as well as 23rd Avenue to 20th Street. This concept also includes a braided ramp that would separate traffic coming onto northbound I-25 from Alameda Avenue and Santa Fe Drive/US 85 from traffic moving from northbound I-25 to US 6/6th Avenue. Also, under this concept, the entire highway is brought up to current engineering design standards. Figure 10 shows the general alignment and cross section for this concept.

Figure 10: Add Collector/Distributor Roads



Proposed Cross Section

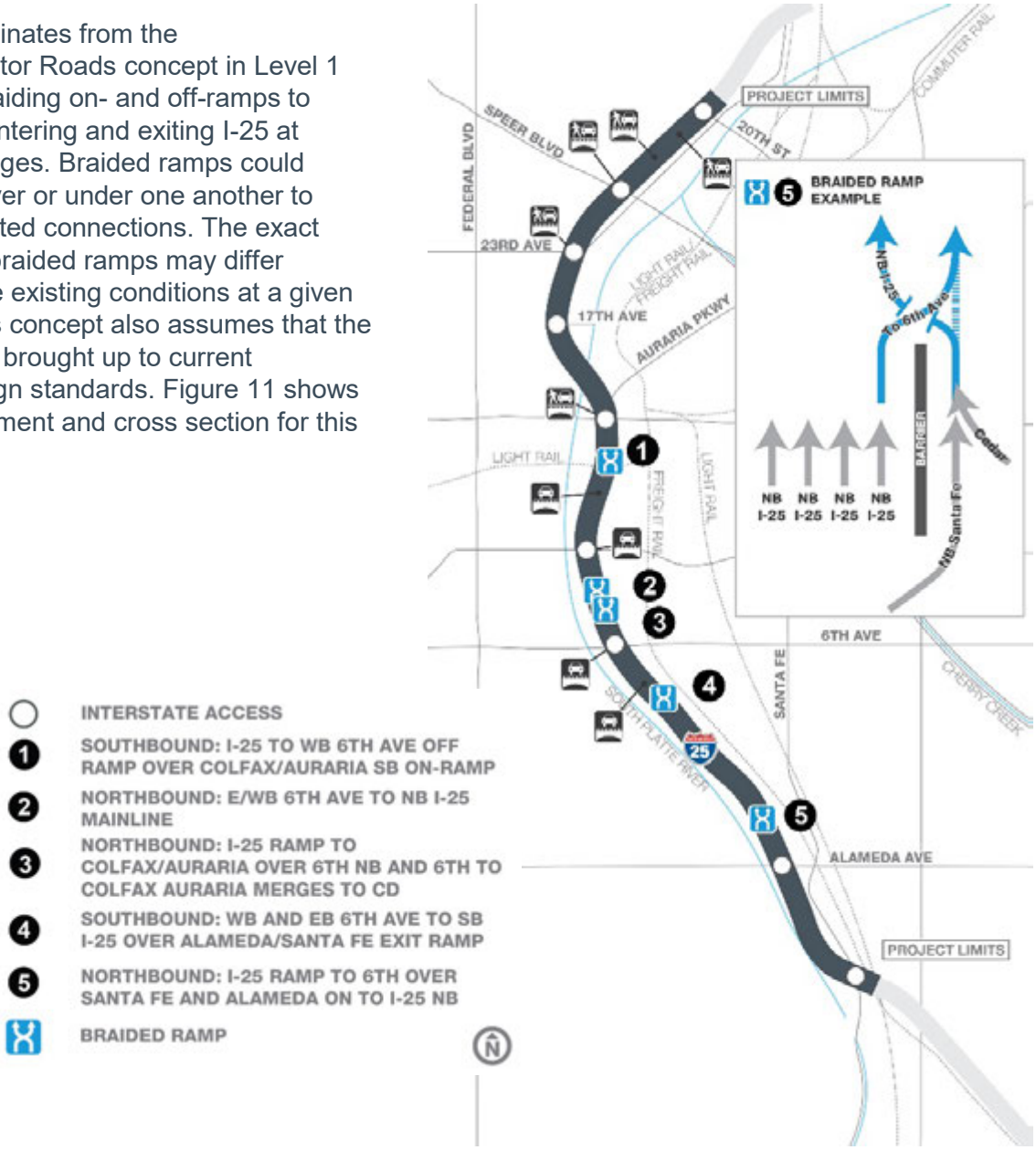


Existing Cross Section

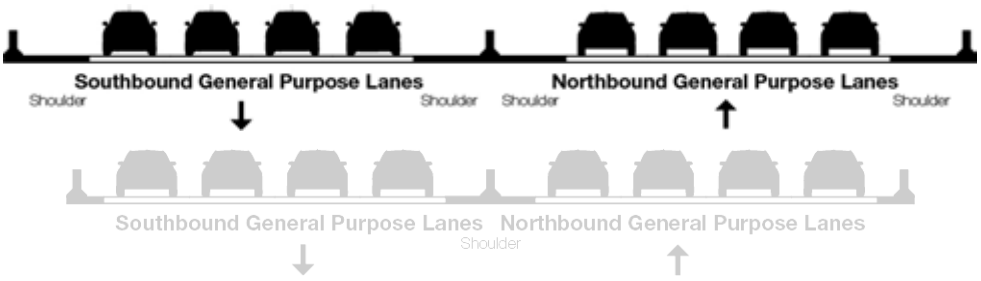
4.2.11. Add Braided Ramps

This concept originates from the Collector/Distributor Roads concept in Level 1 and proposes braiding on- and off-ramps to separate traffic entering and exiting I-25 at various interchanges. Braided ramps could provide ramps over or under one another to create uninterrupted connections. The exact configuration of braided ramps may differ depending on the existing conditions at a given interchange. This concept also assumes that the entire highway is brought up to current engineering design standards. Figure 11 shows the general alignment and cross section for this concept.

Figure 11: Add Braided Ramps



Proposed Cross Section

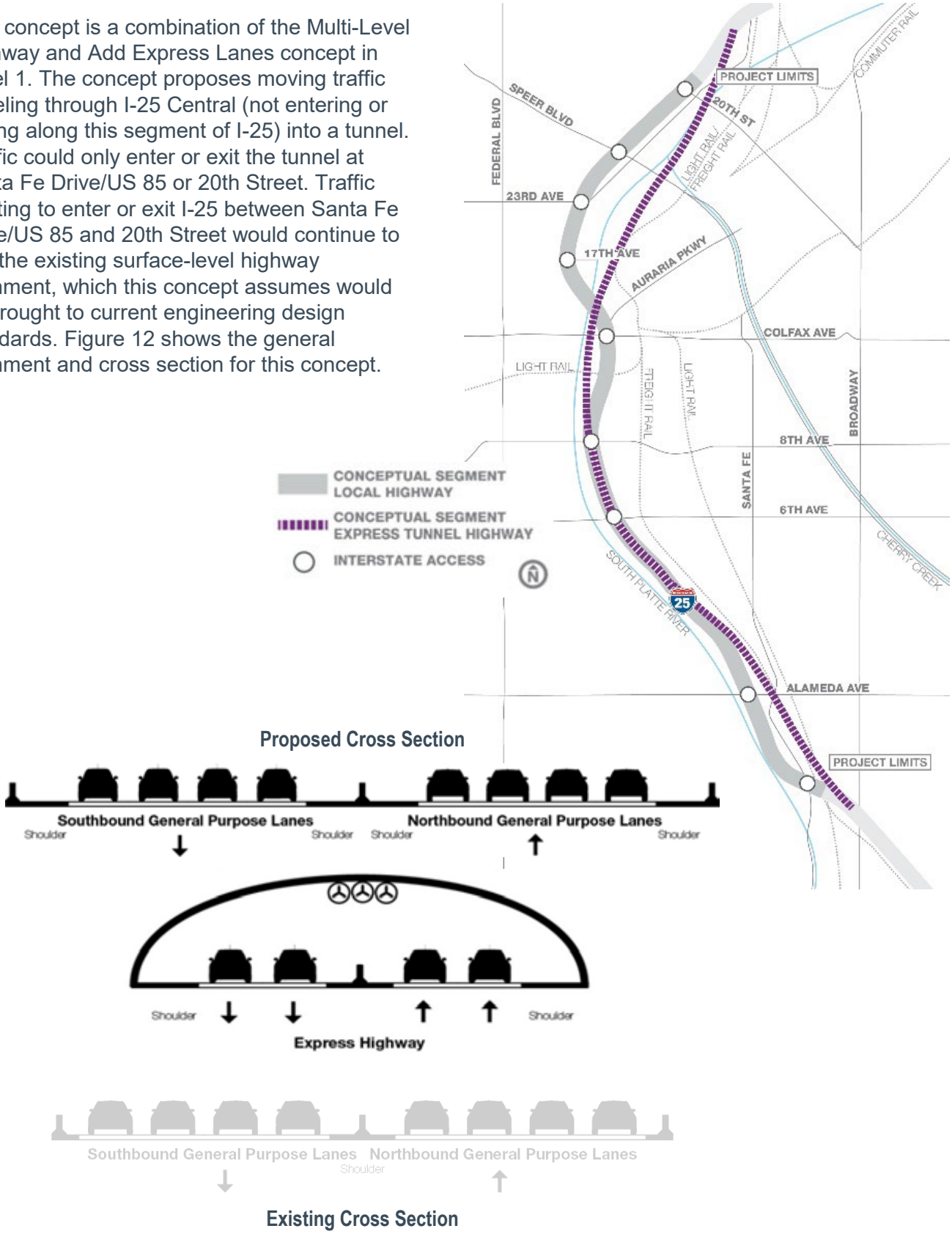


Existing Cross Section

4.2.12. Construct a Tunnel

This concept is a combination of the Multi-Level Highway and Add Express Lanes concept in Level 1. The concept proposes moving traffic traveling through I-25 Central (not entering or exiting along this segment of I-25) into a tunnel. Traffic could only enter or exit the tunnel at Santa Fe Drive/US 85 or 20th Street. Traffic wanting to enter or exit I-25 between Santa Fe Drive/US 85 and 20th Street would continue to use the existing surface-level highway alignment, which this concept assumes would be brought to current engineering design standards. Figure 12 shows the general alignment and cross section for this concept.

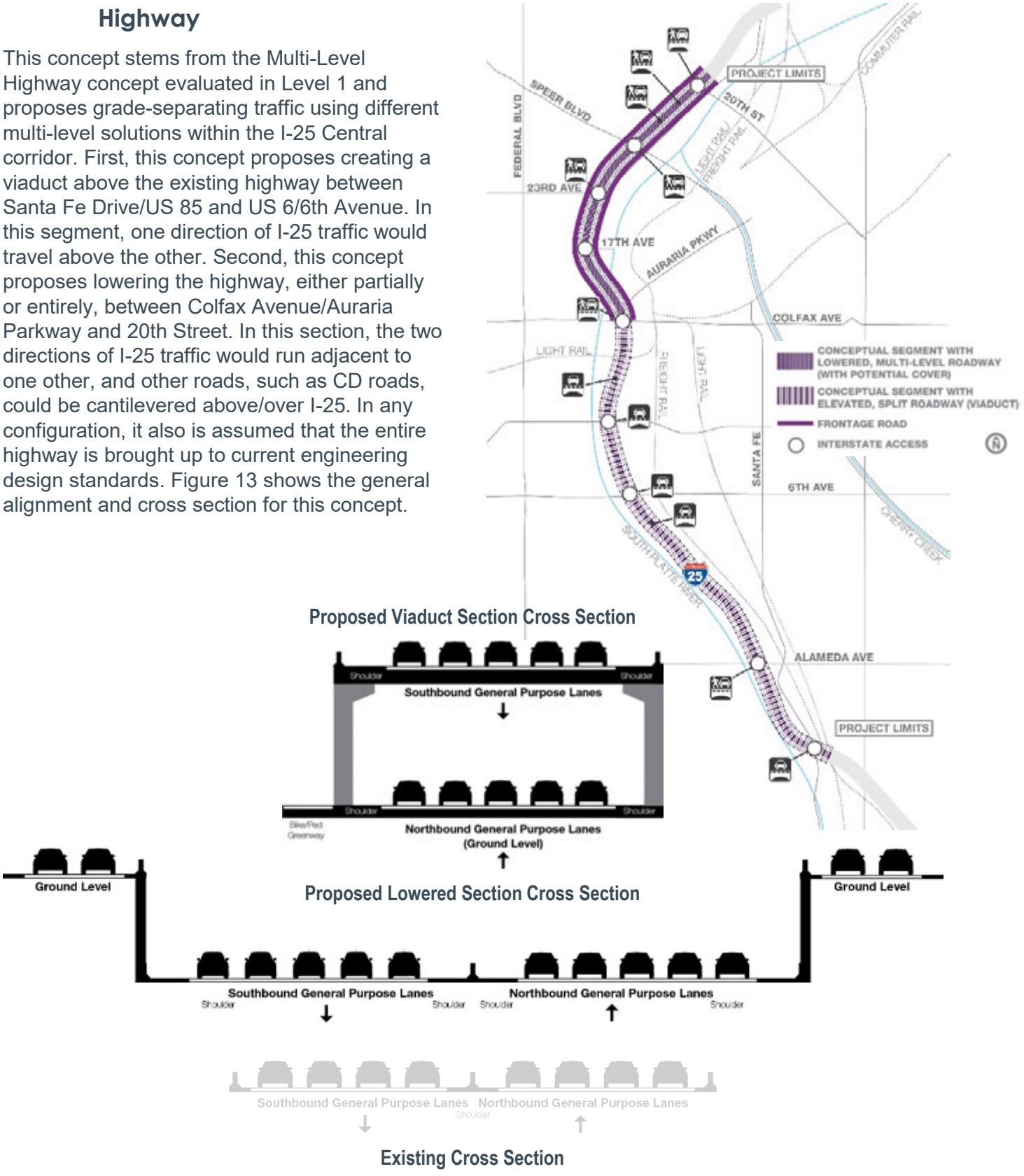
Figure 12: Construct a Tunnel



4.2.13. Construct a Multi-Level Highway

This concept stems from the Multi-Level Highway concept evaluated in Level 1 and proposes grade-separating traffic using different multi-level solutions within the I-25 Central corridor. First, this concept proposes creating a viaduct above the existing highway between Santa Fe Drive/US 85 and US 6/6th Avenue. In this segment, one direction of I-25 traffic would travel above the other. Second, this concept proposes lowering the highway, either partially or entirely, between Colfax Avenue/Auraria Parkway and 20th Street. In this section, the two directions of I-25 traffic would run adjacent to one other, and other roads, such as CD roads, could be cantilevered above/over I-25. In any configuration, it also is assumed that the entire highway is brought up to current engineering design standards. Figure 13 shows the general alignment and cross section for this concept.

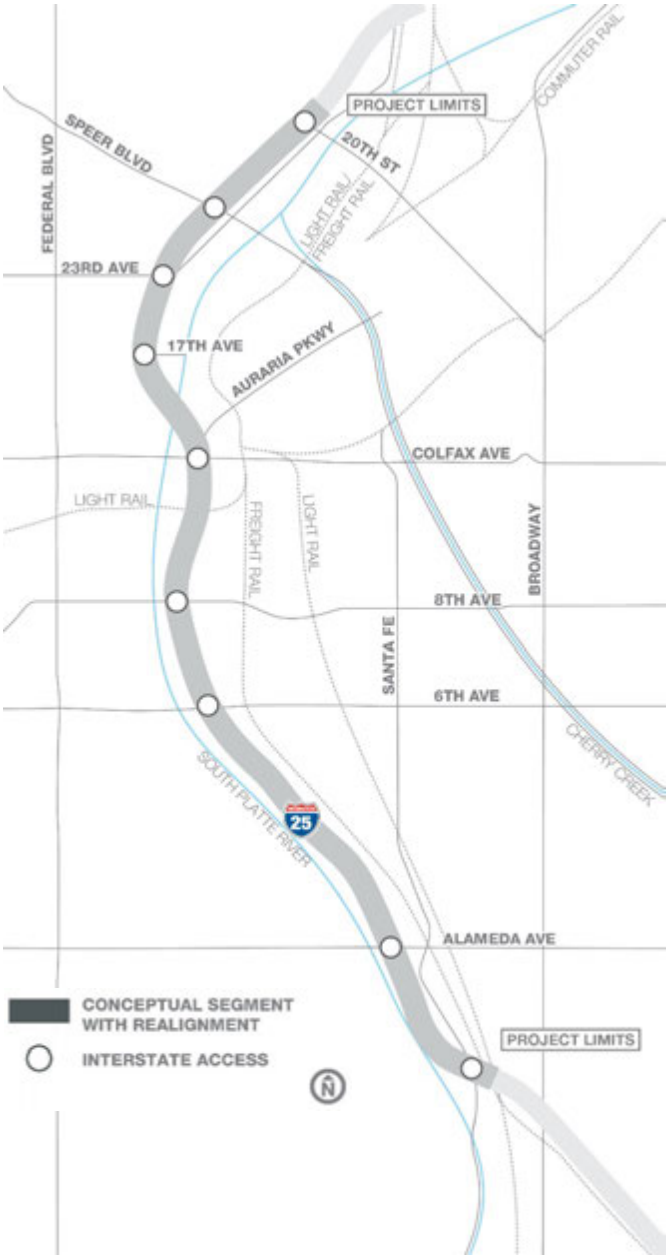
Figure 13: Construct a Multi-Level Highway



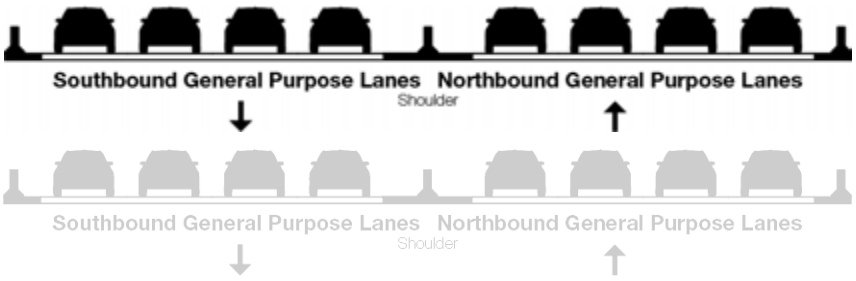
4.2.14. Operations and Demand Management

This concept stems from the TDM and ITS concept evaluated in Level 1 and proposes implementing strategies designed to reduce travel demand and improve the use of the current transportation system, as opposed to investing in major capital improvements. These strategies include TDM and ITS. TDM supports mode shift away from single-occupancy vehicles by providing information, education, and incentives for alternative transportation options. DRCOG's "Way to Go" program (waytogo.org) is an example of a comprehensive TDM program. ITS supports managing traffic operations and may include improvements such as ATM, smart ramp metering/monitoring, and vehicle detection. For the purposes of the Level 2 evaluation, this concept assumes no geometric improvements are made to I-25. Figure 14 shows the general alignment and cross section for this concept.

Figure 14: Operations and Demand Management



Proposed Cross Section

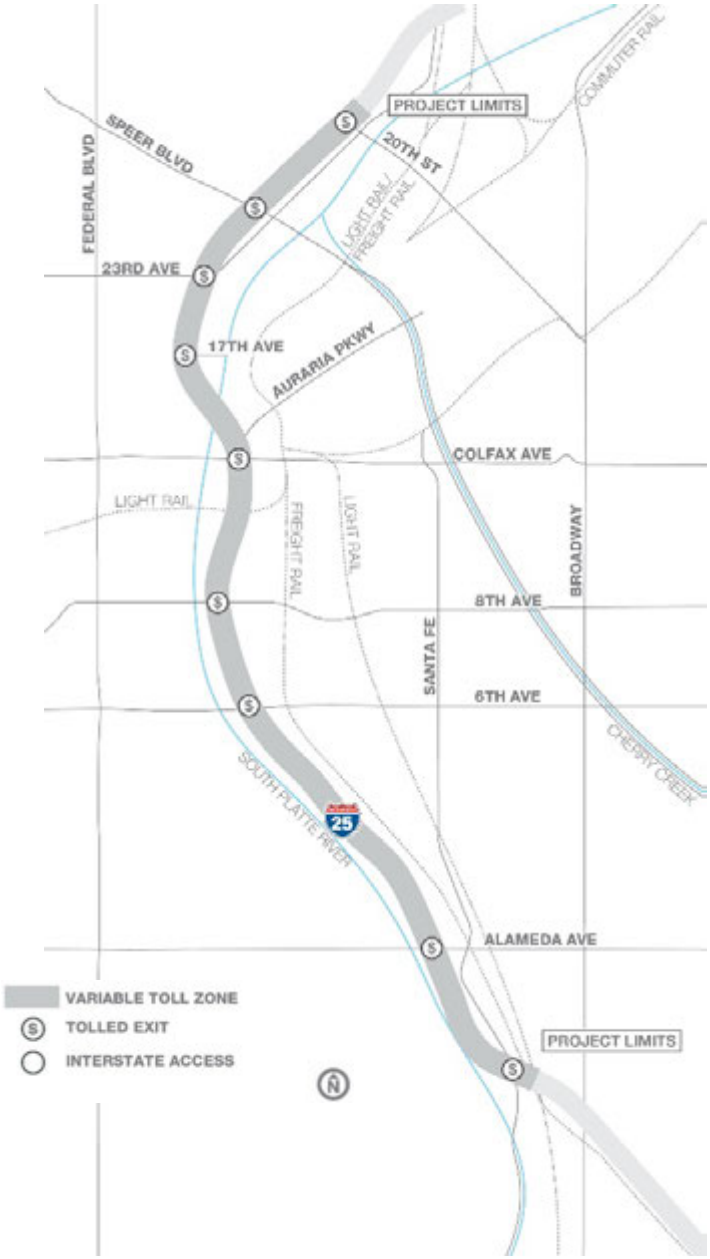


Existing Cross Section

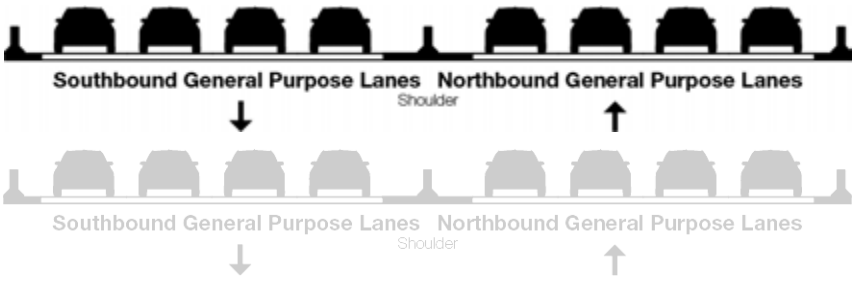
4.2.15. Congestion Pricing

This concept was carried forward from Level 1 and proposes implementing a mechanism to reduce peak congestion by shifting trips to off-peak times or reducing trips during peak times. One variation of this may include implementing variable charges during the commuter peaks. These charges may apply to specific lanes (similar to managed toll lanes); variable tolls on an entire roadway; cordon charges that require a toll to enter a congested area of the city; or per-mile charges in a specific congested area. For the purposes of the Level 2 evaluation, this concept assumes no geometric improvements are made to I-25. Figure 15 shows the general alignment and cross section for this concept.

Figure 15: Congestion Pricing



Proposed Cross Section



Existing Cross Section

4.3. Level 2 Evaluation Process

The Level 2 evaluation process was structured around the project's goals and objectives as well as some additional considerations for feasibility and constructability. These considerations were summarized into eight categories that included safety, constructability, congestion, travel time reliability, access, environment, crossings of I-25, and future flexibility and technology. Within each of these categories, each concept was evaluated based on how it addressed a specific question. A concept could be scored as either green, yellow, or red for a question, with green generally reflecting a positive response to a question, yellow reflecting a neutral response, and red reflecting a negative response. Individual categories, their related sub-questions, and the possible responses are discussed below.

Note that some Level 2 evaluation questions were based on expected future conditions, such as the future travel demand or the future access needs. To respond to these questions, supplemental analyses were performed. The results/outcomes of these supplemental analyses are presented below, as needed.

4.3.1. Safety

Evaluation for the safety goal was based on five criteria questions, listed below. Determinations for all safety-related criteria were qualitatively made based on the experience and judgment of the multi-disciplinary project team.

1. Does the concept eliminate the height clearance issues that currently exist at the 23rd Avenue and Speer Boulevard bridges?
   - Improves all three bridges
   - Improves some of the bridges
   - No bridge improvements
2. Does the concept provide the opportunity to address geometric deficiencies on the I-25 mainline and ramps?
   - Improves geometric conditions in all or most areas while not making them worse anywhere else
   - Improves geometric conditions in some areas while not making them worse anywhere else
   - No notably improved geometric conditions or would make them worse
3. Does the concept accommodate incident management needs (improve emergency response, crash clearance, or queue clearance times)?
   - Accommodates incident management needs in all or most areas while not making conditions worse anywhere else
   - Accommodates incident management needs in some areas while not making conditions worse anywhere else
   - No accommodation for incident management needs or would make conditions worse
4. Does the concept have the potential to reduce the likelihood of secondary crashes?
   - Potential to provide a large reduction in secondary crashes
   - Potential to provide a moderate reduction in secondary crashes
   - No reduction in secondary crashes

5. Does the concept reduce the number of conflict points on the I-25 mainline?
   - Large reduction in the number of conflict points on the mainline freeway
   - Moderate reduction in the number of conflict points on the mainline freeway
   - No or very little reduction in the number of conflict points on the mainline freeway

4.3.2. Constructability

Evaluation of the constructability consideration was based on two criteria questions, listed below. Determinations for all constructability-related criteria were qualitatively made based on the experience and judgment of the multi-disciplinary project team.

1. Does the concept have extraordinary construction and/or maintenance costs?
   - Likely lower cost as compared to other concepts
   - Likely has a moderate cost as compared to other concepts
   - Likely has a high cost as compared to other concepts
2. Does the concept require a substantial amount of coordination with other agencies or private land owners?
   - No substantial amount of coordination with other agencies and/or private land owners required
   - Moderate amount of coordination with other agencies and/or private land owners required
   - Large amount of coordination with other agencies and/or private land owners required

4.3.3. Congestion

Evaluation of the concepts for the congestion goal was based on three criteria questions. Determinations for all congestion-related criteria were qualitatively made based on the experience and judgment of the multi-disciplinary project team and quantitatively supplemented using high-level traffic analysis.

1. Does the concept increase the capacity of I-25?
   - Substantially increases the capacity of I-25
   - Moderately increases the capacity of I-25
   - No increase to the capacity of I-25
2. Does the concept reduce turbulence on the I-25 mainline?
   - Substantially reduces turbulence on the I-25 mainline
   - Moderately reduces turbulence on the I-25 mainline
   - No reduction of turbulence on the I-25 mainline
3. Does the concept reduce the demand for the I-25 mainline (i.e., removing short trips)?
   - Substantially reduces demand for the I-25 mainline
   - Moderately reduces demand for the I-25 mainline
   - No reduction of demand for the I-25 mainline

The traffic analysis efforts and criteria questions related to the congestion goal are discussed in the following subsections.

4.3.4. Preliminary Traffic Analysis

To help answer congestion-related criteria questions, it was necessary to first understand the relative magnitude of future travel demand along the I-25 Central corridor and the different ways in which this travel demand could be accommodated/addressed. This was done in a two-phased approach, first by understanding the magnitude of future travel demand, and second by understanding the impacts of potential demand reduction strategies.

4.3.4.1. Future Travel Demand

To understand the magnitude of future travel demand for I-25 Central, DRCOG's regional travel demand model was used to test four different scenarios:

1. 2040 No Action (no additional capacity)
2. 2040 Bring the Corridor to Standard (a small amount of additional capacity)
3. 2040 One Additional General-Purpose Lane in Each Direction (a moderate amount of additional capacity)
4. 2040 Two Additional General-Purpose Lanes in Each Direction (a larger amount of additional capacity)

The purpose of these scenarios was not to understand or model a specific concept. Rather, the intent was to understand how much demand there could be for the corridor if the highway were not capacity constrained.

Understanding an unconstrained demand for I-25 Central is important because congestion has a direct impact on travel demand and driver route choice. As I-25 becomes more congested, people will use alternate routes to get to their destinations. If congestion becomes severe enough, then people may choose not to travel all together. By examining the travel demand results for the four scenarios listed above, an understanding was gained about how much additional travel demand could be expected if capacity on I-25 Central were increased. A summary of results is presented in Table 4.

Additional information about the methodology used for this analysis and a more-detailed presentation and interpretation of results is provided in the *I-25 Central Traffic Forecasting Technical Memorandum* (November 2018), which is part of Attachment A, *I-25 Central PEL Existing Conditions Assessment Report*, of the *I-25 Central PEL Study Report*. Key findings of the analysis include:

- A large increase in travel demand is anticipated by 2040.
- Increasing capacity on I-25 will result in an increase in average highway speeds, but also will increase the overall travel demand for the corridor.

Table 4: Summary of Preliminary Traffic Analysis Results

Scenario	Daily Vehicle Miles Traveled *(% change from existing conditions)*	Average Evening Peak Period Speed in Miles per Hour (mph) *(% change from existing conditions)*
Existing Conditions	1,539,000 *(n/a)*	30 mph *(n/a)*
2040 No Action	1,711,000 *(+11%)*	25 mph *(-16%)*
2040 Bring the Corridor to Standard	1,764,000 *(+15%)*	26 mph *(-12%)*
2040 One additional lane in each direction	1,868,000 *(+21%)*	29 mph *(-3%)*
2040 Two additional lanes in each direction	1,992,000 *(+28%)*	34 mph *(+13%)*

4.3.4.2. Future Travel Demand Reduction Options

Given current conditions and projections, travel demand on I-25 Central is expected to increase in the future. However, it is important to note that this increase in travel demand could be accommodated in a variety of ways and modes, some of which do not involve an increase in capacity on the highway. The two identified methods of reducing future vehicular travel demand on I-25—which could address the congestion criteria without increasing capacity on the highway—include shifting trips from the highway to public transportation and using pricing methodologies to reduce the travel demand for I-25 Central.

4.3.4.3. Transit Mode-Shift Analysis

Because some concepts being considered in Level 2 include transit improvements, it was important to understand the impact these improvements may have to travel demand on I-25 Central. Therefore, a high-level process was used to estimate the number of trips that may be shifted off I-25 Central if a variety of transit improvements were made.

Note that this analysis was based on a collaborative, qualitative process between the project team and RTD. The results are intended to provide a general understanding of the magnitude of impact of transit improvements and should not be interpreted as an exact forecast of future conditions. Additional information about the methodology used and a more detailed discussion of results is provided in Appendix B, *I-25 Central Order-of-Magnitude Transit Ridership Development Process Technical Memorandum* (April 2019), of Attachment C, *I-25 Central Traffic and Safety Technical Report,* of the *I-25 Central PEL Study Report* (CDOT, 2020).

Based on a collaborative process between RTD and the I-25 Central project team, three different types of transit improvements were identified:

- High-capacity bus improvements on Broadway/Lincoln Street and Federal Boulevard
- Optimization of existing light rail tracks
- Additional light rail tracks (two new tracks between the Broadway & I-25 Station and Colfax Avenue)

These specific transit improvements were evaluated because they were considered to be the improvements that would have the most beneficial impact to I-25 Central. For the analysis, two different ridership forecasts were estimated. First, the total ridership was forecasted. This number included the total number of anticipated users for each facility/service. Second, the total number of trips removed from I-25 was estimated. This number represented a sub-set of the first number and was an estimation of people who would have originally chosen to drive on I-25 but would now take transit because of the improved service. The second number—the estimation of trips removed from I-25 Central—is the value that would be subtracted from the base travel demand for I-25 to understand the potential impact of transit improvements on I-25 Central. A summary of both values for all three transit improvement options is provided in Table 5.

Table 5: Transit Improvement Ridership Estimates

Improvement	2040 No Action Daily Ridership Estimate	Estimated Daily Ridership if Improvements are Provided *(percent difference from no action)*	Estimated Daily Trips Removed from I-25 Central if Improvements are Provided (percent of 2040 No Action ADT on I-25)
High Capacity Bus Improvements on Broadway/Lincoln St & Federal Blvd	23,500	25,000-30,000 *(6%-28%)*	0-500 (0%-<1%)
Optimization of Existing Light Rail Tracks (W, C, D, E, F, & H Lines)	100,500	112,500-117,000 *(12%-16%)*	4,500-5,500 (<1%)
Additional Light Rail Tracks (C, D, E, F, & H Lines)	79,500	95,500-111,500 *(20%-40%)*	6,500-13,500 (<1%)

4.3.4.4. Congestion Pricing Options

In addition to shifting I-25 Central travel demand to alternative forms of transportation, such as public transit, charging people to use I-25 also was considered as an option to reduce travel demand. At this time, no modeling or quantitative analysis has been performed for this type of demand reduction method. For the purposes of the Level 2 evaluation, impacts from congestion pricing options were evaluated qualitatively.

4.3.5. Travel Time Reliability

Evaluation of concepts for the travel time reliability goal was based on one criterion question, listed below. Determinations for the travel time reliability-related criterion were qualitatively made based on the experience and judgment of the multi-disciplinary project team.

1. Does the concept improve the flexibility of I-25 to respond to short-term variations in travel demand, such as sporting events?
   - Provides a high degree of flexibility to accommodate/respond to short-term variations in travel demand
   - Provides a moderate degree of flexibility to accommodate/respond to short-term variations in travel demand
   - No flexibility to accommodate/respond to short-term variations in travel demand

4.3.6. Access

Evaluation of the concepts for the access goal was based on one criterion question, discussed below. Determinations for the access-related criterion were qualitatively made based on the experience and judgment of the multi-disciplinary project team.

1. Do the concept's access locations adequately address current and future transportation needs of the surrounding land uses?
   - Adequately address current and future transportation needs
   - Somewhat address current and future transportation needs
   - Current and future transportation needs not addressed

4.3.7. Environment

Evaluation of the concepts for the environment goal was based on three criteria questions, listed below. Determinations for all environment-related criteria were qualitatively made based on the experience and judgment of the multi-disciplinary project team.

1. Are there impacts to the natural environment (water quality, air quality, noise, biological resources, floodplains)?
   - Minor or no impacts to the natural environment
   - Moderate impacts to the natural environment
   - Large impacts to the natural environment

2. Are there impacts to the social and built environment (historic resources, parks and recreation, trails, land use)?
   - Minor or no impacts to the social or built environment
   - Moderate impacts to the social or built environment
   - Large impacts to the social or built environment

3. Is right of way required?
   - Small amount of new right of way required
   - Moderate amount of new right of way required
   - Large amount of new right of way required

4.3.8. Crossings of I-25

Evaluation of the crossings goal was based on two criteria questions, listed below. Determinations for all crossing-related criteria were qualitatively made based on the experience and judgment of the multi-disciplinary project team.

1. Does the concept support current and future bicycle and pedestrian connection needs across I-25?
   - Supports all bicycle and pedestrian crossing needs as identified in existing Denver planning documents
   - Maintains all existing bicycle and pedestrian crossings and supports some new crossings as identified in existing Denver planning documents
   - Existing bicycle and pedestrian crossings not maintained and/or no support for any new crossings

2. Does the concept support current and future transit and vehicle connection needs across I-25?
   - Supports all transit and vehicle crossing needs as identified in existing Denver planning documents
   - Maintains all existing transit and vehicle crossings and supports some new crossings as identified in existing Denver planning documents
   - Existing transit and vehicle crossings not maintained and/or no support for any new crossings

4.3.9. Future Flexibility and Technology

Evaluation of the future flexibility and technology goal was based on one criterion question, listed below. Determinations for all future flexibility and technology-related criteria were qualitatively made based on the experience and judgment of the multi-disciplinary project team. Additionally, this criterion was evaluated on a binary basis, with answers of “Yes” or “No,” based on if a concept could meet it.

1. Could the concept accommodate future physical changes to the roadway (restriping, new lane assignments, new technology infrastructure, etc.)?

4.4. Level 2 Evaluation Outcomes

Discussion of how each Level 2 concept met each of the above criteria questions follows. For organizational purposed, the Level 2 concepts have been grouped into four “families.” Concepts were grouped based primarily on their anticipated impact on the overall width of the highway. It is important to note that this grouping was done purely for organizational purposes and should not be interpreted as any form of concept packaging or prioritization.

The four families of concepts are listed below. Results of the Level 2 evaluation for each family are summarized in the following tables.

Family 1 (Table 6)

- No Action
- Congestion Pricing
- Operations and Demand Management

Family 2 (Table 7)

- Bring the Corridor to Standard
- Add Collector/Distributor Roads
- Add Braided Ramps
- New Transit Facilities

Family 3 (Table 8)

- Add General-Purpose Lanes (One)
- Add Managed Lanes
- Realign and Split the Corridor

Family 4 (Table 9)

- Add General-Purpose Lanes (Two)
- Construct a Tunnel
- Construct a Multi-Level Highway
- Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines

Table 6: Level 2 Evaluation Results for Family 1

Needs, Goals, and Objectives	Level 2 Question	No Action	Congestion Pricing	Operations and Demand Management
Key Details		• No extra lanes are added to the mainline freeway. • No geometric deficencies are fixed.	• No extra lanes are added to the mainline freeway. • No geometric deficencies are fixed.	• No extra lanes are added to the mainline freeway. • No geometric deficencies are fixed.
Safety	1. Does the concept eliminate the height clearance issues that currently exist at the 23rd Avenue and Speer Boulevard bridges?	• The concept would not improve any of the bridges.	• The concept would not improve any of the bridges.	• The concept would not improve any of the bridges.
	2. Does the concept provide the opportunity to address geometric deficiencies on the I-25 mainline and ramps?	• This concept would not address geometric deficiencies, such as shoulders, lane widths, necessary curve improvements, and sight distances. • This concept would not address the 17 identified ramp spacing deficiencies. • This concept would not address the acceleration/deceleration lane deficiencies.	• This concept would not address geometric deficiencies, such as shoulders, lane widths, necessary curve improvements, and sight distances. • This concept would not address the 17 identified ramp spacing deficiencies. • This concept would not address the acceleration/deceleration lane deficiencies.	• This concept would not address geometric deficiencies, such as shoulders, lane widths, necessary curve improvements, and sight distances. • This concept would not address the 17 identified ramp spacing deficiencies. • This concept would not address the acceleration/deceleration lane deficiencies.
	3. Does the concept accommodate incident management needs (improve emergency response, crash clearance, or queue clearance times)?	• The concept would not accommodate incident management needs.	• The concept would accommodate incident management needs in some areas by reducing congestion to improve response times and reducing the queue clearance times.	• The concept would accommodate incident management needs in some areas by alerting drivers to blocked lanes and providing back-of-queue warnings. • This concept also may provide benefits in incident management with improved alert and response times for first responders.
	4. Does the concept have the potential to reduce the likelihood of secondary crashes?	• The concept would not reduce secondary crashes.	• The concept would not reduce secondary crashes.	• Active traffic management would provide advanced warning of an incident, which could prepare drivers for changing conditions and reduce secondary crashes.
	5. Does the concept reduce the number of conflict points on the I-25 mainline?	• The concept would provide no reduction in the number of conflict points on the mainline freeway.	• The concept would provide no reduction in the number of conflict points on the mainline freeway.	• The concept would provide no reduction in the number of conflict points on the mainline freeway.

Table 6: Level 2 Evaluation Results for Family 1

Needs, Goals, and Objectives	Level 2 Question	No Action	Congestion Pricing	Operations and Demand Management
Constructability	1. Does the concept have extraordinary construction and/or maintenance costs?	🟩	🟩	🟩
		• The concept would have no added cost beyond existing and planned maintenance and operations.	• The concept likely would have a lower cost as compared to other concepts.	• The concept likely would have a lower cost as compared to other concepts.
	2. Does the concept require a substantial amount of coordination with other agencies or private land owners?	🟩	🟨	🟩
		• The concept would not require a substantial amount of coordination with other agencies and/or private land owners.	• This concept would require a moderate amount of coordination with other agencies because traffic patterns are likely to shift to other, non-CDOT managed facilities. Furthermore, additional federal coordination, beyond what is typical for interstate projects, will be required if all lanes of the interstate are to be tolled.	• The concept would not require a substantial amount of coordination with other agencies and/or private land owners.
Congestion	1. Does the concept increase the capacity of I-25?	🟥	🟥	🟥
		• The concept would not increase the capacity of I-25.	• The concept would not increase the capacity of I-25.	• The concept would not increase the capacity of I-25. **Assumption:** This concept would optimize the flow, but not increase the capacity of the highway.
	2. Does the concept reduce turbulence on the I-25 mainline?	🟥	🟨	🟨
		• Turbulence, such as weaving and merging, would not be improved on the I-25 mainline.	• This concept would generate less congestion and, therefore, moderately reduce turbulence.	• This concept would provide variable speed limits and lane assignments, which would moderately reduce turbulence by preparing drivers to be in the proper lane well in advance of lane blockages, highway entrances, highway exits, etc.
	3. Does the concept reduce the demand for the I-25 mainline (i.e., removing short trips)?	🟥	🟩	🟥
		• The concept would not reduce demand on the I-25 mainline.	• By pricing usage of the highway in response to demand, this concept would drastically reduce the potential for demand to exceed capacity.	• Smart/integrated ramp metering could impact some local demand by encouraging shorter trips to be made on the local roadway network. However, this likely would not impact overall demand in a meaningful way.
Travel Time Reliability	1. Does the concept improve the flexibility of I-25 to respond to short-term variations in travel demand, such as sporting events?	🟥	🟨	🟨
		• The concept would not provide flexibility to accommodate/respond to short-term variations in travel demand.	• Having variable congestion pricing can help guarantee a travel time regardless of demand.	• This concept would provide a moderate degree of flexibility to respond to short-term variations in travel demand by being able to better optimize travel flow given differing travel demand patterns. • This concept would minimize the impact of variation in demand, but would not guarantee a travel time.
Access	1. Do the concept's access locations adequately address current and future transportation needs of the surrounding land uses?	🟥	🟥	🟥
		• There would be no changes to the location of accesses. • Existing access locations/configurations likely will not be adequate to accommodate future volumes. • This concept does not address potential changes in access needs as a result of planned development along the corridor.	• There would be no changes to the location of accesses. • Existing access locations/configurations likely will not be adequate to accommodate future volumes. • This concept does not address potential changes in access needs as a result of planned development along the corridor.	• There would be no changes to the location of accesses. • Existing access locations/configurations likely will not be adequate to accommodate future volumes. • This concept does not address potential changes in access needs as a result of planned development along the corridor.

Table 6: Level 2 Evaluation Results for Family 1

Needs, Goals, and Objectives	Level 2 Question	No Action	Congestion Pricing	Operations and Demand Management
Environment	1. Are there impacts to the natural environment? • Water Quality • Air Quality • Noise • Biological Resources • Floodplains	 • Providing no additional water quality features to the highway will result in continued negative impacts to the South Platte River. • Increasing congestion is likely to lower overall speeds on the highway, thus reducing noise pollution.	 • Providing no additional water quality features to the highway will result in continued negative impacts to the South Platte River. • This concept is likely to notably reduce congestion on the highway, thus reducing vehicle emissions and improving air quality. • This concept is likely to increase overall vehicle speeds along the highway and, therefore, has the potential to increase noise pollution.	 • Providing no additional water quality features to the highway will result in continued negative impacts to the South Platte River. • This concept is likely to reduce congestion on the highway, thus reducing vehicle emissions and improving air quality. However, these benefits could be partially offset by an increase in vehicles idling/queuing at ramp meters. • This concept is likely to increase overall vehicle speeds along the highway and, therefore, has the potential to increase noise pollution.
	2. Are there impacts to the social and built environment? • Historic • Parks & Recreation • Trails • Land Use	 • The concept would have minor or no impacts to the social or built environment.	 • The concept would have minor or no impacts to the social or built environment.	 • The concept would have minor or no impacts to the social or built environment.
	3. Is right of way required?	 • The concept would require no new right of way.	 • The concept would require no new right of way.	 • The concept would require no new right of way.
Crossings of I-25 for bicyclists, pedestrians, transit riders, and local vehicle drivers	1. Does the concept support current and future bicycle and pedestrian connection needs across I-25?	 • This concept would maintain all existing crossings and not preclude the addition of additional crossings	 • This concept would maintain all existing crossings and not preclude the addition of additional crossings	 • This concept would maintain all existing crossings and not preclude the addition of additional crossings
	2. Does the concept support current and future transit and vehicle connection needs across I-25?	 • This concept would maintain all existing crossings and not preclude the addition of additional crossings.	 • This concept would maintain all existing crossings and not preclude the addition of additional crossings.	 • This concept would maintain all existing crossings and not preclude the addition of additional crossings.
Future Flexibility and Technology	1. Could the concept accommodate future physical changes to the roadway (restriping, new lane assignments, new technology infrastructure, etc.)?	Yes • This concept would not preclude the implementation of future physical changes or technology along the corridor.	Yes • This concept would not preclude the implementation of future physical changes or technology along the corridor.	Yes • This concept would not preclude the implementation of future physical changes or technology along the corridor.
Determination		**Carried Forward**	**Carried Forward**	**Carried Forward**
Reasoning		Although this concept does not address many of the goals and objectives of this study, it is carried forward to provide a baseline for comparison.	This concept is eliminated as a standalone concept because, on its own, it does not adequately address the identified safety issues along the corridor. However, the concept of congestion pricing could be incorporated into other concepts.	This concept is eliminated as a standalone concept because, on its own, it does not adequately address the identified safety issues along the corridor. However, the concept of operations and demand management could be incorporated into other concepts.

Table 7: Level 2 Evaluation Results for Family 2

Needs, Goals, and Objectives	Level 2 Question	Bring the Corridor to Standard	Add Collector/Distributor Roads	Add Braided Ramps	New Transit Facilities
Key Details		• No extra lanes are added to the mainline freeway. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard.	• No extra lanes are added to the mainline freeway. • All geometric deficencies, excluding some ramp spacing issues, are fixed/brought to standard.	• No extra lanes are added to the mainline freeway. • All geometric deficencies, excluding some ramp spacing issues, are fixed/brought to standard.	• No extra lanes are added to the mainline freeway. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard.
Safety	1. Does the concept eliminate the clearance issues that currently exist at the 23rd Avenue and Speer Boulevard bridges?	🟩	🟩	🟩	🟩
		• The concept would improve all three bridges.	• The concept would improve all three bridges.	• The concept would improve all three bridges.	• The concept would improve all three bridges.
	2. Does the concept provide the opportunity to address geometric deficiencies on the I-25 mainline and ramps?	🟨	🟩	🟩	🟨

		• This concept would address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
		• This concept would not address the 17 identified ramp spacing deficiencies.
		• This concept would address 1 of the 11 acceleration/deceleration lane deficiencies (NB I-25 on-ramp from Kalamath Street); the remaining acceleration/deceleration lane deficiencies are due to ramp spacing.
			• This concept would address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
			• This concept would **not** address the following 4 (of 17) identified ramp spacing deficiencies:
			  ○ I-25 northbound (NB), 17th Ave to 23rd Ave
			  ○ I-25 NB, Colfax Ave to 17th Ave
			  ○ I-25 NB, 17th Ave Off to 17th Ave On
			  ○ I-25 southbound (SB), 23rd Ave to Colfax Ave
			• This concept would **not** address the following 2 (of 11) acceleration/deceleration lane deficiencies:
			  ○ SB I-25 on-ramp from 23rd Ave
			  ○ NB I-25 on-ramp from 23rd Ave
				• This concept would address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
				• This concept would address the following 4 (of 17) identified ramp spacing deficiencies:
				  ○ I-25 NB, US 6 to 8th Ave
				  ○ Westbound (WB) US 6 ramp to NB I-25, NB/SB I-25 diverge to eastbound (EB)/WB US 6 merge
				  ○ SB I-25 on-ramp from EB Colfax Ave, Colfax Ave/Auraria Pkwy merge to Colfax Ave/Lower Colfax Ave merge
				  ○ SB I-25 on-ramp from EB Colfax Ave, Colfax Ave/Lower Colfax Ave to Colfax Ave/I-25 merge
				• This concept would address the following 2 (of 11) acceleration/deceleration lane deficiencies:
				  ○ NB I-25 off-ramp to 8th Ave
				  ○ NB I-25 on-ramp from 8th Ave
					• This concept would address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
					• This concept would not address the 17 identified ramp spacing deficiencies.
					• This concept would address 1 of the 11 acceleration/deceleration lane deficiencies (NB I-25 on-ramp from Kalamath Street); the remaining acceleration/deceleration lane deficiencies are due to ramp spacing.

	3. Does the concept accommodate incident management needs (improve emergency response, crash clearance, or queue clearance times)?	🟩	🟩	🟩	🟩
		• The concept would improve incident management needs with mainline shoulder widening throughout the I-25 Central corridor.	• The concept would improve incident management needs with mainline shoulder widening throughout the I-25 Central corridor.	• The concept would improve incident management needs with mainline shoulder widening throughout the I-25 Central corridor.	• The concept would improve incident management needs with mainline shoulder widening throughout the I-25 Central corridor.

Table 7: Level 2 Evaluation Results for Family 2

Needs, Goals, and Objectives	Level 2 Question	Bring the Corridor to Standard	Add Collector/Distributor Roads	Add Braided Ramps	New Transit Facilities
	4. Does the concept have the potential to reduce the likelihood of secondary crashes?	🟩	🟩	🟩	🟩
		• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.	• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.	• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to provide a reduction in secondary crashes.	• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.
	5. Does the concept reduce the number of conflict points on the I-25 mainline?	🟥	🟩	🟨	🟥
		• The concept would provide no reduction in the number of conflict points on the mainline freeway.	• The concept would provide a reduction in the number of conflict points on the mainline freeway since the CD roads would remove some access points from the mainline.	• The absolute number of conflict points would remain the same, but some weaving conflict points would become merging conflict points, which are assumed to be safer.	• The concept would provide no reduction in the number of conflict points on the mainline freeway.
Constructability	1. Does the concept have extraordinary construction and/or maintenance costs?	🟨	🟨	🟨	🟥
		• The concept likely would have a moderate cost as compared to other concepts because of the required additional right of way.	• The concept likely would have a moderate cost as compared to other concepts because of the required additional right of way.	• The concept likely would have a moderate cost as compared to other concepts because of the required additional right of way.	• This concept likely would have a high cost as compared to other concepts because of a substantial amount of transit infrastructure that would be required. This would be in addition to the right of way required to bring the freeway to standard.
	2. Does the concept require a substantial amount of coordination with other agencies or private land owners?	🟨	🟨	🟨	🟥
		• Due to the amount of required right of way, a moderate amount of coordination with other agencies and/or private land owners would be required.	• Due to the amount of required right of way, a moderate amount of coordination with other agencies and/or private land owners would be required.	• Due to the amount of required right of way, a moderate amount of coordination with other agencies and/or private land owners would be required.	• This concept would require extensive coordination because CDOT does not own or operate local transit routes. • Due to the amount of required right of way, a moderate amount of coordination with other agencies and/or private land owners along the I-25 corridor would be required.
Congestion	1. Does the concept increase the capacity of I-25?	🟨	🟨	🟨	🟨
		• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • New CD road lanes would add capacity in certain sections of the mainline.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate.

Table 7: Level 2 Evaluation Results for Family 2

Needs, Goals, and Objectives	Level 2 Question	Bring the Corridor to Standard	Add Collector/Distributor Roads	Add Braided Ramps	New Transit Facilities
	2. Does the concept reduce turbulence on the I-25 mainline?	🟥 • Improving the roadway geometrics would reduce turbulence at the NB I-25 on-ramp from the Alameda Avenue interchange because the acceleration lane would be brought to standard. • The remaining 10 locations with acceleration/ deceleration length deficiencies would not be addressed since those deficiencies are a result of ramp spacing, which is not addressed in this concept.	🟩 • Turbulence, such as weaving and merging, would be reduced by improving the length of 9 acceleration/deceleration lanes and moving some access points to the CD roads. • Most weaving movements would be moved to the CD roads and, therefore, would not be occurring on the mainline freeway.	🟩 • Turbulence, such as weaving and merging, would be reduced by improving the length of two acceleration/ deceleration lanes. • Turbulence would be improved since many weaving conflict points will be turning into merging conflict points.	🟥 • Improving the roadway geometrics would reduce turbulence at the NB I-25 on-ramp from the Alameda Avenue interchange because the acceleration lane would be brought to standard. • The remaining 10 locations with acceleration/deceleration length deficiencies would not be addressed since those deficiencies are a result of ramp spacing, which is not addressed in this concept.
	3. Does the concept reduce the demand for the I-25 mainline (i.e., removing short trips)?	🟥 • The concept would not reduce demand on the I-25 mainline.	🟩 • The concept would reduce demand on the I-25 mainline, with some short trips being accommodated on the CD roads.	🟥 • The concept could reduce some demand for the I-25 mainline by preventing short trips from being able to enter the highway and immediately exit at the next off-ramp; however, this benefit is likely to be limited because a driver likely still would be able to get off at the second or third consecutive ramp after the braid. • Some braided ramp configurations likely would create short CD roads (for example, on I-25 between Alameda Avenue and US 6), which would remove some vehicles from the mainline freeway.	🟨 • This concept would reduce some demand on the I-25 mainline by shifting people to other modes of transportation.
Travel Time Reliability	1. Does the concept improve the flexibility of I-25 to respond to short-term variations in travel demand, such as sporting events?	🟨 • The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.	🟨 • The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.	🟨 • The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.	🟨 • Improved transit lines would offer a guaranteed travel time, but likely would not notably change vehicular travel times on the actual highway. • The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.
Access	1. Do the concept's access locations adequately address current and future transportation needs of the surrounding land uses?	🟨 • There would be no changes to the location of accesses. • Existing access locations with geometric deficiencies would be replaced. It is assumed that when they are replaced, they are designed in a manner which adequately accommodates future needs.	🟩 • The access locations in this concept could adequately address current and future transportation needs.	🟩 • The access locations in this concept could adequately address current and future transportation needs.	🟨 • The access locations in this concept would not change existing access locations. • Existing access locations/configurations likely will not be adequate to accommodate future volumes. • New and improved transit lines may be able to accommodate some trips from new developments, thus reducing the access demand to and from the highway.

Table 7: Level 2 Evaluation Results for Family 2

Needs, Goals, and Objectives	Level 2 Question	Bring the Corridor to Standard	Add Collector/Distributor Roads	Add Braided Ramps	New Transit Facilities
Environment	1. Are there impacts to the natural environment? • Water Quality • Air Quality • Noise • Biological Resources • Floodplains	🟨	🟨	🟨	🟩
		• Construction along the corridor will require the addition of water quality features. This likely will reduce the highway's impact to water quality. • Bringing the corridor to standard will increase speeds and moderately reduce congestion. In turn, this will have positive effects on air quality. • This concept likely will moderately increase speeds on the corridor, which can increase noise pollution. Furthermore, bringing the corridor to standard may require the highway to be slightly shifted closer to existing properties, which can have negative impacts on noise. Widening the highway likely would have impacts to the South Platte River floodplain between approximately Santa Fe Drive/US 85 and US 6/6th Avenue.	• Construction along the corridor will require the addition of water quality features. This likely will reduce the highway's impact to water quality. • Adding collector/distributor roads and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • This concept likely will moderately increase speeds on the corridor, which can increase noise pollution. Furthermore, adding collector/distributor roads and bringing the corridor to standard will require the highway to be shifted closer to existing properties, which can have negative impacts on noise. • Widening the highway likely would have impacts to the South Platte River floodplain between approximately Santa Fe Drive/US 85 and US 6/6th Avenue.	• Construction along the corridor will require the addition of water quality features. This likely will reduce the highway's impact to water quality. • Adding braided ramps and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • This concept likely will moderately increase speeds on the corridor, which can increase noise pollution. Furthermore, adding braided ramps and bringing the corridor to standard will require the highway to be shifted closer to existing properties, which can have negative impacts on noise. Widening the highway would impact the South Platte River Trail between approximately US 6/6th Avenue and Ellsworth Avenue (approximately 0.5 mile).	• Construction along the corridor will require the addition of water quality features. This likely will reduce the highway's impact to water quality. • Shifting more trips to transit will reduce the use of automobiles, which, in turn, will reduce vehicle emissions along the corridor. This could improve air quality. • This concept likely will moderately increase speeds on the corridor, which can increase noise pollution. Furthermore, bringing the corridor to standard may require the highway to be slightly shifted closer to existing properties, which can have negative impacts on noise. • Widening the highway would impact the South Platte River Trail between approximately US 6/6th Avenue and Ellsworth Avenue (approximately 0.5 mile).
	2. Are there impacts to the social and built environment? • Historic • Parks & Recreation • Trails • Land Use	🟨	🟨	🟨	🟨
		• Widening the highway likely would impact five listed historic resources and seven eligible historic resources. • Widening the highway likely would impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park), two of which are Section 6(f) properties. • Potential partial impact to one cultural institution (Children's Museum of Denver).	• Widening the highway would have potential impacts to five listed historic resources and seven eligible historic resources. • Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park). • Potential partial impact to one cultural institution (Children's Museum of Denver).	• Widening the highway would have potential impacts to five listed historic resources and seven eligible historic resources. • Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park). • Potential partial impact to one cultural institution (Children's Museum of Denver).	• Widening the highway would have potential impacts to five listed historic resources and seven eligible historic resources. • Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park), two of which are Section 6(f) properties. • Potential partial impact to one cultural institution (Children's Museum of Denver).
	3. Is right of way is required?	🟨	🟥	🟨	🟨
		• A moderate amount of right of way would be required to bring the corridor to standard.	• A large amount of right of way would be required when collector/distributor roads are constructed. • Two lanes in each direction with additional buffer space would be required.	• A moderate amount of right of way would be required to bring the corridor to standard and add braided ramps along I-25.	• A moderate amount of right of way would be required to bring the corridor to standard.

Table 7: Level 2 Evaluation Results for Family 2

Needs, Goals, and Objectives	Level 2 Question	Bring the Corridor to Standard	Add Collector/Distributor Roads	Add Braided Ramps	New Transit Facilities
Crossings of I-25 for bicyclists, pedestrians, transit riders, and local vehicle drivers	1. Does the concept support current and future bicycle and pedestrian connection needs across I-25?	☐	☐	☐	☐
		• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.
	2. Does the concept support current and future transit and vehicle connection needs across I-25?	☐	☐	☐	☐
		• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.
Future Flexibility and Technology	1. Could the concept accommodate future physical changes to the roadway (restriping, new lane assignments, new technology infrastructure, etc.)?	Yes	Yes	Yes	Yes
		• This concept would not preclude the implementation of future physical changes and new technology along the corridor.	• This concept would not preclude the implementation of future physical changes and new technology along the corridor.	• This concept would not preclude the implementation of future physical changes and new technology along the corridor.	• This concept would not preclude the implementation of future physical changes and new technology along the corridor.
Determination		Carried Forward	Carried Forward	Carried Forward	Carried Forward
Reasoning		This concept is not recommended as a primary treatment because its potential benefits to congestion and travel time reliability do not balance out the potential construction and environmental considerations. However, the concept of bringing the highway to standard is be incorporated into other concepts.	This concept is carried forward because its potential benefits to safety, congestion, and access likely balance its potential construction and environmental considerations.	This concept is carried forward because its potential benefits to safety, congestion, and access likely balance its potential construction and environmental considerations.	This concept is not recommended as a primary treatment because its potential benefits to congestion do not balance out the constructability considerations. However, the concept of providing transit improvements could be incorporated into other concepts.

Table 8: Level 2 Evaluation Results for Family 3

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (One)	Add Managed Lanes	Realign and Split the Corridor
Key Details		• One additional lane in each direction is added to the mainline freeway. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard.	• One additional lane in each direction is added to the mainline freeway. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard.	• One additional lane in each direction is added to the mainline freeway. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard.
Safety	1. Does the concept eliminate the height clearance issues that currently exist at the 23rd Avenue and Speer Boulevard bridges?	🟩	🟩	🟩
		• The concept would improve all three bridges.	• The concept would improve all three bridges.	• The concept would improve all three bridges.
	2. Does the concept provide the opportunity to address geometric deficiencies on the I-25 mainline and ramps?	🟨	🟨	🟨
		• This concept would address geometric deficiencies, such as shoulders, lane widths, necessary curve improvements, and sight distances. • This concept would not address the 17 identified ramp spacing deficiencies. • This concept would address 1 of the 11 acceleration/ deceleration lane deficiencies (NB I-25 on-ramp from Kalamath Street); the remaining acceleration/deceleration lane deficiencies are due to ramp spacing.	• This concept would address geometric deficiencies, such as shoulders, lane widths, necessary curve improvements, and sight distances. • This concept would not address the 17 identified ramp spacing deficiencies. • This concept would address 1 of the 11 acceleration/deceleration lane deficiencies (NB I-25 on-ramp from Kalamath Street); the remaining acceleration/deceleration lane deficiencies are due to ramp spacing.	• This concept would address geometric deficiencies, such as shoulders, lane widths, necessary curve improvements, and sight distances. • This concept would not address the 17 identified ramp spacing deficiencies. • This concept would address 1 of the 11 acceleration/ deceleration lane deficiencies (NB I-25 on-ramp from Kalamath Street); the remaining acceleration/deceleration lane deficiencies are due to ramp spacing.
	3. Does the concept accommodate incident management needs (improve emergency response, crash clearance, or queue clearance times)?	🟩	🟩	🟩
		• The concept would improve incident management needs with mainline shoulder widening throughout the I-25 Central corridor.	• The concept would improve incident management needs with mainline shoulder widening throughout the I-25 Central corridor.	• The concept would improve incident management needs with mainline shoulder widening throughout the I-25 Central corridor.
	4. Does the concept have the potential to reduce the likelihood of secondary crashes?	🟩	🟩	🟩
		• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.	• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.	• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.
	5. Does the concept reduce the number of conflict points on the I-25 mainline?	🟥	🟥	🟥
		• The concept would provide no reduction in the number of conflict points on the mainline freeway.	• The concept would provide no reduction in the number of conflict points on the mainline freeway • This concept has the potential to increase conflict points depending on where entrances and exits of the managed lanes are located.	• The concept would provide no or very little reduction in the number of conflict points on the mainline freeway.

Table 8: Level 2 Evaluation Results for Family 3

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (One)	Add Managed Lanes	Realign and Split the Corridor
Constructability	1. Does the concept have extraordinary construction and/or maintenance costs?	🟨	🟨	🟥
		• The concept likely would have a moderate cost as compared to other concepts due to the required acquisition of additional right of way.	• The concept likely would have a moderate cost as compared to other concepts due to the required acquisition of additional right of way. • Additional technology investment would be required to support the operations of the managed lanes.	• The concept likely would have a high cost as compared to other concepts due to the required acquisition of a large amount of new right of way.
	2. Does the concept require a substantial amount of coordination with other agencies or private land owners?	🟨	🟨	🟥
		• Due to the amount of required right of way, a moderate amount of coordination with other agencies and/or private land owners would be required.	• Due to the amount of required right of way, a moderate amount of coordination with other agencies and/or private land owners would be required.	• The concept likely would require extensive coordination with other agencies, including, but not limited to, utility owners, property owners, floodplain managers, and more. • Acquiring new right of way would require extensive coordination. • This concept would potentially avoid issues with the railroad.
Congestion	1. Does the concept increase the capacity of I-25?	🟩	🟩	🟩
		• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • Adding one additional general-purpose lane in each direction would increase capacity.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • A managed lane in each direction would increase capacity.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • Adding one additional general-purpose lane in each direction would increase capacity.
	2. Does the concept reduce turbulence on the mainline?	🟥	🟥	🟥
		• Improving the roadway geometrics would reduce turbulence at the NB I-25 on-ramp from the Alameda Avenue interchange because the acceleration lane would be brought to standard. • The remaining 10 locations with acceleration/deceleration lane length deficiencies would not be addressed because those deficiencies are a result of ramp spacing, which is not addressed in this concept.	• Improving the roadway geometrics would reduce turbulence at the NB I-25 on-ramp from the Alameda Avenue interchange because the acceleration lane would be brought to standard. • The remaining 10 locations with acceleration/deceleration lane length deficiencies would not be addressed because those deficiencies are a result of ramp spacing, which is not addressed in this concept. • Turbulence could potentially increase due to managed lane ingress and egress locations.	• Improving the roadway geometrics would reduce turbulence at the NB I-25 on-ramp from the Alameda Avenue interchange because the acceleration lane would be brought to standard. • The remaining 10 locations with acceleration/deceleration lane length deficiencies would not be addressed because those deficiencies are a result of ramp spacing, which is not addressed in this concept.
	3. Does the concept reduce the demand for the I-25 mainline (i.e., removing short trips)?	🟥	🟥	🟥
		• The concept would not reduce demand for the I-25 mainline.	• The concept would not reduce demand for the I-25 mainline.	• The concept would not reduce demand for the I-25 mainline.
Travel Time Reliability	1. Does the concept improve the flexibility of I-25 to respond to short-term variations in travel demand, such as sporting events?	🟨	🟨	🟨
		• The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.	• Through the use of variable pricing or other demand response management strategies (such as opening managed lanes for free during or directly after an incident), the concept would provide a moderate degree of flexibility to accommodate/respond to short-term variations in travel demand. • The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.	• The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.

Table 8: Level 2 Evaluation Results for Family 3

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (One)	Add Managed Lanes	Realign and Split the Corridor
Access	1. Do the concept's access locations adequately address current and future transportation needs of the surrounding land uses?	• The proposed access locations in this concept would not change existing access locations. • Existing access locations with geometric deficiencies and those locations where structures would be rebuilt to accommodate the additional highway width would be replaced. It is assumed that when they are replaced, they are designed in a manner which adequately accommodates future needs.	• The proposed access locations in this concept would not change existing access locations. • Existing access locations with geometric deficiencies and those locations where structures would be rebuilt to accommodate the additional highway width would be replaced. It is assumed that when they are replaced, they are designed in a manner which adequately accommodates future needs.	• The proposed access locations in this concept would not change existing access locations. • Existing access locations with geometric deficiencies and those locations where structures would be rebuilt to accommodate the additional highway width would be replaced. It is assumed that when they are replaced, they are designed in a manner which adequately accommodates future needs.
Environment	1. Are there impacts to the natural environment? • Water Quality • Air Quality • Noise • Biological • Floodplains	• Construction along the corridor will require the addition of water quality features, which likely will reduce the highway's impact to water quality. • Adding additional general-purpose lanes and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • This concept is likely to increase speeds on the corridor, which can increase noise pollution. Furthermore, bringing the corridor to standard and adding additional lanes may require the highway to be shifted closer to existing properties, which can have negative impacts on noise. • Widening the highway likely would have impacts to the South Platte River floodplain between approximately Santa Fe Drive/US 85 and US 6/6th Avenue.	• Construction along the corridor will require the addition of water quality features, which likely will reduce the highway's impact to water quality. • Adding additional general-purpose lanes and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • This concept is likely to increase speeds on the corridor, which can increase noise pollution. Furthermore, bringing the corridor to standard and adding additional lanes may require the highway to be shifted closer to existing properties, which can have negative impacts on noise. • Widening the highway likely would have impacts to the South Platte River floodplain between approximately Santa Fe Drive/US 85 and US 6/6th Avenue.	• Construction along the corridor will require the addition of water quality features, which likely will reduce the highway's impact to water quality. • Adding additional general-purpose lanes and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • This concept is likely to increase speeds on the corridor which can increase noise pollution. Furthermore, realigning the corridor between Alameda Avenue and US 6/6th Avenue will result in the highway being moved closer to existing properties, which can have negative impacts on noise. • Widening and realigning the highway will result in new construction within the South Platte River floodplain.
	2. Are there impacts to the social and built environment? • Historic • Parks & Recreation • Trails • Land Use	• Widening the highway would have potential impacts to five listed historic resources and seven eligible historic resources. • Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park). • Widening the highway would impact the South Platte River Trail between approximately US 6/6th Avenue and Ellsworth Avenue (approximately 0.5 mile). • Potential partial impact to one cultural institution (Children's Museum of Denver).	• Widening the highway would have potential impacts to five listed historic resources and seven eligible historic resources. • Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park). • Widening the highway would impact the South Platte River Trail between approximately US 6/6th Avenue and Ellsworth Avenue (approximately 0.5 mile). • Potential partial impact to one cultural institution (Children's Museum of Denver).	• Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park). • Widening the highway likely would substantially impact or remove one park (Valverde Park). • Widening the highway would impact the South Platte River Trail between approximately US 6/6th Avenue and Alameda Avenue (about 1 mile). • Realigning the highway could result in some property near the South Platte River (between approximately Alameda Avenue and US 6/6th Avenue) being repurposed for other, non-highway uses.

Table 8: Level 2 Evaluation Results for Family 3

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (One)	Add Managed Lanes	Realign and Split the Corridor
	3. Is right of way is required?	🟨	🟨	🟥
		• A moderate amount of right of way would be required to bring the corridor to standard and add one general-purpose lane in each direction.	• A moderate amount of right of way would be required to bring the corridor to standard and add one managed lane in each direction.	• A moderate amount of right of way would be required to bring the corridor to standard and add one general-purpose lane in each direction. • A large amount of new right of way would be required when the southbound lanes of I-25 are realigned between US 6/6th Avenue and Alameda Avenue.
Crossings of I-25 for bicyclists, pedestrians, transit riders, and local vehicle drivers	1. Does the concept support current and future bicycle and pedestrian connection needs across I-25?	🟨	🟨	🟨
		• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.
	2. Does the concept support current and future transit and vehicle connection needs across I-25?	🟨	🟨	🟨
		• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.
Future Flexibility and Technology	1. Could the concept accommodate future physical changes to the roadway (restriping, new lane assignments, new technology infrastructure, etc.)?	Yes	Yes	Yes
		• This concept would not preclude the implementation of future physical changes and new technology along the corridor.	• This concept would not preclude the implementation of future physical changes and new technology along the corridor.	• This concept would not preclude the implementation of future physical changes and new technology along the corridor.
Determination		Carried Forward	Carried Forward	Carried Forward
Reasoning		This concept is carried forward because its potential benefits to safety and congestion likely balance its potential construction and environmental considerations.	This concept is carried forward because its potential benefits to safety, congestion, and travel time reliability likely balance its potential construction and environmental considerations.	This concept is not recommended as a primary treatment because its potential benefits to safety and congestion do not balance out the required new right of way, construction, and environmental considerations. However, the concept of realigning smaller portions of the highway could be incorporated into other concepts.

Table 9: Level 2 Evaluation Results for Family 4

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (two)	Construct a Tunnel	Construct a Multi-Level Highway	Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines
Key Details		• Two additional lanes in each direction are added to the mainline freeway. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard.	• Two additional lanes in each direction are added within a new tunnel. • No geometric deficencies are fixed.	• Two additional lanes in each direction are added to the mainline freeway. • CD roads are added in areas where the highway is lowered. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard. **Assumption:** The entire I-25 mainline will be demolished and rebuilt in this concept.	• Two additional lanes in each direction are added to the mainline freeway. • All geometric deficencies, excluding ramp spacing issues, are fixed/brought to standard. • Additional transit capacity is added to RTD's light rail lines throughout the I-25 Central corridor.
Safety	1. Does the concept eliminate the height clearance issues that currently exist at the 23rd Avenue and Speer Boulevard bridges?	🟩	🟥	🟩	🟩
		• The concept would improve all three bridges.	• The concept would not improve any of the bridges.	• This concept would improve all three bridges.	• The concept would improve all three bridges.
	2. Does the concept provide the opportunity to address geometric deficiencies on the I-25 mainline and ramps?	🟨	🟥	🟩	🟩

		• This concept would address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
		• This concept would not address the 17 identified ramp spacing deficiencies.
		• This concept would address 1 of the 11 acceleration/deceleration lane deficiencies (NB I-25 on-ramp from Kalamath Street); the remaining acceleration/deceleration lane deficiencies are due to ramp spacing.
			• This concept would not address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
			• This concept would not address the 17 identified ramp spacing deficiencies.
			• This concept would not address the acceleration/deceleration lane deficiencies.
				• This concept would address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
				• This concept would address 17 of the 17 identified ramp spacing deficiencies.
				• The concept would address 11 of the 11 acceleration/deceleration lane deficiencies.
					• This concept would address geometric deficiencies such as shoulders, lane widths, necessary curve improvements, and sight distances.
					• This concept would **not** address the following 6 (of 17) identified ramp spacing deficiencies:
					  ○ I-25 NB, 17th Ave to 23rd Ave
					  ○ I-25 NB, 17th Ave Off to 17th Ave On
					  ○ I-25 NB, 23rd Ave to Speer Blvd
					  ○ I-25 NB, Speer Blvd to 20th St
					  ○ I-25 SB, 20th St to Speer Blvd
					  ○ Speer Blvd to I-25 SB
					• This concept would address the following 5 (of 11) acceleration/deceleration lane deficiencies:
					  ○ SB I-25 on-ramp from Zuni St
					  ○ NB I-25 off-ramp to 8th Ave
					  ○ NB I-25 on-ramp from 8th Ave
					  ○ NB I-25 off-ramp to EB Auraria Pkwy
					  ○ NB I-25 on-ramp from EB Colfax Ave

Table 9: Level 2 Evaluation Results for Family 4

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (two)	Construct a Tunnel	Construct a Multi-Level Highway	Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines
	3. Does the concept accommodate incident management needs (improve emergency response, crash clearance, or queue clearance times)?	🟩	🟥	🟩	🟩
		• The concept would accommodate incident management needs with mainline shoulder widening throughout the I-25 Central corridor.	• While the tunnel would accommodate incident management, the existing I-25 alignment would not undergo any of the needed improvements to better accommodate incident management. • Incident management within the tunnel would require additional emergency response coordination.	• The concept would accommodate incident management needs with mainline shoulder widening throughout the I-25 Central corridor.	• The concept would accommodate incident management needs with mainline shoulder widening throughout the I-25 Central corridor
	4. Does the concept have the potential to reduce the likelihood of secondary crashes?	🟩	🟥	🟩	🟩
		• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.	• The concept would not reduce secondary crashes.	• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.	• The addition of standard shoulders and mainline horizontal sight distance improvements throughout the I-25 Central corridor have the potential to reduce secondary crashes.
	5. Does the concept reduce the number of conflict points on the I-25 mainline?	🟥	🟥	🟩	🟨
		• The concept would not reduce the number of conflict points on the mainline freeway.	• The concept would not reduce the number of conflict points on the mainline freeway. • Some users will experience fewer conflict points if they are using the tunnel.	• The concept would provide a large reduction in the number of conflict points due to the installation of the frontage road.	• The concept would provide a moderate reduction in the number of conflict points on the mainline freeway since it would remove/reconfigure the southern portion of the existing highway.

Table 9: Level 2 Evaluation Results for Family 4

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (two)	Construct a Tunnel	Construct a Multi-Level Highway	Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines
Constructability	1. Does the concept have extraordinary construction and/or maintenance costs?	🟥	🟥	🟥	🟥
		• The concept likely would have a high cost as compared to other concepts due to the required additional right of way and reconstruction near the highway to add the two additional lanes in each direction.	• The concept likely would have a high cost as compared to other concepts due to: ○ A large amount of excavation ○ New structures ○ On-going maintenance and operations cost	• The concept likely would have a high cost as compared to other concepts due to: ○ Construction of a large structure ○ A large amount of excavation ○ Additional right of way ○ On-going maintenance costs	• The concept likely would have a high cost as compared to other concepts due to the required acquisition of a large amount of new right of way.
	2. Does the concept require a substantial amount of coordination with other agencies or private land owners?	🟨	🟥	🟥	🟥
		• Due to the amount of required right of way, a moderate amount of coordination with other agencies and/or private land owners would be required.	• The concept likely would require extensive coordination with other agencies, including, but not limited to, utility owners, property owners, floodplain managers, and more. • Acquiring new right of way and easements would require extensive coordination.	• The concept likely would require extensive coordination with other agencies, including, but not limited to, utility owners, property owners, floodplain managers, and more.	• The concept likely would require extensive coordination with other agencies, including, but not limited to, utility owners, property owners, and more. • Acquiring new right of way would require extensive coordination. • Providing transit improvements would require coordination with RTD.
Congestion	1. Does the concept increase the capacity of I-25?	🟩	🟩	🟩	🟩
		• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • Adding two additional general-purpose lanes in each direction would increase capacity.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • Adding two additional general-purpose lanes in each direction (via a tunnel) would increase capacity.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • Adding two additional general-purpose lanes in each direction would increase capacity. • Adding CD roads would increase capacity.	• Improving the roadway geometrics could improve traffic flow, allowing for a more ideal/optimal flow rate. • Adding two additional general-purpose lanes in each direction would increase capacity.
	2. Does the concept reduce turbulence on the mainline?	🟥	🟥	🟩	🟨
		• Improving the roadway geometrics would reduce turbulence at the NB I-25 on-ramp from the Alameda Avenue interchange because the acceleration lane would be brought to standard. • The remaining 10 locations with acceleration/ deceleration lane length deficiencies would not be addressed because those deficiencies are a result of ramp spacing, which is not addressed in this concept.	• Turbulence, such as weaving and merging, would not be improved on the I-25 mainline. • Some drivers will experience less turbulence if they use the tunnel due to the reduced number of conflict points.	• Turbulence would be reduced by improving all 17 ramp spacing deficiencies, all 11 acceleration/ deceleration lane length deficiencies, and constructing the frontage road, which would eliminate a number of conflict points.	• Realigning a portion of the highway would eliminate 5 of the 11 acceleration/deceleration lane length deficiencies. This would be the result of reconstructing the 8th Avenue and Colfax Avenue interchanges.

Table 9: Level 2 Evaluation Results for Family 4

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (two)	Construct a Tunnel	Construct a Multi-Level Highway	Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines
	3. Does the concept reduce the demand for the I-25 mainline (i.e., removing short trips)?	🟥	🟨	🟥	🟨
		• The concept would not reduce demand for the I-25 mainline.	• The concept would not reduce local demand for the I-25 mainline. • Through traffic would be removed from the mainline and carried along the corridor via a tunnel, thereby reducing the overall demand for the at-grade facility.	• The concept would not reduce demand for the I-25 mainline.	• The concept would moderately reduce demand for the I-25 mainline due to the increased capacity of the RTD light rail lines, which could encourage mode shift away from driving the I-25 Central corridor.
Travel Time Reliability	1. Does the concept improve the flexibility of I-25 to respond to short-term variations in travel demand, such as sporting events?	🟨	🟥	🟨	🟨
		• The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.	• The concept would not provide flexibility to accommodate/respond to short-term variations in travel demand.	• The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.	• Transit facilities would offer a guaranteed travel time but would not actually improve the travel time reliability on I-25. • The concept would provide full shoulders throughout the corridor, which would reduce the impact of crashes on travel times.
Access	1. Do the concept's access locations adequately address current and future transportation needs of the surrounding land uses?	🟨	🟥	🟨	🟨
		• The proposed access locations in this concept would not change existing access locations. • Existing access locations with geometric deficiencies and those locations where structures would be rebuilt to accommodate the additional highway width would be replaced. It is assumed that, when they are replaced, they are designed in a manner which adequately accommodates future needs.	• There would be no changes to the location of accesses. • Existing access locations/configurations likely will not be adequate to accommodate future volumes. • This concept does not address potential changes in access needs as a result of planned development along the corridor.	• The proposed access locations in this concept would not change existing access locations. • Existing access locations with geometric deficiencies and those locations where structures would be rebuilt to accommodate the additional highway width would be replaced. It is assumed that, when they are replaced, they are designed in a manner which adequately accommodates future needs.	• Realigning the highway would move it approximately 0.5 miles east of its current location. This would increase the distance traveled for some users and reduce it for others. • Existing access locations with geometric deficiencies and those locations where structures would be rebuilt to accommodate the additional highway width would be replaced. It is assumed that, when they are replaced, they are designed in a manner which adequately accommodates future needs.

Table 9: Level 2 Evaluation Results for Family 4

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (two)	Construct a Tunnel	Construct a Multi-Level Highway	Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines
Environment	1. Are there impacts to the natural environment? • Water Quality • Air Quality • Noise • Biological • Floodplains	🟨	🟨	🟨	🟨
		• Construction along the corridor will require the addition of water quality features, which likely will reduce the highway's impact to water quality. • Adding additional general-purpose lanes and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • This concept is likely to increase speeds on the corridor, which can increase noise pollution. Furthermore, bringing the corridor to standard and adding additional lanes may require the highway to be shifted closer to existing properties, which can have negative impacts on noise. • Widening the highway likely would have impacts to the South Platte River floodplain between approximately Santa Fe Drive/US 85 and US 6/6th Avenue.	• Construction along the corridor will require the addition of water quality features, which likely will reduce the highway's impact to water quality. • Adding additional lanes will increase speeds and reduce congestion, which could have positive effects on air quality. However, these benefits could be offset by a concentration of vehicle emissions near the tunnel's entrance/exit, and the addition of any ventilation exhausts. • This concept is likely to increase speeds on the corridor. which can increase noise pollution. However, some traffic will be moved below ground and would not add to the noise pollution on the surface.	• Construction along the corridor will require the addition of water quality features, which likely will reduce the highway's impact to water quality. • Adding additional general-purpose lanes and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • Constructing a multi-level highway could have both positive and negative impacts to noise. In locations where the highway is lowered below ground level, noise pollution may be reduced. However, in locations where the highway is elevated, noise pollution may increase. • Providing a multi-level highway between Alameda Avenue and US 6/6th Avenue would allow the highway to be expanded without impacting the South Platte River floodplain.	• Construction along the corridor will require the addition of water quality features, which likely will reduce the highway's impact to water quality. • Adding additional general-purpose lanes and bringing the corridor to standard will increase speeds and reduce congestion. In turn, this will have positive effects on air quality. • This concept is likely to increase speeds on the corridor, which can increase noise pollution. Furthermore, realigning the corridor between Alameda Avenue and US 6/6th Avenue will result in the highway being moved closer to existing properties, which likely will increase negative impacts on noise. • Moving the highway away from the South Platte River will remove it from the floodplain.
	2. Are there impacts to the social and built environment? • Historic • Parks & Recreation • Trails • Land Use	🟨	🟩	🟨	🟨
		• Widening the highway would have potential impacts to five listed historic resources and seven eligible historic resources. • Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park). • Widening the highway would impact the South Platte River Trail between approximately US 6/6th Avenue and Ellsworth Avenue (approximately 0.5 mile). • Potential partial impact to one cultural institution (Children's Museum of Denver).	• The concept would have minor or no impacts to the social or built environment.	• Widening the highway would have potential impacts to five listed historic resources and seven eligible historic resources. • Widening the highway would partially impact four parks (Gates Crescent Park, Frog Hollow Park, Phil Milstein Park, and Johnson Habitat Park). • Widening the highway would impact the South Platte River Trail between approximately US 6/6th Avenue and Ellsworth Avenue (approximately 0.5 miles). • A viaduct could create visual barriers to residents and businesses. • Potential partial impact to one cultural institution (Children's Museum of Denver).	• Widening the highway would cause impacts to approximately 10 listed or eligible historic resources between US 6/6th Avenue and 10th Avenue; context around these historic resources would change. • Widening the highway would partially impact a local historic landmark near 10th Avenue. • Widening the highway likely would impact one park (Gates Crescent Park). • Potential partial impact to one cultural institution (Children's Museum of Denver). • Realigning the highway could result in some property near the South Platte River (between approximately Alameda Avenue and US 6/6th Avenue) being repurposed to other, non-highway uses.
	3. Is right of way is required?	🟥	🟩	🟨	🟥
		• A large amount of right of way would be required when two general-purpose lanes are added.	• A limited amount of additional right of way would be required to facilitate the transition between the below-ground and ground-level infrastructure.	• A moderate amount of right of way would be required to accommodate lowered sections of the highway where frontage roads would be added. • No or limited right of way would be required where a viaduct is added.	• A large amount of new right of way would be required when I-25 is realigned adjacent to the RTD corridor.

Table 9: Level 2 Evaluation Results for Family 4

Needs, Goals, and Objectives	Level 2 Question	Add General-Purpose Lanes (two)	Construct a Tunnel	Construct a Multi-Level Highway	Realign Adjacent to RTD C, D, E, F, & H Light Rail Lines
Crossings of I-25 for bicyclists, pedestrians, transit riders, and local vehicle drivers	1. Does the concept support current and future bicycle and pedestrian connection needs across I-25?	🟨	🟩	🟥	🟨
		• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would have the smallest highway width, making it easier to provide additional crossings over I-25.	• In areas where the highway is double-decked (on a viaduct), it would be difficult to provide additional crossings over the highway.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.
	2. Does the concept support current and future transit and vehicle connection needs across I-25?	🟨	🟩	🟥	🟨
		• This concept would maintain all existing crossings and not preclude the addition of new crossings.	• This concept would have the smallest highway width, making it easier to provide additional crossings over I-25.	• In areas where the highway is double-decked (on a viaduct), it would be difficult to provide additional crossings over the highway.	• This concept would maintain all existing crossings and not preclude the addition of new crossings.
Future Flexibility and Technology	1. Could the concept accommodate future physical changes to the roadway (restriping, new lane assignments, new technology infrastructure, etc.)?	Yes	Yes	Yes	Yes
		This concept would not preclude the implementation of future physical changes and new technology along the corridor.	This concept would not preclude the implementation of future physical changes and new technology along the corridor.	This concept would not preclude the implementation of future physical changes and new technology along the corridor.	This concept would not preclude the implementation of future physical changes and new technology along the corridor.
Determination		Carried Forward	Eliminated	Carried Forward	Carried Forward
Reasoning		This concept is carried forward as a primary treatment because its potential benefits to safety and congestion likely balance its potential construction and environmental considerations.	This concept is considered infeasible at this time due to the extreme construction, operations, and maintenance costs of building and operating a tunnel of this length.	This concept is not recommended as a primary treatment because its potential benefits to safety and congestion do not balance out the construction and environmental considerations. However, the concept of having smaller portions of the highway in a multi-level configuration could be incorporated into other concepts.	This concept is not recommended as a primary treatment because its potential benefits to safety and congestion do not balance out the construction and environmental considerations. However, the concept of realigning smaller portions of the highway could be incorporated into other concepts.

5. Level 3

The Level 3 evaluation represented the final, most-detailed round of analysis and was focused on understanding the specific benefits and trade-offs different improvement options may have. This chapter describes the alternatives evaluated in Level 3 and documents their specific benefits, trade-offs, and considerations.

5.1. Level 3 Concepts Considered

Following the conclusion of the Level 2 evaluation process, concepts being carried forward were reviewed and packaged into corridor alternatives. These alternatives were created to test and evaluate a wide range of potential solutions/combinations of improvements. It is important to note that the alternatives presented in this chapter are not intended to be standalone alternatives ready for immediate implementation. Instead, they are a representative sample of a range of improvements. Their evaluation and considerations should be used to further guide development of more refined alternatives in future planning studies.

Based on this desire to have a set of potential improvements that represent a wide range of possibilities/opportunities, four alternatives were evaluated in Level 3. These include:

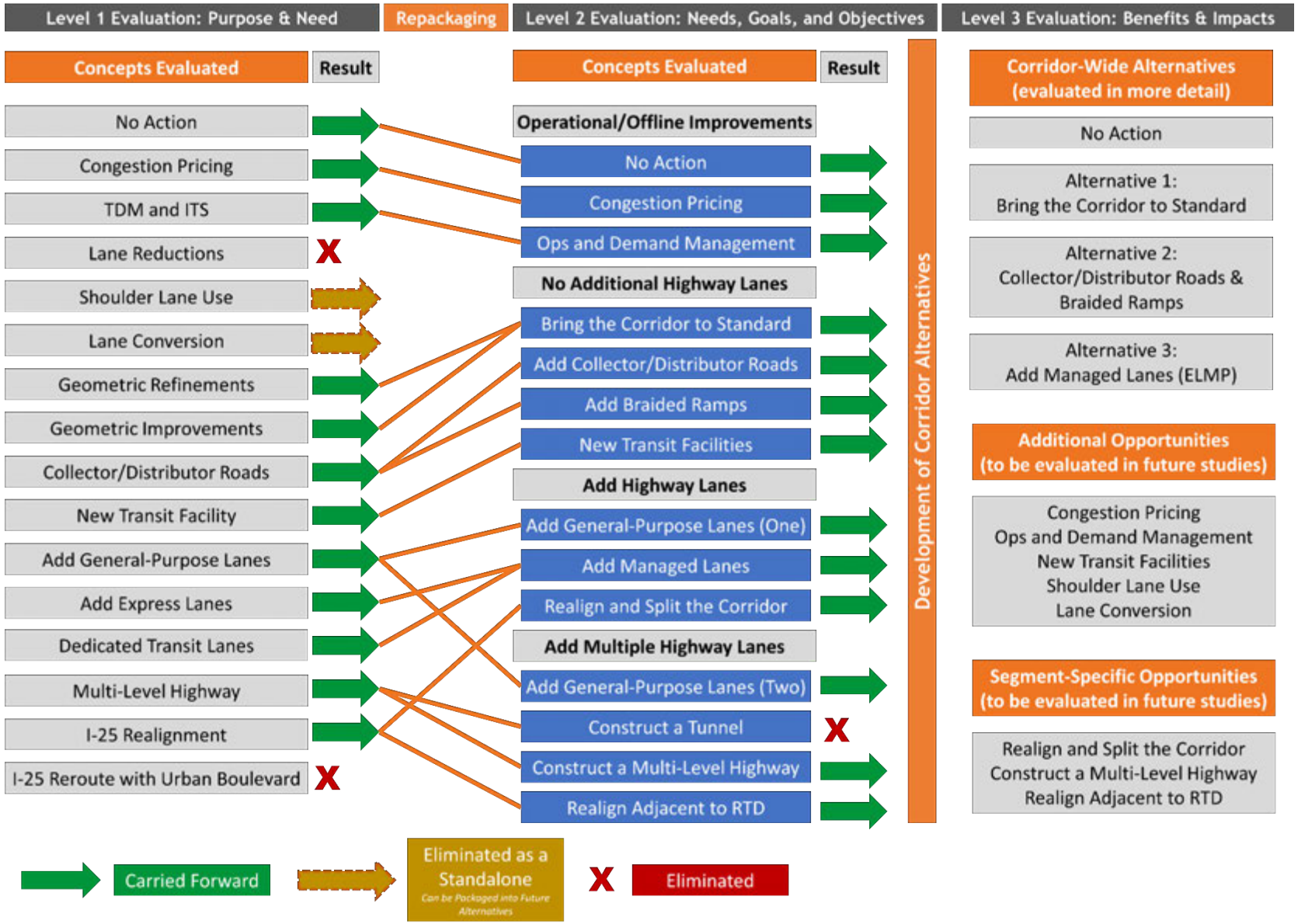
1. No Action Alternative
2. Bring the Corridor to Standard Alternative
3. Collector/Distributor Roads and Braided Ramps Alternative
4. Managed Lanes Alternative

Figure 16 shows the progression of alternative concepts from the Level 1 and Level 2 evaluations to the alternatives evaluated in Level 3. The following sections describe each of these alternatives in detail and include a discussion of the evaluation results.

It is important to note that not all elements carried forward from the Level 2 evaluation process were evaluated in more detail in Level 3. This is because some of those improvements—such as TDM and ITS improvements—should be applied to all build alternatives regardless of their configuration. Additionally, some improvements—such as congestion pricing—could be implemented in a large number of ways, each of which would have a different outcome. This variation and uncertainty for these types of improvements means that analyzing them in any detail in this type of study likely would not result in any meaningful outcomes.

All concepts carried forward from the Level 2 evaluation are still recommended to be evaluated/considered in future studies regardless of if they are specifically packaged into one of the identified Level 3 alternatives or not. For many of these improvements, this mean future NEPA studies; however, some of the larger-scale policy decisions should be evaluated in their own study outside of a project-specific study.

Figure 16: Alternative Concept Progression



5.1.1. No Action Alternative

The No Action Alternative represents the baseline condition against which all other alternatives were compared. This alternative was formulated around the scenario in which no improvements are made to I-25 Central. It is important to note that, although this alternative assumes no improvements are made to I-25 Central, it does assume that other planned improvements—as identified in DRCOG's 2040 Fiscally Constrained Regional Transportation Plan (DRCOG, 2015)—are made to the surrounding roadway network. These improvements are listed below. Figure 17 provides an overview of this alternative.

- Reconfiguration of the Broadway & I-25 interchange
- Improvements to I-70 east of I-25 as part of the Central 70 project
- Lane reductions on Broadway between Cherry Creek and approximately I-25 to implement a two-way protected bicycle track
- Additional travel lanes on Federal Boulevard between 7th Avenue and West Holden Place
- Lane reductions on Colfax Avenue between approximately 15th Street and Grant Street to implement the Colfax BRT project
- Additional travel lanes on Washington Street between approximately I-70 and 58th Avenue; this project may be amended in the near future based on more recent planning completed by Denver
- Reconfiguration of the Alameda Avenue bridge over the South Platte River and the surrounding intersections

Figure 17: No Action Alternative

5.1.2. Bring the Corridor to Standard Alternative

Much of the existing I-25 corridor has substandard geometric elements, including shoulder widths, roadway curvature, stopping sight distance, and ramp spacing. The Bring the Corridor to Standard Alternative proposes to address the defined deficiencies identified in the *I-25 Central Existing Conditions Assessment Report* by providing all necessary geometric improvements to the highway to meet current engineering design standards for FHWA controlling criteria. Figure 18 and Figure 19 provide an overview of this alternative.

The prevailing section of this alternative is four general-purpose lanes, not including acceleration and deceleration lanes, with full-width inside and outside shoulders in each direction. In addition to the transportation network changes in the No Action Alternative, improvements provided in this alternative include:

- Full-width inside and outside shoulders on the mainline
- Standard width travel lanes
- Sufficient stopping sight distance
- Increased space between interstate access locations
- Standard acceleration and deceleration lanes at all ramps
- Revision of the mainline alignment to reduce curves on I-25
- Reconstruction of bridge structures to address height clearance issues and accommodate the widening of I-25

5.1.2.1. 20th Street to Colfax Avenue

To meet standard spacing requirements, the 20th Street and Speer Boulevard interchanges are modified to create a split diamond interchange configuration in the southbound direction. In the existing conditions, vehicles entering southbound I-25 from 20th Street use the 20th Street on-ramp and have direct access to the freeway. However, in this alternative, vehicles entering southbound I-25 from 20th Street will use a dedicated ramp that continues through to Speer Boulevard, entering I-25 south of Speer Boulevard. This proposed configuration provides adequate weave distance between interchange ramps, providing a safer facility. The on-ramp from 20th Street merges with the Speer Boulevard exit ramp. The existing braid between the Speer Boulevard entrance ramp onto I-25 and the I-25 exit ramp to 23rd Avenue is maintained. Northbound, the existing configuration between Speer Boulevard and 20th Street is largely maintained. Vehicles entering onto I-25 from 23rd Avenue will use a dedicated ramp that continues through to Speer Boulevard, entering I-25 north of Speer Boulevard. Exits from I-25 to 23rd Avenue and Speer Boulevard remain.

In this alternative, access to and from I-25 and 17th Avenue is proposed to be closed. Closing the 17th Avenue ramps will permit adequate and safe weaving distances on I-25 between 23rd Avenue and Colfax Avenue. Temporary access at 17th Avenue could be permitted for special events.

5.1.2.2. Colfax Avenue to US 6/6th Avenue

Within this area, the 8th Avenue access is proposed to be closed to provide adequate and safe weaving distance between US 6/6th Avenue and Colfax Avenue/Auraria Parkway. Closing the 8th Avenue ramps will both improve ramp spacing and allow for continuous, additional auxiliary lanes between US 6/6th Avenue and Colfax Avenue/Auraria Parkway in both the northbound and southbound directions, improving operations and safety. All other connections for Colfax Avenue and US 6/6th Avenue remain unchanged.

Figure 18: Bring the Corridor to Standard Alternative

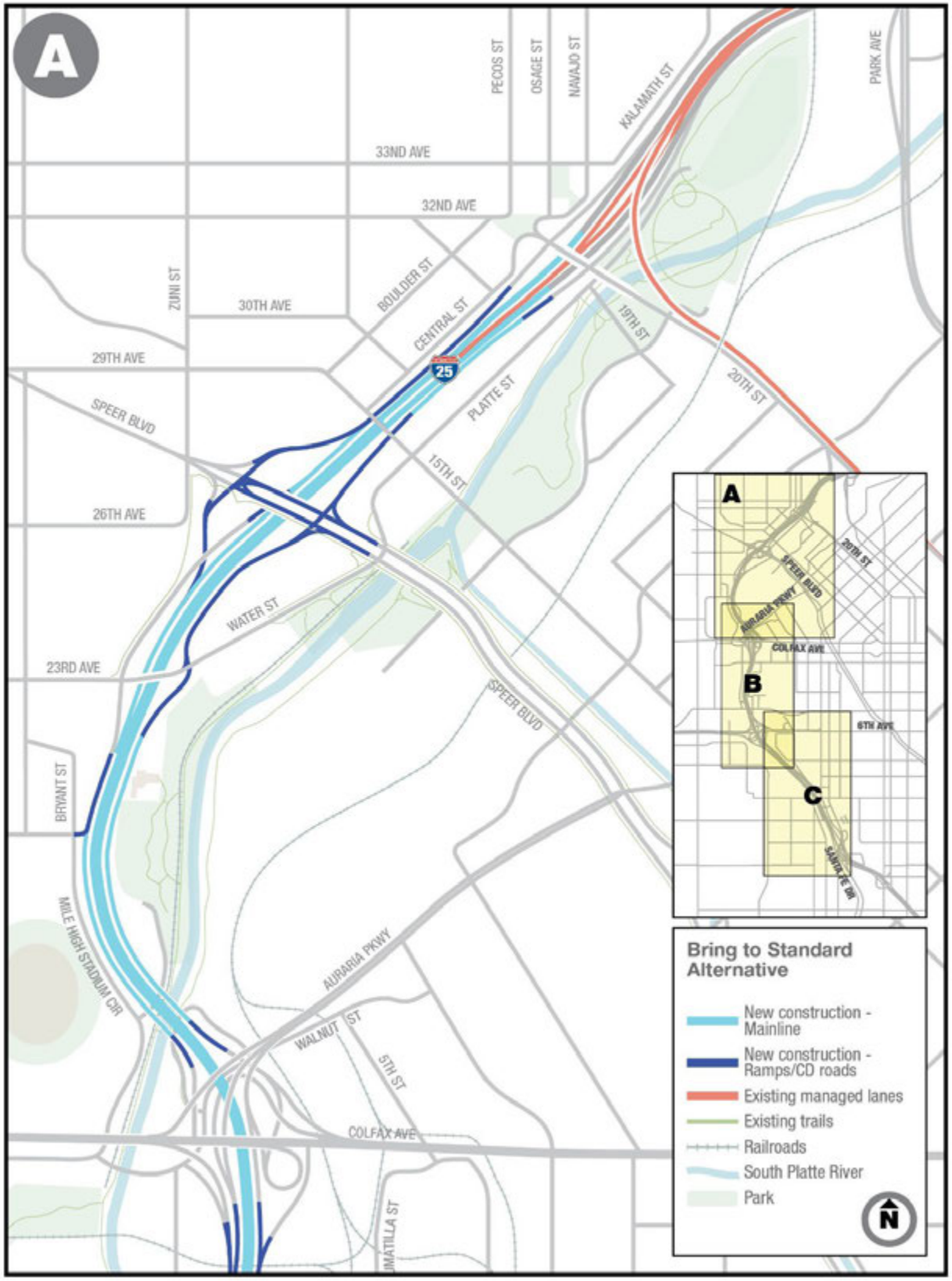
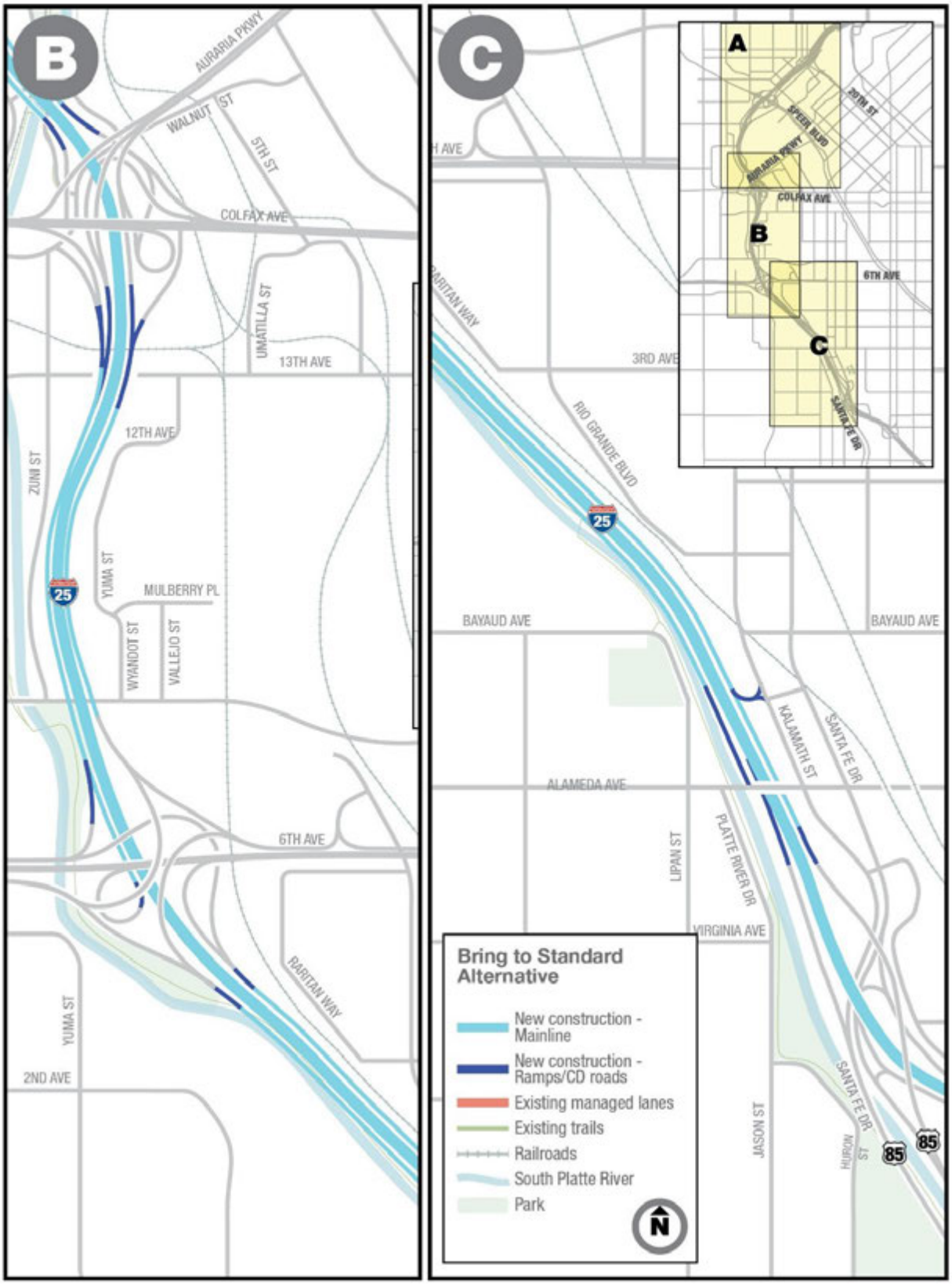


Figure 19: Bring the Corridor to Standard Alternative (Continued)



5.1.2.3. US 6/6th Avenue to Santa Fe Drive/US 85

Between US 6/6th Avenue and Santa Fe Drive/US 85, most access and ramp configurations remain unchanged. The exception to this is the northbound on-ramp from Kalamath Street. This alternative proposes to extend the acceleration lane at this on-ramp to improve safety and reduce congestion. Furthermore, the existing highway is proposed to be slightly realigned to reduce the number and sharpness of curves.

5.1.3. Collector/Distributor Roads and Braided Ramps Alternative

The Collector/Distributor Roads and Braided Ramps Alternative includes all geometric improvements (e.g., shoulder width, mainline alignment, etc.) proposed in the Bring the Corridor to Standard Alternative and proposes new CD roads to be constructed along each side of I-25 from 20th Street to Santa Fe Drive/US 85 in conjunction with braided ramps to allow for management of access to/from I-25. To alleviate the operational and safety issues throughout the corridor, CD roads are proposed to shift vehicle weaving operations onto the lower-speed CD facilities and off the mainline freeway. The CD roads will maintain connections to the local network and have intermittent direct access to the mainline freeway. With the consolidation of interstate access and use of the CD roads for local network connectivity, the necessary spacing of interchanges can be provided on I-25—permitting safer weaving, acceleration, and deceleration distance between on- and off-ramps.

Additionally, braided ramps will be implemented throughout the corridor to separate conflicting movements on I-25. Braided ramps are grade-separated ramps that construct an exit ramp over an entrance ramp (or vice versa). Ramp braiding at specific locations enhances the network by avoiding weaving conflicts where major traffic flows might intersect.

The prevailing cross section of I-25 is four general-purpose lanes, not including acceleration and deceleration lanes, with standard inside and outside shoulders in each direction. Figure 20 and Figure 21 provide an overview of this alternative.

5.1.3.1. 20th Street to Colfax Avenue

Improvements in the southbound direction begin under 20th Street with an exit ramp from I-25 onto a proposed CD road system. The southbound CD road merges with the existing entrance ramp from 20th Street and extends to approximately 17th Avenue. This CD road would serve access to/from Speer Boulevard and 23rd Avenue. The existing braided ramp between the southbound on-ramp from Speer Boulevard and the northbound off-ramp to 23rd Avenue would remain. An additional braid and slip ramp would be provided at the terminus of this CD road. The braid would allow traffic from the CD road going to the southbound I-25 mainline to go over mainline traffic exiting to the next CD road (from Colfax Avenue to US 6/6th Avenue). The slip ramp would provide a direct connection from the 20th Street/Speer Boulevard/23rd Avenue CD road to the next CD road to the south (from Colfax Avenue to US 6/6th Avenue).

In the northbound direction at Colfax Avenue, traffic on I-25 exiting to 23rd Avenue, Speer Boulevard, and 20th Street would exit to a proposed CD road. This new CD road would merge with the existing northbound entrance ramp from 17th Avenue and would continue north to 20th Street. The CD road would serve access to/from 17th Avenue (on-ramp traffic only), 23rd Avenue, Speer Boulevard, and 20th Street—while eliminating the short and unsafe weave distances along I-25 that currently exist. The exit ramp onto this CD road would be braided with the Colfax Avenue northbound entrance ramp. A braided ramp also is proposed at the Speer Boulevard northbound entrance ramp and the CD road connection to 20th street.

Figure 20: Collector/Distributor Roads and Braided Ramps Alternative

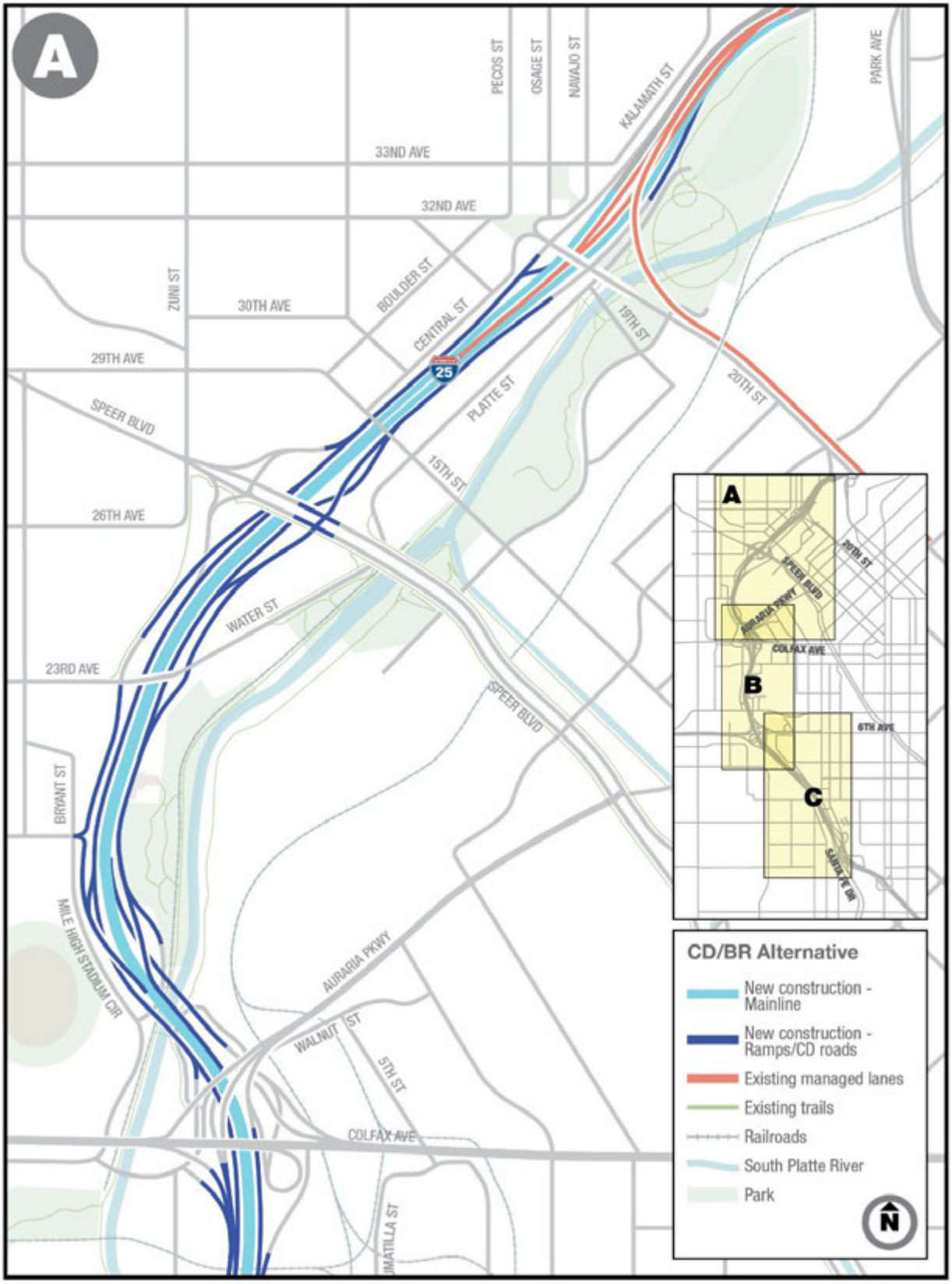
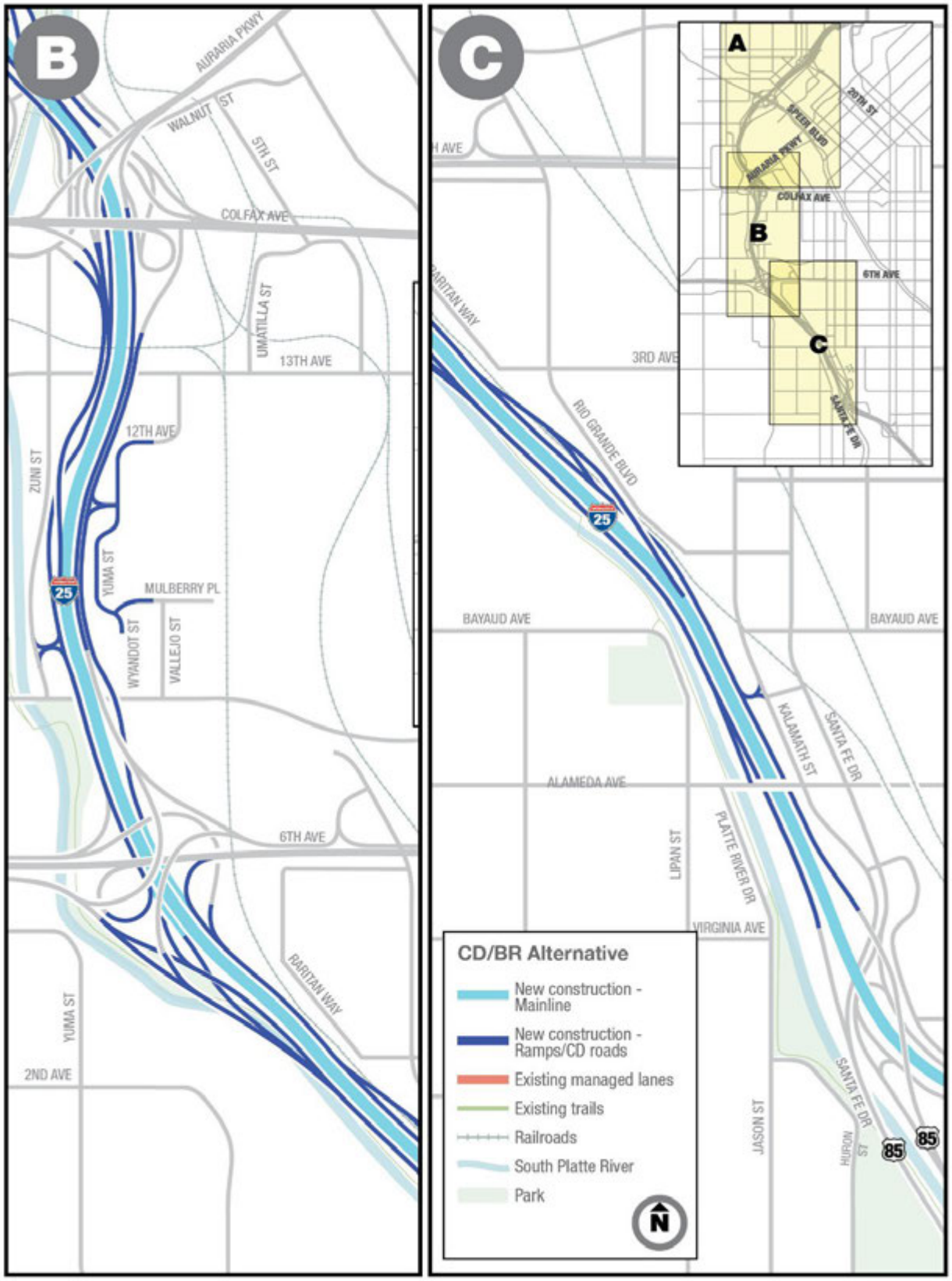


Figure 21: Collector/Distributor Roads and Braided Ramps Alternative (Continued)



5.1.3.2. Colfax Avenue to US 6/6th Avenue

In this alternative, the southbound exit from I-25 to Colfax Avenue is combined with a proposed CD road, which is developed just north of Colfax Avenue and would extend to US 6/6th Avenue. This CD road would serve access to/from I-25 and Colfax Avenue, Auraria Parkway, Lower Colfax Avenue, 8th Avenue, and US 6/6th Avenue. Due to geometric constraints, access to/from some of the local roadways to southbound I-25 and US 6/6th Avenue would be restricted.

- From westbound Colfax Avenue and Auraria Parkway, full access would be provided to all facilities. This would be accomplished by providing both access to the southbound CD road and by providing an additional braided ramp over the CD road directly to southbound I-25.
- From eastbound Colfax Avenue, Lower Colfax Avenue access would be restricted to only southbound I-25 via the same braided ramp used by westbound Colfax Avenue and Auraria Parkway. No access from these facilities would be provided to US 6/6th Avenue.
- From 8th Avenue, access would be restricted to only US 6/6th Avenue. No access would be provided from 8th Avenue to southbound I-25.

Traveling northbound through this area, a new CD road would be constructed starting from approximately US 6/6th Avenue and extending to Colfax Avenue/Auraria Parkway. Coming from I-25, one of the four lanes of traffic would be forced to exit to the CD road and go under the on-ramps from US 6/6th Avenue. From US 6/6th Avenue, drivers would braid over the new CD road and would have a choice to either enter the CD road—to go to 8th Avenue, Colfax Avenue, or Auraria Parkway—or to enter the I-25 northbound mainline. The US 6/6th Avenue on-ramp to the northbound mainline freeway would come on as an add lane and replace the drop lane that was forced to exit to the CD road.

Traffic within this northbound CD road would have access to 8th Avenue, Colfax Avenue, and Auraria Parkway. Past the Auraria Parkway exit, the CD road would merge back into the mainline freeway. This allows for on-ramp traffic from 8th Avenue to access northbound I-25.

5.1.3.3. US 6/6th Avenue to Santa Fe Drive/US 85

The proposed southbound CD road system between US 6/6th Avenue and Santa Fe Drive/US 85 would begin at US 6/6th Avenue. Here, traffic from southbound I-25 would exit into a new CD road and braid underneath the US 6/6th Avenue on-ramps to southbound I-25. Traffic coming from US 6/6th Avenue to southbound I-25 would have the option to either enter the new CD road—to go to Alameda Avenue or Santa Fe Drive/US 85—or to directly enter southbound I-25. Following the merge from US 6/6th Avenue traffic, the CD road would extend south to serve the Alameda Avenue off-ramp before terminating at the Santa Fe Drive/US 85 exit.

Traveling northbound, the existing on-ramp from Santa Fe Drive/US 85 would lead directly into a new CD road. Traffic from the Kalamath Street on-ramp then would merge into this CD road and travel north toward US 6/6th Avenue. Following the merge with the Kalamath Street on-ramp traffic, the CD road would split, with one part going to the I-25 mainline and one part continuing north to the US 6/6th Avenue ramps. Traffic from the CD road going to the northbound I-25 mainline would braid over traffic from the mainline freeway exiting to US 6/6th Avenue. This exiting traffic then would merge with the remaining traffic in the CD road to US 6/6th Avenue. The northbound CD road would terminate at the US 6/6th Avenue off-ramps.

5.1.4. Managed Lanes Alternative

The Managed Lanes Alternative proposes adding a new managed lane in each direction along I-25, consistent with the HPTE *Express Lanes Master Plan* (CDOT/HPTE, 2020). The managed lanes would extend from Santa Fe Drive/US 85 to the existing reversible managed lanes north of 20th Street. New

direct connection ramps between the proposed managed lanes crossing roadway facilities would be at the following locations:

- From eastbound and westbound US 6/6th Avenue to the northbound I-25 managed lanes
- From the northbound I-25 managed lanes to Colfax Avenue
- From the northbound I-25 managed lanes to Auraria Parkway
- From Speer Boulevard to/from the managed lanes to the north (this direct connection ramp was assumed to be reversible, serving southbound off-ramp traffic during the AM peak period and northbound on-ramp traffic during the PM peak period)
- From Auraria Parkway to the southbound I-25 managed lanes

Note that this alternative is predicated on the assumption that the existing, reversible managed lanes between US 36 and 20th Street will be converted to serve bi-directional traffic all day long. This conversion is based on the preliminary outcomes of HPTE's *Express Lanes Master Plan* (CDOT/HPTE, 2020).

In addition to the new managed lanes, this alternative also would include all other improvements identified in the Bring the Corridor to Standard Alternative. The only location where the Managed Lanes Alternative is geometrically different from the Bring the Corridor to Standard Alternative would be northbound between 23rd Avenue and 20th Street. In this area, the Managed Lanes alternative would use the same geometric configuration identified in the Collector/Distributor Roads and Braided Ramps Alternative.

Although this alternative's defining characteristic in the implementation of managed lanes, it should be noted that this alternative is intended to more generally reflect the potential impacts of overall increased capacity on I-25. This capacity could be achieved through either the implementation of managed lanes and/or the implementation of general-purpose lanes. For the purpose of the PEL study, it was decided to evaluate and model a managed lanes configuration instead of a general-purpose lanes configuration because (1) this configuration is consistent with the recommendations made in the *Express Lanes Master Plan* (CDOT/HPTE, 2020), and (2) this configuration is most consistent with current CDOT policy and highway trends in Colorado. Additional discussion about the potential ramifications of this decision is included in Attachment C, *Traffic and Safety Technical Report,* of the *I-25 Central PEL Study Report*.

The specific layout evaluated in this alternative also only includes the addition of a single travel lane in each direction. Although it is possible that more than one additional lane could be added to I-25, it was decided to evaluate only a single additional lane due to the identified space constraints within the corridor. This decision and its potential impacts to the overall outcomes of the PEL were evaluated using the DRCOG TDM. The results and discussion of this analysis is document in the *I-25 Central Traffic Forecasting Technical Memorandum,* which is included in Attachment A, *Existing Conditions Assessment Report*.

The prevailing cross-section of the Managed Lanes Alternative would be four general-purpose lanes and one managed lane with inside and outside shoulders in each direction. Figure 22 and Figure 23 provide an overview of this alternative.

Figure 22: Managed Lanes Alternative

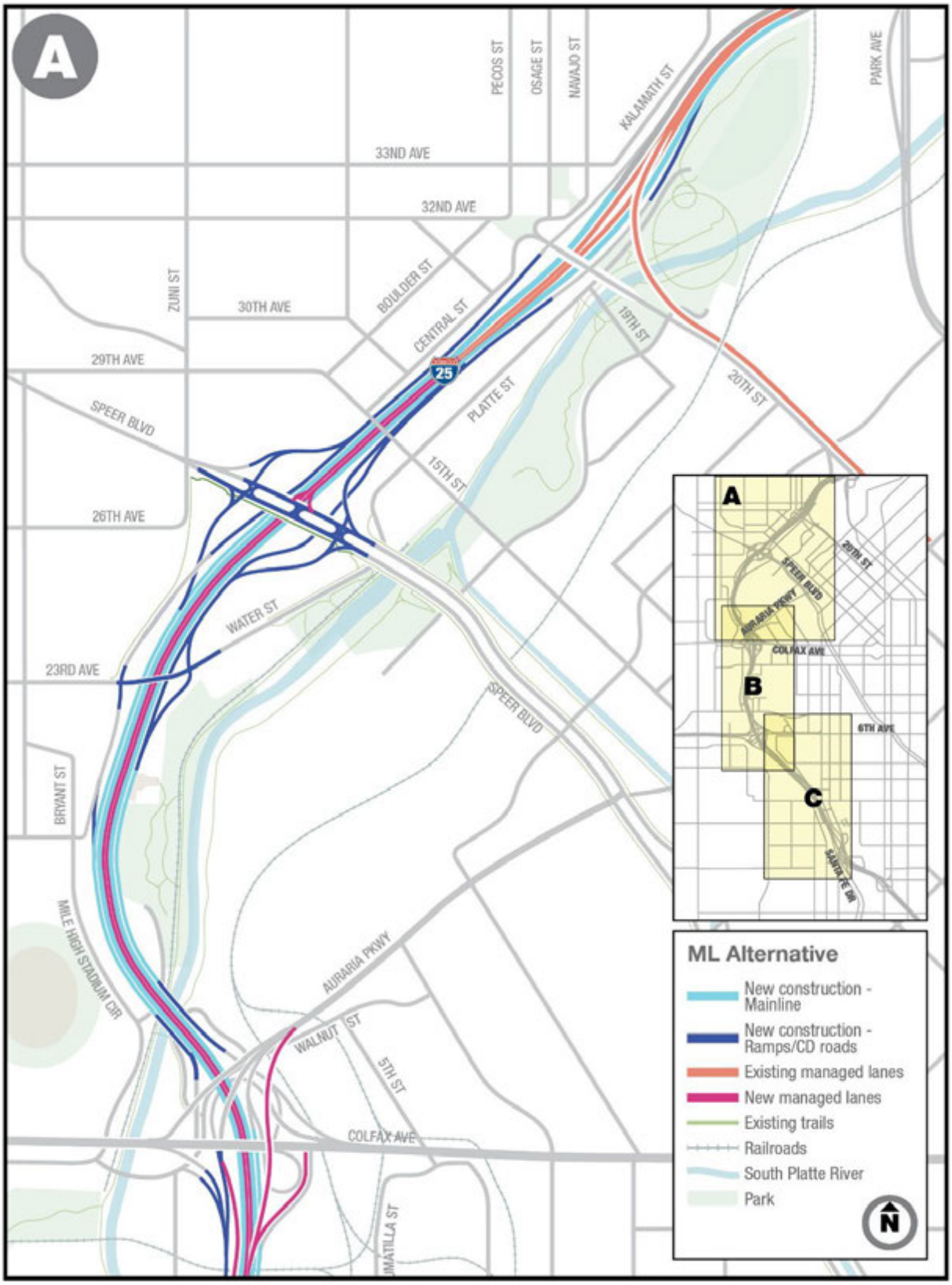
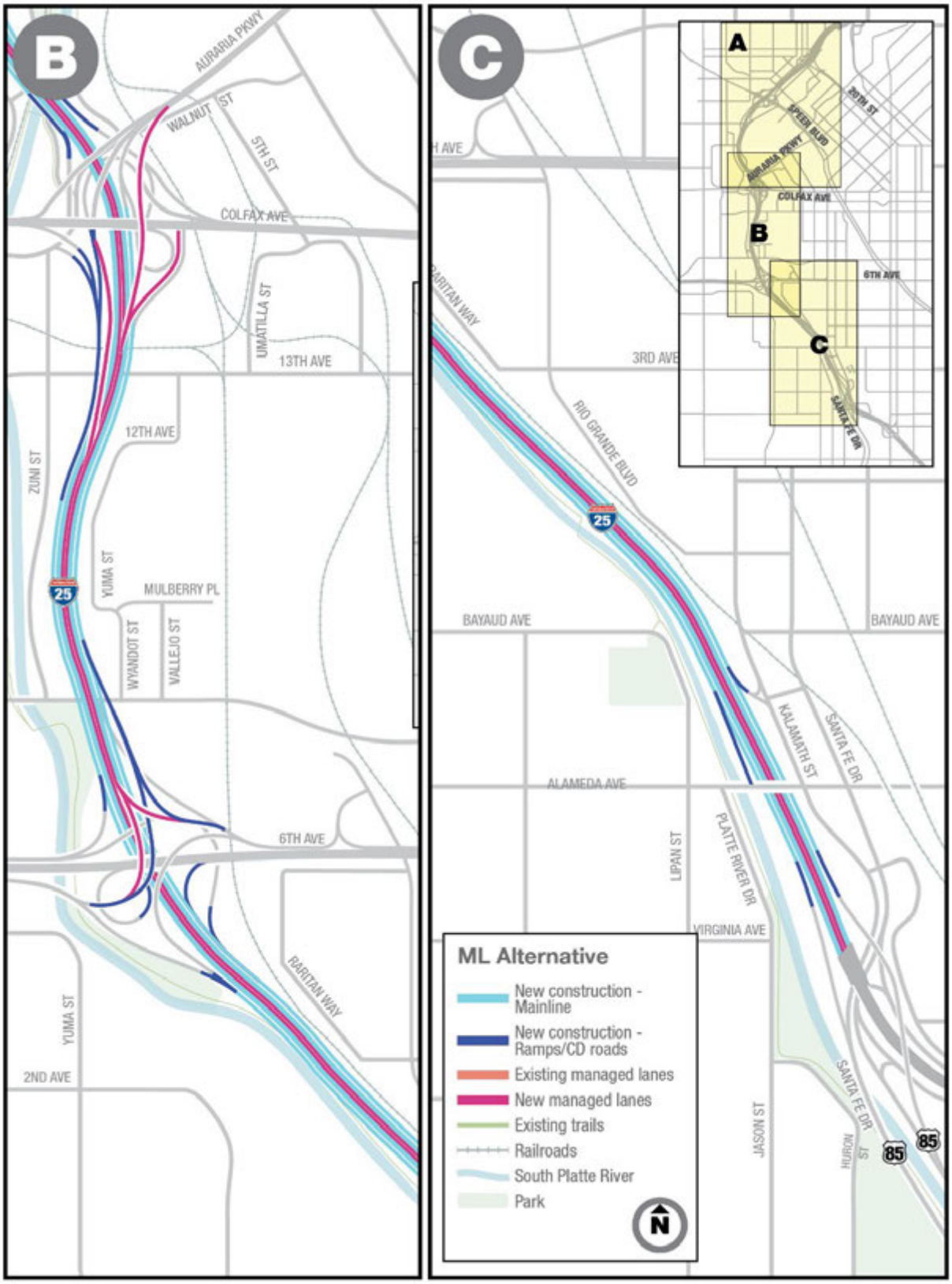


Figure 23: Managed Lanes Alternative (Continued)



5.1.4.1. 20th Street to Colfax Avenue

In this section, the existing managed lanes that currently end near 20th Street would be extended south and a new direct connection from the managed lanes to/from Speer Boulevard would be provided. Based on the preliminary concepts for this connection provided in the *Express Lanes Master Plan* (CDOT/HPTE, 2020), this direct connection ramp was assumed to be reversible. It would serve southbound off-ramp traffic during the AM peak period and northbound on-ramp traffic in the PM peak period. No access to or from the managed lanes to the south of Speer Boulevard would be provided at this location.

In the general-purpose lanes, improvements in the southbound direction would begin under 20th Street with an exit ramp from I-25 onto a proposed CD road system similar to the one described in the Collector/Distributor Roads and Braided Ramps Alternative. The southbound CD road would merge with the existing entrance ramp from 20th Street and extend to 23rd Avenue. This CD road would serve access to/from I-25 at Speer Boulevard and 23rd Avenue. The existing braided ramp would be maintained at the Speer Boulevard southbound entrance ramp onto I-25 and the CD road southbound exit to 23rd Avenue. The frontage road connection from 23rd Avenue to 17th Avenue also would be maintained; however, the southbound on-ramp to I-25 from 17th Avenue would be removed.

In the northbound direction, the Colfax Avenue entrance ramp would feed an auxiliary lane that extends to 23rd Avenue. This extended lane requires the closure of the northbound 17th Avenue on- and off-ramps. The exit from I-25 to Speer Boulevard also includes a CD road that would serve multiple facilities, including access to/from 23rd Avenue, Speer Boulevard, and 20th Street. Additionally, a braided ramp is proposed at the Speer Boulevard northbound entrance ramp over the CD road connection to 20th street.

5.1.4.2. Colfax Avenue to US 6/6th Avenue

The managed lanes would continue through this section. Traveling southbound, there would be a direct connection ramp from Auraria Parkway to the southbound managed lanes. In the northbound direction, there would be direct connection ramps from eastbound and westbound US 6/6th Avenue to the northbound managed lanes and a direct connection ramp from the northbound managed lanes to Colfax Avenue and Auraria Parkway.

Within this segment, all 8th Avenue access is proposed to be closed to provide adequate and safe weaving distances. Closing this access allows continuous auxiliary lanes between US 6/6th Avenue and Colfax Avenue/Auraria Parkway in both the northbound and southbound directions.

5.1.4.3. US 6/6th Avenue to Santa Fe Drive/US 85

The new managed lanes would be carried through this segment and begin/end near Santa Fe Drive/US 85. Between US 6/6th Avenue and Santa Fe Drive/US 85, access and ramp configurations remain unchanged; however, the I-25 alignment between US 6/6th Avenue and Santa Fe Drive/US 85 is proposed to be straightened to eliminate unnecessary curves and increase safety along the segment.

5.2. Level 3 Evaluation Process

Unlike the Level 1 and Level 2 evaluation processes, which were focused on a concept's ability to satisfy specific criteria related to the project's purpose, need, goals, and objectives, the Level 3 evaluation focused on an alternative's potential benefits and impacts relative to the other alternatives evaluated. The goal of the Level 3 evaluation was to make recommendations for improvements based on the elements within each alternative, rather than recommending one single alternative.

To this end, the Level 3 evaluation process was divided into different categories, with each using different information to comparatively evaluate alternatives. These categories included traffic operations analysis, safety analysis, crossings analysis, and impacts analysis. Outcomes of the evaluation are discussed in more detail below.

5.2.1. Traffic Operations Analysis

Each of the Level 3 alternatives was modeled using microsimulation traffic analysis. Typically, this analysis would be completed using the most currently available forecasted travel demand, which in this case would be a planning horizon year of 2040. By 2040, the travel demand for the I-25 Central traffic analysis area is projected to increase by approximately 20 percent. However, existing conditions within the traffic analysis area already include significant congestion. Although planned improvements to the transportation network were included in the 2040 No Action Alternative model, the model cannot process the forecasted future travel demand. The network within the microsimulation traffic model experiences significant queue spillbacks that prevent the model from fully evaluating the evening peak period.

To analyze the potential benefits of the alternatives, the project team—with input and concurrence from FHWA and Denver staff—agreed that overall travel demand should be reduced to a point at which the microsimulation traffic model could produce reasonable results without grid-locking. Based on an iterative testing process, a global 10 percent travel demand reduction was applied to the entire microsimulation model.

With this demand reduction, the conditions analyzed in the PEL study reflect a planning horizon year of approximately 2030. A summary of this analysis is shown in Table 10. Additional information about the methodology of the traffic analysis and modeling as well as a more detailed presentation and discussion of findings of that analysis is included in Attachment C, *Traffic and Safety Technical Report*, of the *I-25 Central PEL Study Report*.

Table 10: Operations and Congestion by Alternative

Alternative	Key Findings
No Action	Without improvements, increasing travel demand will result in a continued deterioration of traffic operations.
Bring the Corridor to Standard	Improves freeway operations. • Increased ramp spacing (removal of access at 8th Avenue & 17th Avenue) helps to smooth traffic flow. • Without reconfiguration of the existing ramps, queues spill back onto the mainline and local networks.

Table 10: Operations and Congestion by Alternative

Alternative	Key Findings
Collector/Distributor Roads and Braided Ramps	Improves freeway operations with an emphasis on access. • CD roads help to improve ramp spacing (I-25 access served by CD roads), which results in smoother/improved traffic flow. • CD roads hold queues off of the mainline freeway. • Separating major movements using braided ramps improves safety and congestion.
Managed Lanes	Improves freeway operations with an emphasis on travel time reliability. • Increased ramp spacing (removal of access at 8th Avenue & 17th Avenue) helps to smooth traffic flow. • Adding managed lanes increases the capacity of the highway, resulting in reduced congestion. • Without reconfiguration of the existing ramps, some queues spill back onto the mainline and local networks.

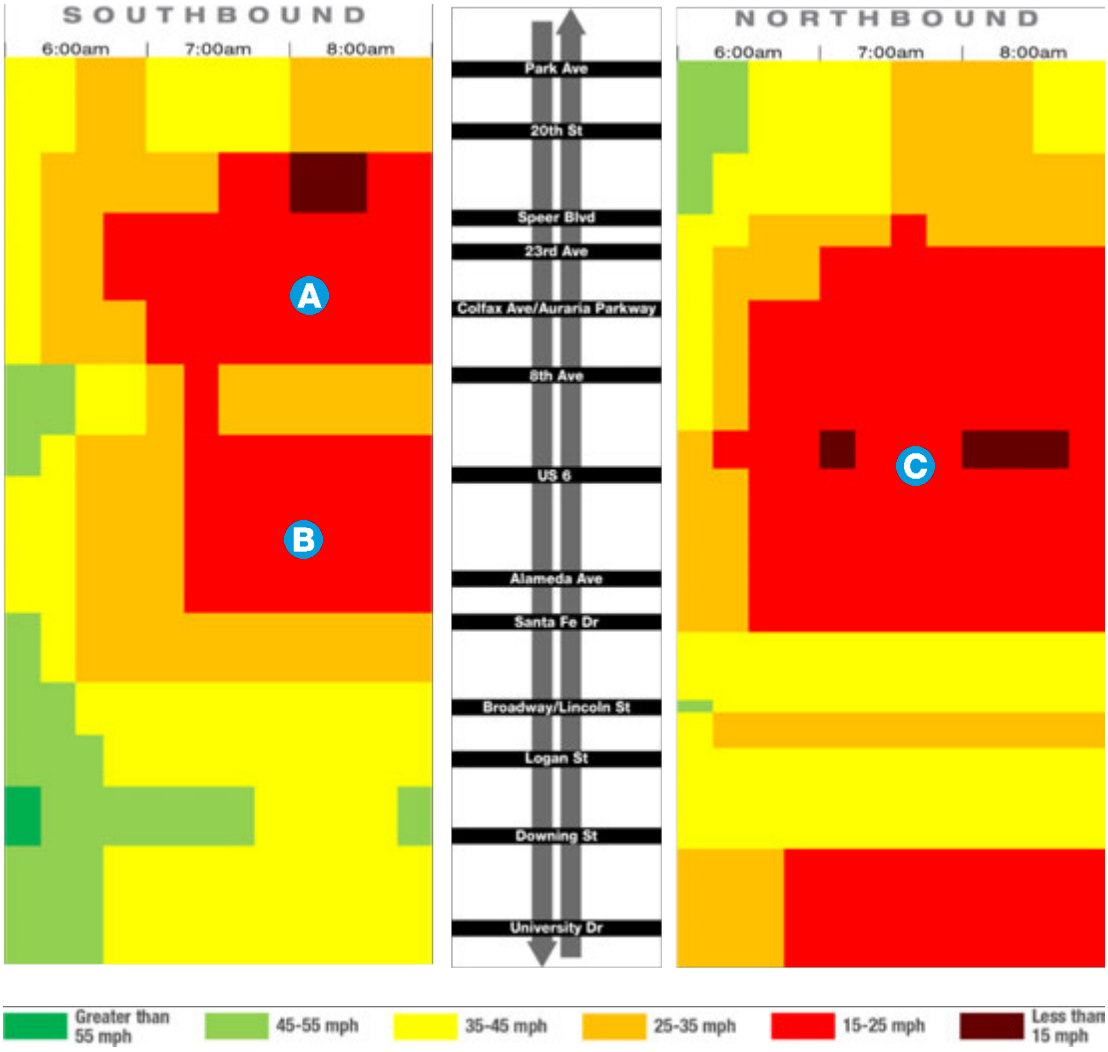
This analysis showed that, in comparison to the No Action Alternative, the Managed Lanes Alternative provided the most congestion relief, followed by the Collector/Distributor Roads and Braided Ramps Alternative, and then the Bring the Corridor to Standard Alternative. Figure 24 summarizes the average travel times on I-25 for each alternative.

Figure 24: I-25 Central Level 3 Alternative Travel Times—Broadway to Park Avenue

Notes: "CD/BR" = Collector/Distributor Roads and Braided Ramps Alternative, "GP" = general-purpose lane, "ML" = managed lane
Source: Travel time information was obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

In addition to examining the total travel times, alternatives also were evaluated for travel speed. Examining the average speed at specific locations along the corridor across the peak periods for each alternative provided an understanding of which elements of the alternative perform best and which elements of the alternative do not provide as much benefit. Figure 25 through Figure 32 show annotated heat diagrams depicting and describing the average speeds on I-25 for each alternative.

Figure 25: No Action Alternative Average, AM Peak Period Speeds on I-25



A Five lanes of traffic north of 20th Street, plus the existing managed lane, must merge into four lanes of traffic underneath Colfax Avenue. This creates a bottleneck and causes traffic to slow.

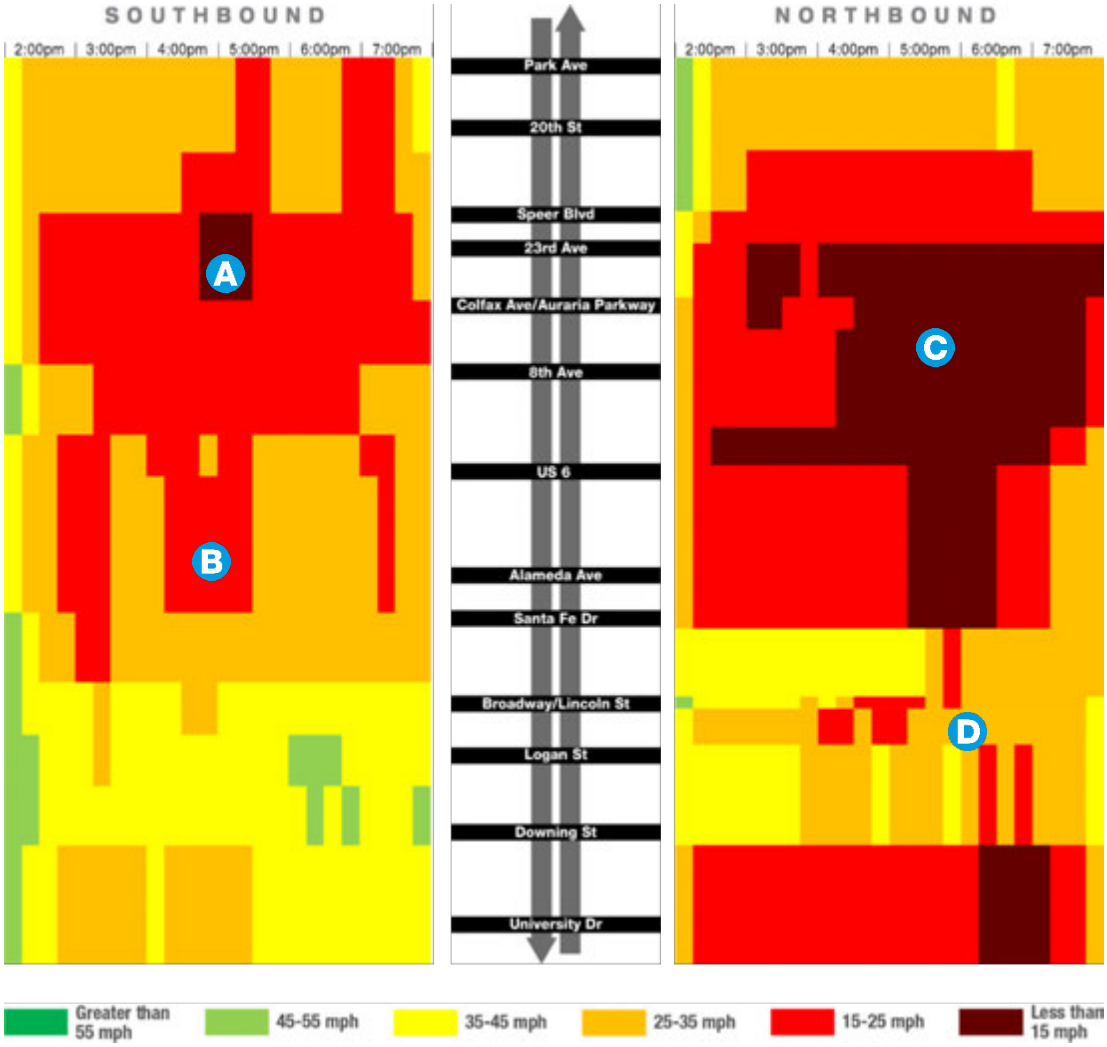
B Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting I-25 at Alameda Avenue and Santa Fe Drive/US 85. This lane changing causes traffic to slow.

C Without improvements, northbound I-25 is anticipated to have continuous stop-and-go traffic beginning at Santa Fe Drive/US 85 and continuing to approximately Speer Boulevard due to high mainline and ramp volumes.

D Traffic coming northbound on I-25 into the I-25 Central corridor from south of the I-25 Central corridor is metered/constrained due to existing capacity limitations between University Drive and Downing Street.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

Figure 26: No Action Alternative Average, PM Peak Period Speeds on I-25



A Five lanes of traffic north of 20th Street must merge into four lanes of traffic underneath Colfax Avenue. This creates a bottleneck and causes traffic to slow.

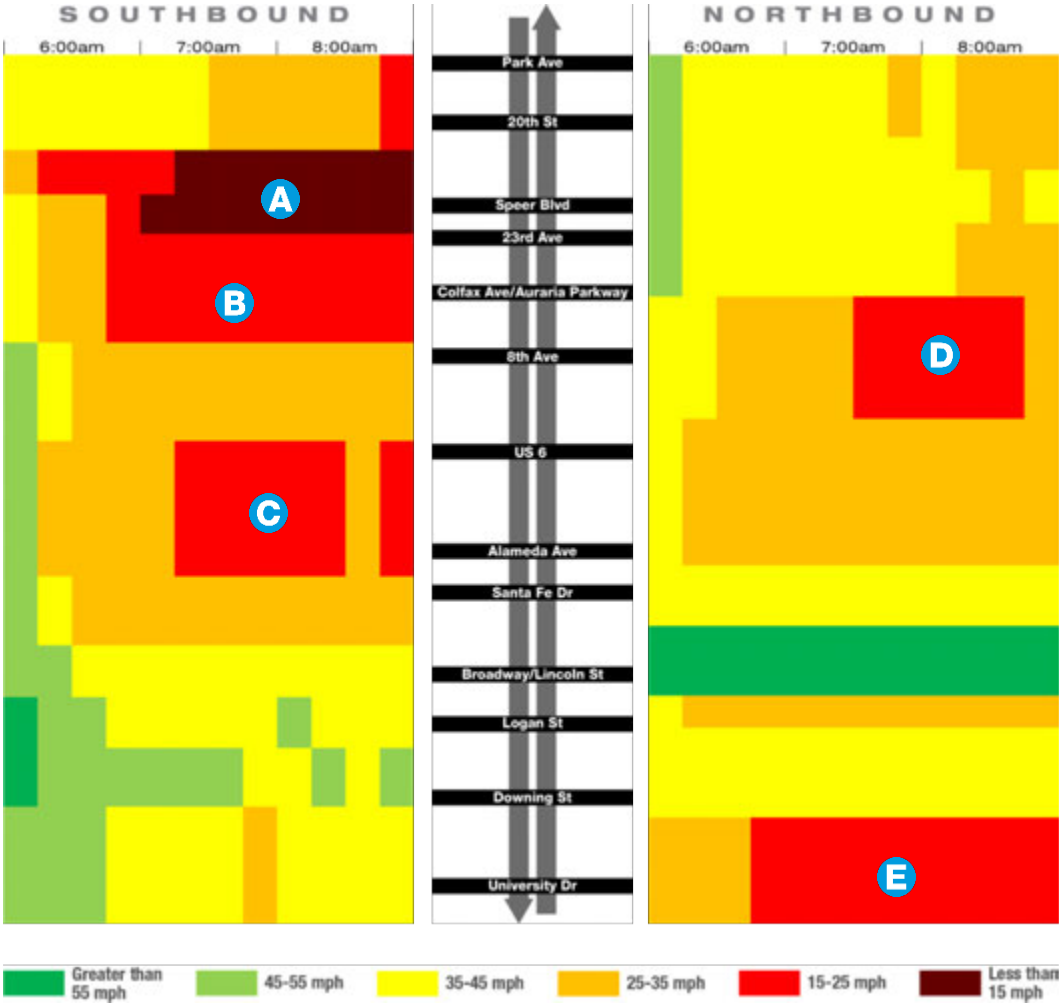
B Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting I-25 at Alameda Avenue and Santa Fe Drive/US 85. This lane changing causes traffic to slow.

C Without improvements, northbound I-25 is anticipated to have continuous stop-and-go traffic beginning at Santa Fe Drive/US 85 and continuing to approximately Speer Boulevard due to high mainline and ramp volumes.

D Spillback congestion from the area between Santa Fe Drive/US 85 to Colfax Avenue/Auraria Parkway is limited due to the metering effects south of the I-25 Central corridor. Capacity limitations on northbound I-25 near University Drive result in fewer vehicles being able to reach the I-25 Central corridor. This limits the length of queues within the I-25 Central corridor.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

Figure 27: Bring the Corridor to Standard Alternative, AM Peak Period Average Speeds on I-25



A Moderate to heavy traffic volumes coming onto I-25 from 20th Street and Speer Boulevard must weave across traffic exiting to Speer Boulevard and Colfax Avenue and merge with traffic exiting from the existing managed lane. This causes the freeway to slow.

B Five lanes of traffic north of 20th Street must merge into four lanes of traffic underneath Colfax Avenue. This creates a bottleneck and causes traffic to slow.

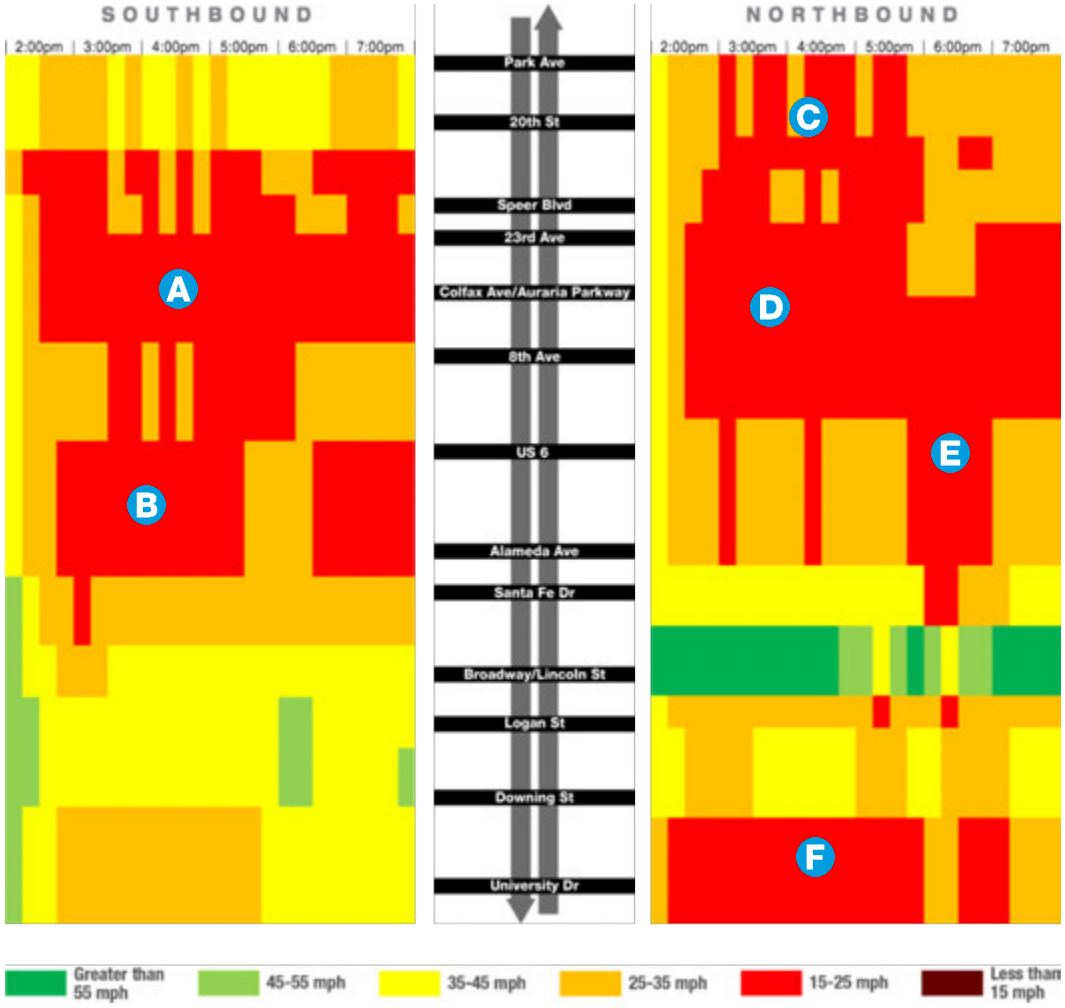
C Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting I-25 at Alameda Avenue and Santa Fe Drive/US 85. This lane changing causes traffic to slow.

D Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting at Colfax Avenue and Auraria Parkway. This lane changing causes traffic to slow.

E Traffic coming northbound on I-25 into the I-25 Central corridor from south of the I-25 Central corridor is metered/constrained due to existing capacity limitations between University Drive and Downing Street.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

Figure 28: Bring the Corridor to Standard Alternative, PM Peak Period Average Speeds on I-25



A Five lanes of traffic north of 20th Street must merge into four lanes of traffic underneath Colfax Avenue. This creates a bottleneck and causes traffic to slow.

B Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting I-25 at Alameda Avenue and Santa Fe Drive/US 85. This lane changing causes traffic to slow.

C Improving the flow through the I-25 Central corridor pushes more vehicles into the I-70 and I-25 interchange. This results in a slowdown to the north of the I-25 Central corridor.

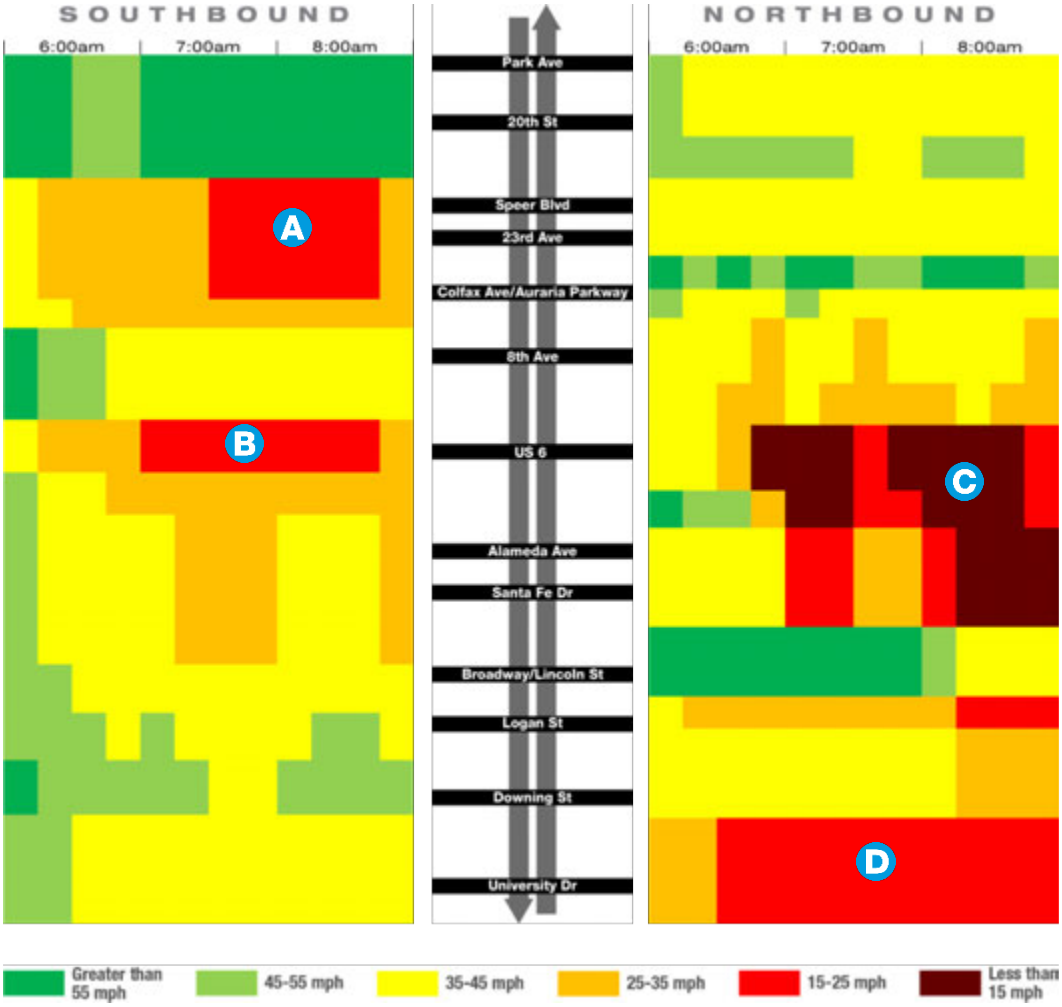
D High northbound on-ramp volumes from US 6/6th Avenue to Speer Boulevard cause traffic to slow.

E Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting at Colfax Avenue and Auraria Parkway. This causes traffic to slow.

F Traffic coming northbound on I-25 into the I-25 Central corridor from south of the I-25 Central corridor is metered/constrained due to existing capacity limitations between University Drive and Downing Street.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

Figure 29: Collector/Distributor Roads and Braided Ramps Alternative, AM Peak Period Average Speeds on I-25



A The large volume of southbound I-25 traffic exiting to Colfax Avenue, 8th Avenue, and US 6/6th Avenue must merge to the right to access the CD road. Shortly after the CD road exit, on-ramp traffic from 20th Street, Speer Boulevard, 23rd Avenue, and 17th Avenue must merge into the mainline. These two movements result in a slowdown in southbound traffic.

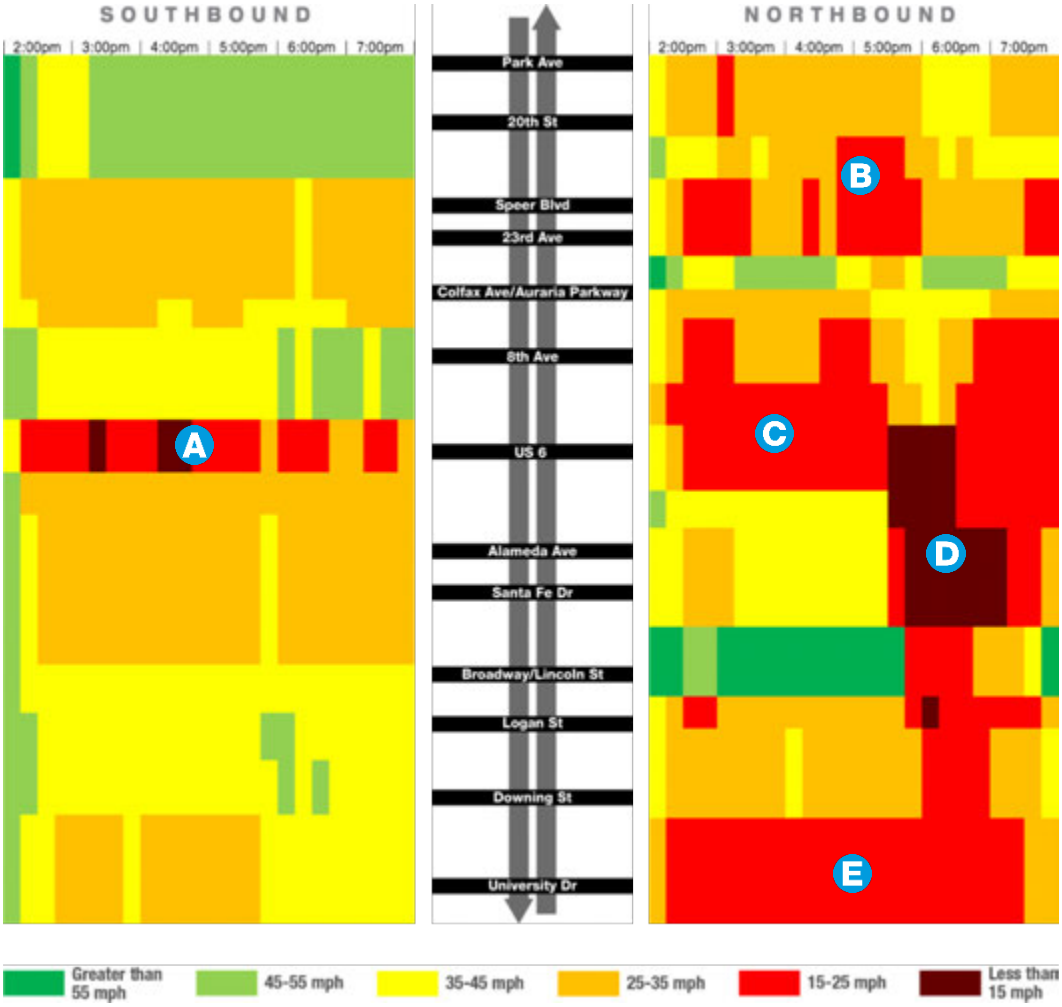
B Traffic coming onto I-25 from Colfax Avenue and Auraria Parkway must change lanes across traffic exiting at the Alameda Avenue and Santa Fe Drive/US 85 CD road. This causes traffic to slow.

C One lane of traffic exits to the 8th Avenue, Colfax Avenue, and Auraria Parkway CD road, resulting in three lanes of traffic on the mainline freeway for a short section until the US 6/6th Avenue on-ramp comes on as an additional lane. This three-lane cross section creates a bottleneck and results in the slowing of traffic.

D Congestion between University Drive and Downing Street meters northbound I-25 traffic entering the corridor.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

Figure 30: Collector/Distributor Roads and Braided Ramps Alternative, PM Peak Period Average Speeds on I-25



A Traffic coming onto I-25 from Colfax Avenue and Auraria Parkway must change lanes across traffic exiting at the Alameda Avenue and Santa Fe Drive/US 85 CD road. This causes traffic to slow.

B High on-ramp volumes from Speer Boulevard merging with high mainline volumes meet and/or exceed the capacity of the mainline freeway, resulting in vehicle slowing.

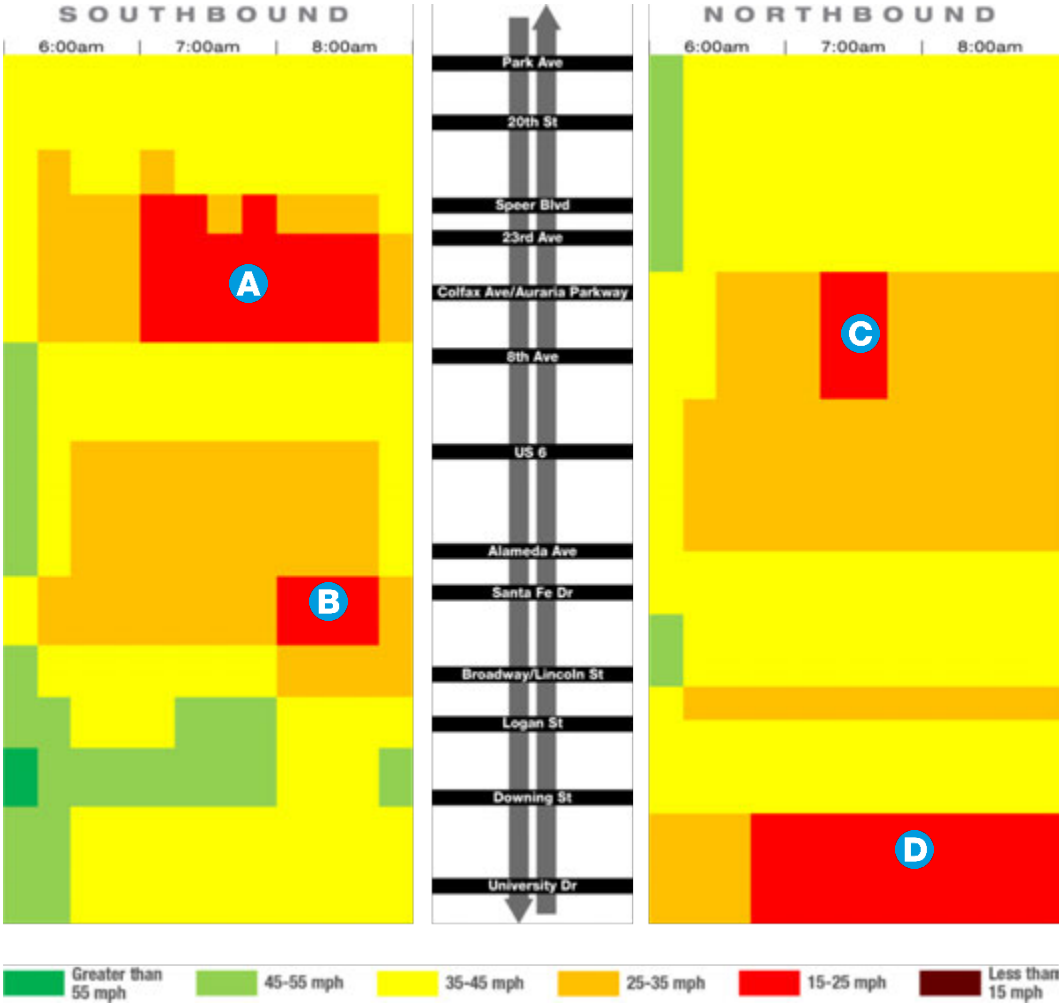
C Heavy on-ramp volumes from US 6/6th Avenue cause the freeway to slow.

D One lane of traffic exits to the 8th Avenue, Colfax Avenue, and Auraria Parkway CD road, resulting in three lanes of traffic on the mainline freeway for a short section until the US 6/6th Avenue on-ramp comes on as an additional lane. This three-lane cross section creates a bottleneck and results in the slowing of traffic.

E Congestion between University Drive and Downing Street meters northbound I-25 traffic entering the corridor.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

Figure 31: Managed Lanes Alternative, AM Peak Period Average Speeds on I-25



Note: Speeds depicted in this diagram only represent speeds in the general-purpose lanes.

A Five general-purpose lanes of traffic north of 20th Street must merge into four lanes of traffic underneath Colfax Avenue. This creates a bottleneck and causes traffic to slow.

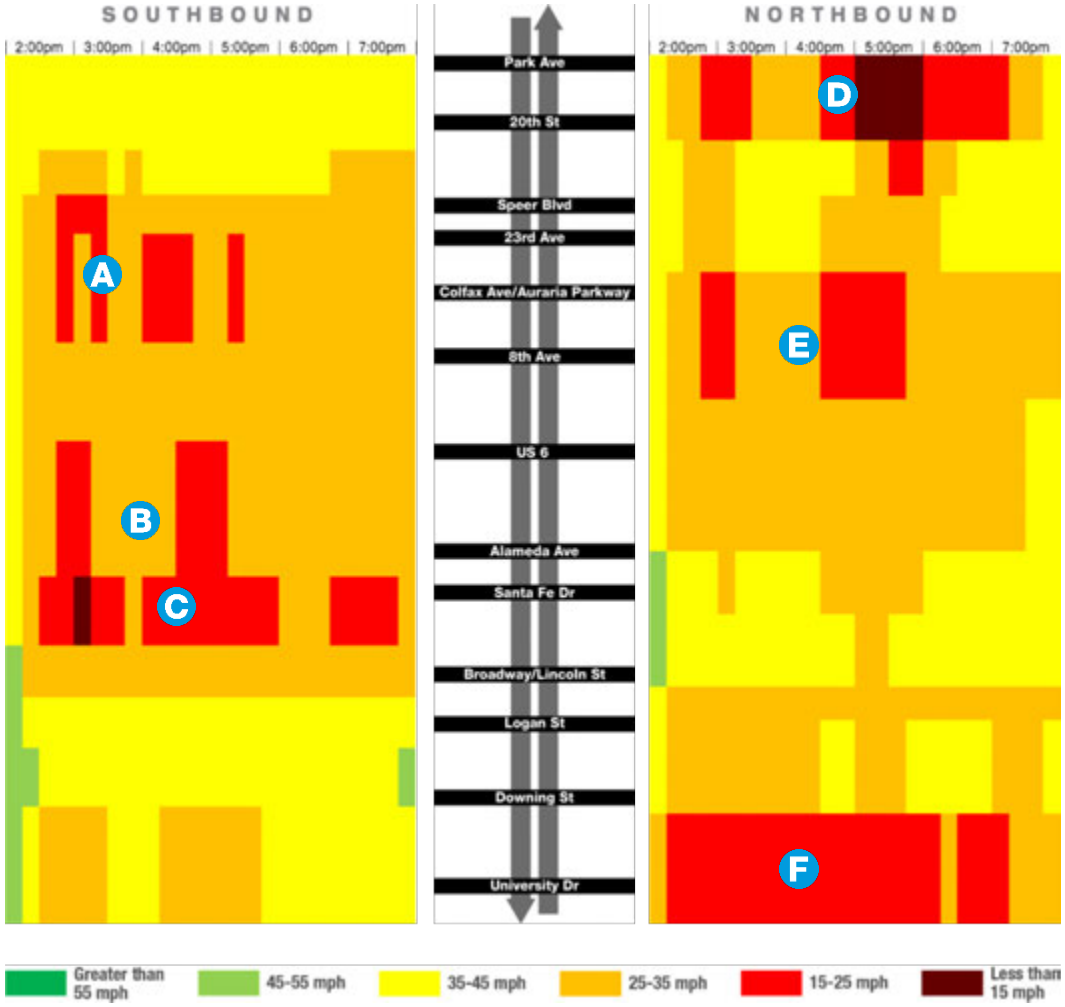
B The new southbound managed lane ends near Santa Fe Drive/US 85 and the traffic in the managed lane must merge back into the four general-purpose lanes. This lane reduction causes traffic to slow.

C Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting at Colfax Avenue and Auraria Parkway. This causes traffic to slow.

D Congestion between University Drive and Downing Street meters northbound I-25 traffic entering the corridor.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

Figure 32: Managed Lanes Alternative, PM Peak Period Average Speeds on I-25



Note: Speeds depicted in this diagram only represent speeds in the general-purpose lanes.

A Five general-purpose lanes of traffic north of 20th Street must merge into four lanes of traffic underneath Colfax Avenue. This creates a bottleneck and causes traffic to slow.

B Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting I-25 at Santa Fe Drive/US 85. This lane changing causes traffic to slow.

C Where the southbound managed lane ends near Santa Fe Drive/US 85, the traffic in the managed lane must merge back into the four general-purpose lanes. This lane reduction causes traffic to slow.

D Improving the flow through the I-25 Central corridor pushes more vehicles into the I-70 and I-25 interchange. This results in a slowdown to the north of the I-25 Central corridor.

E Traffic coming onto I-25 from US 6/6th Avenue must change lanes across traffic exiting at Colfax Avenue and Auraria Parkway. This causes traffic to slow.

F Congestion between University Drive and Downing Street meters northbound I-25 traffic entering the corridor.

Source: Speed data were obtained from the I-25 Central PEL microsimulation traffic models. Additional information about these data can be found in Attachment C, Traffic and Safety Technical Report.

5.2.2. Safety Analysis

The safety analysis performed on each Level 3 alternative was based on the American Association of State Highway and Transportation Officials (AASHTO) *2010 Highway Safety Manual* (HSM) methodology. This methodology uses statistical analysis calibrated to historical conditions to predict the number of crashes on a future roadway facility based on its specific design elements and configuration (AASHTO, 2010).

The 2010 HSM methodology was originally developed for use during the design phase of projects to help decision makers understand the specific safety benefits/trade-offs of detailed design elements, such as safety trade-offs for different shoulder widths in space constrained areas. The HSM was intended to help designers decide, from a safety perspective, if decisions made during the design process would impact safety of a roadway. This detailed trade-off analysis, although very useful in the design phase of a project, does not perfectly reflect the high-level planning nature of the alternatives evaluated in the PEL Study. The alternatives evaluated at this level of study are conceptual in nature and, therefore, most of the details that the HSM analyzes are neither well defined nor differentiated within or between different alternatives.

The outcomes of the HSM analysis and more information about its methodology and application are presented in Attachment C, *Traffic and Safety Technical Report,* of the *I-25 Central PEL Study Report*. However, a blended approach was used for the overall evaluation of Level 3 alternatives in which the quantitative HSM results guided and informed a qualitative evaluation. The outcome of this approach, presented below, was a discussion about the potential benefits and considerations of the key elements of each alternative.

5.2.2.1.1. No Action Alternative

Without improvements, the conditions on I-25 Central are expected to continue to deteriorate between now and 2030. As traffic volumes increase, the total number of crashes are expected to also increase between the existing conditions (approximately 1,000 crashes per year) and future No Action Alternative conditions.

5.2.2.1.2. Bring the Corridor to Standard Alternative

The Bring the Corridor to Standard Alternative is predicted to provide an overall reduction in the total number of crashes on I-25 as compared to the No Action Alternative. Key improvements provided in this alternative which contribute to improved safety include:

- Improved roadway geometrics—including more gentle curves and full width travel lanes—will give drivers more time and space to react to changing roadway conditions
- Improved ramp spacing will reduce the turbulence on the freeway from vehicles merging and weaving, allowing for a more predictable and constant flow of traffic
- Improved and added full-width shoulders will provide space for disabled vehicles to be removed from traffic and allow first responders to assist drivers outside of the active travel lanes

5.2.2.1.3. Collector/Distributor Roads and Braided Ramps Alternative

The Collector/Distributor Roads and Braided Ramps Alternative is expected to further reduce the number of crashes as compared to the Bring the Corridor to Standard Alternative. Key improvements provided in this alternative which contribute to improved safety include:

- Improved roadway geometrics—including more gentle curves and full width travel lanes—will give drivers more time and space to react to changing roadway conditions
- Collector/distributor roads will reduce the turbulence on the mainline freeway from vehicles merging and weaving, allowing for a more predictable and constant flow of traffic
- Collector/distributor roads will provide space away from the mainline freeway to hold off-ramp queues. This will prevent these queues from spilling back onto the mainline freeway and posing an unexpected hazard to through-traffic
- Braided ramps will remove the need for vehicles to weave. This significantly reduces conflict points on the highway and makes the flow of traffic safer and more predictable
- Improved and added full-width shoulders will provide space for disabled vehicles to be removed from traffic and allow first responders to assist drivers outside of the active travel lanes

5.2.2.1.4. Managed Lanes Alternative

The Managed Lanes Alternative is expected to provide some safety benefits to the corridor, while also introducing new safety elements to consider. Key elements provided in this alternative that contribute to improved safety include:

- Improved roadway geometrics—including more gentle curves and full width travel lanes—will give drivers more time and space to react to changing roadway conditions
- Improved ramp spacing will reduce the turbulence on the freeway from vehicles merging and weaving, allowing for a more predictable and constant flow of traffic
- Improved and added full-width shoulders will provide space for disabled vehicles to be removed from traffic and allow first responders to assist drivers outside of the active travel lanes
- Separating the through/regional traffic from the local traffic entering and/or exiting in the freeway will reduce weaving between travel lanes

In addition to providing benefits to safety, the addition of managed lanes in this alternative may also introduce new safety concerns. These concerns primarily extend from the differential in speeds expected to occur between the general-purpose lanes and the managed lanes. Because the managed lanes are expected to only be separated from the general-purpose lanes via painted stripes, these speed differentials have the potential to result in additional crashes as some drivers attempt to merge into or out of the managed lanes. Based on observations made about other managed lane facilities already in operation across Colorado, this merging behavior is likely to occur both at designated managed lane ingress and egress locations and, due to lane-changing violations, at locations where ingress and egress is prohibited.

At this time, there is limited historical safety information available about managed lane facilities. Furthermore, the safety calculations are based on assumptions of detailed design considerations—such as the width of the buffer space provided between the general-purpose lanes and the managed lanes, or the design of managed lane ingress and egress locations. Because of these factors, the impact of managed lanes on the overall safety of the corridor is not well known. Future studies should reassess the safety of the managed lanes once more detailed design information is available.

Table 11: Safety Considerations by Alternative

Alternative	Key Considerations
No Action	Worse than existing conditions because volumes on I-25 increase. • There is an approximate 1-percent to 3-percent increase in all crashes as compared to existing conditions. • There is an approximate 5-percent to 7-percent increase in fatal and injury crashes.
Bring the Corridor to Standard	Improved geometrics and ramp spacing help optimize weaving and merging movements. • There is an approximate 40-percent reduction in crashes as compared to the No Action Alternative.
Collector/Distributor Roads and Braided Ramps	Minimizes the needs for vehicles to weave and manages ramp queuing. • There is an approximate 50-percent reduction in crashes as compared to the No Action Alternative.
Managed Lanes	Managed lanes with direct connections reduce the need for vehicles to weave and helps improve overall flow of the highway. • There is an anticipated crash reduction of between 40 percent and 50 percent as compared to the No Action Alternative.

5.2.3. Local Network Analysis

Because I-25 Central is located in a dense urban environment where the local roadway network provides many alternate routes to the highway, the Level 3 traffic analysis also examined each alternative's impact on the local roadway network. In general, this analysis showed that, when more capacity is available on I-25 during the peak travel periods, less traffic diverts to the local roadway network. A summary of this analysis is shown in Table 12. Additional information about the methodology used to perform this analysis and more detailed results of this analysis can be found in Attachment C, *Traffic and Safety Technical Report*, of the *I-25 Central PEL Study Report*.

Table 12: Local Network Operations and Congestion by Alternative

Alternative	Key Considerations
No Action	No improvements
Bring the Corridor to Standard	Pulls some traffic from the local network onto I-25
Collector/Distributor Roads and Braided Ramps	Pulls a large amount of traffic from the local network onto I-25 (CD roads facilitate short local trips)
Managed Lanes	Pulls some traffic from the local network onto I-25

5.2.4. Multimodal Connectivity Analysis

As part of the alternative's evaluation process, the PEL Study considered the existing and potential future crossing needs of I-25. This included crossings for all modes of travel, such as bicycles, pedestrians, transit vehicles, and cars. Evaluation of these crossings was completed through a collaborative effort between the PEL study team and representatives from Denver.

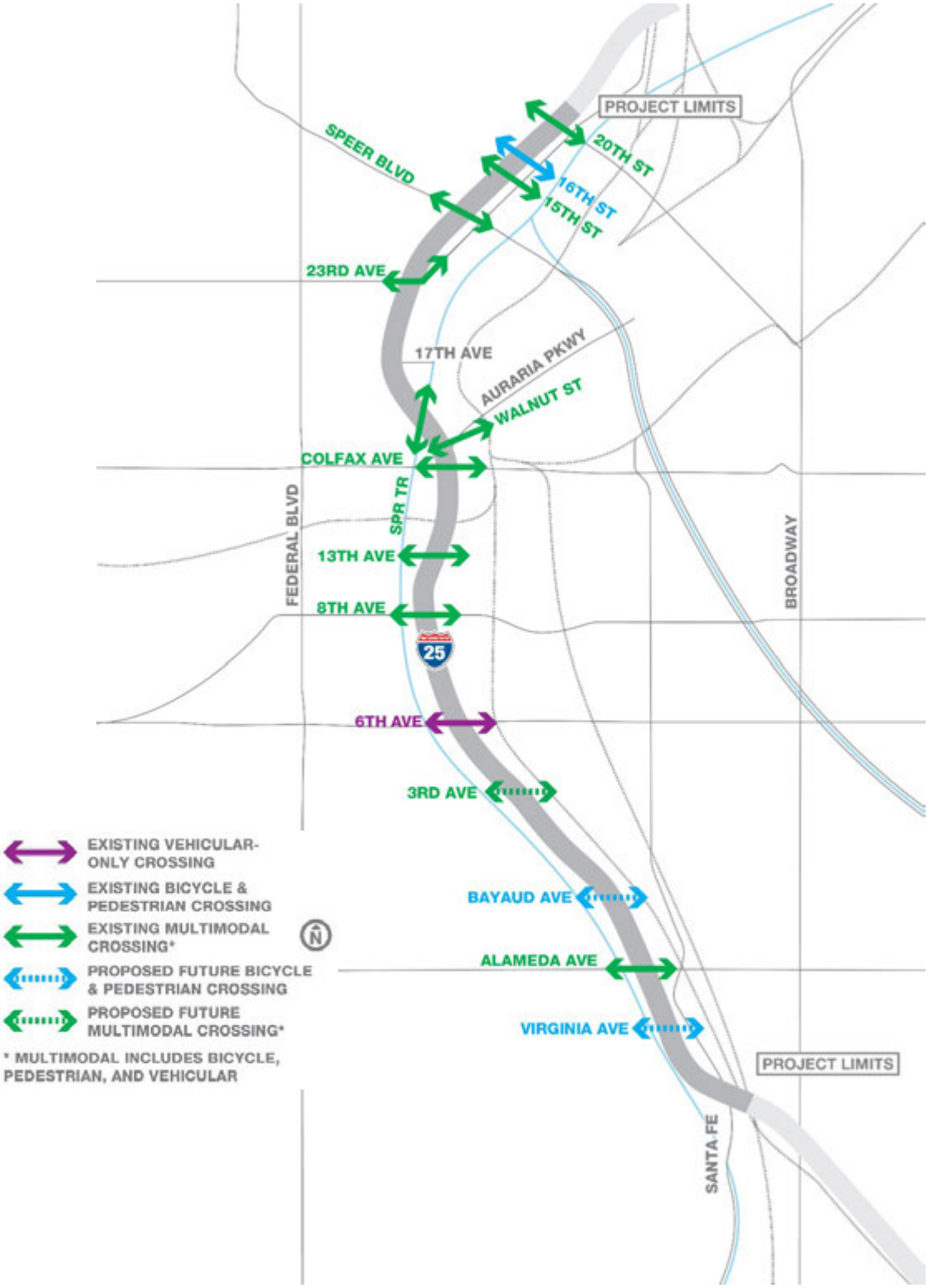
The evaluation process used for crossings of I-25 was completed in two parts. The first part focused on identifying the general locations/areas where crossings are needed. This also included identifying the type of crossing needed—such as bicycle and pedestrian only versus a crossing that accommodates all modes of travel—within each area. The second part of the crossing evaluation was the identification of a list of considerations that should be applied to all future studies and projects.

The identification of locations/areas where additional crossings are needed was completed using information gathered in the *I-25 Central Existing Conditions Assessment Report*, which is Attachment A of the *I-25 Central PEL Study Report* (CDOT, 2020); the *Valley Highway EIS* (CDOT, 2006); and *Denver Moves: Pedestrians & Trails* (Denver, 2019). Figure 33 summarizes the existing and potential future crossings identified through the crossing analysis.

At the PEL level of study, not enough information is known to identify the exact details of each crossing location. However, through the collaborative evaluation effort, key considerations were identified that should inform future, more-detailed studies and projects. These considerations include:

- Efforts should be made to reduce the crossing distance for pedestrians and bicyclists.
- Where crossings accommodate vehicle and non-vehicle movements and/or where crossings may cross entrance and exit ramps to/from I-25, future studies and projects should focus on providing safe and comfortable places for non-vehicular traffic to travel next to and cross vehicle traffic.

Figure 33: Existing and Potential Future Crossings of I-25



5.2.5. Impacts Analysis

At the PEL level of study, there is not enough detail to quantify impacts to individual environmental resources. This type of analysis will be completed during future, more-detailed studies. However, there was a desire to understand the relative impacts between alternatives within the PEL. To accomplish this at this level of study, impacts were measured by the amount of land (right of way) that would be required to implement the alternative.

It should be noted that the alternatives evaluated within this PEL are at the conceptual level. This means that detailed engineering work was not completed on these alternatives. Therefore, the level of impacts presented in this technical report should be viewed as relative order of magnitude of difference between alternatives and not as absolute values of impact. Furthermore, to ensure that all alternatives were evaluated consistently, a few key assumptions were used for this analysis, including:

- For all at-grade roadway segments, it was assumed that the impact limits would be 25 feet away from the edge of roadway.
- For all structures, it was assumed that the impact limits extend to 50 feet past the edge of roadway.

Based on this analysis, the Collector/Distributor Roads and Braided Ramps Alternative would have the most impact, followed by the Managed Lanes Alternative, then the Bring the Corridor to Standard Alternative, and, finally, the No Action Alternative, which would have the least impact. Table 13 summarizes the level of impact by alternative.

Table 13: Level of Impact by Alternative

Alternative	Level of Impact
No Action	No Impact
Bring the Corridor to Standard	Least Impact (10 acres to 15 acres)
Collector/Distributor Roads and Braided Ramps	Most Impact (35 acres to 45 acres)
Managed Lanes	More Impact (30 acres to 40 acres)

**level of impact was determined using conceptual level of design for reference only*

5.3. Level 3 Evaluation Outcomes

All three build alternatives analyzed in Level 3 provide benefits to corridor operations and safety and come with some level of impact. Bringing the corridor to standard would not fulfill all needs alone, but it will be the foundation for additional improvements. Managed lanes provide additional congestion and travel time reliability benefits while CD roads and braided ramps improve both safety, congestion, and access. Relative impacts and trade-offs suggest CD roads and braided ramps may have slightly greater impacts than managed lanes, but, being at the same relative magnitude, neither is the obvious better choice at this level of study. Features from all three recommended alternatives and all relative trade-offs should be considered in future NEPA processes, Early Action projects, or other types of project development work. The alternatives described on pages 69-83 represent possible combinations of features that may or may not be ultimately selected for construction.

6. References

American Association of State Highway and Transportation Officials (AASHTO). 2010. *Highway Safety Manual*. Washington, DC: AASHTO.

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Colorado Department of Transportation (CDOT). 2006. *I-25 Valley Highway Environmental Impact Statement and Record of Decision.* Denver, CO: FHWA and CDOT. Available at: https://www.codot.gov/library/studies/i-25-valley-highway-EIS.

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