This chapter examines the effects of the alternatives evaluated on transportation facilities within the study area. This includes roadways, transit systems and services, pedestrian and bicycle facilities, and truck and rail freight services.

Since the 2008 Draft EIS was published, new traffic analysis tools have been developed that improve the ability to forecast traffic conditions under varying scenarios, including how managed lanes and tolling may impact traffic flow.

Data used for the original traffic analysis was collected in 2003 and future forecasts were based on DRCOG’s 2030 Metro Vision Regional Transportation Plan (2005). The analysis for this Supplemental Draft EIS considers current federal and state regulations and requirements. It uses current (2012) traffic data, DRCOG’s 2035 travel demand model origin-destination trip data, and the Dynamic Urban Systems for Transportation (DynusT) modeling software to evaluate transportation impacts and mitigation measures.

4.1 What are the existing transportation facilities in the study area?

Exhibit 4-1 shows the transportation impacts study area, which is the same as the project area that was identified earlier in the document.

The existing transportation system in the study area is multi-modal and includes roadways, transit systems, pedestrian and bicycle facilities, and truck and rail freight service. The study area is at a critical location in the transportation system, serving national, regional, and local transportation needs for human and freight mobility within the Denver region, Colorado, and the western United States.
Exhibit 4-1. Transportation impacts study area

In the study area, I-70 is a mature, fully access-controlled freeway. I-70 serves as a gateway to Aurora and Commerce City; provides regional access to the Stapleton Redevelopment Area and the developing northeast portion of Aurora; and is a critical link for travel to DIA. A substantial number of the people traveling on I-70 (nearly 50 percent) begin or end their trip within the study area.

In addition to accommodating airport and inter-city travel, the I-70 corridor is home to many industrial and warehousing businesses. These businesses account for much of the trucking and freight operations in the corridor.

Existing local connectivity

I-70 travels east and west within the study area. Several major roadways—refer to Exhibit 4-2 and Exhibit 4-3—provide north-south connectivity across I-70. There are 18 major roadways within the study area between Washington Street and Tower Road with some form of access to I-70, by either direct ramps or slip ramps from collector-distributor roads or frontage roads. Fifteen of these roadways provide north-south connectivity across I-70. Because I-70 is an elevated viaduct between Washington Street and Colorado Boulevard, several more minor roadways provide continuous connectivity beneath I-70 or intersect with 46th Avenue, as shown in Exhibit 4-3.
A large number of minor arterials, collectors, and residential streets provide east-west connectivity between the major north-south arterials. Specific to the study area, 46th Avenue provides for local east-west connectivity directly under I-70 between Washington Street and Colorado Boulevard (see Exhibit 4-4). 46th Avenue does not provide direct access to/from Colorado Boulevard. Frontage roads on either side of I-70—Stapleton Drive North and Stapleton Drive South—begin on the east side.
of Colorado Boulevard. These roadways provide local connectivity between Colorado Boulevard and Monaco Street. Stapleton Drive North is a two-lane roadway for westbound traffic and Stapleton Drive South is a two-lane roadway for eastbound traffic. Similar to 46th Avenue, these roadways provide a route for local travelers to circulate without using I-70, as well as a parallel route to bypass some of the congestion on I-70.

Colfax Avenue is the only roadway other than I-70 that provides continuous east-west connectivity through the study area from I-25 to Tower Road. Various other roadways provide parallel route choices for shorter distances within the study area, including 56th Avenue, 48th Avenue, 40th Avenue, 17th Avenue, 35th Avenue, 23rd Avenue, Montview Boulevard, Smith Road, and Martin Luther King Jr. Boulevard.

**Exhibit 4-4. 46th Avenue and Stapleton Drive North/South Existing Conditions**
Existing transit services

Existing transit service in the study area consists of local, limited, express, regional, and Sky Ride bus routes, as shown in Exhibit 4-5. Some of the bus services currently use I-70 for a portion of their route, and others cross I-70, using the surface street network. Traffic congestion can impact travel times for transit both on the surface streets and along I-70. Bus service with associated Park-N-Ride lots is provided throughout the corridor. Exhibit 4-7 highlights the bus routes in the Elyria and Swansea Neighborhood.

Exhibit 4-5. Existing transit service

Source: RTD
Existing pedestrian and bicycle facilities

Pedestrian and bicycle accommodations within the study area are primarily provided by sidewalks in the study area. In addition, there are several designated bicycle routes and off-street trail facilities in the area. Exhibit 4-6 illustrates the existing pedestrian and bicycle route system within the study area, and Exhibit 4-7 highlights the bicycle routes in the Elyria and Swansea Neighborhood. Route D-13 is currently a signed bicycle route that provides a north-south connection via Clayton Street.

Sidewalks are widely available within the vicinity of the project. However, walking conditions on these sidewalks are not necessarily safe or comfortable. Sidewalks typically range from three feet to five feet wide, which can be too narrow for pedestrians to walk comfortably or pass each other. Additionally, per Denver’s sidewalk policy, property owners are responsible for installation, repair, and maintenance of all sidewalks within the public right of way that adjoin their property, leading to uneven or broken sidewalk surfaces. The existing I-70 viaduct and 46th Avenue create a gap in the pedestrian network. Insufficient lighting, difficult street crossings, and poor guidance to destinations also lead to pedestrian concerns.

Exhibit 4-6. Existing bicycle and pedestrian network

Source: Denver

What is Denver’s sidewalk policy?

Section 49-551.1 of the Revised Municipal Code of Denver establishes that abutting property owners are responsible for the installation, repair, and maintenance of all sidewalks within the public right of way. The city will inspect sidewalks and—if they are found to be in need of maintenance or repair—notify property owners of their responsibility to arrange for repairs.
Exhibit 4-7. Elyria and Swansea bicycle and bus routes

Existing trucking facilities

Motor freight uses I-70 extensively for east-west travel through the Denver region and for pick-up and delivery to businesses and distribution centers within the study area. Trucks make up approximately 9 percent to 11 percent of traffic on I-70 west of Peña Boulevard and 13 percent of traffic east of Peña Boulevard. Trucks are required to stay on designated truck routes when driving through Denver. They also are required to use designated delivery routes when making pick-ups and deliveries. Exhibit 4-8 highlights the truck routes and delivery routes within the study area, along with specific restrictions for transport of hazardous materials along these routes.
Exhibit 4-8. Existing truck routes

Source: CDOT

Existing rail freight facilities

Currently, the UPRR, BNSF Railway, and Denver Rock Island Railroad operate within the study area, providing through-service, train consolidation operations, and intermodal transfers—or switching—to local businesses. Each railroad company owns and operates its own system of tracks within the study area. The BNSF Railway operates service on the Front Range Subdivision; the UPRR operates on the Limon and Greeley Subdivision and the Denver Rock Island Railroad operates an industrial switching yard (Silver Yard) on the north side of I-70 between Monaco and Quebec Streets.

Several rail storage and transfer facilities, lead tracks, and industry spur tracks are located in the I-70 study area. These rail lines cross the study area in a north-south direction in the west end of the corridor and run parallel to I-70 south of its alignment, as shown in Exhibit 4-9.
4.1.2 What are the existing safety concerns?

CDOT documented existing traffic safety concerns within the study area in the *I-70 East Corridor EIS Safety Evaluation (2004c)* and *Safety Evaluation Addendum: I-70 Corridor Plan (2013a)*. The study analyzed crash history for a three-year period (July 1, 2009 through June 30, 2012). During this time, 2,872 reported crashes occurred between I-25 and Tower Road, with 309 causing injuries, and seven resulting in fatalities. Rear-end collisions and sideswipes are the predominant crash types, which indicate corridor-wide congestion and/or inadequate auxiliary lanes.

This study provides a detailed analysis of areas where the number of crashes was higher than expected, including segments at York Street, Steele Street, and Colorado Boulevard. The closely spaced on and off ramps in these segments—combined with short auxiliary lanes—requires drivers to make speed changes within a short distance. These factors contribute to the high crash rate along portions of I-70.

4.1.3 What are the existing traffic conditions?

DynusT software was used to evaluate the existing conditions for the study area. More information about DynusT can be found in Attachment E, *Traffic Technical Report*, and a flowchart of the process to create the calibrated sub-area DynusT model is shown.
in Exhibit 4-10. To start the analysis, a regional 2010 DynusT model was built to replicate the 2010 DRCOG regional travel demand model. For analysis purposes, a sub-area—or a portion of the regional model, capturing a vast majority of trips into, out of, and through the study area—provided the basis for evaluating existing and future conditions. Exhibit 4-11 shows the DynusT sub-area limits in comparison to the study area. Daily traffic data, such as volumes for numerous links on I-70, 46th Avenue, and various local roadways, intersection turning movement counts, interstate travel speeds, and interstate travel time, ensured full calibration of the sub-area network that best replicated 2012 conditions.

**Exhibit 4-10. Traffic modeling process**

![Traffic Modeling Process Diagram]

**Regional Travel Demand Model**

The regional model includes the following counties:

- Adams
- Arapahoe
- Boulder
- Broomfield
- Clear Creek
- Denver
- Douglas
- Gilpin
- Jefferson
- Weld (southwest)
Exhibit 4-11. DynusT sub-area model limits

The calibrated DynusT sub-area model’s existing roadway network provided the baseline for evaluating the following performance measures, as defined in more detail in the subsequent discussions.

- Daily and peak-period volumes
- I-70 average speeds (level of congestion)
- Vehicle miles of travel (VMT) and vehicle hours of travel (VHT)
- Travel times
- East-west local street volumes (diversion from highway)

**Existing traffic volumes**

Daily and peak-period volumes provide a picture of how well a particular roadway is able to process vehicles. I-70 between I-25
and Tower Road, 46th Avenue between Washington Street and Colorado Boulevard, and Stapleton Drive North/South between Colorado Boulevard and Quebec Street are the primary roads of interest for this document. Changes to the roadway geometry, such as adding capacity or improving regional connectivity, may result in changes to the volume of traffic using any particular roadway. Maximizing the through-put on a freeway such as I-70 will result in lower volumes on the local streets. 46th Avenue passes directly through many of the residential areas near I-70. Increases in traffic on 46th Avenue may result in an increase in crashes and safety issues, reducing the overall quality of life for the neighborhood residents.

**Existing I-70 traffic volumes**

Exhibit 4-12 displays the existing directional daily traffic volumes and peak-period traffic volumes. Bi-directional daily volumes are lowest—less than 75,000 vehicles per day (vpd)—at the east and west ends of the study area, primarily because there are only two lanes in each direction of I-70 for these portions of the highway. Volumes peak in the area between I-270 and I-225, with 200,000 vpd (105,000 vpd westbound and 95,000 vpd eastbound) just east of the Central Park Boulevard interchange. The segments between Washington Street and Central Park Boulevard generally carry between 130,000 vpd and 150,000 vpd. The merges and diverges for I-25, I-270, I-225, and Peña Boulevard result in large volume increases/decreases (between 40,000 vpd and 80,000 vpd) at each location. As much as 75 percent of the traffic on I-70 occurs during the peak periods of the day.

**Existing 46th Avenue and Stapleton Drive North/South traffic volumes**

The current volumes on 46th Avenue and Stapleton Drive North/South, displayed in Exhibit 4-13, indicate that the morning and evening peak periods tend to be very similar for both eastbound and westbound directions. Daily traffic volumes peak at approximately 20,000 vpd just west of Steele Street. Typical daily volumes on the remaining segments of 46th Avenue tend to be less than 10,000 vpd. During the peak periods, 60 percent to 70 percent of the traffic volumes occur.

Volumes on Stapleton Drive North/South (see Exhibit 4-13) range between 12,000 vpd and 20,000 vpd. The I-70 slip ramps located west of Dahlia Street and east of Monaco Street provide for access to and from the large industrial area between Colorado Boulevard and Quebec Street, which is consistent with the higher volumes on these roadways.
Exhibit 4-12. Existing I-70 traffic volumes

Source: Existing (2012) calibrated DynusT model.
Exhibit 4-13. Existing 46th Avenue and Stapleton Drive traffic volumes

Source: Existing (2012) calibrated DynusT model.
Existing I-70 average speeds

Average speeds, which represent the level of congestion on I-70, affect two performance measures of the highway system: mobility and safety. Higher speeds, or lower levels of congestion, result in shorter travel times, or better mobility. Speed also can reduce safety on a facility, especially if there is a large speed differential or stop-and-go conditions typically associated with congestion.

Congestion along I-70 results in delays for motorists and can result in an increase in crashes. Congestion is related to average travel speeds—as the travel speeds go down, the level of congestion goes up. DynusT produces figures known as “heat diagrams” based on the average travel speeds on a particular route (see Exhibit 4-14). The diagrams use colors to visually depict the travel speeds expected for a given time of day by location. Dark blue (cool temperatures) represents free-flow speeds (no congestion) and dark red (hot temperatures) depict locations with low travel speeds (heavy congestion). The top of the figure shows the travel direction, and the map at the bottom of the figures shows the location on I-70. The time scale on the left vertical axis represents trip starting times and the color (or heat) scale legend on the right side indicates the average speed of the vehicles.

The average speeds for eastbound and westbound I-70 are shown in Exhibit 4-15. The figure shows minor levels of eastbound congestion between Brighton Boulevard and York Street during the morning peak period. This congestion is due to the closely spaced merge/diverge areas for I-25, Washington Street, Brighton Boulevard, and York Street. Slowing speeds and congestion also are present during the peak periods of the day on the segment near I-270 and I-225. This is consistent with the heavy amount of traffic entering and exiting at these freeway-to-freeway connections. Overall, there is more eastbound congestion during the morning peak period than the rest of the day. Eastbound speeds typically remain above 45 mph for the majority of the day.

Exhibit 4-15 also shows westbound congestion between Peña Boulevard and I-225 during the morning peak period. There is also congestion between the I-225 and the I-270 interchanges during the peak periods. This area also has pockets of speeds below 50 mph for a majority of the day. Again, this congestion is consistent with the heavy amount of merging and diverging traffic associated with these freeway-to-freeway connections. Westbound I-70 shows congestion between Colorado Boulevard and York Street for the majority of the day due to the close proximity of the interchanges.

### Heat diagrams

The purpose of heat diagrams is to identify overall trends in vehicle speeds or congestion levels on I-70. The areas that have warmer colors (yellows/oranges/reds) identify locations of reduced speeds or higher congestion.

It is more important first to focus on where the congestion occurs and the pattern of the congestion (recurring or isolated), and then to look at the length or duration of the congestion.

### Free-flow speeds

Free-flow speeds assume that drivers travel the speed limit with no congestion present.
spacing of the interchanges in this area. Westbound I-70 speeds tend to remain above 40 mph for most of the day. Overall, westbound I-70 has more periods with speeds below 30 mph (approaching 20 mph) than eastbound I-70.

**Exhibit 4-14. Example heat diagram showing average speeds on I-70**

Source: DynusT model.
There are more than 15.2 million miles traveled each day within the sub-area, with a little more than 10 percent of this occurring on the I-70 corridor between I-25 and Tower Road.

All of the trips in the sub-area total approximately 0.5 million hours of travel each day, with the trips on I-70 (between I-25 and Tower Road) making up about 7 percent of this total.

It takes slightly longer than 12 minutes to travel eastbound or westbound between I-25 and Tower Road at free-flow speeds (the posted speed limit). Under existing conditions, eastbound trips take approximately 17 minutes during the morning peak and almost 15 minutes during the evening peak (25 percent to 40 percent longer than free-flow travel). During the morning peak, the westbound trips take nearly 21 minutes (75 percent longer than free-flow times) and the evening peak takes about 17 minutes (40 percent longer than the free-flow travel time) for the same stretch of highway.

**Existing 46th Avenue and Stapleton Drive North/South travel times**

Travel times for 46th Avenue from Brighton Boulevard to Colorado Boulevard (a distance of about 1.5 miles) generally
take between three and four minutes for eastbound and westbound trips under existing conditions. Existing travel times on Stapleton Drive North/South between Colorado Boulevard and Quebec Street (a distance of about two miles) takes about three to four minutes for eastbound traffic and four to five minutes for westbound trips. The travel times are consistent with low volumes and uncongested travel along roadways with lower speed limits (less than 35 mph) and several signalized intersections.

**Existing east-west local street volumes**

DynusT identifies the volume of traffic that will choose to use the freeway versus the volume of traffic that will use the local street facilities. This measure is important because it quantifies the amount of traffic that may divert to local roads when encountering congestion on the freeways instead of I-70 based on congestion in the study area. This will help identify impacts to residents, pedestrians, and bicyclists along these local roadways resulting from changes in traffic patterns.

As I-70 becomes congested, motorists may decide to use parallel local streets to complete east-west trips within the sub-area. Exhibit 4-16 shows a series of screenlines intended to capture the total east-west volumes on the parallel local streets to the north and south of I-70. The east-west volumes for the identified roadways north of I-70 were added together to provide a single value of vehicles using parallel routes to the north of I-70. A similar approach applies for the identified roads south of I-70. Exhibit 4-17 shows the results of the existing (2012) conditions analysis.
Exhibit 4-16. East-west parallel route screenlines

Exhibit 4-17. Existing screenline volumes

Source: Existing (2012) calibrated DynusT model.
4.2 How were future traffic and transportation evaluated?

Before conducting the analysis of the No-Action or Build Alternatives, future (2035) transportation system characteristics were identified. All I-70 project alternatives assume implementation of the transportation improvements identified in the DRCOG 2035 MVRTP. This includes both programmed projects (those budgeted in the five-year TIP) and planned projects (those not in the TIP, but included in the adopted DRCOG 2035 MVRTP). The more significant planned and programmed improvements to the transportation system within the study area are shown in Exhibit 4-18. For a complete list of projects, refer to the DRCOG 2035 MVRTP.

In addition to planned roadway improvements, the analysis assumed the implementation of major transit system improvements within the Denver region as part of RTD’s FasTracks program. Of most significance in the study area is the East Corridor commuter rail project, which will run from downtown Denver to DIA (see Exhibit 4-18).

Exhibit 4-18. 2035 transportation system improvements

![Exhibit 4-18. 2035 transportation system improvements](source: DRCOG, 2011)
Individual travel demand models and DynusT roadway networks consistent with future (2035) transportation system improvements were developed for the alternatives. A travel demand model estimates traffic demand based on where population and employment will grow in the region, and then predicts how the resulting travel demand distributes over the regional transportation network. The evaluation of the individual roadway networks within the travel demand models provided the future (2035) origin-destination data for the various alternatives. The origin-destination output from the travel demand models became the input to the individual roadway networks within DynusT.

4.3 How do the project alternatives affect the transportation facilities?

Consistent with federal regulations, this document fully evaluates potential effects to the transportation facilities that might result from the No-Action Alternative and the Build Alternatives (Revised Viaduct Alternative and Partial Cover Lowered Alternative and their design options) presented in Exhibit 4-19.

Exhibit 4-19. Summary of project alternatives and options

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Expansion Options</th>
<th>Connectivity Options</th>
<th>Operational Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Action</td>
<td>• North</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>• South</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Build Alternatives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revised Viaduct</td>
<td>• North</td>
<td>N/A</td>
<td>• General-Purpose Lanes</td>
</tr>
<tr>
<td></td>
<td>• South</td>
<td></td>
<td>• Managed Lanes</td>
</tr>
<tr>
<td>Partial Cover Lowered</td>
<td>N/A</td>
<td>• Basic</td>
<td>• General-Purpose Lanes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Modified</td>
<td>• Managed Lanes</td>
</tr>
</tbody>
</table>

The following section briefly discusses the major changes to I-70, 46th Avenue, and Stapleton Drive North/South for the No-Action and Build Alternatives. Attachment A, Alternative Maps, contains figures showing the roadway configurations within the study area for each of the future alternatives. For more detail on the alternatives and their options, see Attachment C, Alternative Analysis Technical Report.

In the No-Action Alternative, the overall transportation facilities remain unchanged within the study area. This alternative does reconstruct the elevated portion of I-70 between Brighton Boulevard and Colorado Boulevard. The reconstruction of the North or South Expansion Options: impacts on traffic patterns

The No-Action Alternative and Revised Viaduct Alternative both have options that shift I-70 north or south. These shifts have no impact on traffic circulation and are each considered a single alternative for the purpose of discussing transportation impacts.
viaduct does not add any capacity to I-70. 46th Avenue and Stapleton Drive North/South remain in their current configuration and do not experience any capacity improvements.

The Build Alternatives add capacity to I-70 through the addition of one travel lane in each direction for the sections east of Chambers Road and west of Brighton Boulevard. The portion of I-70 between Brighton Boulevard and Chambers Road receives two more lanes of capacity in each direction. All of the added capacity will either be in the form of general-purpose (not priced) lanes or managed (priced) lanes.

46th Avenue has unique configurations for each of the Build Alternatives. In the Revised Viaduct Alternative, 46th Avenue continues to operate similarly to the existing conditions, with some modifications to the connectivity at Brighton Boulevard. In the Partial Cover Lowered Alternative, Basic Option, 46th Avenue is a one-way couplet between Brighton Boulevard and Colorado Boulevard, with eastbound travel on the south side of I-70 and westbound travel on the north side of I-70. 46th Avenue connects across Colorado Boulevard to align with Stapleton Drive North/South to provide continuous east-west connectivity as far west as Quebec Street. The configuration is the same for both Operational Options.

In the Partial Cover Lowered Alternative, Modified Option, 46th Avenue is very similar to the Partial Cover Lowered Alternative, Basic Option, except for the section between York Street and Garfield Street. In this section, 46th Avenue will have two-way operations on both the north and south sides of I-70. This option also eliminates the portion of 46th Avenue north of I-70 between Columbine Street and Clayton Street.

**Effects on local connectivity**

The No-Action Alternative minimally affects the north-south and east-west roadway connections in the study area. The only significant change occurs at the York Street interchange for the South Expansion Option. This change affects the eastbound off-ramp configuration and will require some re-routing of local trips using the adjacent street network. All of the other existing interchange forms remain the same in the No-Action Alternative. Attachment A, *Alternative Maps*, contains figures showing the connectivity for the No-Action Alternative.

The Build Alternatives (see Attachment A, *Alternative Maps*) make the following changes to the interchanges:

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**Capacity**

A travel lane on a roadway can serve a specific number of vehicles in an hour. This number of vehicles per hour per lane is called capacity. If a new lane is added to a road, the capacity of the road will increase.

**One-way couplet**

A one-way couplet is a pair of parallel streets with each street only allowing one-way travel, but in opposite directions. Together the two streets operate as a single street.
• All of the Build Alternatives remove the York Street interchange, which requires drivers to use local streets to gain access to and from I-70 at adjacent interchanges.

• The Revised Viaduct Alternative and the Partial Cover Lowered Alternative, Basic Option create a split-diamond interchange configuration with collector-distributor roads between Steele Street and Colorado Boulevard.

• The Partial Cover Lowered Alternative, Modified Option moves the west highway access at Steele Street/Vasquez Boulevard to Colorado Boulevard to make Colorado Boulevard a full diamond interchange.

• All of the Build Alternatives alter the location of the Holly Street interchange ramps to form a more traditional diamond interchange. The slip ramps currently located east of Monaco Street and west of Dahlia Street move to the west of Monaco Street and east of Dahlia Street, respectively.

• All other interchanges within the study area continue to provide similar access as existing conditions with some modifications to the ramp types that do not affect the overall connectivity.

The Build Alternatives have the same north-south and east-west roadway connections as existing conditions, with the exception of the area between Brighton Boulevard and Colorado Boulevard. A discussion of the differences between the Build Alternatives for the Brighton Boulevard to Colorado Boulevard section is provided in the following paragraphs.

Exhibit 4-20 displays the local north-south roadway connections for the Revised Viaduct Alternative. Fillmore Street and Milwaukee Street are extended under I-70 and across 46th Avenue. Similar to existing conditions, 46th Avenue continues to provide two-way connectivity under I-70.
The Partial Cover Lowered Alternative, Basic Option, shown in Exhibit 4-21, continues to provide north-south connectivity at York Street, Josephine Street, Columbine Street, Clayton Street, Steele Street, and Garfield Street. 46th Avenue is no longer located underneath I-70, but is a one-way couplet between Brighton Boulevard and Colorado Boulevard with eastbound travel on the south side of I-70 and westbound travel on the north side of I-70. This alternative eliminates the connection between 46th Avenue and Milwaukee Street and the portion of Elizabeth Street north of 46th Avenue and south of 47th Avenue. All other north-south streets within this area end at either eastbound or westbound 46th Avenue. 46th Avenue extends across Colorado Boulevard and connects with the existing one-way couplet of Stapleton Drive North and Stapleton Drive South. These streets are extended to the east and connect to the Quebec Street ramps to allow for connectivity between Colorado Boulevard and Quebec Street.
Exhibit 4-21. North/south connectivity over I-70 with Partial Cover Lowered Alternative, Basic Option

The Partial Cover Lowered Alternative, Modified Option, shown in Exhibit 4-22, is similar to the Basic Option with the following exceptions:

- Eliminates the portion of Josephine Street over I-70 and converts it to a bicycle/pedestrian facility.

- Converts York Street and Josephine Street to two-way traffic between 47th Avenue and 45th Avenue.

- Converts 46th Avenue, south and north of I-70, to two-way operations (one-lane in each direction) between York Street and Garfield Street.

- Eliminates the portion of 46th Avenue on the north side of I-70 between Columbine Street and Clayton Street.

- Adds an overpass at Milwaukee Street.
Effects on transit service facilities

Transit service within the study area should not be substantially affected. Changes associated with the Build Alternatives within the study area, including modifications to the surface street network, will improve safety and reduce congestion, which will have an overall benefit to transit service.

Transit travel times and variability could potentially improve by implementing managed lanes. Providing an incentive for buses to travel in the managed lanes could reduce transit delay by allowing buses to avoid roadway congestion.

Effects on pedestrian and bicycle facilities

Pedestrian and bicycle facility improvements associated with the Build Alternatives will enhance the safety of pedestrians and bicyclists within the study area. Intersections that are being improved will have countdown lights installed at signalized crosswalks to improve pedestrian safety. More opportunities to enhance the pedestrian environment include sidewalk connectivity, Americans with Disabilities Act improvements, greater sidewalk width, and improved lighting. All alternatives maintain connectivity of Denver Bike Route (D-13) to provide north-south access via Clayton Street.

While the Partial Cover Lowered Alternative will limit the amount of pedestrian and bicycle north-south crossing locations, the cover provides connectivity between neighborhoods. This

Cover
As part of the Partial Cover Lowered Alternative, a cover will be placed on top of I-70. The cover, located between Columbine Street on the west and Clayton Street on the east, reconnects the neighborhoods north and south of I-70. The design details for the cover are being studied and will be coordinated with the local neighborhoods.
alternative also provides shorter pedestrian crossing distances over 46th Avenue, which will enhance safety. The design allows pedestrians to cross two lanes of traffic at a time, instead of four lanes.

**Effects on trucking facilities**

Overall, the Build Alternatives will improve highway freight transport through and into the study area by adding capacity on I-70, reducing delays, and improving safety. These improvements increase operating efficiency and reduce operating costs for the trucking industry. The changes associated with the Build Alternatives will not substantially alter the designated truck routes or the delivery routes. Potential changes to truck routes or delivery routes may be necessary due to changes in the roadway network or redevelopment that may occur in the study area. Future truck and delivery routes may require alteration or additions based on unknown future needs.

In some cases, interchanges will be reconfigured, but these changes will improve overall safety and traffic flow. Changes to the local street network may marginally increase the distance trucks have to travel off the designated truck routes or delivery routes to get to or from their destination. While existing truck travel within the Elyria and Swansea Neighborhood is a concern of local residents, changes associated with the Build Alternatives should not significantly impact these streets because any potential changes to the designated truck routes and delivery routes could be coordinated with the City to ensure impacts are minimized. This could be accomplished by setting up specific truck routes, prohibition on some roadways, and/or specific delivery times based on input from local citizen groups.

**Effects on rail freight facilities**

None of the Build Alternatives will permanently impact rail service within or through the study area. All existing rail crossings of the I-70 alignment are grade separated, with the railroad currently passing beneath I-70. Grade separation of all of these crossings will be maintained.

The Partial Cover Lowered Alternative will require the construction of a new bridge for the UPRR Greeley Subdivision just east of Brighton Boulevard and for the BNSF Market Lead just east of Steele Street/Vasquez Boulevard. This will result in temporary impacts to railroad operations for track relocations required to phase the construction of the new grade-separated structures. None of the other alternatives will require the building of new railroad structures. I-70 will be located above the railroad at all crossings, similar to existing conditions.
East of Colorado Boulevard, all of the Build Alternatives involve similar construction. Between Monaco and Quebec Street, the Denver Rock Island Railroad has switching yard tracks that are located below an I-70 bridge. The build improvements will maintain current operations through construction of new bridges and/or relocate track operations to a similar condition. The UPRR spur track at Havana Street will be relocated to the east below bridges for the ramps and mainline I-70 highway.

4.3.1 How do the project alternatives affect safety?

The No-Action Alternative does not address current safety issues other than reconstructing the viaduct portion of I-70. Growth in traffic volume is likely to result in an overall increase in the number, frequency, and severity of crashes on I-70. The overall safety of the highway will degrade by 2035 without improvements or at least the implementation of some safety enhancements.

The Build Alternatives address the safety concerns and infrastructure deficiencies identified in CDOT’s I-70 East Corridor EIS Safety Evaluation (2004c) and Safety Evaluation Addendum: I-70 Corridor Plan (2013a). By relieving congestion and correcting identified deficiencies, the anticipated crash rates along I-70 decrease with the Build Alternatives. The safety evaluation included analysis of the interchanges. The evaluation identified specific improvements, such as the addition of turn lanes or turn signals, at specific locations to improve safety. The Build Alternatives include these improvements to enhance safety within the study area.

4.3.2 How will the project alternatives affect traffic conditions?

The following sub-sections provide a discussion of how the traffic conditions will change between 2012 and 2035 without any improvements to I-70, as well as how the Build Alternatives compare to the No-Action Alternative using the same performance measures previously described for existing conditions (2012). Attachment E, Traffic Technical Report provides a detailed description of the analyses, results, and comparisons of the performance measures between the existing conditions (2012), No-Action Alternative, and Build Alternatives.

To simplify the presentation of the analysis results in the exhibits, the following abbreviations are used for the Build Alternatives and their different design options:

- Revised Viaduct Alternative, North or South Options and General-Purpose Lanes Option: RV—GP
• Revised Viaduct Alternative, North or South Options and Managed Lanes Option: RV—ML

• Partial Cover Lowered Alternative, Basic Option and General-Purpose Lanes Option: PCL—BO—GP

• Partial Cover Lowered Alternative, Basic Option and Managed Lanes Option: PCL—BO—ML

• Partial Cover Lowered Alternative, Modified Option and General-Purpose Lanes Option: PCL—MO—GP

• Partial Cover Lowered Alternative, Modified Option and Managed Lanes Option: PCL—MO—ML

**Future I-70 volumes**

Exhibit 4-23 provides a comparison of the No-Action Alternative (2035) to the existing mainline I-70 traffic volumes (2012). Daily and peak-period traffic increases on every highway segment. Typically, individual segments of I-70 will experience an increase in directional daily volumes of between 20 percent and 40 percent compared to existing conditions. This indicates the highway does have some limited reserve capacity with the current number of lanes.

Exhibit 4-24 displays the comparison of the I-70 daily and peak-period traffic volumes for the Build Alternatives compared to the No-Action Alternative. The data for the Managed Lanes Option represent the total volume serviced by all lanes of I-70 (general-purpose lanes plus managed lanes). In general, all segments of I-70 experience an increase of daily volumes between 30 percent and 50 percent compared to the No-Action Alternative. Some individual segments experience an increase in daily volumes of almost 100 percent. The peak-period volumes display similar growth trends as the daily volumes. Overall, all of the Build Alternatives process similar volumes throughout the day.

Improving traffic on I-70 results in drivers choosing to use I-70 instead of the local roadways to travel through the study area.

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**Future I-70 traffic**

I-70 has very limited reserve capacity based on the current number of lanes on the highway. Improving I-70 through the addition of more lanes (general purpose or managed) results in more drivers using I-70 instead of the local roadways to travel through the study area.

All of the Build Alternatives show the ability to process an equal amount of traffic on I-70. As a performance measure, traffic volumes on I-70 are not a distinguishing factor between the alternatives.
Exhibit 4-23. No-Action Alternative, I-70 volumes

Source: No-Action (2035) DynusT model.
Exhibit 4-24. Build Alternatives, I-70 volumes

Source: Build (2035) Alternatives DynusT models.
Future 46th Avenue and Stapleton Drive North/South traffic volumes

Exhibit 4-25 displays the projected daily and peak-period volumes on 46th Avenue and Stapleton Drive North/South for the No-Action Alternative compared to the existing conditions. Without improvements to I-70, traffic volumes on all segments of these roadways more than double compared to the existing conditions. Much of this increase is likely due to drivers trying to bypass the increased levels of congestion on I-70 by using the closest parallel alternate route. It is likely that short trips between adjacent interchanges are using local streets to avoid I-70 congestion. Increased traffic on the local roads will have a negative effect on neighborhood residents’ quality of life and will expose pedestrians and bicyclists to more vehicular traffic at all crossing locations.

Exhibit 4-26 shows the daily and peak-period volumes projected to use 46th Avenue and Stapleton Drive North/South for the Build Alternatives compared to the No-Action Alternative. In general, most segments of the roadways experience a decrease in traffic compared to the No-Action Alternative. The eastbound Brighton Boulevard to York Street segment experiences an increase due to the elimination of the York Street interchange and traffic exiting I-70 at Brighton Boulevard and then using 46th Avenue to access York Street. The westbound Josephine Street to York Street segment traffic volume increases significantly for the Partial Cover Lowered Alternative, Modified Option, because Josephine Street is not continuous over I-70 in these options. The segments around Steele Street and Colorado Boulevard that experience increases are primarily due to the different ramp configurations at these interchanges. Overall, a reduction in congestion on I-70 results in drivers using I-70 for more trips, which reduces the traffic on the local streets.
Exhibit 4-25. No-Action Alternative, 46th Avenue and Stapleton Drive North/South volumes

Source: No-Action (2035) DynusT model.
Exhibit 4-26. Build Alternatives, 46th Avenue and Stapleton Drive North/South volumes

Source: Build (2035) Alternatives DynusT models.
Future I-70 average speeds

Exhibit 4-27 displays the No-Action Alternative average speeds for eastbound and westbound I-70. Both directions of I-70 will experience longer periods of congestion and reduced speeds throughout the day. This will happen at locations of high merge/diverge movements, such as freeway-to-freeway interchanges or where several ramps occur in a short distance. Speeds as low as 10 mph will be common in both directions during the peak periods and speeds below 45 mph will be typical for most of the day for both directions. The increase in traffic volumes on I-70 will result in congestion for long periods of the day and on more segments of the highway compared to existing conditions. The increase in I-70 congestion will result in drivers using parallel local streets within study area.

Exhibit 4-27. No-Action Alternative average speeds

Exhibit 4-28 to Exhibit 4-31 display the average speeds on I-70 for the Build Alternatives and all of their design options. For the Managed Lanes Option, the figures display the average speeds for vehicles using the general-purpose lanes only. In general, all of the Build Alternatives show less congestion throughout the day compared to the No-Action Alternative. The following describes what will occur for the General-Purpose Lanes Option, as shown in Exhibit 4-28 to Exhibit 4-30:
• Westbound congestion will continue to exist during the morning peak in the area between the Peña Boulevard on ramp and the I-225 exit ramp. Congestion will persist around the I-270 diverge area, although it will be less intense than the No-Action Alternative, with speeds remaining above 40 mph for the most part. Congestion also will continue for most of the day near I-25 due to I-70 only having two lanes through this interchange area. Overall, the westbound heat diagrams show similar characteristics to each other for the entire day.

• For eastbound trips, vehicles are encountering less overall congestion than with the No-Action Alternative. There is still congestion between I-270 and I-225 during the evening peak period, but the duration and intensity is reduced. Congestion occurs near Tower Road, as the number of lanes is reduced to two lanes through this interchange. Overall, the eastbound heat diagrams show similar characteristics in the morning and early afternoon hours. The location of congestion is similar in the evening hours between the different alternatives, with the Partial Cover Lowered Alternative, Modified Option with General-Purpose Lanes Option showing longer duration of congestion between I-270 and I-225.

The following describes what will occur for the Managed Lanes Option, as shown in Exhibit 4-32 to Exhibit 4-31:

• The average speeds during the day are lower compared to the General-Purpose Lanes Option. This is because there are fewer general-purpose lanes in the Managed Lanes Option, so they become congested more easily.

• Overall, the westbound heat diagrams show similar characteristics to each other for the entire day. The peak spreading that occurs due to the addition of managed lanes results in shorter periods of congestion more frequently throughout the day.

• For eastbound trips, the Managed Lanes Option continues to encounter congestion in the area between I-225 and Tower Road, due to the high number of merge/diverge movements and the lack of additional general-purpose lanes in this area. Overall, the eastbound heat diagrams show similar traits to each other, exhibiting a cyclic pattern that is consistent with the prices in the managed lanes fluctuating up and down as demand for these lanes changes throughout the day.

Peak spreading
The Managed Lanes Option has fewer general-purpose lanes. If drivers do not alter their departure times, the congestion in the general-purpose lanes will result in high demand for the managed lanes. The result will be higher prices in the managed lanes. As a result, managed lanes will impact driver travel behavior, resulting in a spreading out of demand over the day so that pricing can remain reasonable.

The managed lanes result in a cyclic pattern of drivers choosing to use the managed lanes to avoid congestion in the general-purpose lanes and drivers using the general-purpose lanes to avoid high prices in the managed lanes. This results in general-purpose lanes experiencing shorter periods of congestion that are less intense overall, but cyclic throughout the day.
Exhibit 4-28. I-70 average speeds for Revised Viaduct Alternative with General-Purpose Lanes

Source: Build (2035) Alternative DynusT models.

Exhibit 4-29. I-70 average speeds for Partial Cover Lowered Alternative, Basic Option with General-Purpose Lanes

Source: Build (2035) Alternative DynusT models.
Exhibit 4-30. I-70 average speeds for Partial Cover Lowered Alternative, Modified Option with General-Purpose Lanes

Source: Build (2035) Alternative DynusT models.

Exhibit 4-31. I-70 average speeds for Revised Viaduct Alternative with Managed Lanes

Source: Build (2035) Alternative DynusT models.
Exhibit 4-32. I-70 average speeds for Partial Cover Lowered Alternative, Basic Option with Managed Lanes

Source: Build (2035) Alternative DynusT models.

Exhibit 4-33. I-70 average speeds for Partial Cover Lowered Alternative, Modified Option with Managed Lanes

Source: Build (2035) Alternative DynusT models.
Future VMT

Exhibit 4-34 compares the No-Action Alternative daily VMT to existing conditions for vehicles using I-70, as well as all vehicles within the sub-area. VMT in the No-Action Alternative increases by almost 60 percent for the sub-area and by approximately 40 percent for I-70 when compared to existing conditions. In the No-Action Alternative, I-70 accounts for less than 9 percent of the sub-area VMT, this is about 2 percent less than existing conditions. The figure demonstrates that more traffic will use local streets because of increased congestion on I-70.

Exhibit 4-34. VMT, No-Action Alternative

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>No-Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,586,000</td>
<td>2,195,000</td>
</tr>
<tr>
<td></td>
<td>15,243,000</td>
<td>24,482,000</td>
</tr>
</tbody>
</table>

Legend

Source: No-Action (2035) DynusT model.

Exhibit 4-35 compares the Build Alternatives’ daily VMT for the sub-area and I-70 to that of the No-Action Alternative. The VMT for the Managed Lanes Option includes the vehicles using the general-purpose and managed lanes on I-70. All of the Build Alternatives result in an approximate 35-percent increase in VMT on I-70 and a 3-percent increase in VMT for the entire sub-area. This means that while overall traffic increases in the Build Alternatives, more traffic is accommodated on I-70 and less traffic uses local streets compared to the No-Action Alternative.

VMT

VMT, calculated by multiplying the number of vehicles using an entire system or an individual roadway by the distance they travel, is a common measure of highway use. VMT estimates are useful in estimating crash rates and pollutant emissions. The transportation system as a whole will benefit based on how well I-70 is able to account for a larger share of the sub-area VMT.
Exhibit 4-35. VMT, Build Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>VMT 2035</th>
<th>Build Alternative DynusT model</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV-ML</td>
<td>2,975,000</td>
<td>25,332,000</td>
</tr>
<tr>
<td>RV-GP</td>
<td>2,953,000</td>
<td>25,055,000</td>
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<tr>
<td>PCL-MO-ML</td>
<td>2,935,000</td>
<td>25,125,000</td>
</tr>
<tr>
<td>PCL-MO-GP</td>
<td>2,945,000</td>
<td>25,046,000</td>
</tr>
<tr>
<td>PCL-BO-ML</td>
<td>2,959,000</td>
<td>25,036,000</td>
</tr>
<tr>
<td>PCL-BO-GP</td>
<td>2,995,000</td>
<td>25,192,000</td>
</tr>
<tr>
<td>No-Action</td>
<td>2,195,000</td>
<td>24,482,000</td>
</tr>
</tbody>
</table>

Legend: I-70 | Sub-area
Source: Build (2035) Alternatives DynusT models.

Future VHT

Exhibit 4-36 displays the daily sub-area and I-70 VHT for the No-Action Alternative and existing conditions. Without any improvements to I-70, the No-Action Alternative daily VHT increases by almost 300 percent for the sub-area, and I-70 will experience an increase of more than 200 percent compared to the existing conditions. The increase in VHT indicates higher overall levels of congestion throughout the study area because of more traffic on I-70 and the local streets.

Exhibit 4-36. VHT, No-Action Alternative

<table>
<thead>
<tr>
<th>Alternative</th>
<th>VHT 2035</th>
<th>No-Action (2035) DynusT model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>31,300</td>
<td>446,900</td>
</tr>
<tr>
<td>No-Action</td>
<td>99,700</td>
<td>1,703,000</td>
</tr>
</tbody>
</table>

Legend: I-70 | Sub-area
Source: No-Action (2035) DynusT model.
Exhibit 4-37 compares the Build Alternatives’ daily VHT for the sub-area and I-70 to that of the No-Action Alternative. The VHT for the Managed Lanes Option includes the drivers using the general-purpose and managed lanes on I-70. All of the Build Alternatives result in lower overall VHT for both the sub-area and I-70. The General-Purpose Lanes Option reduces VHT on I-70 by 2 percent to 9 percent and by 14 percent to 17 percent across the entire sub-area. The Managed Lanes Option has larger reductions in VHT of about 16 percent to 27 percent for I-70 and about 40 percent for the sub-area.

Overall, the reduction in congestion results in less time spent traveling within the study area and on I-70. Looking at both VMT and VHT together indicates that more trips occur in less time with the Build Alternatives.

Exhibit 4-37. VHT, Build Alternatives

<table>
<thead>
<tr>
<th>Option</th>
<th>VHT (Build 2035)</th>
<th>VHT (No-Action)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV-ML</td>
<td>83,400</td>
<td>1,012,000</td>
</tr>
<tr>
<td>RV-GP</td>
<td>92,500</td>
<td>1,418,000</td>
</tr>
<tr>
<td>PCL-MO-ML</td>
<td>73,000</td>
<td>998,000</td>
</tr>
<tr>
<td>PCL-MO-GP</td>
<td>98,000</td>
<td>1,411,000</td>
</tr>
<tr>
<td>PCL-BO-ML</td>
<td>82,300</td>
<td>1,020,000</td>
</tr>
<tr>
<td>PCL-BO-GP</td>
<td>90,500</td>
<td>1,464,000</td>
</tr>
<tr>
<td>No-Action</td>
<td>99,700</td>
<td>1,703,000</td>
</tr>
</tbody>
</table>

Legend: I-70 | Sub-area

Source: Build (2035) Alternatives DynusT models.

Future I-70 travel times

Exhibit 4-38 shows the No-Action Alternative travel times for I-70 between I-25 and Tower Road compared to the existing conditions and free-flow conditions. Travel times for westbound I-70 increase to about 60 minutes during the morning and evening peak periods, which is triple the current times. Eastbound travel times more than double in the morning peak period to 30 minutes and increase to about 65 minutes in the evening peak period, which is five times as long as current travel times. The travel times show that the peak periods occur over
more hours of the day with higher levels of congestion and longer delays in the future.

**Exhibit 4-38. No-Action Alternative, I-70 travel times**

Exhibit 4-39 shows the Build Alternatives’ travel times compared to the No-Action Alternative. For the Managed Lanes Option, a driver can choose to make a trip through the study area by using either general-purpose lanes, managed lanes, or a combination of the two. The aforementioned exhibit contains two lines for each of the alternatives that have managed lanes: (1) a dashed line that represents the travel time for vehicles that use only managed lanes to go from I-25 to Tower Road or vice-versa,
and (2) a solid line that represents a vehicle that makes the same trip using only general-purpose lanes. This represents the best- and worst-case scenarios, but many travelers will likely experience travel times between these two extremes. The current analysis focuses on travel times for trips going from end to end of the study area within a single lane type.

All of the Build Alternatives have lower travel times during the peak periods. The General-Purpose Lanes Option continues to have distinct morning and evening peak periods, but the additional lanes on I-70 result in shorter overall peak periods and times compared to the No-Action Alternative. The Managed Lanes Option tends to have lower overall peak-period travel times (in the general-purpose lanes), but the peak periods occur over more hours of the day compared to the General-Purpose Lanes Option. This is because drivers will change their travel behaviors by making trips at different times of the day to avoid paying tolls and because there are fewer general-purpose lanes on I-70. As a result, trips are spread out over more hours of the day and the managed lanes will operate more reliably at lower toll rates.

**Future 46th Avenue and Stapleton Drive North/South travel times**

Exhibit 4-40 presents the results of the No-Action Alternative travel times for 46th Avenue and Stapleton Drive North/South compared to existing conditions. Without improvements to I-70, the travel times for these roadways nearly double during the peak periods. All trips on 46th Avenue and Stapleton Drive North/South between about 7:00 a.m. and 8:00 p.m. (about 13 hours of the day) experience longer trip times under the No-Action Alternative. Drivers are using these parallel local streets to avoid congestion on I-70.

Exhibit 4-41 displays the Build Alternatives’ travel times for 46th Avenue and Stapleton Drive North/South compared to the No-Action Alternative. In general, improvements to I-70 reduce the number of vehicles using these roadways which result in travel times that are very similar to or better than those of the No-Action Alternative.
Exhibit 4-39. Build Alternatives, I-70 travel times

Source: Build (2035) Alternatives DynusT models.
Exhibit 4-40. No-Action Alternative, 46th Avenue and Stapleton Drive North/South travel times

Source: No-Action (2035) DynusT model.
Exhibit 4-41. Build Alternatives, 46th Avenue and Stapleton Drive North/South travel times

Source: Build (2035) Alternatives DynusT models.
Future east-west screenline volumes

Exhibit 4-42 shows the east-west volumes crossing the screenlines for the No-Action Alternative compared to existing conditions. Traffic using local streets traveling east and west within the study area increases 60 percent to 250 percent. While some of this increase can be associated with natural growth in traffic, the large increases are consistent with drivers avoiding congestion on I-70 by using parallel local streets.

Exhibit 4-42. No-Action Alternative, screenline volumes

Exhibit 4-43 displays the screenline volumes for the Build Alternatives compared to the No-Action Alternative. All of the Build Alternatives result in lower traffic volumes crossing the screenlines, with the exception of the screenline north of I-70 between York Street and Steele Street. This screenline does experience an increase in traffic for both Build Alternatives.

Differences in connectivity in the area and the elimination of the York Street interchange are the primary reasons for the increase at this screenline. Furthermore, the spreading out of the peak periods that occurs in the Managed Lanes Option results in even more drivers choosing to use I-70 over the local roads.

Local street traffic

The Build Alternatives reduce congestion on I-70, resulting in more drivers using the highway for east-west trips. This alleviates congestion on local roads.
Exhibit 4-43. Build Alternatives, screenline volumes

Source: Build (2035) Alternatives DynusT models.
Travel time reliability

The ability to preserve capacity and provide reliable travel times is the main purpose for including managed lanes on a highway. The operating speed of managed lanes must be sufficiently higher than the nearby general-purpose lanes for drivers to perceive a benefit and choose to pay a toll to use the managed lanes. Operating speeds above 45 mph in the managed lanes for all hours of the day ensure drivers a reliable trip time for which they are willing to pay. DynusT dynamically assigns vehicle trip paths based on a person’s value of time, current travel times for all possible paths between a particular origin and destination, and the current toll in the managed lane. The value of time is a fixed function within the model, but the other two factors can vary based on prevailing traffic conditions and a set of predefined managed lane criteria.

One criterion allowed DynusT to vary the price of the managed lanes based on the level of congestion (congestion pricing) within the managed lanes. The congestion pricing was controlled by establishing a minimum price of $0.50 per car or $1.50 per truck. The maximum toll was set at $20.00 per car ($60.00 per truck). DynusT uses an algorithm to determine if a driver will choose to use the managed lanes based on the estimated travel time it will take to complete the desired trip given current and projected congestion on I-70, the value of time, and the current toll rate. As operations begin to deteriorate in the general-purpose lanes, more drivers will choose to use the managed lanes, which will decrease the average travel speeds in the managed lanes, triggering an increase in the toll price. The toll price increases or decreases depending on traffic demand in the managed lanes so that an operating speed at or above 45 mph is maintained in the managed lanes at all times. Overall, the goal is to provide reliable trip times by preserving the capacity of the managed lanes through congestion pricing.

The managed lanes are about 12 miles long in each direction. A travel time of 16 minutes or less from end to end equates to operating speeds of 45 mph or greater. The Build Alternatives maintain an average operating speed of 45 mph or greater (in both directions) between 87 percent (21 hours) and 97 percent (23 hours) of the day.

4.4 Summary of transportation impacts and mitigation measures

Evaluation of the impacts on mobility and access needs of the study area for the No-Action Alternative and the Build Alternatives has considered the effectiveness of the
improvements on traffic operations and safety on I-70, impact on access and circulation needs on the local streets in the vicinity of I-70, and impact on the other transportation facilities in the study area (transit, freight, and bicycle/pedestrian). Exhibit 4-44 provides a summary of transportation impacts and mitigation.

Generally, any of the Build Alternatives will improve I-70 operations compared to the No-Action Alternative, due to the addition of new lanes, improvement to ramps, addition of auxiliary lanes, improvements to roadways, and modification of interchanges to better facilitate traffic movements. Implementation of managed lanes will provide additional benefits to operations of I-70 as a whole, will preserve capacity on I-70, and will provide reliable travel times. The general-purpose lanes in these alternatives will operate slightly less efficiently than the managed lanes.

The removal of the York Street interchange in all Build Alternatives and changes to the Steele Street and Colorado Boulevard interchanges will have an adverse impact on circulation and an increase in truck traffic on some of the local streets in the vicinity of these changes.

Freight service within and through the study area via rail will have minimal impacts, as none of the existing rail lines will be severed by I-70 improvements. Through-truck freight movements will be improved by the added capacity and improved safety of all Build Alternatives. Local truck traffic along surface streets will increase slightly due to changes in interchanges at York Street, Steele Street, and Colorado Boulevard.

None of the Build Alternatives will adversely affect any of the existing or planned transit or bicycle/pedestrian facilities in the study area. All of the Build Alternatives improve pedestrian/bicycle facilities through the construction of sidewalks, addition of ramps, and the addition of cover(s) over I-70 in the Partial Cover Lowered Alternative. Access to the managed lanes could improve transit operations and reliability.
### Exhibit 4-44. Summary of transportation impacts and mitigation

<table>
<thead>
<tr>
<th>Alternative/Option</th>
<th>Impacts and/or Benefits</th>
<th>Mitigation Measures Applicable to All Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No-Action Alternative</strong></td>
<td>Adverse effects to mobility, access, safety, and operations since no changes to capacity, interchanges, or other facilities will be made</td>
<td>• Reroute traffic to north-south streets that remain open, since most of the discontinued streets are low-volume local streets that do not connect across 46th Avenue</td>
</tr>
</tbody>
</table>
| **Revised Viaduct Alternative** | • Improved pedestrian/bicycle facilities  
• Improved traffic operations due to the addition of new lanes, improvement to ramps, adding auxiliary lanes, improvements to roadways, and modification of interchanges  
• Impacts to local traffic volumes caused by removal of the York Street interchange and changes to the Steele Street/Vasquez Boulevard interchange and the Colorado Boulevard interchange | • Coordinate with RTD for phasing of improvements to minimize disruptions to transit operations  
• Coordinate with UPRR, BNSF, and Denver Rock Island Railroads for phasing of improvements to minimize disruptions to railroad operations |
| **Partial Cover Lowered Alternative** | • Improved pedestrian/bicycle facilities  
• Improved traffic operations due to the addition of new lanes, improvement to ramps, adding auxiliary lanes, improvements to roadways, and modification of interchanges  
• Impacts to local circulation since some of the north-south street connectivity is being discontinued due to design restrictions  
• Impacts to local traffic volumes caused by removal of the York Street interchange and changes to the Steele Street/Vasquez Boulevard interchange and the Colorado Boulevard interchange |                                                                                           |
| **Managed Lanes Option (option to Build Alternatives)** | • Improved transportation operations, preservation of transportation capacity, and providing reliable travel times                                                                                                   |                                                                                                                   |