I-70 Floyd Hill to Veterans Memorial Tunnels

Transportation and Traffic Technical Report

February 2021
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List of Acronyms

AASHTO	American Association of State Highway and Transportation Officials
CDOT	Colorado Department of Transportation
CMF	Crash Modification Factor
CMGC	Construction Manager/General Contractor
CR	County Road
CSS	Context Sensitive Solutions
EA	Environmental Assessment
EB	Eastbound
EL	Express Lane
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
GPL	General Purpose Lane
GVWR	Gross Vehicle Weight Rating
HCS	Highway Capacity Manual
HSM	Highway Safety Manual
I-70	Interstate 70
IAR	Interstate Access Request
LOS	Level of Service
MP	Milepost
mph	Miles per hour
NB	Northbound
NEPA	National Environmental Policy Act
PEIS	Programmatic Environmental Impact Statement
PPSL	Peak Period Shoulder Lane
ROD	Record of Decision
RTD	Regional Transportation District
SB	Southbound
SH	State Highway
SPF	Safety Performance Function
TTI	Travel Time Index
US	United States Highway
VHT	Vehicle hours traveled
VMT	Vehicle miles traveled
WB	Westbound

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1 Introduction and Purpose of this Report

The Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA), in cooperation with local communities and other agencies, are conducting the Interstate 70 (I-70) Floyd Hill to Veterans Memorial Tunnels Environmental Assessment (EA) to advance a portion of the program of improvements for the I-70 Mountain Corridor identified in the 2011 Tier 1 *Final I-70 Mountain Corridor Programmatic Environmental Impact Statement* (PEIS) and approved in the 2011 *I-70 Mountain Corridor Record of Decision* (ROD). The EA is a Tier 2 National Environmental Policy Act (NEPA) process and is supported by resource-specific technical reports.

The purpose of this technical report is to document the analysis of transportation and traffic. Included is the methodology for analyzing transportation and traffic, Existing Conditions and model calibration, Project impact analysis, and the recommended minimization and mitigation measures, as necessary.

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2 Proposed Action and Alternatives

2.1 Description of Proposed Action and Alternatives

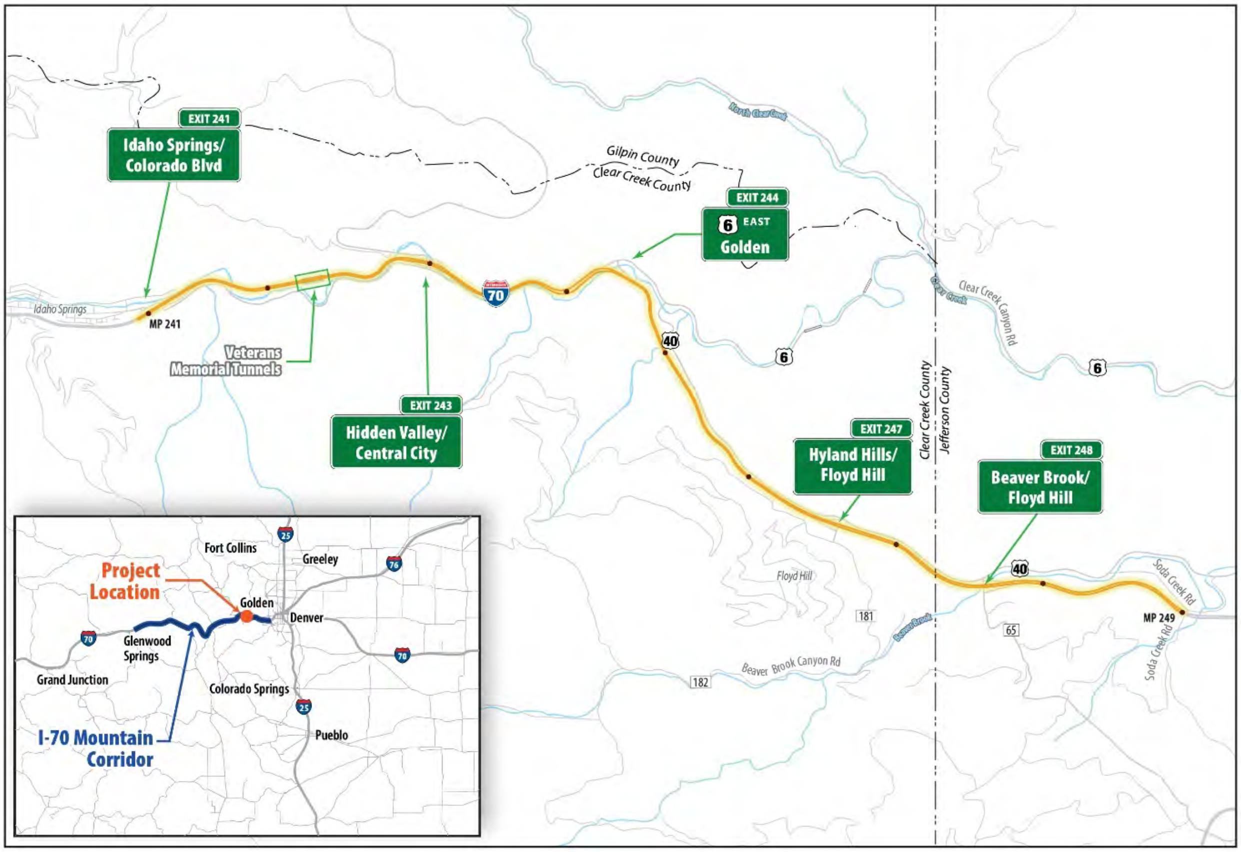
CDOT and FHWA propose improvements along approximately 8 miles of the I-70 Mountain Corridor from the top of Floyd Hill through the Veterans Memorial Tunnels to the eastern edge of Idaho Springs. The purpose of the Project is to improve travel time reliability, safety, and mobility, and address the deficient infrastructure through this area.

The major Project elements include:

- Adding a third westbound travel lane to the two-lane section of I-70 from the current three-lane to two-lane drop (approximately milepost [MP] 246) through the Veterans Memorial Tunnels
- Constructing a new frontage road between the U.S. Highway 6 (US 6) interchange and the Hidden Valley/Central City interchange
- Improving interchanges and intersections throughout the Project area
- Improving design speeds and stopping sight distance on horizontal curves
- Improving the multimodal trail (Clear Creek Greenway) between US 6 and the Veterans Memorial Tunnels
- Reducing animal-vehicle conflicts and improving wildlife connectivity
- Providing two permanent air quality monitors at Floyd Hill and Idaho Springs to collect data on local air quality conditions and trends
- Coordinating rural broadband access with local communities, including providing access to existing/planned conduits and fiber in the interstate right of way

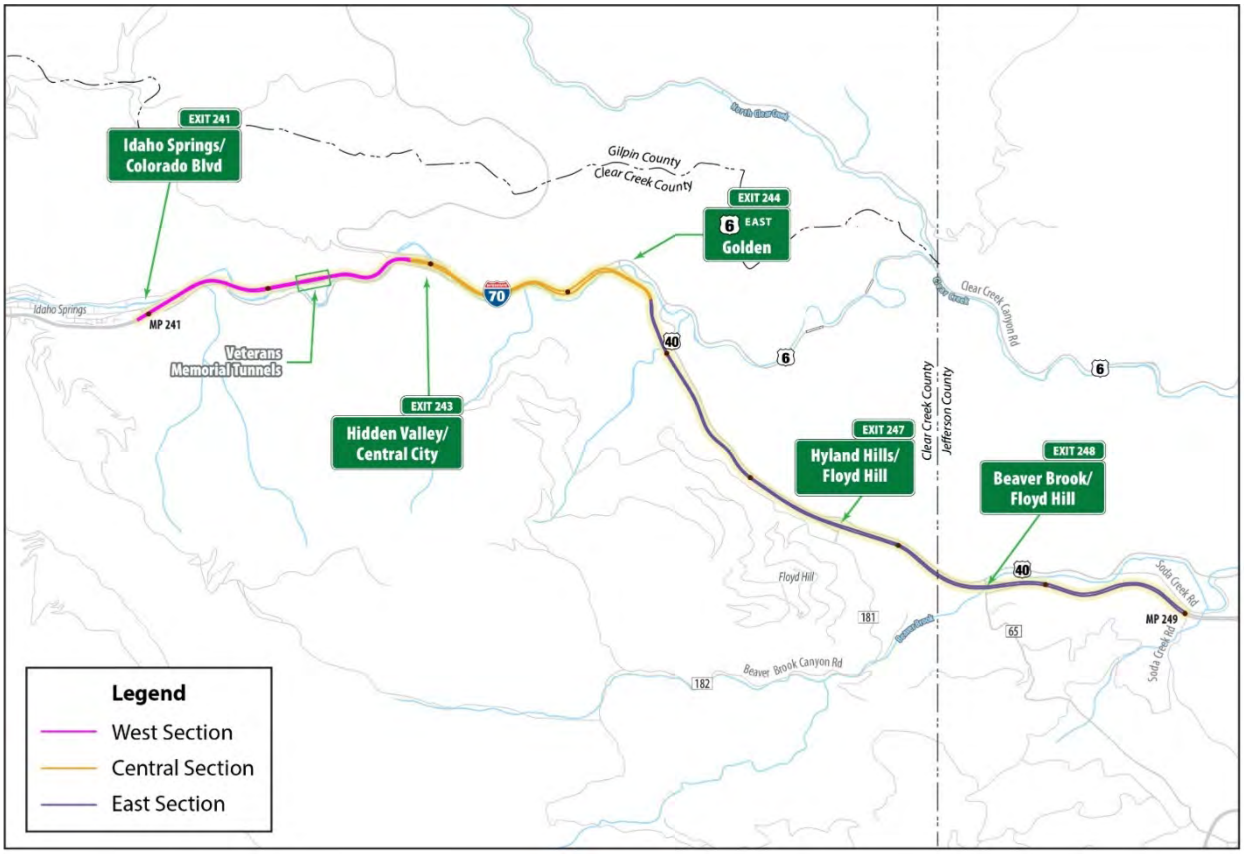
The Project is located on I-70 between MP 249 east of Exit 248 (Beaver Brook/Floyd Hill) half-diamond interchange and MP 241 near Exit 241 (Idaho Springs/Colorado Boulevard) interchange, west of the Veterans Memorial Tunnels. It is located mostly in Clear Creek County, with the eastern end in Jefferson County (see Exhibit 1). The primary roadway construction activities would occur between Exit 247 (Hyland Hills/Floyd Hill) interchange and the western portals of the Veterans Memorial Tunnels (MP 247.6 and MP 242.3, respectively), with the Project area extended east and west to account for signing, striping, and fencing.

Exhibit 1. Project Location



Three alternatives are being evaluated in the EA: (1) No Action Alternative, (2) Tunnel Alternative, and (3) Canyon Viaduct Alternative. The Project improvements are grouped into three geographic sections: (1) East Section (eastern Project limits to Exit 244 [US 6/Golden] interchange), (2) Central Section (Exit 244 [US 6/Golden] interchange to Hidden Valley/Central City interchange), and (3) West Section (Hidden Valley/Central City interchange through Veterans Memorial Tunnels) (see Exhibit 2).

Exhibit 2. East, Central, and West Project Sections



2.2 No Action Alternative

The No Action Alternative includes ongoing highway maintenance. In addition, due to its poor condition, the westbound I-70 bridge at the bottom of Floyd Hill is programmed to be replaced regardless of whether CDOT moves forward with one of the action alternatives. Therefore, replacing the bridge in kind (as a two-lane bridge) is part of the No Action Alternative. Under the No Action Alternative, the bridge would be replaced in its current location but would need to be designed to current standards, with a 55-mile-per-hour (mph) design speed and improved sight distance with wider shoulders.

2.3 Action Alternatives

The action alternatives—the Tunnel Alternative and the Canyon Viaduct Alternative—include the same improvements in the East Section and West Section to flatten curves, add a third westbound travel lane (the new lane would be an Express Lane [EL]), provide wildlife and water quality features, and improve interchange/intersection operations.

Through the Central Section between Exit 244 (US 6/Golden) interchange and Exit 243 (Hidden Valley/Central City) interchange, the action alternatives vary in how they provide for the third westbound I-70 travel lane and frontage road connections as follows:

- The **Tunnel Alternative** would realign westbound I-70 to the north (along the curve between MP 244.3 and MP 243.7) through a new 2,200-foot-long tunnel west of US 6. Eastbound I-70 would be realigned within the existing I-70 roadway template to flatten curves to improve design speed and sight distance. This alternative also would include two design options for the alignment of the new frontage road north or south of Clear Creek.

- The **Canyon Viaduct Alternative** would realign approximately one-half mile of both the westbound and eastbound I-70 lanes (along the curve between MP 244 and MP 243.5) on viaduct structures approximately 400 feet south of the existing I-70 alignment on the south side of Clear Creek Canyon. Through the realigned area, the frontage road would be constructed under the viaduct on the existing I-70 roadway footprint north of Clear Creek. The Clear Creek Greenway (Greenway) would be reconstructed along its current alignment on the south side of Clear Creek, north of the viaduct. The viaduct would cross above Clear Creek and the Greenway twice.

Additional information regarding the alternatives evaluated in the EA can be found in *the I-70 Floyd Hill to Veterans Memorial Tunnels Alternatives Analysis Technical Report* (Appendix A3 to the EA) and in Section 6.1, Action Alternatives Transportation Network Characteristics of this document.

2.3.1 East Section

In the East Section between the top of Floyd Hill and the US 6 interchange, the action alternatives are the same. Through this section, westbound I-70 would be widened to the south to accommodate a third travel lane. The typical section would include an additional 12-foot travel lane and inside and outside shoulders of varying widths, depending on sight distance needs around curves. The proposed footprint would include a 4-foot buffer between the new planned Express Lane and the existing (general purpose) lanes.

In the eastbound direction, the three travel lanes would be retained but the roadway would be realigned where needed to accommodate westbound widening or curve modifications to improve sight distance and safety. An approximately one-mile-long eastbound auxiliary (climbing) lane would be added in the uphill (eastbound) direction between Exit 244 (US 6/Golden) and Exit 247 (Hyland Hills/Floyd Hill) interchange. Water quality features would be added along the south side of the eastbound lanes.

At Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill), the split-diamond interchange configuration (with on- and off-ramps connected by U.S. Highway 40 [US 40]) would remain, and no new accesses would be provided. However, roundabout intersections constructed at the ramp terminals on US 40 as part of a separate project address immediate issues with traffic flow and delays at the Floyd Hill neighborhood ingress and egress.

Wildlife fencing would be added along the north and south sides of I-70 between Exit 247 (Hyland Hills/Floyd Hill) interchange on the west and Soda Creek Road on the east to reduce wildlife-vehicle collisions.

2.3.2 Central Section

The Central Section of the Project involves the most substantial improvements—including realigning curves, adding a third westbound travel lane, improving the Greenway, and providing the frontage road connection. These improvements occur within the most-constrained section of the Project area, where the existing I-70 footprint and planned roadway improvements are located between canyon rock walls north and south of existing I-70 and Clear Creek. Because of these constraints, the action alternatives within this section include the same improvements but differ with respect to the I-70 mainline and frontage road alignments and the relationship of the roadway improvements to the rock walls and the creek. The Greenway would be reconstructed generally along its existing alignment under both action alternatives, but the Greenway's location to the creek and roadway infrastructure would differ.

2.3.2.1 I-70 Mainline

The I-70 mainline through this section continues the same roadway typical section from the East Section. Both alternatives would provide an additional westbound 12-foot travel lane; inside and outside shoulders of varying widths, depending on sight distance needs around curves; and a 4-foot buffer between the new planned Express Lane and the existing (general purpose) lanes.

Under the Tunnel Alternative, approximately one mile of westbound I-70 would be realigned to the north near the US 6 interchange through a 2,200-foot-long tunnel that would tie in to the existing westbound I-70 alignment and elevation just east of the Hidden Valley/Central City interchange. The three eastbound I-70 lanes through this area would remain within the existing roadway prism but would be realigned, moving approximately 100 feet north into the rock face adjacent to the existing westbound lanes to flatten horizontal curves and improve the design speed and sight distance.

Under the Canyon Viaduct Alternative, the westbound I-70 alignment would shift to the south on a new 5,300-foot-long viaduct beginning at approximately MP 245 east of the exit ramp to US 6 and it would rejoin the existing alignment about one-half mile east of Exit 243 (Hidden Valley/Central City) interchange at approximately MP 243.5. Through this area, eastbound I-70 also would be realigned on a separate viaduct structure next to westbound I-70 from MP 243.4 east to just beyond MP 244.3. Both viaduct structures would cross Clear Creek and the Greenway twice near MP 243.9 and MP 243.5 (approximately 60 feet above ground level).

2.3.2.2 Frontage Road

Both alternatives include a new approximately 1.5-mile-long frontage road connection between the Hidden Valley/Central City interchange and the US 6 interchange. The frontage road would run from the intersection of CR 314 and Central City Parkway (south of the I-70 eastbound off-ramp at Exit 243 (Hidden Valley/Central City) interchange where CR 314, which acts as a frontage road from east Idaho Springs, terminates) to the US 6/I-70 ramp terminal at Exit 244 (US 6/Golden). The roadway section for the frontage road would consist of two 11-foot lanes (one in the eastbound direction and one in the westbound direction) with consistent 2-foot shoulders. The design speed would be 30 mph and the roadway would be constructed to comply with Clear Creek County local access standards.

The Tunnel Alternative includes two design options for this frontage road:

- **North Frontage Road Option** would provide the new frontage road connection between the two interchanges mostly on the north side of Clear Creek. The I-70 mainline would be realigned north into the mountainside, requiring substantial rock cuts (150 feet high) to make room for the frontage road between the creek and existing I-70. The Greenway would be reconstructed along its current alignment north of Clear Creek.

- **South Frontage Road Option** would provide the new frontage road connection between the two interchanges mostly on the south side of Clear Creek. Moving the frontage road to the south side of the creek would require new rock cuts on the south side of Clear Creek Canyon and less substantial rock cuts on the north side of I-70. The Greenway would be reconstructed generally along its current alignment south of Clear Creek; the Greenway would be located closer to the frontage road alignment than under the North Frontage Road Option, but the design seeks to maximize horizontal and vertical separation between the facilities.

Under the Canyon Viaduct Alternative, the existing I-70 pavement under the elevated structures would be repurposed for the frontage road; excess right of way would be available for other uses—presumably creek and recreation access—through this approximately one-mile area of the canyon.

2.3.3 West Section

The West Section between Exit 243 (Hidden Valley/Central City) interchange and the Veterans Memorial Tunnels continues the widening of the interstate to add the third westbound travel lane and to flatten the S-curve in this location. Improvements in this section are the same under both action alternatives. The curve modifications require realigning both the I-70 mainline and frontage road through this section. The I-70 mainline alignment would shift south approximately 100 feet around the first curve from Exit 243 (Hidden Valley/Central City) interchange, then north around the second curve approximately 50 feet, continuing a slight (25-foot) shift north before tying in to the existing alignment at the Veterans Memorial Tunnels. Much of CR 314 would be realigned south between the Doghouse Rail Bridge over Clear Creek near the Veterans Memorial Tunnels east portal and Exit 243 (Hidden Valley/Central City) interchange. A small section of CR 314 (between MP 242.6 and MP 242.7) would remain and connect to the reconstructed portions west and east.

These alignment shifts result in substantial rock cuts on both the north and south sides of the canyon. On the north side, rock cuts up to 160 feet high would be required next to the I-70 westbound lanes (along the curve in the area where CR 314 is not reconstructed). To realign CR 314 south, rock cuts from 70 feet to 100 feet high are required on the south side of the canyon. Additionally, a 1,200-foot section of Clear Creek, which is located between I-70 and CR 314, would need to be relocated south near MP 242.5.

The Exit 243 (Hidden Valley/Central City) interchange would not be reconstructed, and the I-70 bridges would remain because they are wide enough to accommodate the widened I-70 footprint without being replaced. All the on- and off-ramps for the interchange would be reconstructed, but the bridges over Clear Creek for the I-70 westbound off-ramp and I-70 eastbound on-ramp also can be retained. New bridges over Clear Creek to the west would be needed for the I-70 westbound on-ramp and I-70 eastbound off-ramp to accommodate the curve flattening and shift of I-70 to the south in this location. The CDOT maintenance facility would need to be relocated. The ramp termini intersections would be converted to roundabouts to help improve operations and safety for traffic on Central City Parkway, the new frontage road, CR 314, and those using the interchange ramps.

No changes are required west of the Veterans Memorial Tunnels. Within the westbound tunnel, the roadway would be restriped for the third lane (the expansion of the tunnel to accommodate the third lane was completed in 2014). After the tunnel, restriping and signing would continue west to Exit 241 (Idaho Springs/Colorado Boulevard) interchange, where the third lane would terminate. The Express Lane would operate in conjunction with the westbound Mountain Express Lane (MEXL) during peak periods (winter and summer weekends).

2.4 Construction of Action Alternatives

CDOT is planning to use a Construction Manager/General Contractor (CMGC) delivery method for construction of the Project. This contracting method involves a contractor advising in the design phases to better define Project technical requirements and costs, improve design quality and constructability, and reduce risks through the construction phase. This method promotes innovation and aligns well with the multidisciplinary Context Sensitive Solutions process. It was used successfully on the Twin Tunnels projects to reduce environmental impacts and accommodate community values in the design and construction project development phases.

Construction of the action alternatives is anticipated to be complex and could take four to five years, but it could occur generally within the proposed right of way. CDOT would work with the CMGC to refine the construction details and develop a plan that promotes safety and minimizes disruption to the traveling public and nearby residents and businesses.

The Tunnel Alternative would take approximately one year longer than the Canyon Viaduct Alternative; most of the additional time would be needed for the tunnel blasting and construction that could take place without disrupting traffic. However, in addition to the tunnel rock blasting, the Tunnel Alternative has considerable rock cuts at the tunnel portals and along the north side of I-70 to realign curves, widen the highway, and add the frontage road connection. Rock cuts, staging for the excavation of the tunnel portals, and haul of waste rock are major construction activities that are likely to interrupt traffic on I-70 due to the increased construction equipment traffic on the highway and the proximity of construction to live traffic, the need for temporary lane closures and detours, and closures for blasting. The North Frontage Road Option has significantly larger (taller and longer) rock cuts than the South Frontage Road Option.

The Canyon Viaduct Alternative has substantially less rock cut and blasting compared to the Tunnel Alternative but would require more work in the existing highway right of way. Bridge construction over and pier placement within the highway template will need to be carefully coordinated. However, construction of some elements, such as the bench portion of the viaduct, are separated from the existing I-70 alignment and could be constructed offline similarly to the tunnel excavation.

Specific construction methods and phasing will be determined with contractor input and could affect the duration and/or physical requirements for construction activities. The focus of environmental impact analysis during the NEPA process is to identify resources and locations sensitive to construction impacts and incorporate reasonable mitigation measures, including the potential to avoid impacts by avoiding sensitive areas, to inform the contractor’s plans. Final design and construction plans will consider changes in resource impacts, and reevaluations will be completed as needed during final design.

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3 Analysis Methodology

The assumptions, methodology, and analysis tools used to complete the analysis of existing and future transportation and traffic conditions for this Project are included in the *Traffic Analysis Methodology Technical Memorandum* found in Appendix A and the *Model Calibration Results Technical Memorandum* found in Appendix B, which are summarized in this section.

The main purpose of completing traffic analyses was to assist with understanding the existing and future traffic needs for I-70 in the Project Area. The traffic operations analysis was used to assist with the development and identification of a proposed action.

The EA analysis was focused on the transportation network elements between Exit 248 (Beaver Brook/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard). Additional elements outside of these limits were evaluated on an as-needed basis to respond to questions and to determine possible impacts from vehicles avoiding congestion on I-70 and using other roadways in the study area, if necessary.

Anticipating that this Project will include modification of existing access to I-70, which will result in the need to complete an Interstate Access Request (IAR), the traffic analysis focused on a study area that is slightly different than the overall EA Project limits. The EA Project limits, shown in Exhibit 1, are from Exit 241 (Idaho Springs/Colorado Boulevard) to just east of Exit 248 (Beaver Brook/Floyd Hill). The traffic analysis study area (see Exhibit 3) includes the EA Project limits and one interchange in either direction of travel on I-70, per IAR guidelines from FHWA, which requires the inclusion of one interchange beyond the location where existing access may be changed or modified. Thus, the traffic operations analyses focused on the transportation system between Exit 240 (State Highway [SH] 103/Mt Evans) and Exit 252 (SH 74/Evergreen Parkway) and included:

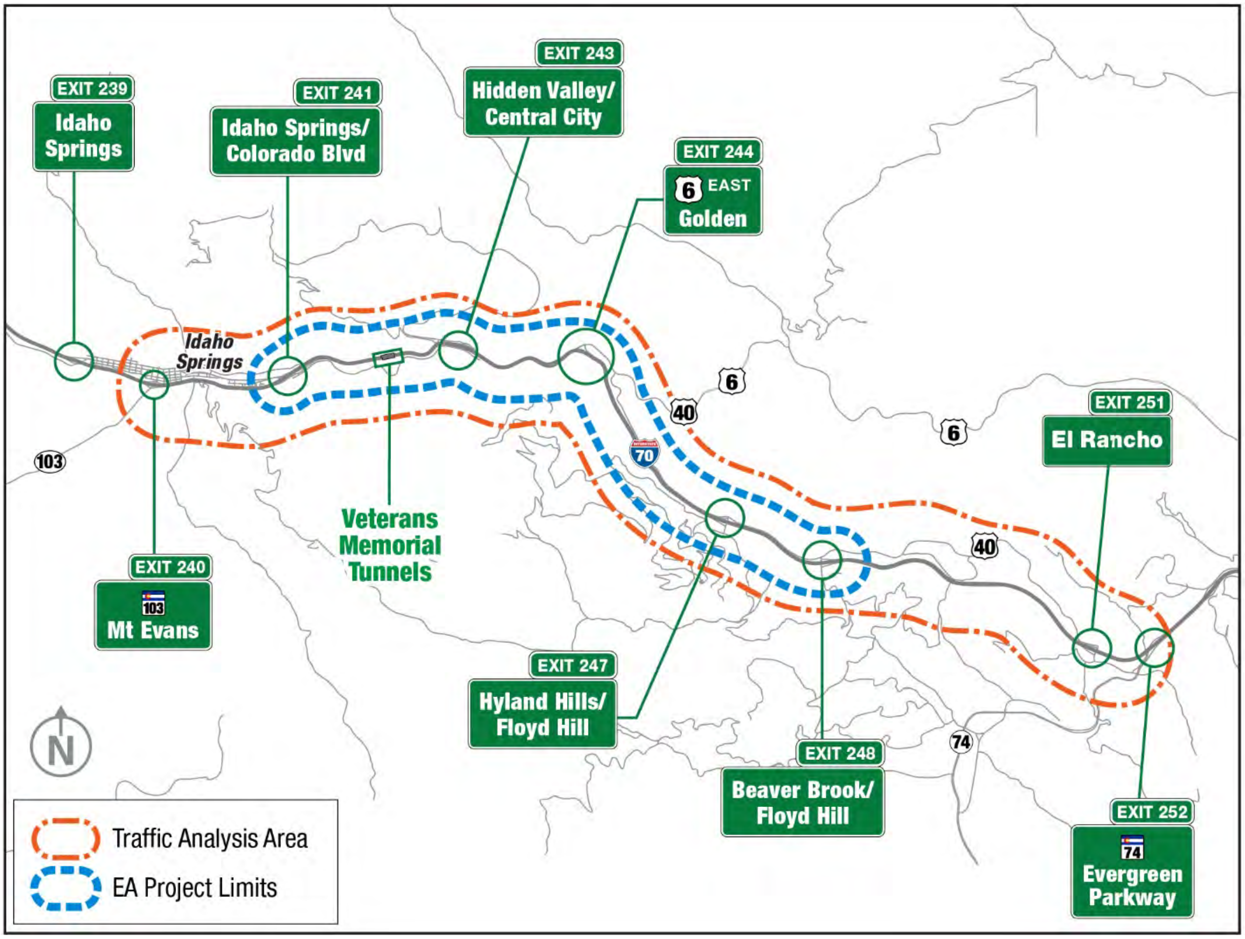
- All ramp merge and diverge areas, weave sections, and basic freeway segments
- All ramp junction intersections with connecting surface streets between Exit 248 (Beaver Brook/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard)[1]
- The intersections along US 40 at US 6, Homestead Road, and CR 65
- Ingress/egress and termini of the potential new westbound Express Lane (EL) and Peak Period Shoulder Lane (PPSL)

The following is a summary of the modeling methodology and assumptions.

- All analyses in support of this study used TransModeler or Synchro software.
- The analyses were completed for a typical winter Saturday (westbound peak) and a typical summer Sunday (eastbound peak).
- The full extents of the TransModeler model include the hours from 4:00 a.m. to 10:00 p.m. (for each day) and the following features:
    - I-70 (eastbound and westbound) from Exit 228 (Georgetown) to Exit 252 (SH 74/Evergreen Parkway) and all interchanges in-between
    - Parallel routes, such as US 40, CR 314 (East Idaho Springs Road), and all frontage roads
    - Intersections at or near the interchanges, along frontage roads, and along US 40

Note that the measures of effectiveness for I-70 generally are for the entire traffic analysis study area, but other measures for the local roads and intersections focus on the same area as the EA, from Exit 248 (Beaver Brook/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard).

Exhibit 3. Traffic Analysis Study Area



4 Existing Conditions

An Existing Conditions analysis was completed to develop an understanding of the traveling experience for current network users. The following sections describe the current transportation system within the study area, the existing safety conditions, existing traffic volumes/patterns, and existing traffic operations.

4.1 Existing (2018) Transportation Network Characteristics

This section describes the existing geometry of I-70, its interchanges, and portions of the connecting local street system that will be evaluated as part of the traffic analysis. Overall, the traffic analysis study area includes the transportation system between approximately MP 240 and approximately MP 252, which contains the following eight interchanges:

1. Exit 240 (SH 103/Mt Evans)
2. Exit 241 (Idaho Springs/Colorado Boulevard)
3. Exit 243 (Hidden Valley/Central City)
4. Exit 244 (US 6/Golden)
5. Exit 247 (Hyland Hills/Floyd Hill)
6. Exit 248 (Beaver Brook/Floyd Hill)
7. Exit 251 (El Rancho)
8. Exit 252 (SH 74/Evergreen Parkway)

The following sections describe the different elements of the transportation system within the traffic analysis study area.

4.1.1 I-70 Mainline

Within the traffic analysis study area, I-70 is a full access-controlled freeway that travels generally on an east-west alignment through mountainous terrain with steep grades and sharp curves. It passes through the Veterans Memorial Tunnels near MP 242. Exhibit 4 and Exhibit 5 summarize the geometric characteristics for westbound and eastbound I-70, respectively.

Exhibit 4. Existing Conditions—Westbound I-70 Geometric Characteristics

Mileposts		Lanes		Speed Limit (mph)	Features
Start	End	GPL*	Other		
252	247	3[1]	0	65	Sharp curves and steep upgrade
247	244	2[2]	0[3]	55/45[4]	Sharp curves and steep downgrade
244	242	2[2]	0	55/45[4]	Sharp curves, tunnel, relatively flat
242	240.5	2[2]	0	60	Curves and relatively flat

GPL = General-purpose lane

1. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to the right two lanes.

2. Vehicles with GVWR greater than 26,000 pounds are restricted to the right lane.

3. The westbound bore for the Veterans Memorial Tunnels has been widened to accommodate a third lane, but this extra width is currently striped off as an extra wide shoulder.

4. Vehicles with GVWR greater than 26,000 pounds are restricted to a speed of 45 mph and all other vehicles are restricted to a speed for 55 mph.

Exhibit 5. Existing Conditions—Eastbound I-70 Geometric Characteristics

Mileposts		Lanes		Speed Limit (mph)	Features
Start	End	GPL*	Other		
240.5	241	2[1]	1[2]	60	Relative flat and straight
241	243.7	2[1]	1[3]	55	Sharp curves, tunnel, and relatively flat
243.7	244	3[4]	0[5]	55	Sharp curves and relatively flat
244	247	3[4]	0	65	Sharp curves and steep upgrade
247	252	3	0	65	Sharp curves and steep downgrade

GPL = General-purpose lanes

1. Vehicles with GVWR greater than 26,000 pounds are restricted to the right lane.

2. Eastbound peak period shoulder lane (EB PPSL).

3. EB PPSL transitions to a full time Express Lane.

4. Vehicles with GVWR greater than 26,000 pounds are restricted to the right two lanes.

5. Express Lane transitions to a general-purpose lane.

4.1.2 I-70 Interchanges

There are eight major roadways that intersect with I-70 at grade-separated interchanges within the traffic analysis study area. Each interchange provides full or partial access to I-70 in the form of ramps that have acceleration/deceleration lanes of varying lengths. Some of the partial movement interchanges are split diamond configurations that are connected to each other via US 40, which is located on one side or the other of I-70. Exhibit 6 contains a list of the interchanges within the traffic analysis study area. Each interchange is illustrated and described in more detail in the following sections.

Exhibit 6. Existing Conditions—Interchange Forms

Intersecting Roadway	Interchange Form
Exit 240 (SH 103/Mt Evans)	Full Movement Tight Diamond
Exit 241 (Idaho Springs/Colorado Boulevard)	Full Movement Diamond
Exit 243 (Hidden Valley/Central City)	Full Movement Tight Diamond
Exit 244 (US 6/Golden)	Partial Movement Offset Single Point[1]
Exit 247 (Hyland Hills/Floyd Hill)	Partial Movement Split Diamond[2]
Exit 248 (Beaver Brook/Floyd Hill)	Partial Movement Split Diamond[3]
Exit 251 (El Rancho)	Partial Movement Split Diamond[4]
Exit 252 (SH 74/Evergreen Parkway)	Partial Movement Split Diamond[5]

1. Access to westbound I-70, from westbound I-70, and from eastbound I-70 provided by ramps. No direct access to eastbound I-70 provided at this interchange.

2. Access to westbound I-70 and from eastbound I-70 provided by ramps. Access to eastbound I-70 and from westbound I-70 via frontage road (US 40) and ramps at Exit 248 (Beaver Brook/Floyd Hill).

3. Access to eastbound I-70 and from westbound I-70 provided by ramps. Access to westbound I-70 and from eastbound I-70 via frontage road (US 40) and ramps at Exit 247 (Hyland Hills/Floyd Hill).

4. Access to westbound I-70 and from eastbound I-70 provided by ramps. Access to eastbound I-70 and from westbound I-70 via frontage road (US 40) and ramps at Exit 252 (SH 74/Evergreen Parkway).

5. Access to eastbound I-70 and from westbound I-70 provided by ramps. Access to westbound I-70 and from eastbound I-70 via frontage road (US 40) and ramps at Exit 251 (El Rancho).

4.1.2.1 Exit 240 (SH 103/Mt Evans)

The full movement interchange of I-70 at Exit 240 (SH 103/Mt Evans) is shown in Exhibit 7. This interchange is a tight diamond interchange. SH 103 passes over I-70 with two-way stop-controlled intersections at the eastbound and westbound I-70 ramp junctions. SH 103 is a two-lane regional highway that provides access to the Mount Evans recreational area south of I-70. North of I-70, SH 103 continues north before ending at a T-intersection with Colorado Boulevard in Idaho Springs.

The exit ramps are single lane with 45 mph advisory speeds. The on-ramps are single lane with no ramp meters. The posted speed limit for SH 103 is 30 mph.

Exhibit 7. Exit 240 (SH 103/Mt Evans) Interchange

4.1.2.2 Exit 241 (Idaho Springs/Colorado Boulevard)

The full movement interchange of I-70 at Exit 241 (Idaho Springs/Colorado Boulevard), shown in Exhibit 8, functions similar to a diamond interchange with off-set intersections. Colorado Boulevard passes over I-70 and continues for a short distance before ending at the intersection of the eastbound I-70 on-ramp and CR 314. Colorado Boulevard feeds directly onto the eastbound on-ramp, and traffic turning to and from CR 314 is controlled by stop signs. The posted speed limit on Colorado Boulevard is 30 mph and the posted speed limit on CR 314 is 35 mph. Colorado Boulevard is a two-lane arterial and CR 314 is a two-lane frontage roadway.

The eastbound on-ramp is two lanes wide and is equipped with ramp metering traffic signals. The eastbound I-70 single-lane off-ramp intersects at a stop-controlled intersection with Colorado Boulevard just south of I-70 and west of the CR 314 intersection. The ramp has an exit advisory speed of 40 mph.

There is a single-lane roundabout on the north side of I-70 that forms the other ramp junction intersection at this interchange. The roundabout has four legs, two of which provide for two-way traffic on Colorado Boulevard. The third leg is the westbound I-70 single-lane off-ramp, which is hook shaped between I-70 and Colorado Boulevard with an advisory speed of 15 mph.

The fourth leg of the roundabout is the westbound I-70 single-lane on-ramp, which also is hook shaped between Colorado Boulevard and I-70.

Exhibit 8. Exit 241 (Idaho Springs/Colorado Boulevard) Interchange

4.1.2.3 Exit 243 (Hidden Valley/Central City)

The full movement interchange of I-70 at Exit 243 (Hidden Valley/Central City) is shown in Exhibit 9. This interchange is a tight diamond and Central City Parkway passes under I-70 with signalized intersections for the eastbound and westbound I-70 ramps. Central City Parkway dead ends just south of I-70 at the intersection with CR 314 and this intersection also is controlled by the same traffic signal for the eastbound ramps. There is a maintenance road just north of I-70 that forms a fifth leg at the intersection for the westbound ramps.

The exit ramps are single lane with 40 mph advisory speeds. The on-ramps are single lane with no ramp meters. CR 314 is a two-lane frontage roadway, and Central City Parkway is a four-lane arterial roadway. The speed limit for Central City Parkway is 30 mph and CR 314 has a speed limit of 35 mph.

Exhibit 9. Exit 243 (Hidden Valley/Central City) Interchange

4.1.2.4 Exit 244 (US 6/Golden)

The partial movement interchange (see Exhibit 10) of I-70 at Exit 244 (US 6/Golden) is an offset single point interchange. This interchange has westbound on- and off-ramps in addition to an eastbound off-ramp. The three ramps intersect at a single intersection that is located northeast of I-70. The intersection also is the start/end of US 6. All ramps are single lanes, and the eastbound off-ramp has an advisory speed of 35 mph while the westbound off-ramp has an advisory speed of 30 mph. The westbound on-ramp is not controlled by a ramp meter traffic signal.

US 6 is a two-lane regional highway with a posted speed limit of 45 mph. Drivers that are looking for an alternative route or an additional option to travel between Denver and the mountain areas to the west will use this interchange and US 6 to avoid I-70. In addition, other drivers that are attempting to avoid I-70 congestion will use US 40 and US 6 as a parallel route and access to/from I-70 at this interchange.

Exhibit 10. Exit 244 (US 6/Golden) Interchange

4.1.2.5 Exit 247 (Hyland Hills/Floyd Hill)

The partial movement interchange of I-70 at Exit 247 (Hyland Hills/Floyd Hill), is shown in Exhibit 11 and is one half of a split diamond interchange, with the other half being at Exit 248 (Beaver Brook/Floyd Hill), as shown in Exhibit 12. The Exit 247 interchange has a westbound on-ramp and an eastbound off-ramp. Homestead Road passes over I-70 and connects CR 181/Hyland Drive on the south side of I-70 and to US 40 on the north side of I-70. The single-lane eastbound off-ramp is controlled by a stop sign at Homestead Road and has an advisory speed of 30 mph. The single-lane westbound on-ramp is not controlled by a ramp meter traffic signal.

US 40 provides connectivity between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill) interchanges to allow for circulation and full access to I-70. US 40 is a two-lane regional highway that has speed limits between 35 mph and 45 mph. Homestead Road is a two-lane collector roadway with a speed limit of 35 mph.

Exhibit 11. Exit 247 (Hyland Hills/Floyd Hill) Interchange

4.1.2.6 Exit 248 (Beaver Brook/Floyd Hill)

The partial movement interchange of I-70 at Exit 248 (Beaver Brook/Floyd Hill), as shown in Exhibit 12, is one half of a split diamond interchange, with the other half being at Exit 247 (Hyland Hills/Floyd Hill), as shown in Exhibit 11. This interchange has an eastbound on-ramp and a westbound off-ramp. CR 65 passes over I-70 and connects to US 40 on the north side of I-70. The single-lane westbound off-ramp is controlled by a stop sign at CR 65 and has an advisory speed of 35 mph. The single-lane eastbound on-ramp is not controlled by a ramp meter traffic signal.

US 40 provides connectivity between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill) interchanges to allow for circulation and full access to I-70. US 40 is a two-lane regional highway that has speed limits between 35 mph and 45 mph. CR 65 is a two-lane collector roadway with a speed limit of 35 mph.

Exhibit 12. Exit 248 (Beaver Brook/Floyd Hill) Interchange

4.1.2.7 Exit 251 (El Rancho)

The partial movement interchange of I-70 at Exit 251 (El Rancho), see Exhibit 13, is one half of a split diamond interchange, with the other half being Exit 252 (SH 74/Evergreen Parkway) interchange (see Exhibit 14). This interchange has a westbound on-ramp and an eastbound off-ramp. US 40 passes over I-70 from the north side to the south side of the freeway. The single-lane eastbound off-ramp is controlled by a stop sign at US 40 and has an advisory speed of 35 mph. The single-lane westbound on-ramp is not controlled by a ramp meter traffic signal.

US 40 provides connectivity between Exit 251 (El Rancho) and Exit 252 (SH 74/Evergreen Parkway) interchanges to allow for circulation and full access to I-70. US 40 is a two-lane regional highway that has speed limits between 25 mph and 35 mph.

Exhibit 13. Exit 251 (El Rancho) Interchange

4.1.2.8 Exit 252 (SH 74/Evergreen Parkway)

The partial movement offset single point interchange of I-70 at Exit 252 (SH 74/Evergreen Parkway), see Exhibit 14, is one half of a split diamond interchange, with the other half being Exit 251 (El Rancho) interchange, as shown in Exhibit 13. This interchange has an eastbound on-ramp and a westbound off-ramp. The two ramps intersect on the south side of I-70 at a signalized intersection with US 40 and Swede Gulch Road, at which point the ramps continue south through the intersection and become SH 74. The two-lane westbound off-ramp has an advisory speed of 45 mph. The two-lane eastbound on-ramp is not controlled by a ramp meter traffic signal.

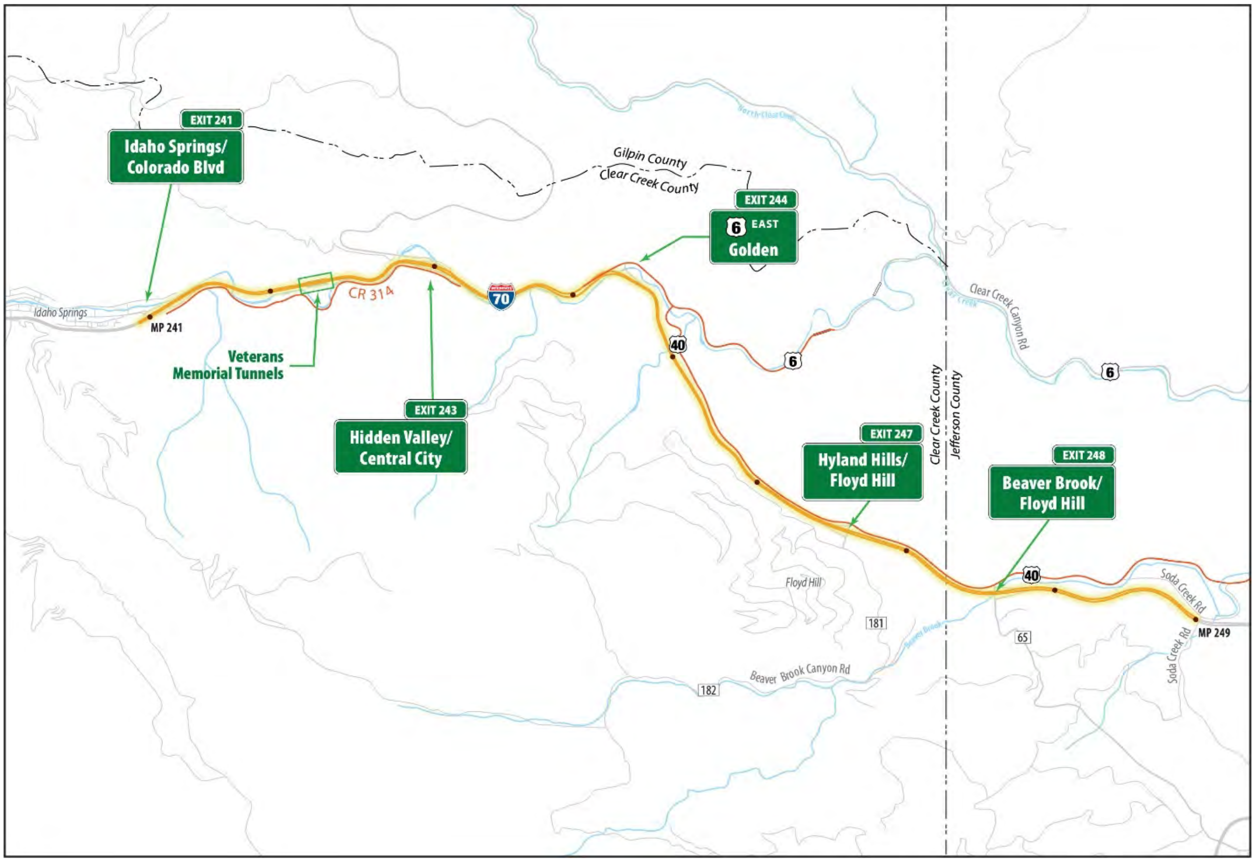
US 40 provides connectivity between Exit 252 (SH 74/Evergreen Parkway) and Exit 251 (El Rancho) interchanges to allow for circulation and full access to I-70. US 40 is a two-lane regional highway that has speed limits between 25 mph and 35 mph. SH 74 is a four-lane principal highway with a 40-mph speed limit. Swede Gulch Road is a four-lane collector roadway with a speed limit of 25 mph.

Exhibit 14. Exit 252 (SH 74/Evergreen Parkway) Interchange

4.1.3 Local Road Network

Due to the mountainous terrain, the local road network is minimal within the study area. Most local roads in the study area are for local traffic and provide access to residential development. Very few of the local roads provide connectivity to other major roadways but most of them do provide an alternate route to I-70 through the study area. The following sections provide a brief description of the more-significant local roadways within the study area. Exhibit 15 shows the local roads in the study area.

Exhibit 15. Local Road Network in Study Area



4.1.3.1 SH 103

SH 103 is a two-way, two-lane mountainous highway with sharp curves and steep grades. The highway has posted speed limits between 25 mph and 45 mph and provides access between I-70 and Mount Evans Road. The highway acts as the main entrance into the downtown/shopping/entertainment district of Idaho Springs and provides connectivity to Colorado Boulevard north of I-70. This roadway provides access to/from I-70 at Exit 240 (SH 103/Mt Evans) interchange, as shown in Exhibit 7.

4.1.3.2 Colorado Boulevard/I-70 Business

Colorado Boulevard, also known as I-70 Business, is a two-way, two-lane collector that passes through the City of Idaho Springs. The roadway has a posted speed limit between 25 mph and 35 mph. The roadway provides connectivity to SH 103, which connects to I-70 at Exit 240 (SH 103/Mt Evans) near the center of Idaho Springs. The roadway continues west, connecting directly to a frontage road system that parallels I-70 all the way to Exit 228 (Georgetown). This frontage road system provides access to I-70 through connectivity with other interchanges west of the study area, including Exit 235 (Dumont), Exit 234 (Downieville), Exit 232 (US 40/Empire/Granby), and Exit 228 (Georgetown). This roadway provides access to/from I-70 at Exit 241 (Idaho Springs/Colorado Boulevard) interchange, as shown in Exhibit 8.

4.1.3.3 Central City Parkway

Central City Parkway is a four-lane mountainous roadway with sharp curves and steep grades. The roadway is an undivided facility with a posted speed limit of 50 mph. The roadway provides direct access between I-70 and Central City. This roadway (refer to Exhibit 9) provides access to/from I-70 at Exit 243 (Hidden Valley/Central City) interchange.

4.1.3.4 US 6

US 6 is a two-way, two-lane regional highway that provides a regional alternate route to I-70 by allowing drivers another route between Denver and Golden. US 6 has less grade than I-70, but many more sharp curves and passes through tunnels that have height restrictions of 13 feet. Speed limits along US 6 range between 40 mph and 55 mph. This roadway provides access to/from I-70 at Exit 244 (US 6/Golden) interchange (see Exhibit 10). Exhibit 15 shows the limits of US 6 in the study area.

4.1.3.5 Homestead Road

Homestead Road is a two-way, two-lane rural collector that provides access between I-70 and local communities south of I-70. The roadway has a posted speed limit of 25 mph. This roadway provides access to/from I-70 at Exit 247 (Hyland Hills/Floyd Hill) interchange and is shown in Exhibit 11.

4.1.3.6 CR 65

CR 65 is a two-way, two-lane rural collector that provides access between I-70 and Bergen Park, which is located along SH 74 south of I-70. The roadway has a posted speed limit of 35 mph. This roadway is an alternate route for drivers going to and from the City of Evergreen and I-70. This roadway, as shown in Exhibit 12, provides access to/from I-70 at Exit 248 (Beaver Brook/Floyd Hill) interchange.

4.1.3.7 US 40

US 40 does provide some alternate routing opportunity because it parallels I-70 between Exit 252 (SH 74/Evergreen Parkway) and Exit 244 (US 6/Golden). This two-way, two-lane regional highway is located on the south side of I-70 between Exit 252 (SH 74/Evergreen Parkway) and Exit 251 (El Rancho), then it crosses over to the north side of I-70. US 40 remains on the north side of I-70 while providing connectivity to Exit 248 (Beaver Brook/Floyd Hill), Exit 247 (Hyland Hills/Floyd Hill), and finally Exit 244 (US 6/Golden). The roadway has posted speed limits between 25 mph and 45 mph. US 40 intersects with US 6 about one-half mile east of Exit 244 (US 6/Golden) interchange. Refer to Exhibit 15 for the limits of US 40 within the study area.

4.1.3.8 CR 314

CR 314 provides connectivity parallel to I-70 between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard). This two-way, two-lane frontage roadway is paved for most of its length with a short unpaved section about midway between the interchanges. The roadway has a posted speed between 25 mph and 35 mph. Refer to Exhibit 15 for the limits of CR 314 within the study area.

4.1.4 Transit/Bus Service

The study area is outside of the current Regional Transportation District (RTD) boundaries; thus, there are no RTD routes that pass through the study area. There are several RTD routes that provide service along I-70 up to the SH 74/Evergreen Parkway interchange and then south into the City of Evergreen. There is a Park-n-Ride facility located at the SH 74/Evergreen Parkway interchange.

Other bus services, such as Bustang, which is sponsored by CDOT, provide regional daily services along I-70 between Denver and Glenwood Springs. The Bustang route does not include any stops within the study area, but does have one stop in Idaho Springs, which is just west of the study area. There are numerous other private/charter bus services that use I-70 to move people between Denver and many of the resort locations in the mountains. Many of these services are related to events such as skiing, gambling, or touring.

4.1.5 Truck Facilities

I-70 is a major truck freight route across Colorado and is a vital link in the national truck freight network, providing the most direct route between the Front Range of Colorado and interstate/intrastate destinations to the west. I-70 is a designated Hazardous Material Route and does not have any weight restrictions. There are no major truck facilities—such as truck stops, ports of entry, or weigh stations—within the study area. The nearest port of entry/weigh station is located approximately seven miles west of the study area at Exit 234 (Dumont/Downieville).

4.1.6 Freight Rail Facilities

There are no freight rail facilities near the I-70 corridor.

4.2 Existing Safety Conditions

Safety is one of the driving factors for evaluating improvements as part of this study. In an effort to gather as much safety-related data as possible, analysis from previous studies was reviewed, current crash numbers were summarized, and a detailed evaluation of Existing Conditions and the future action alternatives was completed using the American Association of State Highway and Transportation Officials (AASHTO) *Highway Safety Manual* (HSM) (2014) predictive methods. The following sections provide a summary of the different safety reviews and analyses that have been performed in support of this study.

4.2.1 PEIS Safety Assessment Study

The March 2011 *I-70 Mountain Corridor PEIS Safety Technical Report* identified the base of Floyd Hill as an area of safety concern. Crash rates on I-70 at the base of Floyd Hill were more than double the statewide average. It was suggested that the curves at the base of Floyd Hill be modified to a higher design speed. Interchanges within the study area that were recommended for improvements included Exit 244 (US 6/Golden), Exit 247 (Hyland Hills/Floyd Hill), and Exit 248 (Beaver Brook/Floyd Hill). The US 6 interchange was recommended for reconstruction to have entrance and exit ramps on the right side of the highway, as well as a wider curve on westbound I-70 allowing for a higher design speed. Recommendations for Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill) interchanges included reconstructing ramps to increase capacity and prevent traffic from backing up onto I-70.

4.2.2 DiExSys™ Crash Data Analysis

A preliminary review of crash data using data contained in DiExSys™ was completed in advance of a more in-depth analysis to be completed by CDOT. Crash data for a five-year period between June 30, 2011, and June 30, 2016, were evaluated for the following roadway segments:

- I-70 between MP 240 and MP 252
- US 6 between I-70 and MP 258 (approximately one-half mile east of US 40)
- US 40 between US 6 and Evergreen Parkway

4.2.2.1 I-70 Mainline Crash Summary

In the five years of crash data, there were 901 crashes on I-70, with 422 (47 percent) in the westbound direction and 479 (53 percent) in the eastbound direction, as summarized in Exhibit 16. Nearly 80 percent of all crashes resulted in property damage only, about 20 percent of the crashes caused injuries, and less than one percent of all crashes resulted in a fatality. Rear-end crashes were the most common type on westbound I-70, while crashes involving fixed objects (barriers, signs, etc.) were the most common type for eastbound travel. Sideswipes and crashes involving animals were other crash types that accounted for at least 10 percent of the crash totals on I-70. Other notable information that was obtained from the crash data includes:

- Almost 37 percent of crashes occurred with a vehicle traveling off the roadway.
- Nearly 32 percent of the crashes occurred in dark conditions and about 70 percent of those occurred in unlighted conditions.
- Approximately 19 percent of crashes occurred during snow/sleet/hail events.
- 50 percent of all crashes were single-vehicle crashes.

Exhibit 17 shows the number of crashes on I-70 by approximate location within the study area. The data indicate that westbound crashes were most frequent in the area between Exit 247 (Hyland Hills/Floyd Hill) and Exit 240 (SH 103/Mt Evans). This portion of westbound I-70 has steep grades and sharp curves, and it is only two lanes wide. Eastbound crashes are higher between MP 240 and Exit 244 (US 6/Golden). This is the portion of the study area where eastbound travel has many ramps and sharp curves, and it was only two lanes wide until 2015 when the EB PPSL was added for the peak days.

Exhibit 16. DiExSys™ I-70 Mainline Crashes[1]

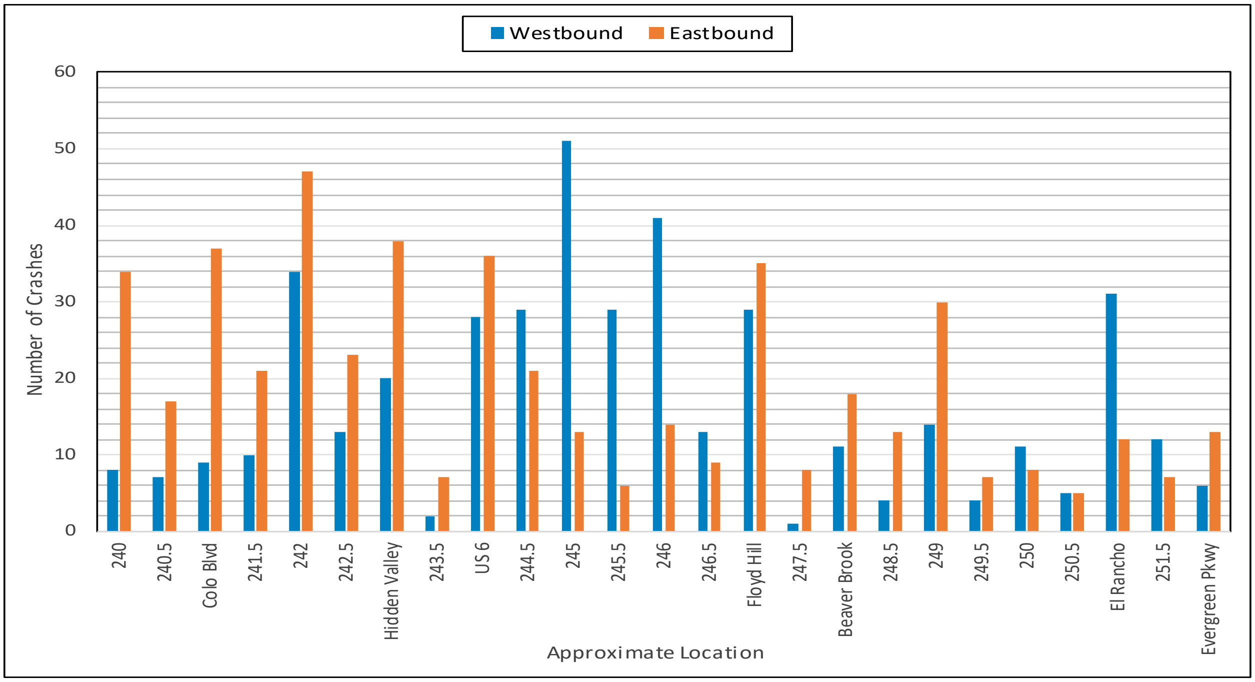
Category	Westbound[2]	Eastbound[2]	Total[3]
Severity			
Property Damage Only	334 (79%)	384 (80%)	718 (80%)
Injury	87 (21%)	93 (19%)	180 (20%)
Fatality	1 (<1%)	2 (<1%)	3 (0%)
Crash Type			
Rear End	165 (39%)	104 (22%)	269 (30%)
Fixed Object	102 (24%)	152 (32%)	254 (28%)
Sideswipe	53 (13%)	89 (19%)	142 (26%)
Animal	61 (14%)	70 (15%)	131 (15%)
Overturning	12 (3%)	22 (5%)	34 (4%)
Embankment	11 (3%)	18 (4%)	29 (3%)
Boulders/Rocks	5 (1%)	7 (1%)	12 (1%)
Parked Car	3 (1%)	4 (1%)	7 (1%)
Pedestrian	2 (<1%)	0 (0%)	2 (0%)
Bicycle	0 (0%)	1 (<1%)	1 (0%)
All Other	8 (2%)	12 (3%)	20 (2%)

1. DiExSysTM data for June 30, 2011, to June 30, 2016.

2. Percentage is based on the total crashes by direction of travel.

3. Percentage is based on the total number of crashes for both directions.

Exhibit 17. DiExSys™ I-70 Mainline Crashes[1] by Direction and Approximate Location



1. DiExSys™ data for June 30, 2011, to June 30, 2016.

4.2.2.2 I-70 Ramp-Related Crash Summary

In addition to the mainline crashes on I-70, there were a total of 14 crashes on ramps and 9 crashes at or related to the ramp junction intersections, as follows:

- Two crashes on the eastbound loop off-ramp at Exit 241 (Idaho Springs/Colorado Boulevard). This loop ramp has subsequently been removed and replaced with a traditional off-ramp.
- Six crashes at the ramp junction intersections at Exit 243 (Hidden Valley/Central City).
- One crash on the eastbound on-ramp and westbound on-ramp at Exit 243 (Hidden Valley/Central City).
- One crash at the westbound Exit 244 (US 6/Golden) ramp junction intersection and six crashes on Exit 244 (US 6/Golden) ramps.
- Two crashes at the Exit 247 (Hyland Hills/Floyd Hill) ramp junction intersections and one crash on the westbound on-ramp.
- One crash on the eastbound on-ramp at Exit 248 (Beaver Brook/Floyd Hill).
- Two crashes are listed as being ramp related, but the data are unclear as to the location.

4.2.2.3 US 6 Crash Summary

There were 32 crashes on US 6 within the study area. Crashes on US 6 are shown by severity and crash type in Exhibit 18. There were 18 crashes (roughly 56 percent) that caused property damage only, and an additional 13 crashes (roughly 41 percent) resulting in injuries. One crash resulted in a fatality. Rear-end crashes were the most common crash type on US 6, with approach turn, embankment, and crashes involving boulders/rocks being the next most common types.

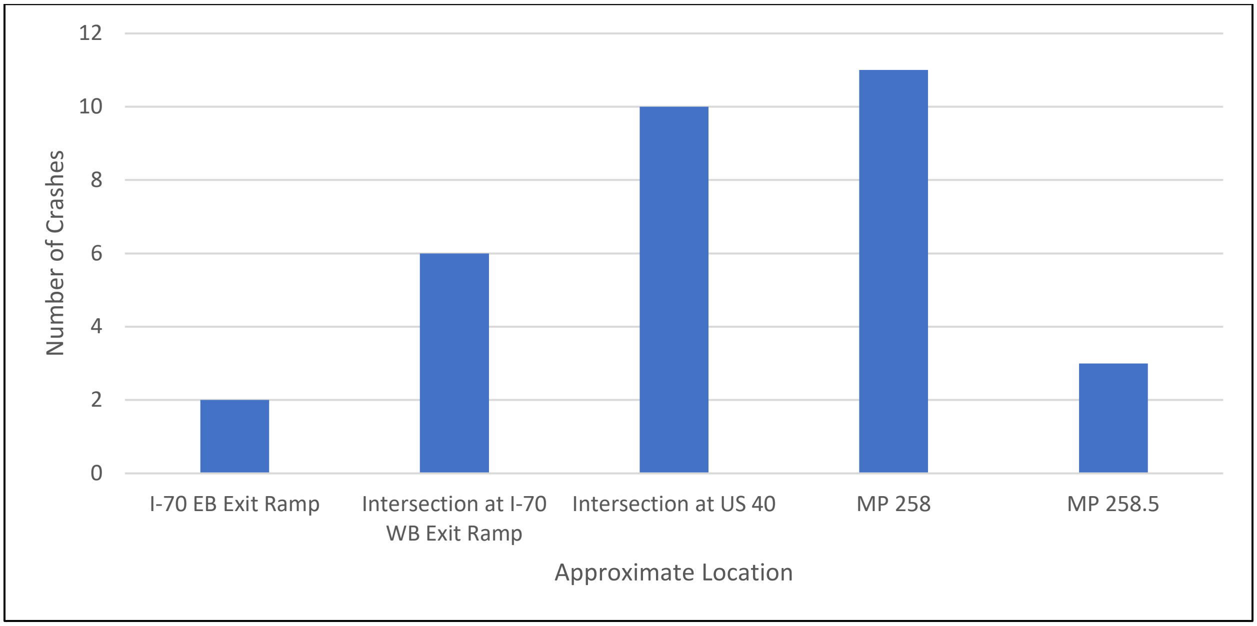
Exhibit 18. DiExSys™ US 6 Crashes[1]

Category	Number of Crashes[2]
Severity	
Property Damage Only	18 (56%)
Injury	13 (41%)
Fatality	1 (3%)
Crash Type	
Rear End	12 (38%)
Approach Turn	3 (9%)
Embankment	3 (9%)
Boulders/Rocks	3 (9%)
Fixed Object	2 (6%)
Head On	2 (6%)
Overturning	2 (6%)
All Other	5 (17%)

1. DiExSys™ data for June 30, 2011, to June 30, 2016.
2. Percentage is based on the total crashes

Exhibit 19 shows the number of crashes on US 6 by their approximate location. The greatest number of crashes occurred at the intersection at US 40 and at MP 258, which is east of the US 40 intersection. Of the 10 crashes at the intersection of US 6 and US 40, 8 were rear-end type crashes. The typology of crashes at MP 258 is considerably more varied.

Exhibit 19. DiExSys™ US 6 Crashes[1] by Approximate Location



I-70 EB Exit Ramp	2
Intersection at I-70 WB Exit Ramp	6
Intersection at US 40	10
MP 258	11
MP 258.5	3

1. Data for June 30, 2011, to June 30, 2016.

4.2.2.4 US 40 Crash Summary

Crash data on US 40 from June 30, 2011, to June 30, 2016, are summarized in Exhibit 20. Of the 40 reported crashes, 22 caused property damage only and 18 resulted in injuries. There were no fatal crashes on US 40. The most common crash type observed on US 40 was rear-end crashes, accounting for 25 percent of all crashes. The next most common crash type was fixed-object crashes, which accounted for 20 percent of all crashes on US 40. Approach turn, sideswipe, and wild animal crashes were the next most common crash types.

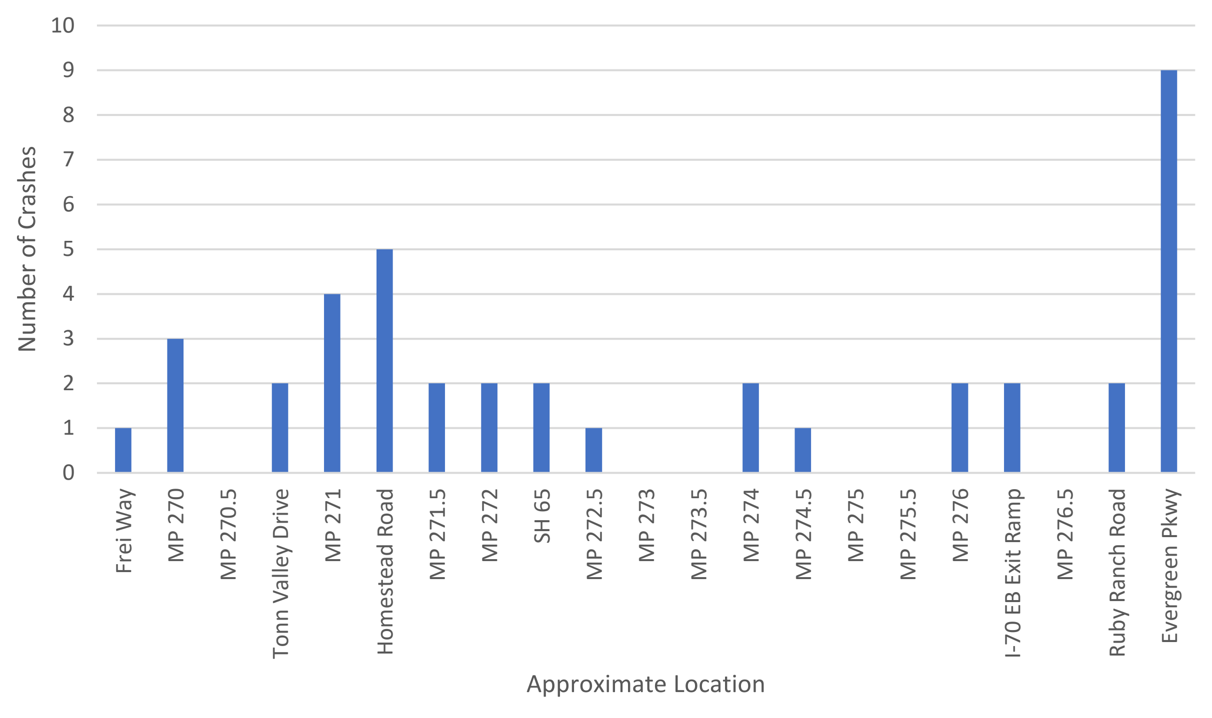
Exhibit 20. DiExSys™ US 40 Crashes[1]

Category	Number of Crashes[2]
Severity	
Property Damage Only	22 (55%)
Injury	18 (45%)
Fatality	0 (0%)
Crash Type	
Rear End	10 (25%)
Fixed Object	8 (20%)
Approach Turn	5 (12.5%)
Sideswipe	4 (10%)
Wild Animal	3 (7.5%)
Other Object	3 (7.5%)
All other	7 (17.5%)

1. DiExSysTM data for June 30, 2011, to June 30, 2016.
2. Percentage is based on the total crashes

Exhibit 21 shows the number of crashes on US 40 by approximate location. Most crashes occurred at intersections and driveways, which represent 55 percent of crashes on US 40 combined. The intersection of US 40 and Evergreen Parkway has the most crashes of any location along US 40. The location with the second-most crashes occurs at US 40 and Homestead Road (Exit 247).

Exhibit 21. DiExSys^{TM} US 40 Crashes[1] by Approximate Location



1. Data for June 30, 2011, to June 30, 2016

4.2.3 CDOT Safety Assessment Report

In January 2018, the CDOT Safety Engineering and Analysis Group published the *I-70: MP 242 to MP 248 Reconstruction/Widening Safety Assessment Report* (Appendix A2 to the EA). The purpose of the safety assessment was to identify existing safety issues and potential improvements to improve safety along I-70 between MP 242 and MP 248. The report reviewed crash data for I-70 between January 1, 2014, and December 31, 2016. The study findings included:

- A total of 345 crashes occurred on I-70, with only one crash involving a fatality.
- Fixed-object crashes were the most common type of event, followed by rear-end, sideswipe, and wild animal crashes.
- Fixed-object crashes usually involved a concrete barrier or guardrail.
- Eastbound crashes occurred most frequently between 2:00 p.m. and 4:00 p.m., while westbound crashes occurred most frequently between 7:00 a.m. and 8:00 a.m., 1:00 p.m. and 2:00 p.m., or 5:00 p.m. and 6:00 p.m.
- More crashes occurred on a Saturday than any other day, with Monday and Friday being the next highest days for crashes.
- Summer and winter months had more crashes than the other seasons, with July, January, February, and March having the highest number of crashes (July is highest overall).
- Most crashes occur in dry conditions.

- Only 10 percent of crashes involved heavy vehicles, with sideswipe, rear-end, and fixed-object crashes being the most common type of event, and only 40 percent of the heavy vehicle crashes were in the westbound direction.
- There was a moderate to high potential for crash reduction on I-70 in the study area.
- Ramp and ramp terminal crashes were very low.

Based on the study's findings, some of the recommendations included:

- Consider a third westbound lane to reduce congestion-related crashes.
- If an express lane is considered, it should begin west of MP 244 or west of Exit 244 (US 6/ Golden) to allow two westbound general-purpose lanes on the steep downgrade leading up to MP 244.
- Increase inside/outside shoulder widths to 12 feet.
- Consider enhanced Intelligent Transportation Systems infrastructure—variable speed limits, dynamic speed displays, and variable message signs.
- Consider in-pavement lighting, especially between MP 242 and MP 244.
- Use durable and highly reflective striping.
- Consider wildlife fencing, especially between MP 246 and MP 248.

The study went on to conclude that any improvement project should consider:

- Skid-resistant surfaces and improved drainage
- Upgraded guardrail
- Safety edge application
- Correction to super-elevation and crowns
- Improved pavement markings, signage, and delineation

4.2.4 HSM Analysis

In 2019, an Existing Conditions safety analysis was completed using the HSM predictive methods for evaluating freeways, ramps, and interchanges and two-lane rural roads, among other facility types. This section provides a summary of the methodology and approach to complete the analysis. For more details, refer to Appendix C, for the *Safety Performance Evaluation Technical Report.*

The safety analysis study area is slightly different than the overall EA Project limits (see Exhibit 22) because the safety performance analysis only evaluated areas where the roadway design changed. The safety analysis study area stretches from the Veterans Memorial Tunnels to just east of the Exit 248 (Beaver Brook/Floyd Hill) interchange and includes the four service interchanges.

The analysis considered the following elements of the roadway network:

- I-70 mainline
- Local roads, such as US 40, CR 65, and US 6
- Ramp termini intersections at each interchange in the study area

Exhibit 22. HSM Safety Analysis Study Area

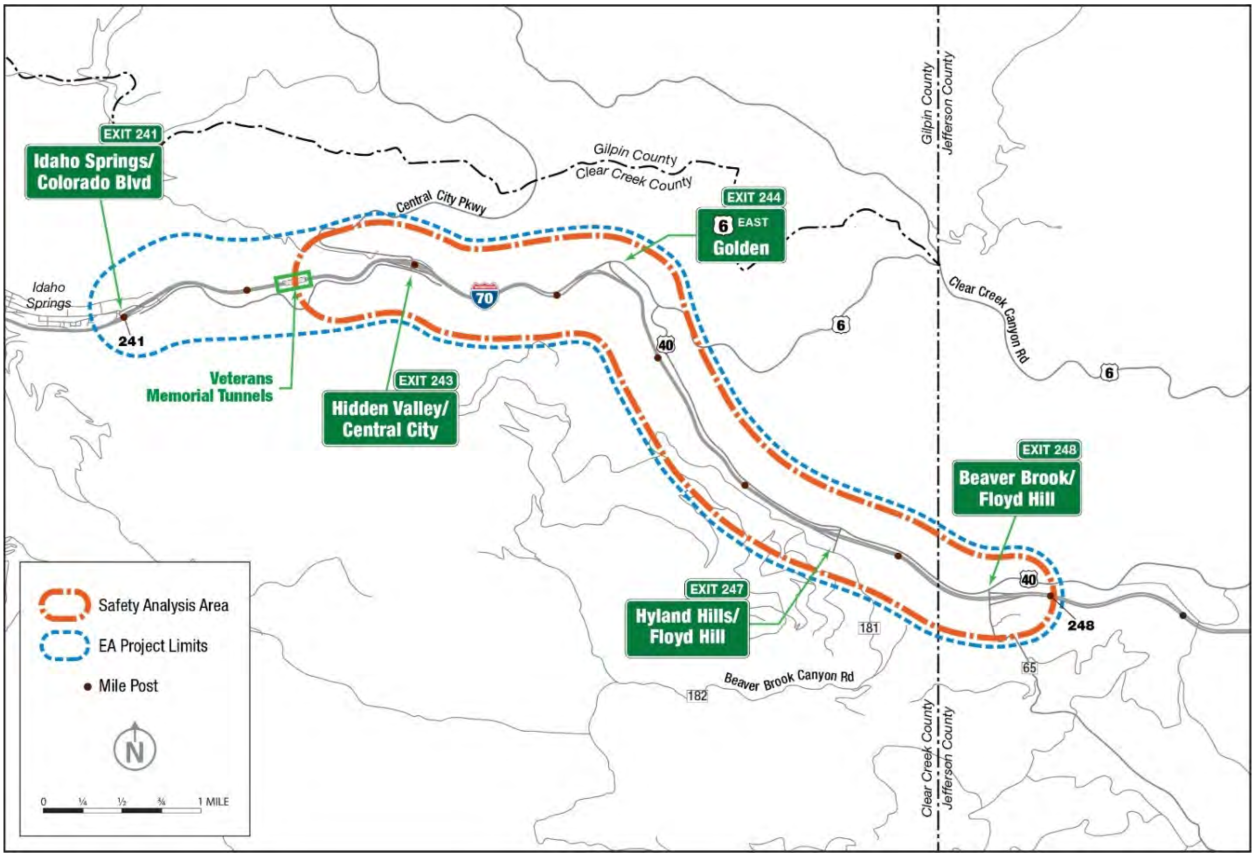


Exhibit 23 presents the results of the HSM analysis of Existing Conditions for I-70. The analysis predicts the number of crashes that are expected to occur within the study area based on geometric conditions and average annual daily traffic volumes. These values serve to form a baseline against which the future No Action conditions can be compared. The results indicate that most crashes on I-70 should occur on the mainline with most of the crashes being property damage only, which is consistent with the other crash analyses summarized in the previous sections. More details on the results of the HSM analysis for Existing Conditions can be found in Appendix C.

Exhibit 23. **Existing Predicted Annual HSM Crash Analysis Results (I-70 and Interchanges)**

Major Road	Name	2018 Existing Conditions		
		Fatal and Injury	Property Damage Only	Total
I-70	Mainline	32.6	92.7	125.3
I-70	Speed Change Lanes	4.5	17.2	21.7
Exit 248 (Beaver Brook/Floyd Hill)	Eastbound Entrance	0.0	0.1	0.1
	Eastbound Entrance at CR 65	0.0	0.0	0.0
	Westbound Exit	0.0	0.0	0.1
	US 40 & CR 65	1.0	1.3	2.3
	Westbound Exit at CR 65	0.1	0.2	0.3
	Total	1.1	1.7	2.8
Exit 247 (Hyland Hills/Floyd Hill)	Westbound Entrance	0.0	0.0	0.1
	US 40 & Homestead Road	0.8	1.1	1.9
	Westbound Entrance at Homestead Road	0.0	0.0	0.0
	Eastbound Exit	0.0	0.0	0.1
	Eastbound Exit at Homestead Road	0.1	0.1	0.2
	Total	0.9	1.3	2.2
Exit 244 (US 6/ Golden)	Westbound Exit	0.1	0.1	0.2
	Westbound Exit at US 6	0.3	0.4	0.7
	Westbound Entrance	0.2	0.3	0.5
	Eastbound Exit	0.1	0.1	0.2
	Total	0.7	0.9	1.6
Exit 243 (Hidden Valley/ Central City)	Westbound Exit	0.1	0.1	0.2
	Westbound Ramps at Central City Pkwy	0.1	0.1	0.2
	Westbound Entrance	0.0	0.0	0.1
	Eastbound Exit	0.0	0.0	0.1
	Eastbound Ramps at Central City Pkwy	0.0	0.0	0.1
	Eastbound Entrance	0.0	0.0	0.1
	Total	0.3	0.4	0.7
Interchange Total		3.0	4.3	7.3
Mainline Total		37.1	109.8	147.0
Grand Total		40.1	114.1	154.3

4.3 Existing Traffic Volumes and Patterns

Traffic in the study area follows distinct seasonal and weekly patterns. Patterns for the daily I-70 mainline and local roads are discussed in the following sections.

4.3.1 I-70

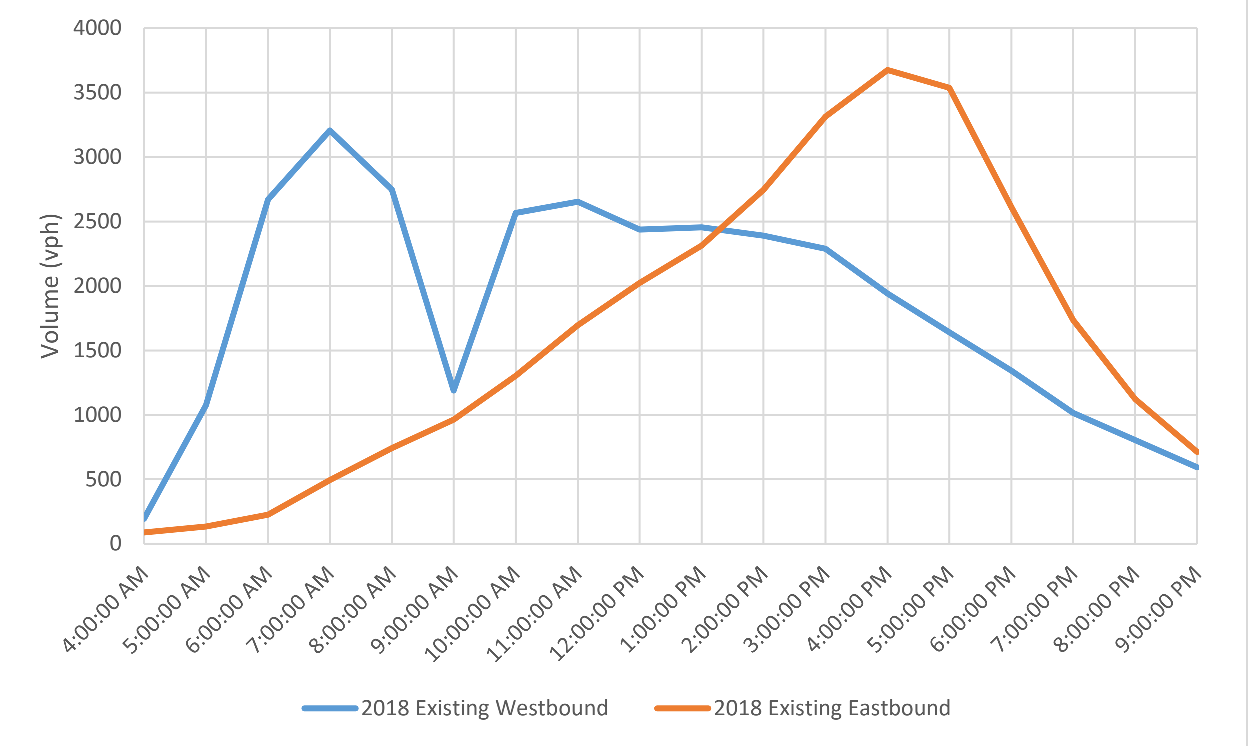
Average weekday travel patterns on I-70 are relatively consistent throughout the year, while traffic volumes on Fridays and weekends change dramatically depending on the time of year. Mondays through Thursdays are characterized by relatively stable westbound conditions, with slight eastbound peaks in the morning hours and westbound peaks in the evening hours. Fridays show much higher westbound volumes all day long, with peak conditions in the late afternoon hours. Saturday and Sunday have heavy westbound volumes in the morning hours, with Saturdays having the heaviest westbound volumes. Eastbound peaks occur during the afternoon hours for all days of the week, but the Sunday eastbound volumes are much higher than the other days and the peak volumes are spread out over more hours of the day.

Winter weekend traffic patterns on I-70 (shown in Exhibit 24 and Exhibit 25) are characterized by directional peaks coinciding with recreational travel to ski areas. Winter weekends have large early morning peaks traveling westbound, with eastbound peaks occurring in the afternoon. Large westbound peaks also are observed on Fridays in the evening hours as travelers get a jump start to the ski weekends. The highest eastbound peaks occur in the afternoon hours for all days of the week, but on the weekends (Friday through Sunday), the Sunday eastbound peaks last much longer than Fridays and Saturdays.

Summer weekend travel patterns on I-70—refer to Exhibit 26 and Exhibit 27—are characterized by directional peaks, with generally longer-lasting peaks than observed during the winter. The highest westbound volumes on summer weekends are observed on Saturday mornings. Westbound peaks are more gradual in the summer months compared to winter, as winter traffic is dominated by people traveling to ski areas, which are all open during relatively similar hours. Summer recreational activities are far more diverse, which causes more gradual peaks on I-70. Similar to the winter months, the highest eastbound volumes during summer weekends are observed on Sunday afternoons. Eastbound traffic is highest on Sundays as people are returning to the Front Range from the mountain activity areas to the west. For more details about daily volume patterns on I-70, refer to Appendix A.

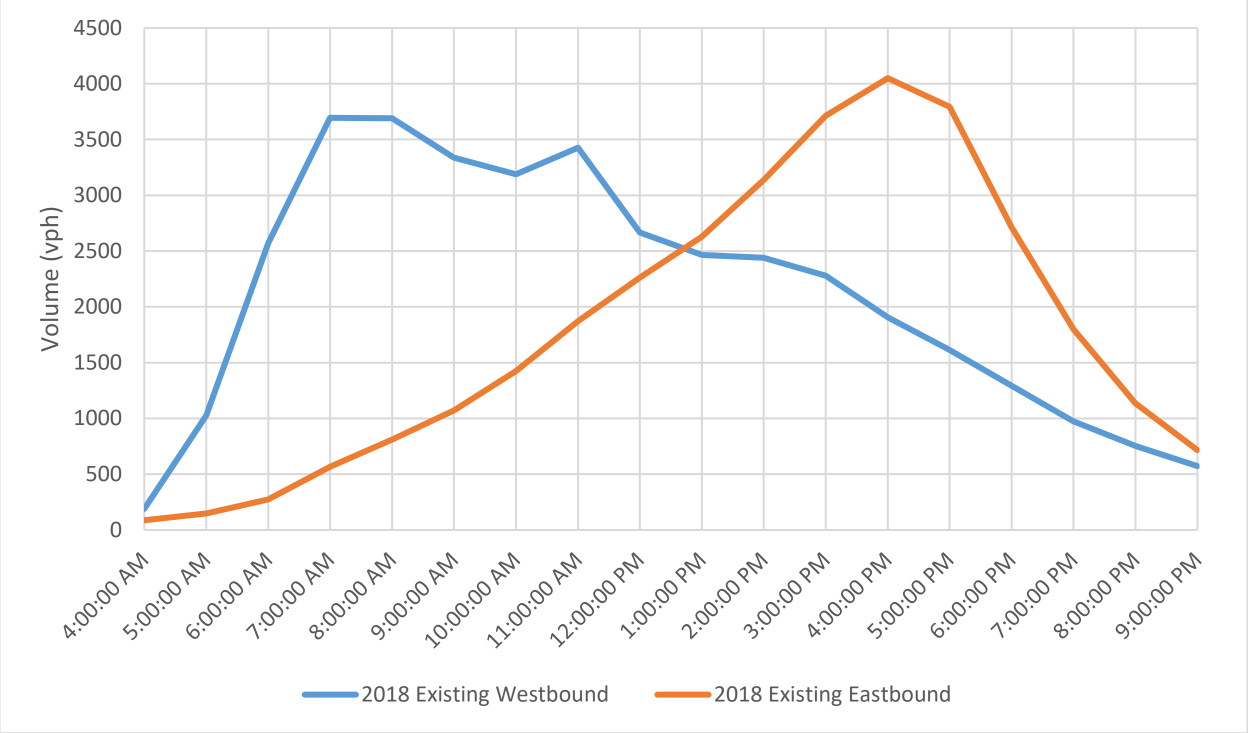
Note that eastbound I-70 has a managed Express Lane (EL) at the location west of the Veterans Memorial Tunnels in Existing Conditions. The eastbound volumes at this location are a sum of the volumes using the general purpose lanes (GPL) and EL for a total eastbound volume on I-70.

Exhibit 24. Existing I-70 Winter Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



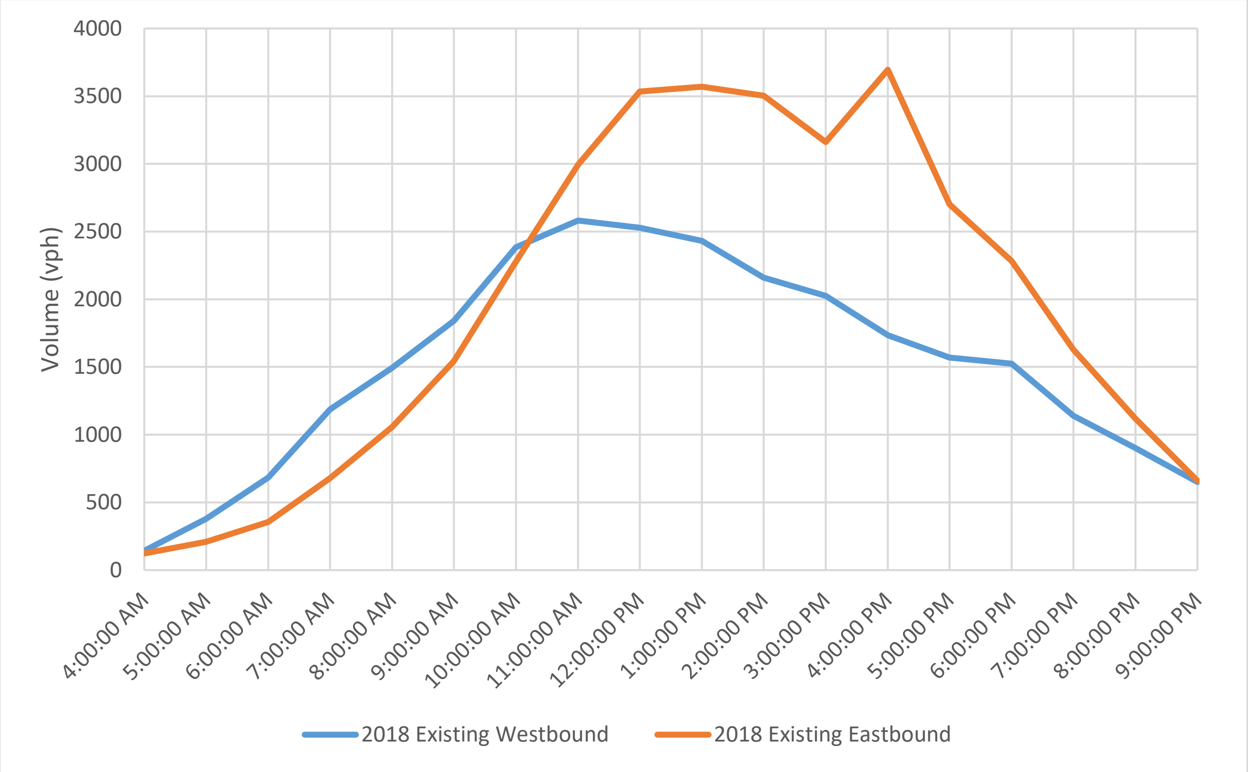
Source: TransModeler microsimulation analysis.
Note: The large drop around 9:00 a.m. is the result of severe congestion on I-70 that results in gridlock.

Exhibit 25. Existing I-70 Winter Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



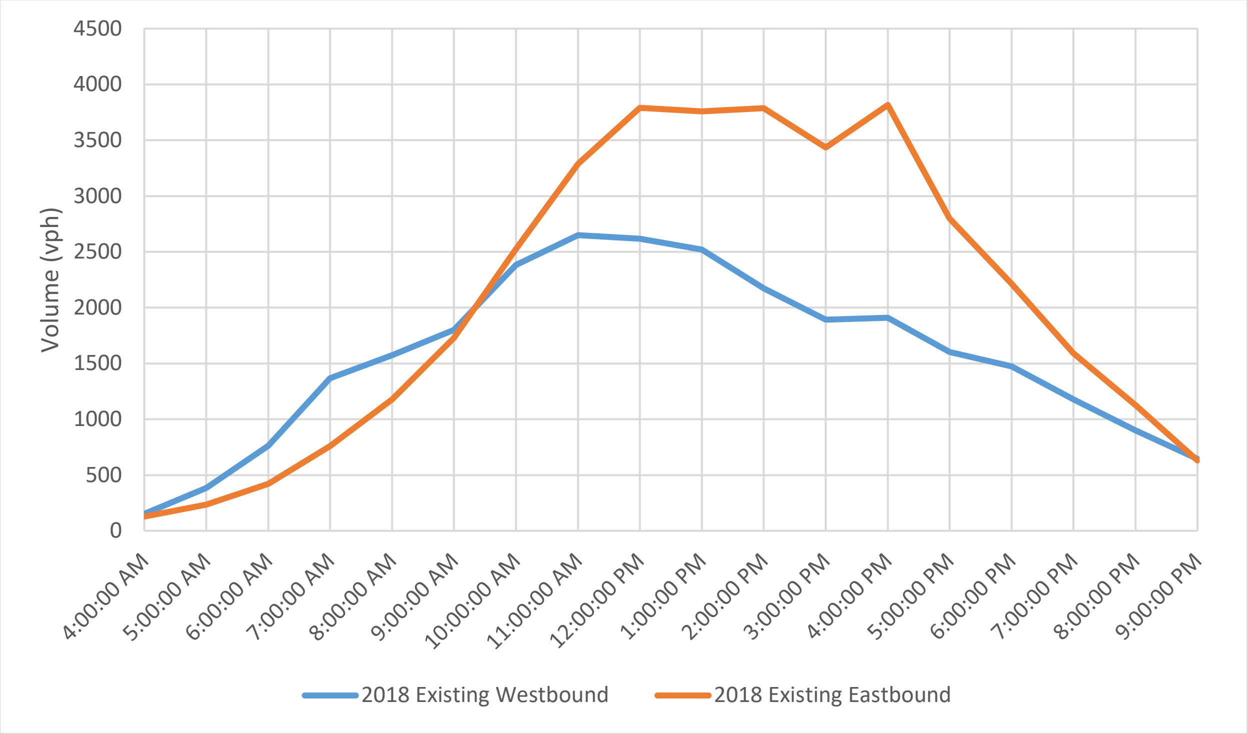
Source: TransModeler microsimulation analysis.

Exhibit 26. **Existing I-70 Summer Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)**



Source: TransModeler microsimulation analysis.

Exhibit 27. **Existing I-70 Summer Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)**

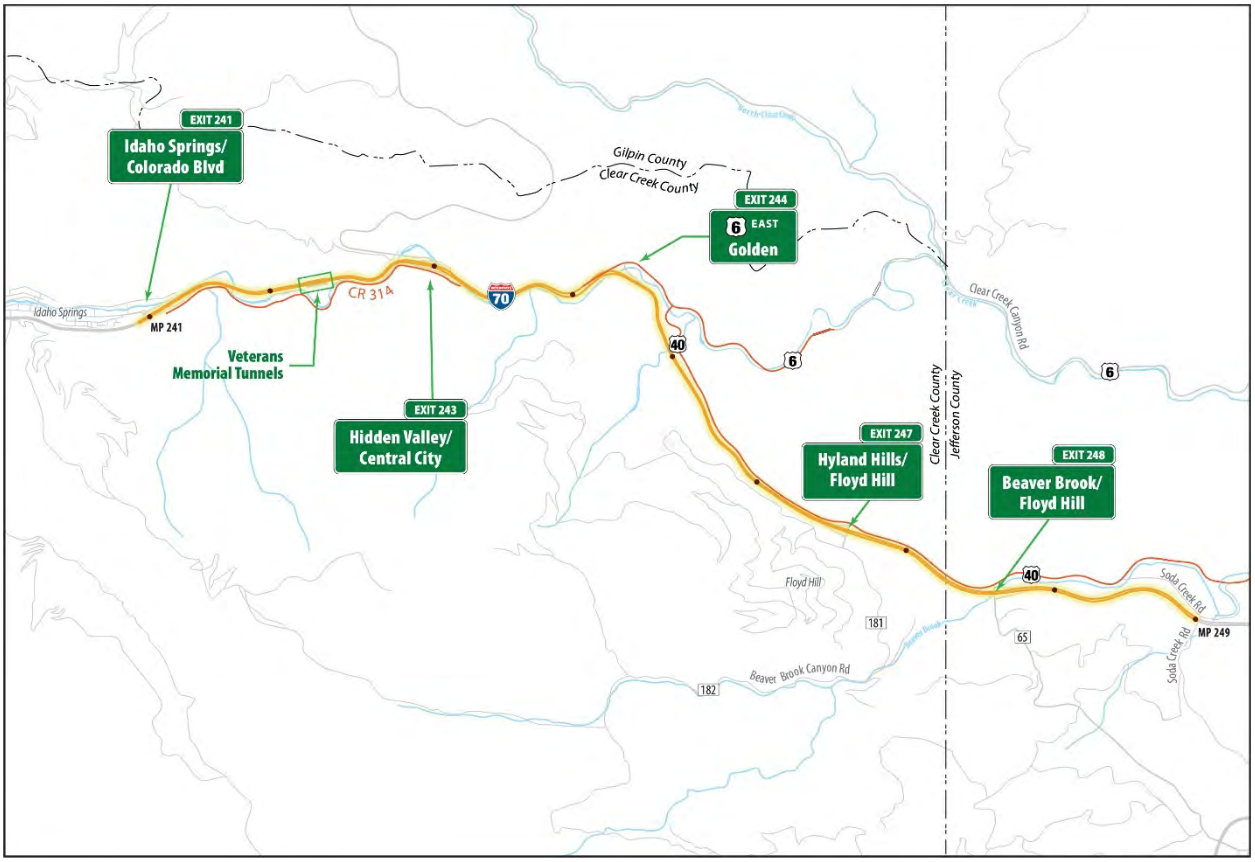


Source: TransModeler microsimulation analysis.

4.3.2 Local Roads

The three local roads of primary interest as those that provide alternate routes to I-70 are US 40, CR 314, and US 6, as shown in Exhibit 28. Each of these roads is discussed in more detail in the following sections.

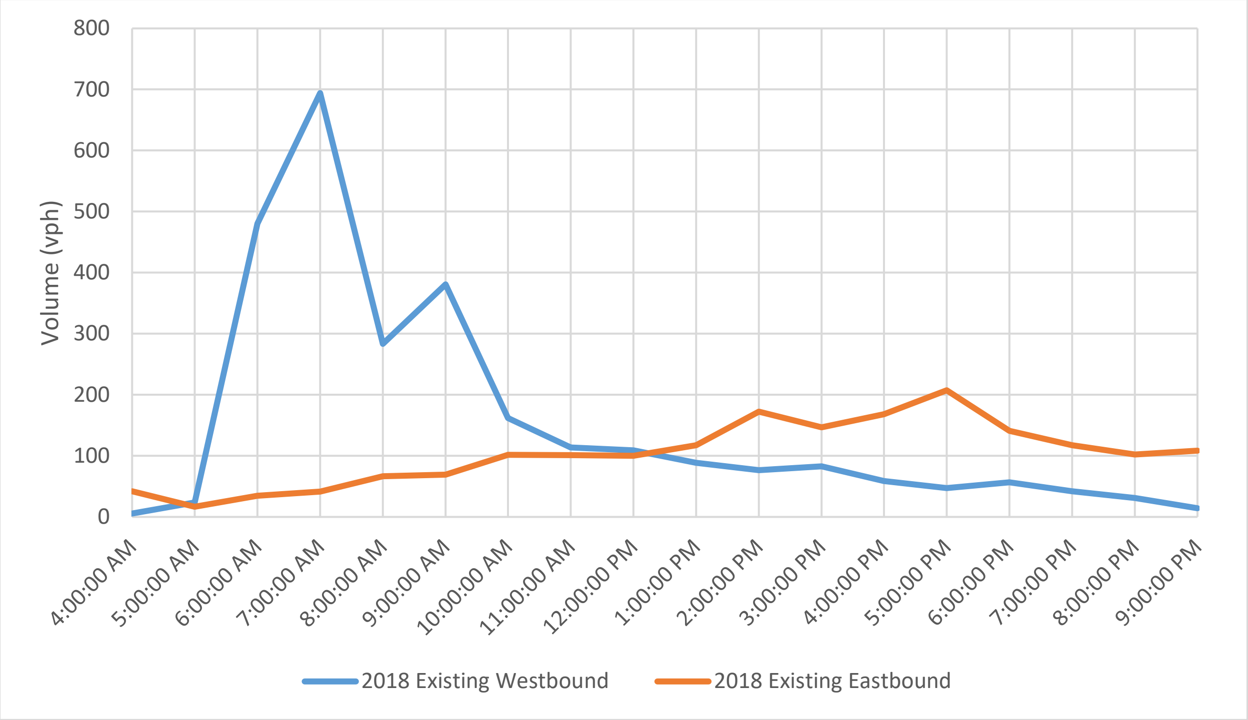
Exhibit 28. Local Roads of Primary Interest in the Study Area



4.3.2.1 US 40

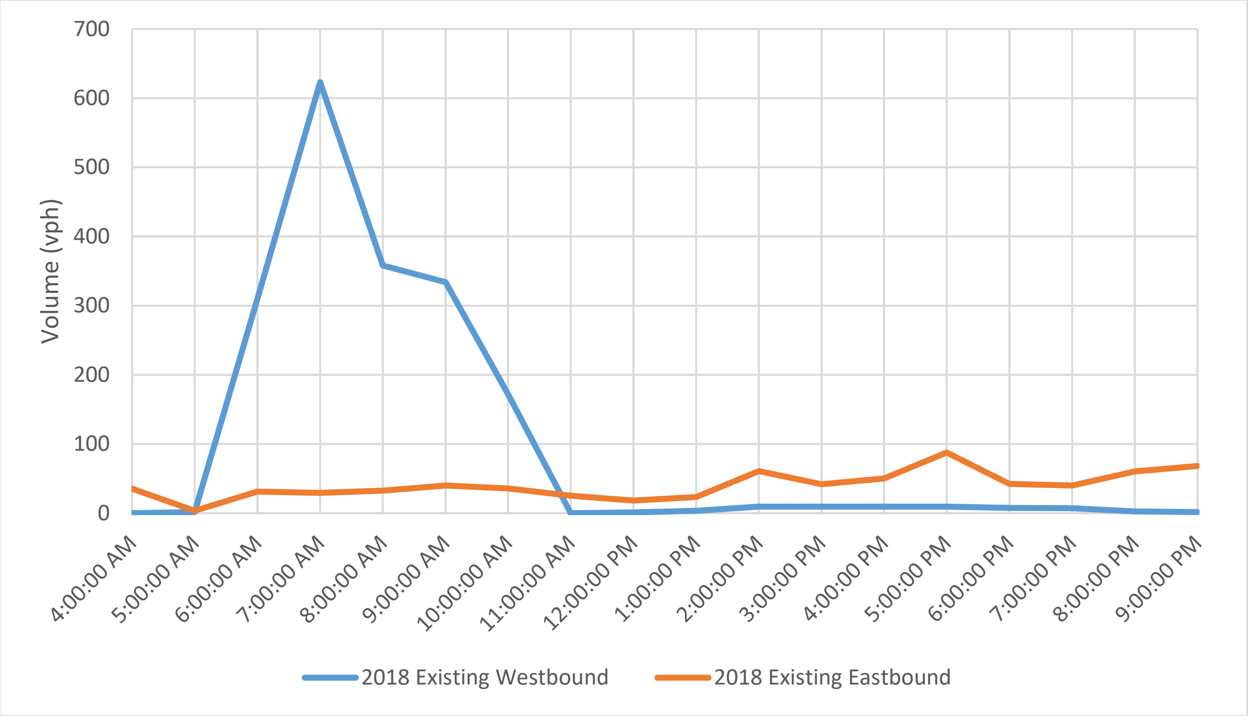
For US 40, the two locations of interest are: (1) between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill), and (2) between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden). The existing volumes along US 40 are shown in Exhibit 29 and Exhibit 30 for a winter Saturday and Exhibit 31 and Exhibit 32 for a summer Sunday. The highest volumes on US 40 in the study area occur between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill) interchanges. In this area, US 40 serves as the sole connection between the two half-diamond interchanges, and it also carries through traffic on US 40 headed to destinations farther to the east. Volume patterns on US 40 vary between summer and winter conditions. In the winter, there are large volume peaks in the morning hours as US 40 is parallel to I-70 from Evergreen Parkway to US 6, providing an alternate route during congested winter mornings.

Exhibit 29. **Existing US 40 Winter Volumes—Between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill)**



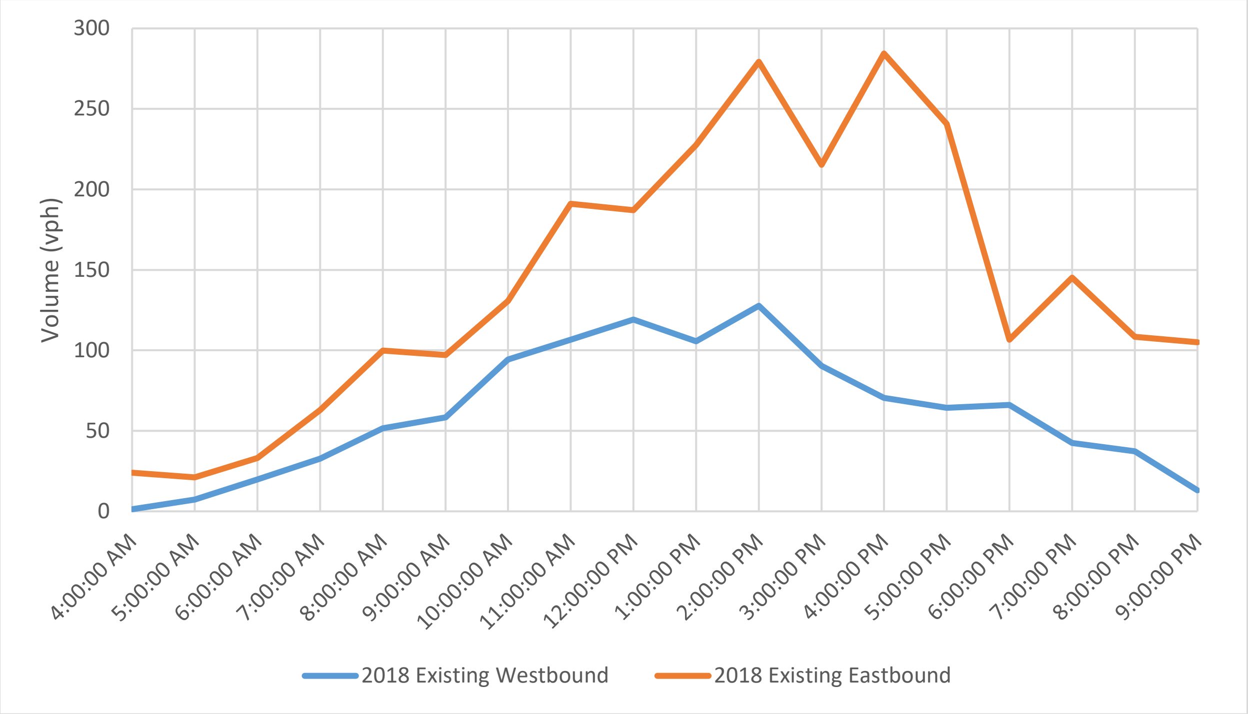
Source: TransModeler microsimulation analysis.

Exhibit 30. **Existing US 40 Winter Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)**



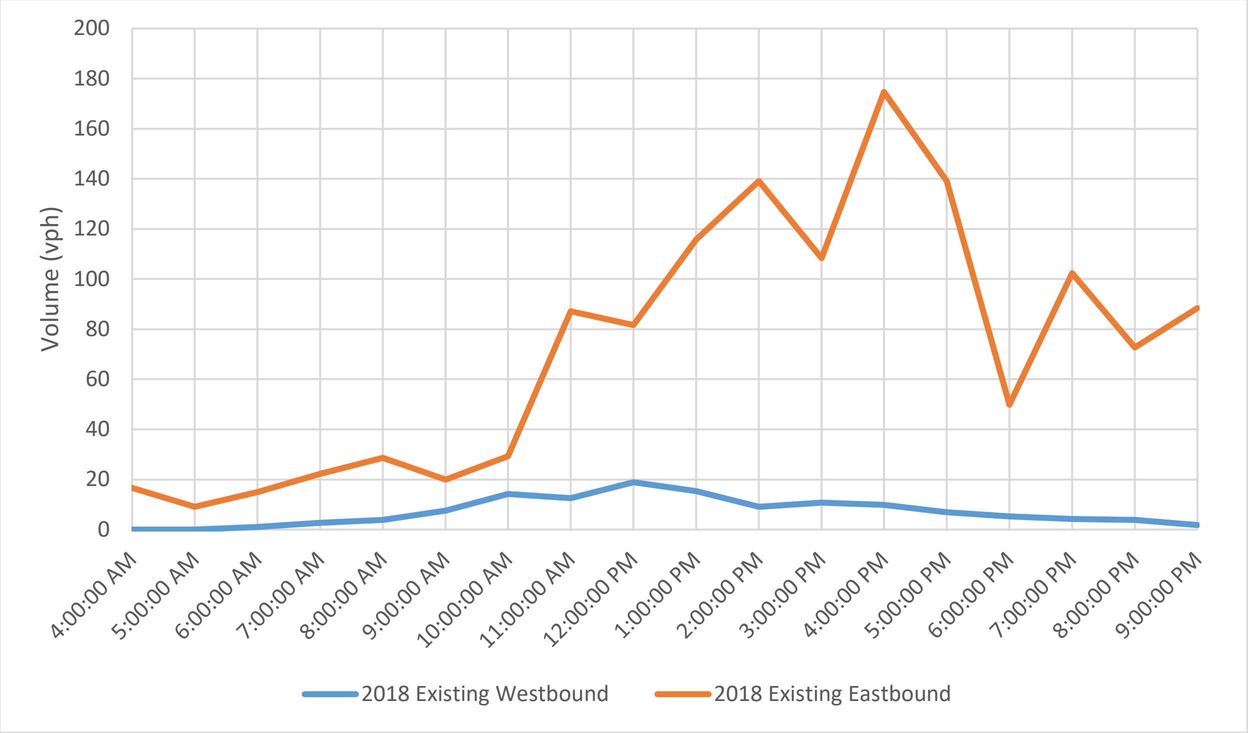
Source: TransModeler microsimulation analysis.

Exhibit 31. Existing US 40 Summer Volumes—Between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill)



Source: TransModeler microsimulation analysis.

Exhibit 32. Existing US 40 Summer Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)

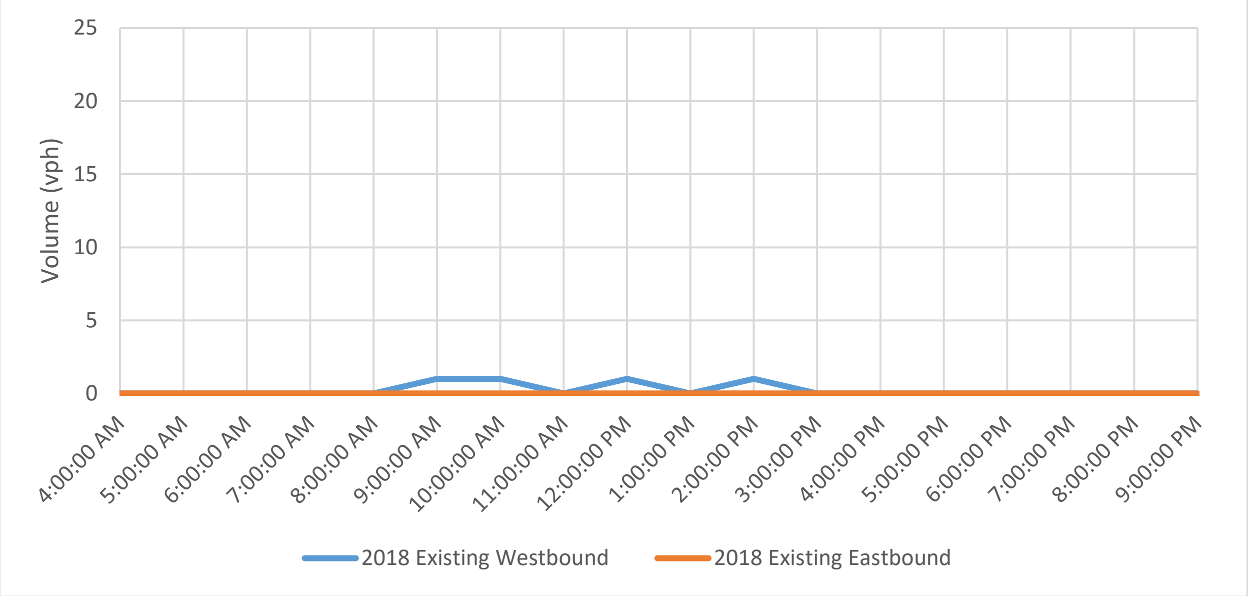


Source: TransModeler microsimulation analysis.

4.3.2.2 CR 314

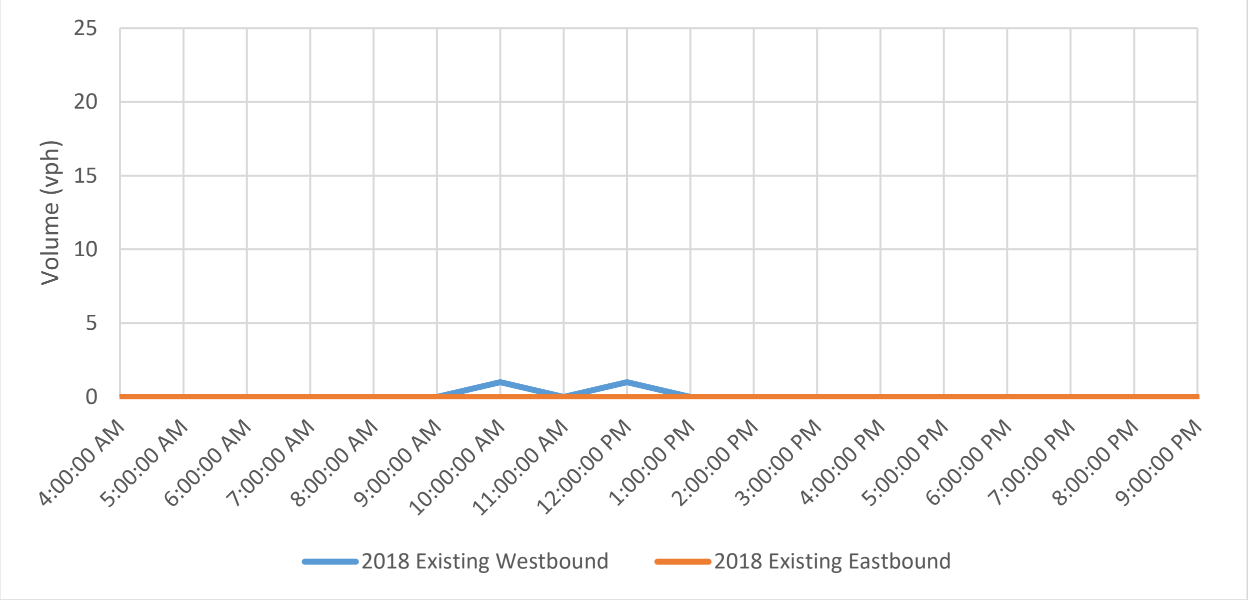
CR 314 provides an alternate route to I-70 between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard). Unlike US 40, it appears that CR 314 is not used as an alternate route during normal congestion on I-70. Rather, CR 314 is occasionally used as an alternate route during unusual events. The observed volume patterns on CR 314 for a winter Saturday are shown in Exhibit 33 and for a summer Sunday are shown in Exhibit 34.

Exhibit 33. Existing CR 314 Winter Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

Exhibit 34. Existing CR 314 Summer Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)

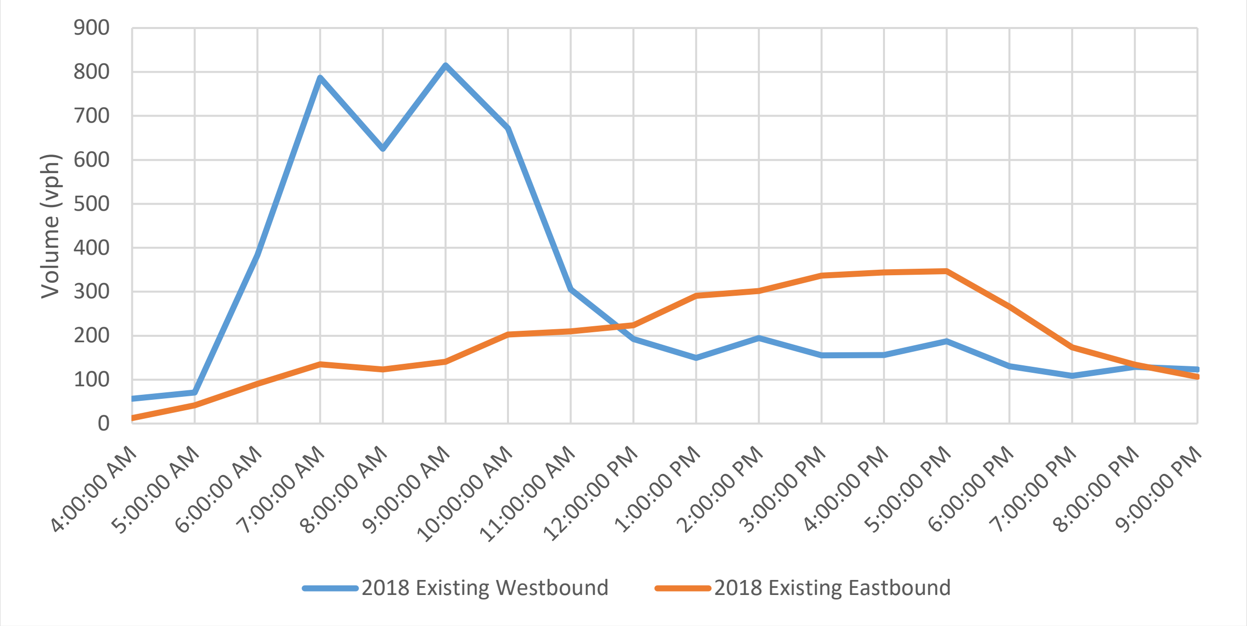


Source: TransModeler microsimulation analysis.

4.3.2.3 US 6

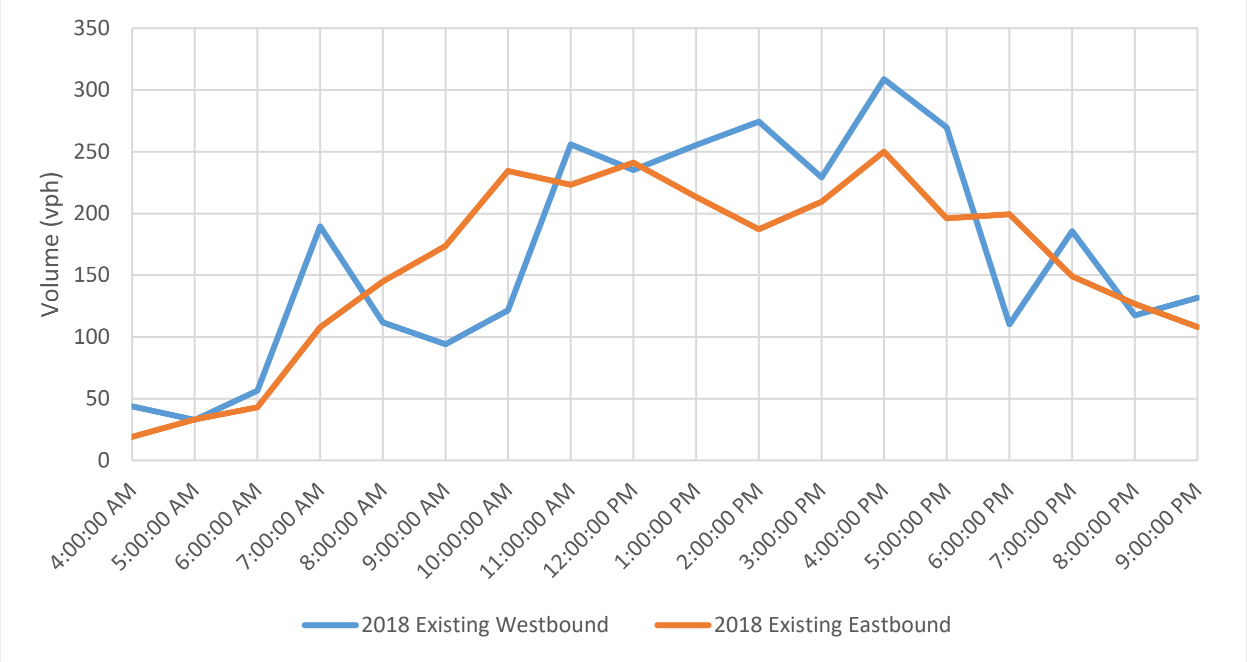
As can be seen in Exhibit 35 and Exhibit 36, the volume patterns vary greatly between winter and summer conditions on US 6. In the winter, there is a rapid peak in the morning hours, with the majority of morning traffic traveling westbound on US 6 to the east of the intersection with US 40. The summer peak hours on US 6 occur later in the day, with lower peak volume than winter conditions.

Exhibit 35. Existing US 6 Winter Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

Exhibit 36. Existing US 6 Summer Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

4.4 Existing Operational Conditions

The Existing Conditions operational characteristics of the study corridor, which will be used as a baseline for the No Action analysis, are discussed in the following sections and include:

- Vehicle miles traveled (VMT) and vehicle hours of travel (VHT)
- Volume throughput on I-70
- Travel times
- Travel speeds and congestion
- Travel time reliability on I-70
- Freeway segment (basic, merge, diverge, and weave) LOS
- Ramp terminal intersection LOS and queues

4.4.1 VMT and VHT

Existing vehicle miles traveled (VMT) and vehicle hours traveled (VHT) are shown in Exhibit 37 by season for the primary corridors modeled in the study area. On I-70, VMT is similar between winter Saturdays and summer Sundays, but there is significantly higher VHT for winter Saturdays, indicating that congestion is more severe on winter Saturdays. VMT is higher in the winter on US 6 and US 40 than it is in the summer, consistent with vehicles using these roads as alternate routes to I-70. VHT increases by a similar proportion to VMT on US 6 between summer and winter. Congestion on US 40 is much more severe in the winter than the summer, as shown by much higher VHT on US 40 in the winter. CR 314 is used very little under Existing Conditions, so VMT and VHT are very low.

Exhibit 37. Existing VMT and VHT

Facility	Winter Saturday		Summer Sunday	
	VMT	VHT	VMT	VHT
I-70	717,959	18,409	702,106	13,074
US 6	7,771	190	4,248	102
US 40	15,715	2,636	8,309	222
CR 314	1	0.04	0.4	0.02

Source: TransModeler microsimulation analysis.

4.4.2 Throughput on I-70

Highways such as I-70 have the ability to process a certain volume of vehicles, typically referred to as the service capacity of the highway. A typical capacity for an interstate highway can be more than 2,400 vehicles-per-hour-per-lane (vphpl). However, a number of factors such as grades, curves, vehicle mix, demand, driver familiarity, and access conditions, all tend to result in a capacity that is lower than the typical value. For this study, two locations were evaluated to identify the maximum throughput on I-70. The first location is located East of Exit 241 (Idaho Springs/Colorado Boulevard). At this location I-70 has two westbound lanes (2 GPL) and three eastbound lanes (2 GPL + 1 PPSL). The second location is located Exit 247 (Hyland Hills/Floyd Hill) where I-70 has three lanes (3 GPL) lanes in each direction of travel.

A review of Exhibit 24 through Exhibit 27 indicates that volume of vehicles being processed by I-70 in Existing Conditions is different based on the direction of travel, location, and the peak day. For eastbound I-70, volumes east of Exit 241 (Idaho Springs/Colorado Boulevard) peak around 4,000 vph during the winter and about 3,800 vph during the Summer. Part of the reason for the difference is because winter volumes grow gradually over more hours before reaching their peak, but in the summer the volumes on eastbound I-70 grow more rapidly and this results in more congestion in the area near the Veterans Memorial Tunnels due to the sharp curves. East of Exit 247 (Hyland Hills/Floyd Hill), eastbound I-70 processes about the same volume on both peak days, which is more of a result of the steep grades coming up Floyd Hill just to the west of this location.

For westbound I-70, volumes grow rapidly during the morning hours in the winter resulting in the highway reaching a breaking point of about 3,200 vph just east of Exit 247 (Hyland Hills/Floyd Hill). Due to the steep grades on Floyd Hill and the lane drop that occurs just west of this location, the highway basically experiences a failure situation where traffic flow is significantly impacted, and high levels of congestion occur. At Exit 241 (Idaho Springs/Colorado Boulevard), the winter westbound flow on I-70 increases to about 3,700. This increase is primarily because the bottleneck at the top of Floyd Hill acts to meter flow beyond that point and also because of the high influx of vehicles at Exit 244 (US 6/Golden) interchange. In the summer, westbound I-70 volumes do experience the rapid increases like the winter conditions and the highway can process the flows, up to a maximum of about 2,600 vph, without resulting in bottlenecks or high congestion.

Exhibit 38 summarizes the maximum throughputs on I-70 by direction of travel and peak day of the year.

Exhibit 38. Existing I-70 Throughput

Travel Direction	Winter Saturday		Summer Sunday	
	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241
Eastbound	3,700 vph	4,000 vph	3,600 vph	3,800 vph
Westbound	3,200 vph	3,700 vph	2,600 vph	2,600 vph

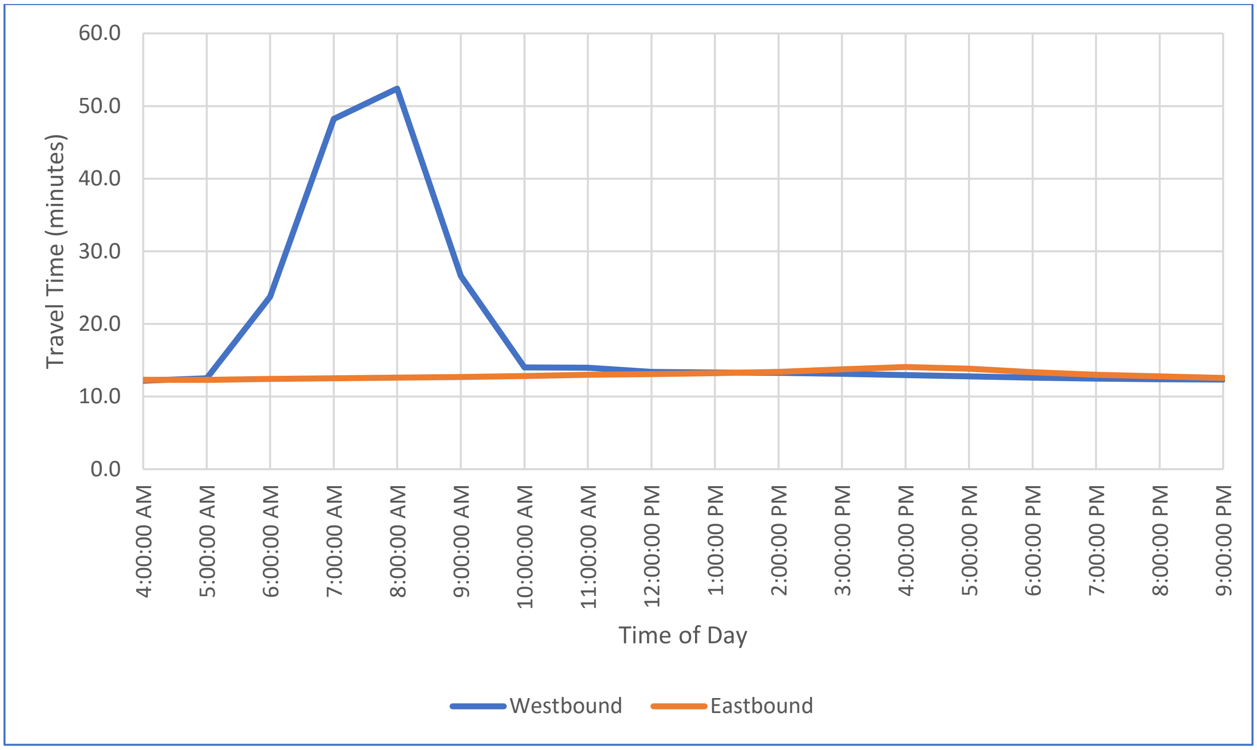
Source: TransModeler microsimulation analysis.

4.4.3 Travel Times

Due to seasonal differences, travel times are presented for a representative winter Saturday and summer Sunday, the peak conditions for westbound and eastbound travel, respectively. Directional travel times, obtained from TransModeler, for the whole study corridor from Exit 252 (SH 74/Evergreen Parkway) to Exit 240 (SH 103/Mt Evans) are shown in Exhibit 39 for a winter Saturday and Exhibit 40 for a summer Sunday. The westbound direction experiences significant congestion on a typical winter Saturday morning, with travel times as much as five times greater than the free-flow travel time (about 13 minutes). Westbound summer travel times are near free-flow conditions for the day. Eastbound travel times are near free-flow travel times (about 12 minutes) across the day for both winter and summer conditions. This is because eastbound congestion on I-70 occurs west of the study area and vehicles do not experience much delay (other than slowing for curves and steep grades) within the study area.

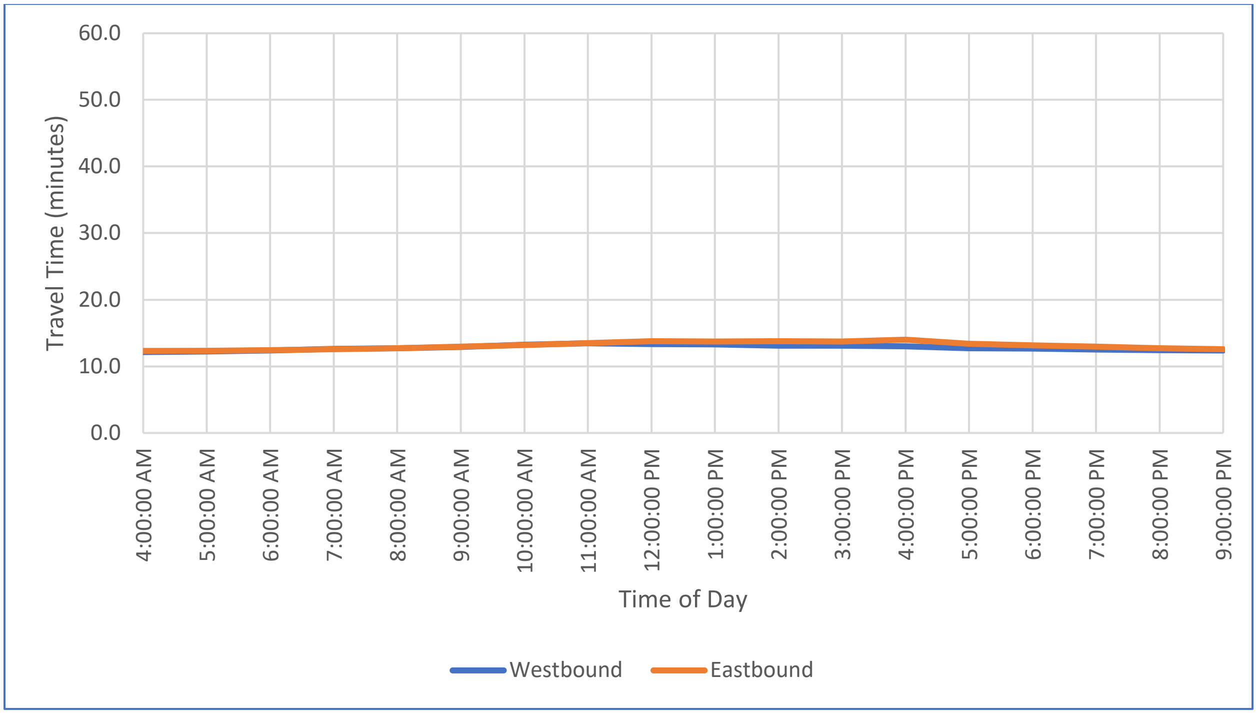
Comparing the relative travel time to the volumes on I-70, there is an apparent discrepancy between the service volume of the corridor and the travel demand. Westbound service volumes have a higher peak in the summer months than the winter months, though comparing westbound travel times reveals that there is much greater demand in the winter months, as evidenced by the considerably longer travel time. This phenomenon indicates that winter Saturday mornings are the peak travel time in the westbound direction, despite having lower volumes served than the westbound afternoon peak on summer Sundays. In the eastbound direction, travel times are comparable between summer and winter conditions, indicating that demand is captured in the service volume. Therefore, the peak eastbound travel time occurs during summer Sunday afternoons, which have the highest eastbound volume.

Exhibit 39. Existing Winter Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



Source: TransModeler microsimulation analysis.

Exhibit 40. Existing Summer Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



Source: TransModeler microsimulation analysis.

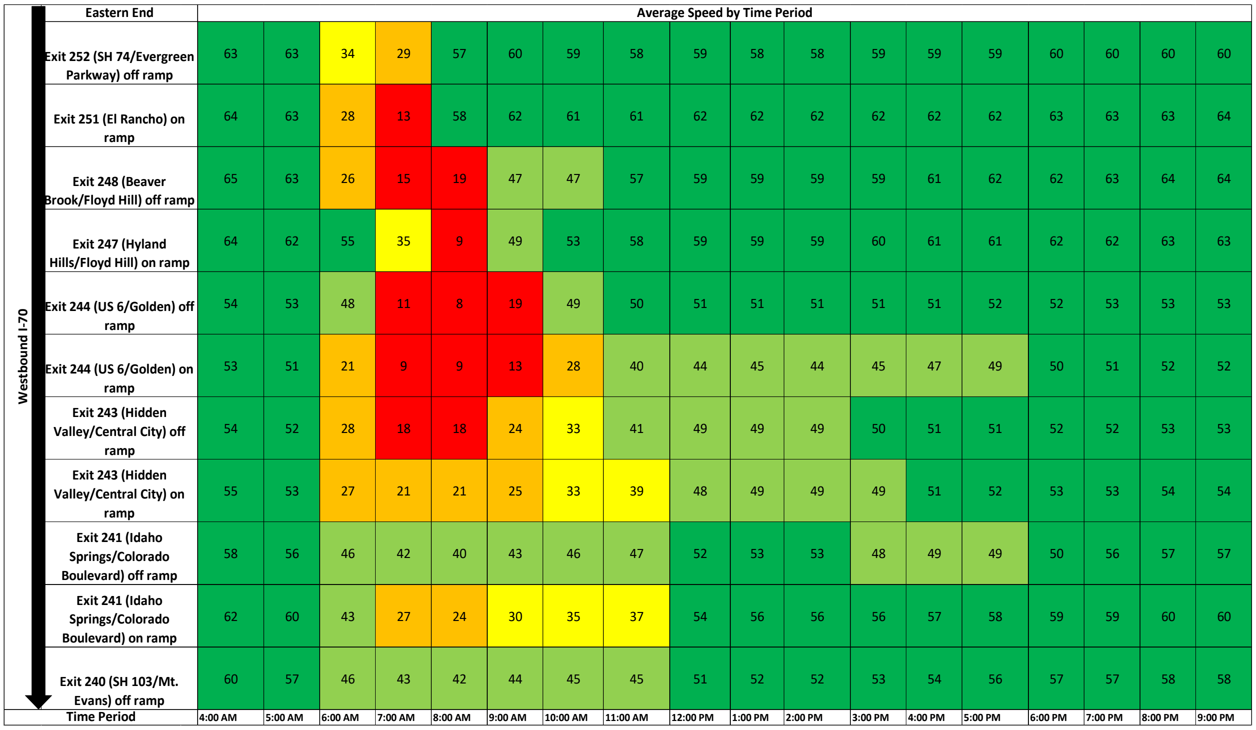
4.4.4 Travel Speeds and Congestion

The level of congestion on a facility can be approximated using speed. As a roadway becomes more congested, the average speed on the facility decreases. Breaking the study area down into segments reveals the location, magnitude, and duration of congestion throughout the day.

Under winter conditions, congestion occurs in the westbound direction, primarily during the morning hours. Exhibit 41 shows the speed on westbound I-70 by segment under winter Saturday conditions. The segment with the lowest speeds for the longest time, and therefore the most congestion, is between Exit 247 (Hyland Hills/Floyd Hill) and the Exit 243 (Hidden Valley/Central City) interchanges. This segment includes the steep downgrade on Floyd Hill, the large number of vehicles entering I-70 from US 6, and the tight curves just east of the Exit 243 (Hidden Valley/Central City) interchange. The congestion extends east beyond the limits of the study area Exit 252 (SH 74/Evergreen Parkway) and gradually dissipates over the morning hours leading up to noon. Downstream of the Exit 243 (Hidden Valley/Central City) interchange, there is less congestion as shown by the higher speeds. Exhibit 42 shows the speed on eastbound I-70 by segment under winter Saturday conditions. Eastbound speeds are slightly reduced near the west end of the study area during the afternoon peak but the remaining segments of I-70 operate at higher speeds.

Under summer Sunday conditions (Exhibit 43 and Exhibit 44) there is little westbound congestion, as evidenced by speeds remaining relatively constant throughout the day throughout the study area. There is some evidence of slowing in the middle of day in the area between Exit 244 (US 6/Golden) and Exit 243 (Hidden Valley/Central City). This is primarily due to the sharp curves in this area. Eastbound speeds also show little variation throughout the day, indicating minimal congestion in the study area on summer Sundays. The congestion that does occur is during the afternoon and early evening hours between Exit 244 (US 6/Golden) and the western limits of the study area. The sharp curves and narrow roadway through the Veterans Memorial Tunnels area and vehicles merging onto I-70 at the interchanges causes vehicles to slow resulting in some congestion.

Exhibit 41. Existing Winter Westbound Congestion Diagram



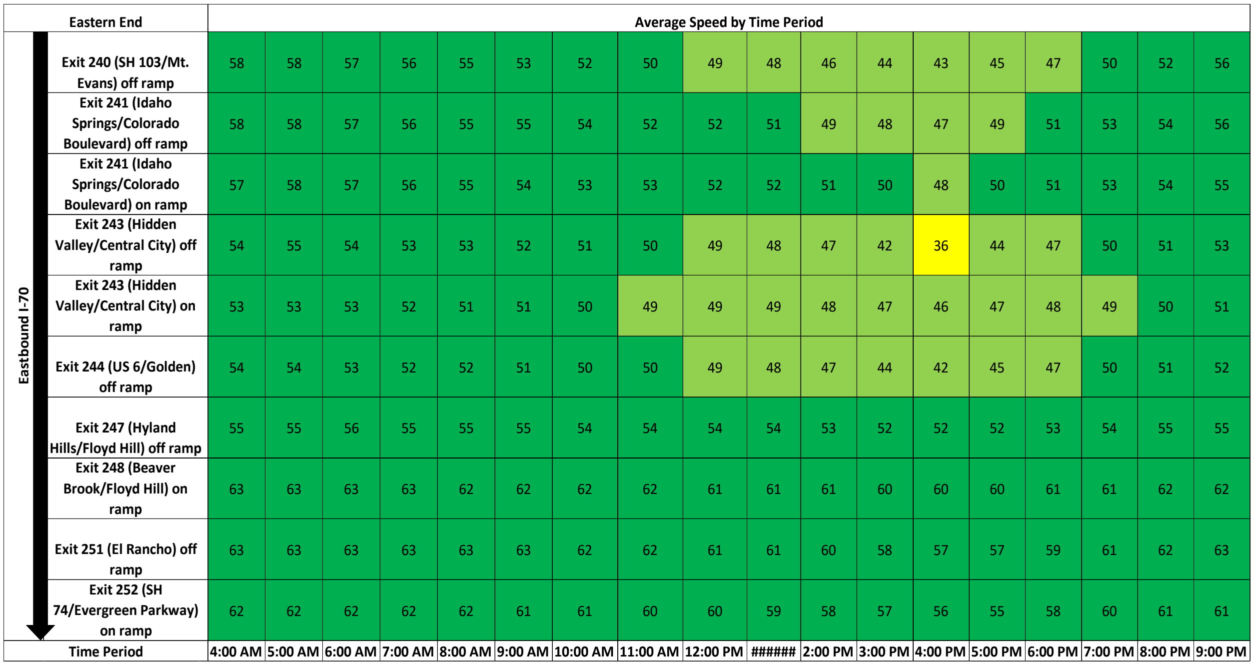
	Eastern End	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	63	63	34	29	57	60	59	58	59	58	58	59	59	59	60	60	60	60
	Exit 251 (El Rancho) on ramp	64	63	28	13	58	62	61	61	62	62	62	62	62	62	63	63	63	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	63	26	15	19	47	47	57	59	59	59	59	61	62	62	63	64	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	64	62	55	35	9	49	53	58	59	59	59	60	61	61	62	62	63	63
	Exit 244 (US 6/Golden) off ramp	54	53	48	11	8	19	49	50	51	51	51	51	51	52	52	53	53	53
	Exit 244 (US 6/Golden) on ramp	53	51	21	9	9	13	28	40	44	45	44	45	47	49	50	51	52	52
	Exit 243 (Hidden Valley/Central City) off ramp	54	52	28	18	18	24	33	41	49	49	49	50	51	51	52	52	53	53
	Exit 243 (Hidden Valley/Central City) on ramp	55	53	27	21	21	25	33	39	48	49	49	49	51	52	53	53	54	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	56	46	42	40	43	46	47	52	53	53	48	49	49	50	56	57	57
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	62	60	43	27	24	30	35	37	54	56	56	56	57	58	59	59	60	60
	Exit 240 (SH 103/Mt. Evans) off ramp	60	57	46	43	42	44	45	45	51	52	52	53	54	56	57	57	58	58
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 42. Existing Winter Eastbound Congestion Diagram



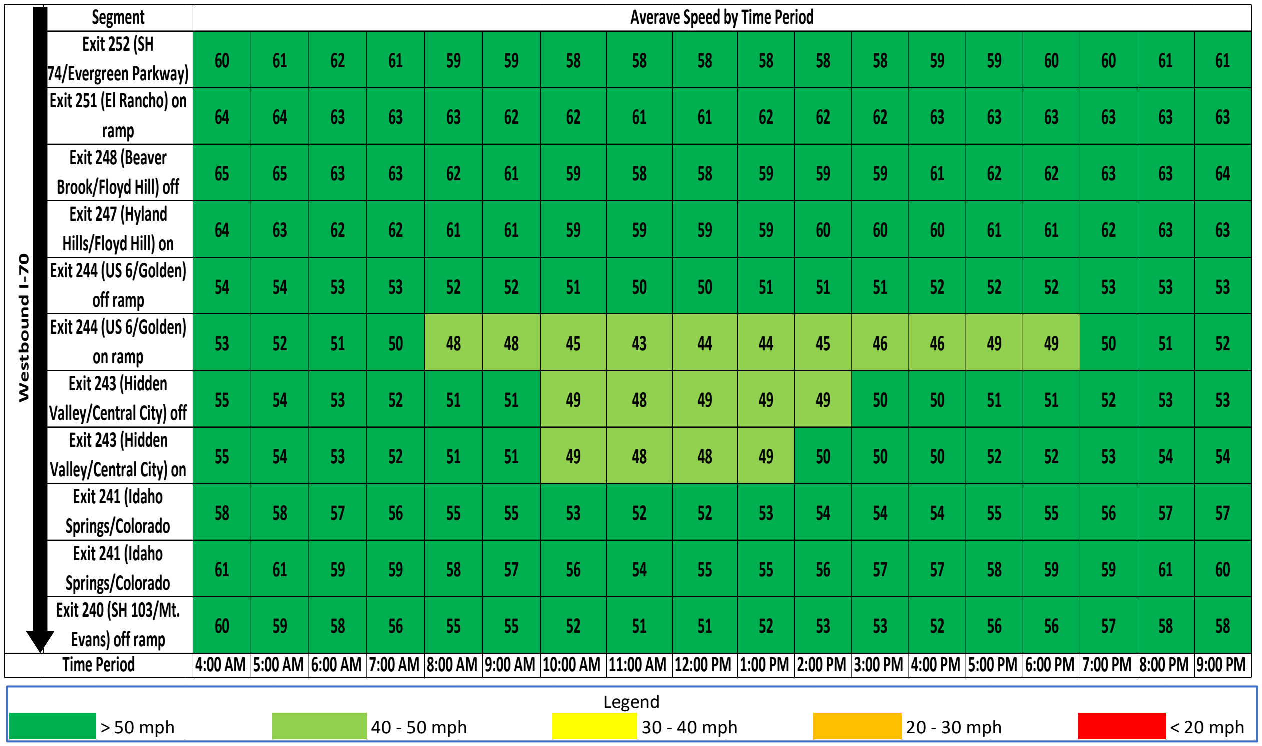
	Eastern End	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) off ramp	58	58	57	56	55	53	52	50	49	48	46	44	43	45	47	50	52	56
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	58	57	56	55	55	54	52	52	51	49	48	47	49	51	53	54	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	58	57	56	55	54	53	53	52	52	51	50	48	50	51	53	54	55
	Exit 243 (Hidden Valley/Central City) off ramp	54	55	54	53	53	52	51	50	49	48	47	42	36	44	47	50	51	53
	Exit 243 (Hidden Valley/Central City) on ramp	53	53	53	52	51	51	50	49	49	49	48	47	46	47	48	49	50	51
	Exit 244 (US 6/Golden) off ramp	54	54	53	52	52	51	50	50	49	48	47	44	42	45	47	50	51	52
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	55	55	56	55	55	55	54	54	54	54	53	52	52	52	53	54	55	55
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	63	63	63	63	62	62	62	62	61	61	61	60	60	60	61	61	62	62
	Exit 251 (El Rancho) off ramp	63	63	63	63	63	63	62	62	61	61	60	58	57	57	59	61	62	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	62	62	62	62	62	61	61	60	60	59	58	57	56	55	58	60	61	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	######	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 43. Existing Summer Westbound Congestion Diagram



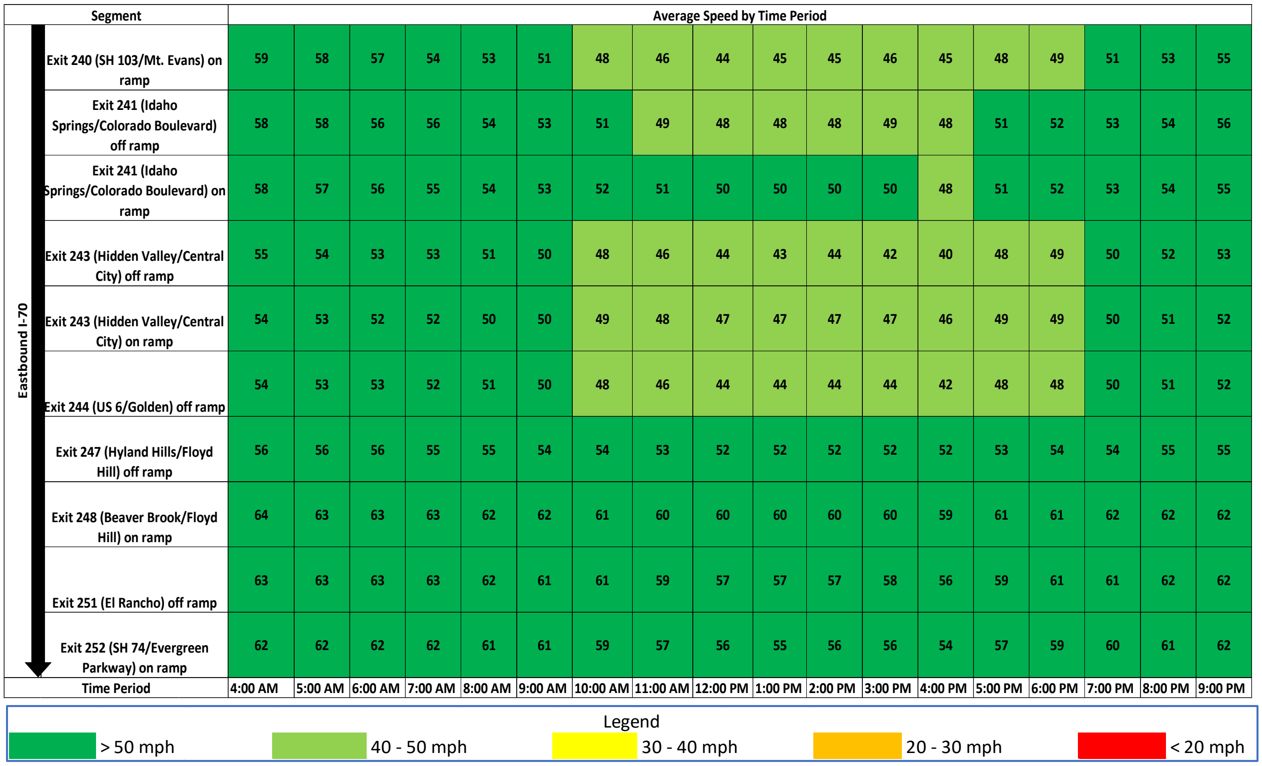
	Segment	Averave Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway)	60	61	62	61	59	59	58	58	58	58	58	58	59	59	60	60	61	61
	Exit 251 (El Rancho) on ramp	64	64	63	63	63	62	62	61	61	62	62	62	63	63	63	63	63	63
	Exit 248 (Beaver Brook/Floyd Hill) off	65	65	63	63	62	61	59	58	58	59	59	59	61	62	62	63	63	64
	Exit 247 (Hyland Hills/Floyd Hill) on	64	63	62	62	61	61	59	59	59	59	60	60	60	61	61	62	63	63
	Exit 244 (US 6/Golden) off ramp	54	54	53	53	52	52	51	50	50	51	51	51	52	52	52	53	53	53
	Exit 244 (US 6/Golden) on ramp	53	52	51	50	48	48	45	43	44	44	45	46	46	49	49	50	51	52
	Exit 243 (Hidden Valley/Central City) off	55	54	53	52	51	51	49	48	49	49	49	50	50	51	51	52	53	53
	Exit 243 (Hidden Valley/Central City) on	55	54	53	52	51	51	49	48	48	49	50	50	50	52	52	53	54	54
	Exit 241 (Idaho Springs/Colorado	58	58	57	56	55	55	53	52	52	53	54	54	54	55	55	56	57	57
	Exit 241 (Idaho Springs/Colorado	61	61	59	59	58	57	56	54	55	55	56	57	57	58	59	59	61	60
	Exit 240 (SH 103/Mt. Evans) off ramp	60	59	58	56	55	55	52	51	51	52	53	53	52	56	56	57	58	58
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩	> 50 mph	🟩	40 - 50 mph	🟨	30 - 40 mph	🟧	20 - 30 mph	🟥	< 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 44. Existing Summer Eastbound Congestion Diagram



	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	59	58	57	54	53	51	48	46	44	45	45	46	45	48	49	51	53	55
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	58	56	56	54	53	51	49	48	48	48	49	48	51	52	53	54	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	57	56	55	54	53	52	51	50	50	50	50	48	51	52	53	54	55
	Exit 243 (Hidden Valley/Central City) off ramp	55	54	53	53	51	50	48	46	44	43	44	42	40	48	49	50	52	53
	Exit 243 (Hidden Valley/Central City) on ramp	54	53	52	52	50	50	49	48	47	47	47	47	46	49	49	50	51	52
	Exit 244 (US 6/Golden) off ramp	54	53	53	52	51	50	48	46	44	44	44	44	42	48	48	50	51	52
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	56	56	56	55	55	54	54	53	52	52	52	52	52	53	54	54	55	55
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	63	63	63	62	62	61	60	60	60	60	60	59	61	61	62	62	62
	Exit 251 (El Rancho) off ramp	63	63	63	63	62	61	61	59	57	57	57	58	56	59	61	61	62	62
	Exit 252 (SH 74/Evergreen Parkway) on ramp	62	62	62	62	61	61	59	57	56	55	56	56	54	57	59	60	61	62
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

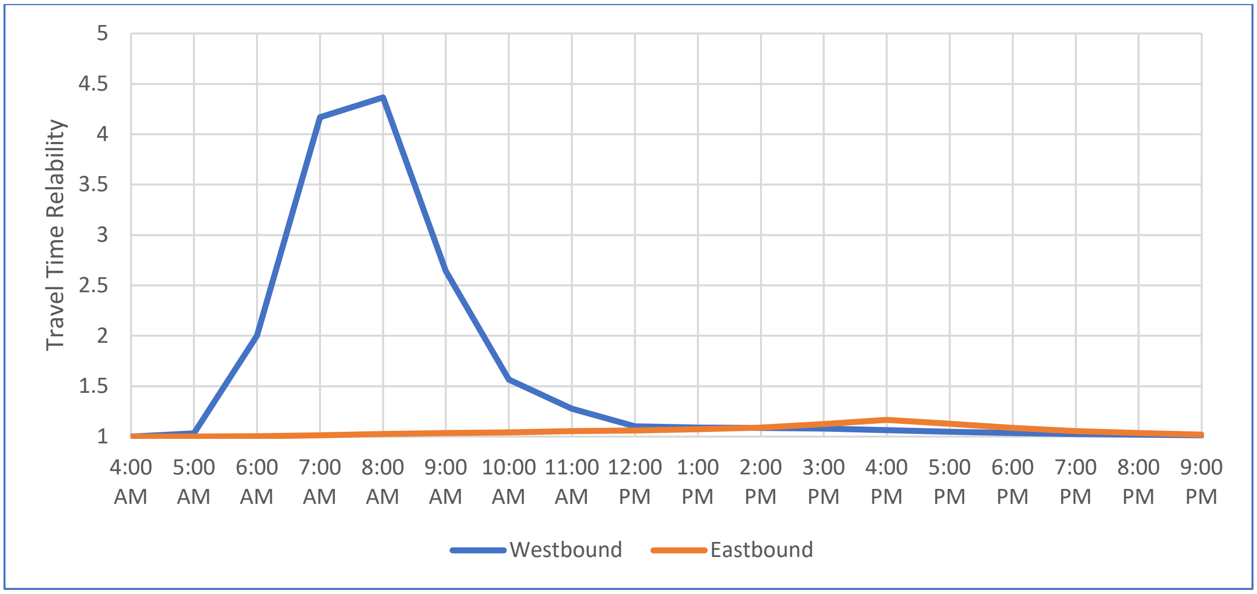
🟩	> 50 mph	🟩	40 - 50 mph	🟨	30 - 40 mph	🟧	20 - 30 mph	🟥	< 20 mph

Source: TransModeler microsimulation analysis.

4.4.5 Travel Time Reliability on I-70

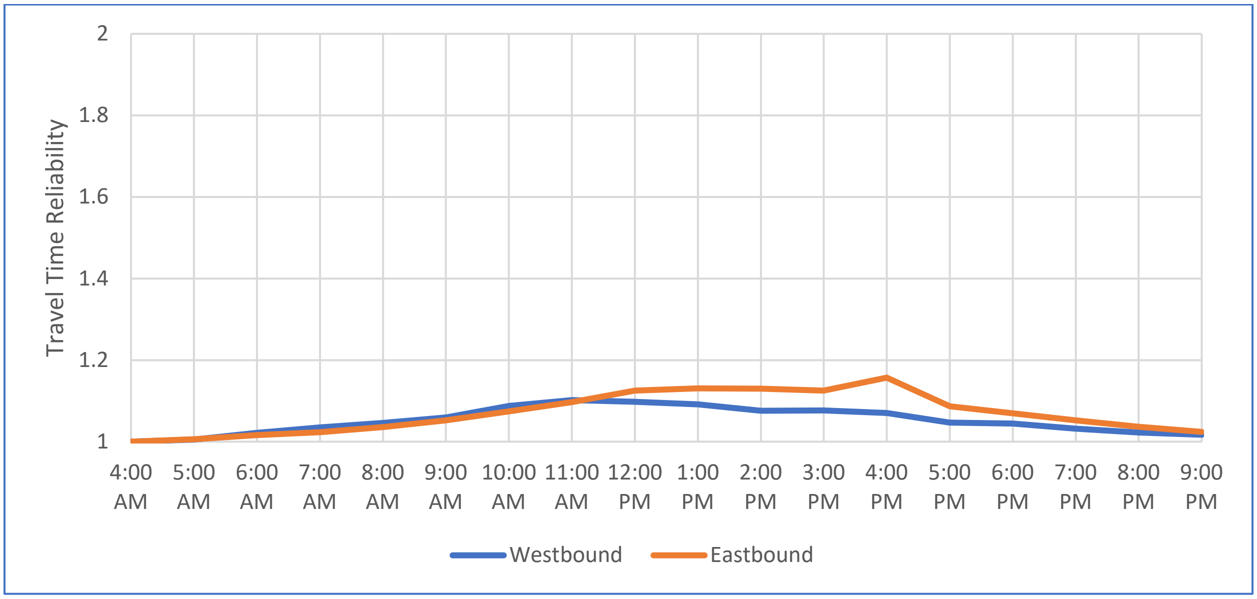
Travel time reliability on I-70 in the study area are shown in Exhibit 45 for the winter and Exhibit 46 for the summer. Travel time reliability is shown as the ratio of travel time on the corridor to free-flow travel time. Under winter conditions, there is significant variability in travel time along the corridor. The westbound morning peak causes travel times to increase to more than four times the free-flow travel time in the corridor. Outside of the westbound morning peak, winter Saturday travel time reliability on I-70 is stable. Summer Sunday conditions have little variation in travel time reliability, typically less than 1.2, through the study area in both westbound and eastbound directions.

Exhibit 45. Existing Winter I-70 Travel Time Reliability



Source: TransModeler microsimulation analysis.

Exhibit 46. Existing Summer I-70 Travel Time Reliability



Source: TransModeler microsimulation analysis.

4.4.6 Freeway Segment LOS

Based upon definitions in the *Highway Capacity Manual (HCM), 6th Edition*, I-70 between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans) was divided into freeway facility segments (basic, weave, merge, or diverge). TransModeler software then was used to determine the density in passenger cars-per mile-per lane (pc/mi/ln) for each segment for each hour of the analysis period. The density values then were compared to the thresholds in the HCM to get an LOS for each segment in the study area. TransModeler is a stochastic approach to analyzing the freeway while the definitions in the HCM are based upon deterministic methodologies. Thus, LOS based on density from TransModeler is not to be confused with LOS based on HCM methodology. The LOS presented in this study is to provide a picture of operations on I-70 based upon thresholds provided in the HCM. Exhibit 47 shows the LOS definitions for different freeway segments base on definitions provided in the HCM.

Exhibit 47. Freeway Segment Level of Service Criteria

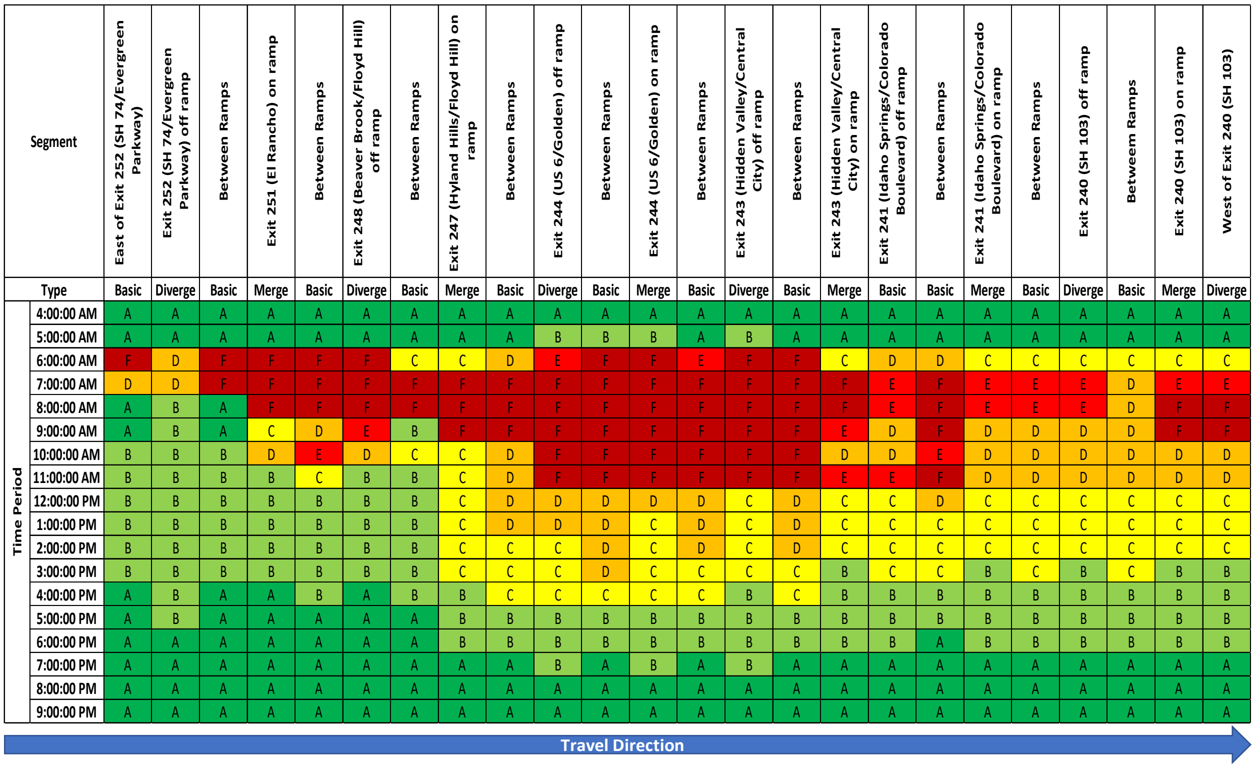
Level of Service	Segment Density (pc/mi/ln)		
	Basic Segment	Weaving Segment	Merge/Diverge Segment
A	0-11	0-10	0-10
B	>11-18	>10-20	>10-20
C	>18-26	>20-28	>20-28
D	>26-35	>28-35	>28-35
E	>35-45	>35-43	>35
F	>45 or demand exceeds capacity	>43 or demand exceeds capacity	Demand exceeds capacity

Source HCM. 6th Edition.

The LOS for the freeway segments for Existing Conditions are shown in Exhibit 48 through Exhibit 51. The LOS results are similar to the speed diagrams previously discussed. Westbound winter LOS shows heavy congestion during the morning hours from end to end of the study area but it is concentrated in the area between Exit 247 (Hyland Hills/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard). This time period correlates to the period when most traffic is headed west to ski areas which open early in the morning. Eastbound I-70, during the winter, does show poor operations in the later afternoon hours (after 3:00 p.m.), which is consistent with the time when skiers are returning east toward the Front Range.

The summer westbound I-70 LOS does show moderate congestion during the midday hours. but the operations do not reach failure level consistent with bottleneck conditions. This is consistent with individuals heading west during the summer over more hours of the day, not concentrated in the morning like winter travel patterns. The summer eastbound I-70 shows LOS that is consistent with congestion and operational failure through the afternoon hours, which is consistent with the time when individuals are heading back to the Front Range after spending time recreating in the mountains. The poor operations are confined west of Exit 244 (US 6/Golden), which is after the sharp curves and also at a point where the highway is 3GPL.

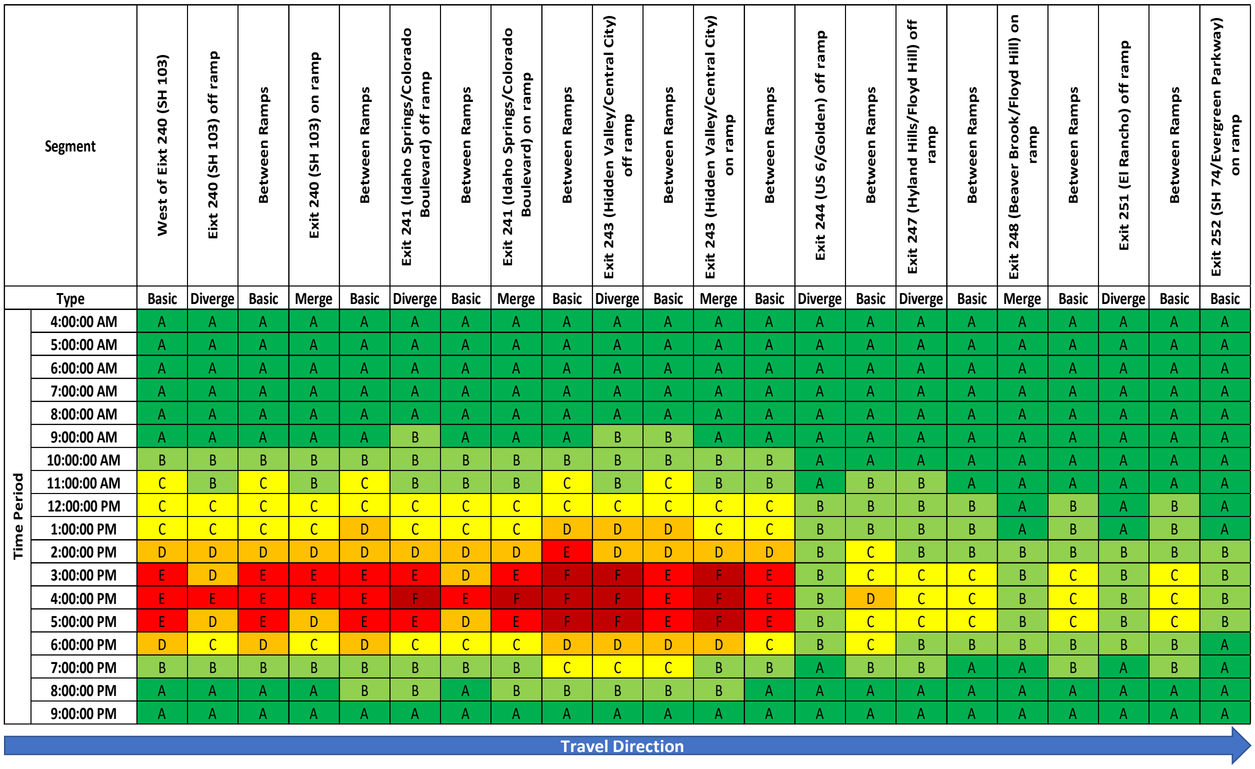
Exhibit 48. Existing Winter Westbound I-70 LOS



Segment	East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period																								
4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
5:00:00 AM	A	A	A	A	A	A	A	A	A	B	B	B	A	B	A	A	A	A	A	A	A	A	A	A
6:00:00 AM	F	D	F	F	F	F	C	C	D	E	F	F	E	F	F	C	D	D	C	C	C	C	C	C
7:00:00 AM	D	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	E	E	E	D	E	E
8:00:00 AM	A	B	A	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	E	E	E	D	F	F
9:00:00 AM	A	B	A	C	D	E	B	F	F	F	F	F	F	F	F	E	D	F	D	D	D	D	F	F
10:00:00 AM	B	B	B	D	E	D	C	C	D	F	F	F	F	F	F	D	D	E	D	D	D	D	D	D
11:00:00 AM	B	B	B	B	C	B	B	C	D	F	F	F	F	F	F	E	E	F	D	D	D	D	D	D
12:00:00 PM	B	B	B	B	B	B	B	C	D	D	D	D	D	C	D	C	C	D	C	C	C	C	C	C
1:00:00 PM	B	B	B	B	B	B	B	C	D	D	D	C	D	C	D	C	C	C	C	C	C	C	C	C
2:00:00 PM	B	B	B	B	B	B	B	C	C	C	D	C	D	C	D	C	C	C	C	C	C	C	C	C
3:00:00 PM	B	B	B	B	B	B	B	C	C	C	D	C	C	C	C	B	C	C	B	C	B	C	B	B
4:00:00 PM	A	B	A	A	B	A	B	B	C	C	C	C	C	B	C	B	B	B	B	B	B	B	B	B
5:00:00 PM	A	B	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
6:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B
7:00:00 PM	A	A	A	A	A	A	A	A	A	B	A	B	A	B	A	A	A	A	A	A	A	A	A	A
8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Source: TransModeler microsimulation analysis.

Exhibit 49. Existing Winter Eastbound I-70 LOS



Segment	West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period																						
4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
8:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
9:00:00 AM	A	A	A	A	A	B	A	A	A	B	B	A	A	A	A	A	A	A	A	A	A	A
10:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
11:00:00 AM	C	B	C	B	C	B	B	B	C	B	C	B	B	A	B	B	A	A	A	A	A	A
12:00:00 PM	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	B	B	A	B	A	B	A
1:00:00 PM	C	C	C	C	D	C	C	C	D	D	D	C	C	B	B	B	B	A	B	A	B	A
2:00:00 PM	D	D	D	D	D	D	D	D	E	D	D	D	D	B	C	B	B	B	B	B	B	B
3:00:00 PM	E	D	E	E	E	E	D	E	F	F	E	F	E	B	C	C	C	B	C	B	C	B
4:00:00 PM	E	E	E	E	E	F	E	F	F	F	E	F	E	B	D	C	C	B	C	B	C	B
5:00:00 PM	E	D	E	D	E	E	D	E	F	F	E	F	E	B	C	C	C	B	C	B	C	B
6:00:00 PM	D	C	D	C	D	C	C	C	D	D	D	D	C	B	C	B	B	B	B	B	B	A
7:00:00 PM	B	B	B	B	B	B	B	B	C	C	C	B	B	A	B	B	A	A	B	A	B	A
8:00:00 PM	A	A	A	A	B	B	A	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A
9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Source: TransModeler microsimulation analysis.

Exhibit 50. Existing Summer Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	8:00:00 AM	A	B	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	9:00:00 AM	A	B	A	A	B	A	B	B	C	B	C	B	C	B	C	B	B	B	B	B	B	B	B	B
	10:00:00 AM	B	B	B	B	B	B	B	C	C	C	D	C	C	C	D	C	C	C	C	C	C	C	B	B
	11:00:00 AM	B	B	B	B	B	B	B	C	D	D	D	D	D	D	D	C	C	C	C	C	C	C	C	C
	12:00:00 PM	B	B	B	B	B	B	B	C	D	D	D	D	D	C	D	C	C	C	C	C	C	C	C	C
	1:00:00 PM	B	B	B	B	B	B	B	C	D	D	D	C	D	C	D	C	C	C	C	C	C	C	C	C
	2:00:00 PM	B	B	B	B	B	B	B	B	C	C	D	C	C	C	C	B	C	C	B	C	B	C	B	B
	3:00:00 PM	B	B	B	B	B	B	B	B	C	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B
	4:00:00 PM	A	B	A	A	B	A	A	B	C	C	C	B	C	B	C	B	B	B	B	B	B	B	B	B
	5:00:00 PM	A	B	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	6:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 51. Existing Summer Eastbound I-70 LOS

Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	A	B	B	B	A	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	B	C	B	C	B	B	A	A	B	A	A	A	A	A	A
	10:00:00 AM	C	C	D	C	C	C	C	C	D	D	D	C	C	B	B	B	B	A	B	A	B	A
	11:00:00 AM	D	D	E	D	E	E	D	D	E	E	E	E	D	B	C	C	B	B	C	B	C	B
	12:00:00 PM	E	D	E	E	E	E	D	E	F	F	E	F	E	B	C	C	C	B	C	B	C	B
	1:00:00 PM	D	D	E	D	E	E	D	E	F	F	E	F	E	B	C	C	C	B	C	B	C	B
	2:00:00 PM	D	D	E	E	E	E	D	E	F	F	E	F	E	B	D	C	C	B	C	B	C	B
	3:00:00 PM	D	C	D	D	D	D	D	E	F	E	E	F	D	B	C	C	C	B	C	B	C	B
	4:00:00 PM	D	D	E	D	E	E	D	F	F	E	E	F	E	B	D	C	C	B	D	B	C	B
	5:00:00 PM	C	C	D	C	D	D	C	C	D	D	D	D	C	B	C	B	B	B	C	B	C	B
	6:00:00 PM	C	B	C	B	C	C	C	C	C	C	C	C	C	B	B	B	B	A	B	A	B	A
	7:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	B	B	A	A	A	A	A	A
	8:00:00 PM	A	A	A	A	A	B	A	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

4.4.7 Intersection LOS and Queues

Based on definitions in the *HCM, 6th Edition*, all ramp terminal intersections between Exit 246 (US 6) and Exit 241 (Idaho Springs/Colorado Boulevard) and key intersections along US 40 were evaluated using peak hour volumes and Synchro10 software to determine approach and intersection-wide control delay in seconds per vehicle (s/veh). The delay values then were compared to the thresholds in the HCM to determine intersection LOS. Exhibit 52 shows the LOS definitions provided in the HCM for different types of intersection control.

Exhibit 52. Intersection Level of Service Criteria

Level of Service	Control Delay (s/veh)			
	Signalized	Two-Way Stop-Controlled	All-Way Stop-Controlled	Roundabout
A	0-10	0-10	0-10	0-10
B	>10-20	>10-15	>10-15	>10-15
C	>20-35	>15-25	>15-25	>15-25
D	>35-55	>25-35	>25-35	>25-35
E	>55-80	>35-50	>35-50	>35-50
F	>80	>50	>50	>50

Source: HCM, 6th Edition.

Intersection LOS by approach is shown in Exhibit 53 for the winter AM westbound peak and the summer PM eastbound peak conditions. Performance of intersections is worse under westbound peak conditions, particularly along US 40, due to the high volume of vehicles using US 40 to bypass congestion on the I-70 mainline. The summer conditions show that most intersections and approaches operate at LOS C or better.

In addition to LOS, Synchro was used to evaluate the approach queues at each of the evaluated ramp terminal intersections and key intersections along US 40. Queues on most approaches during both the winter and summer are relatively minor in nature (under 100 feet or four vehicles) with the exception of a few approaches during the winter peak. At the US 6 and US 40 intersection, the queue for vehicles on US 40 extends back to the east several hundred feet. This is because the intersection is a stop-controlled intersection and—with a combination of high traffic volume on US 40 that wants to turn left onto US 6 and the very high westbound volumes on US 6—there are few acceptable gaps for vehicles to turn off US 40 onto US 6.

The high volume of vehicles that use US 40 to bypass congestion on westbound I-70 result in strain on the intersections at CR 65 and Homestead Road. This results in long queues (several hundred feet) for the northbound approach of CR 65 and the westbound approach of US 40 at Homestead Road.

Exhibit 53. Existing Ramp Terminal Intersection LOS

Intersection	Approach	2018 Existing	
		LOS/95% Queues (ft)	
		Winter Saturday (AM)	Summer Sunday (PM)
Colorado Blvd WB Ramps	WB Off-Ramp[3]	A/50	A/25
	EB Colorado Blvd[3]	A/25	A/75
	WB Colorado Blvd[3]	A/0	A/0
	Overall[3]	A	A
Colorado Blvd EB Ramps	EB Off-Ramp[2]	A/10	B/15
Hidden Valley WB Ramps	SB CCP[1]	B/70	B/65
	NB CCP[1]	B/20	B/75
	WB Off-Ramp[1]	C/25	C/25
	Service Road[1]	D/25	D/25
	Overall[1]	B	B
Hidden Valley EB Ramps	SB CCP[1]	A/20	B/10
	NB CCP[1]	B/10	B/70
	EB Frontage[1]	C/15	C/45
	EB Off-Ramp[1]	D/20	B/70
	Overall[1]	C	B
US 6 and WB Ramp	WB Off-Ramp[2]	B/10	B/25
US 6 and US 40	WB US 40[2]	F/650	B/10
Homestead/EB Ramp	EB Off-Ramp[2]	A/5	B/15
Homestead/US 40	WB US 40[2]	F/535	B/25
CR 65/WB Ramp	WB Off-Ramp[2]	B/50	B/10
CR 65/US 40	NB CR 65[2]	F/325	B/25

Note: For stop-controlled intersections, only the worst approach LOS and queue lengths are reported.
1. Signalized intersection
2. Stop-controlled intersection
3. Roundabout intersection

4.5 Existing Conditions Summary

Existing conditions in the corridor are defined by the following:

- There are consistent weekday conditions and seasonal weekend peaks.
- Winter Saturdays are characterized by large, severe westbound morning peaks with much smaller and more gradual eastbound afternoon peaks.
- Summer Sundays are characterized by gradual midday westbound peaks and some afternoon eastbound peaks.
- Winter Saturday mornings have the lowest westbound speeds, highest VHT, and most congestion.
- Summer Sunday afternoons have the highest eastbound VMT in the corridor.

- Most crashes occur on the mainline and typically do not involve heavy vehicles.
- I-70 in the study area has a moderate to high potential for crash reduction.
- Travel times on a winter Saturday peak day are more than four times longer than all other times of the year.
- Most intersections operate at LOS C or better during the peak periods, but there are a few approaches that are failing (LOS F) during the winter peak and may need mitigation.

5 No Action Analysis

The 2045 No Action model was created from the 2018 Existing Conditions model by forecasting traffic demand to 2045 and incorporating planned changes in the corridor that are independent of the Project. The following sections briefly discuss the results of the 2045 No Action Analysis and how they compare to the Existing Conditions.

5.1 No Action Transportation Network Characteristics

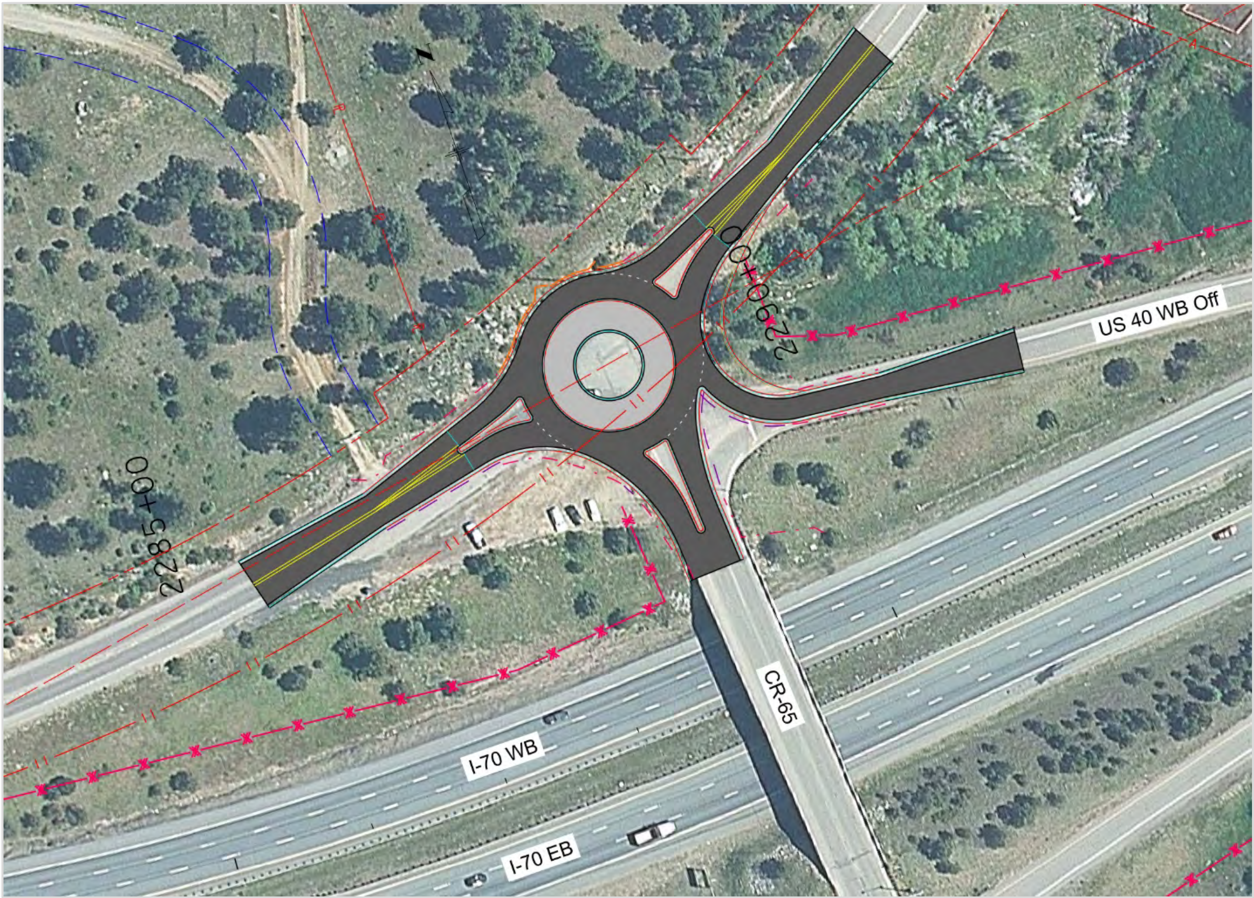
The future No Action transportation network is similar to the Existing Conditions network, including inclusion of the existing eastbound PPSL, with a few additions. A PPSL will be added to westbound I-70 starting at the Veterans Memorial Tunnels and extending to the west to the US 40 interchange (Exit 232). The PPSL will be added to the left side of I-70 and will be a tolled facility that will be open only on peak travel days, which are assumed to be weekends and on Fridays/Mondays of holiday weekends. The PPSL will have variable toll rates to help manage the volume of traffic to maintain reliable travel through the corridor and to preserve capacity.

In addition, the future No Action network updates CR 314 to reflect roadway upgrades to improve roadway widths and pavement surfaces to provide a better connection between Exit 241 (Idaho Springs/Colorado Boulevard) and Exit 243 (Hidden Valley/Central City). The US 40 Roundabouts project is currently in design to replace current intersections on US 40 at CR 65 and Homestead Road with roundabouts. All other interchange configurations, ramps, local road, and ramp junction intersections are assumed to remain the same as Existing Conditions.

5.1.1.1 Exit 248 (Beaver Brook/Floyd Hill)

At Exit 248 (Beaver Brook/Floyd Hill), the westbound I-70 off-ramp, CR 65, and US 40 currently are signed as two distinct intersections. Because of the close proximity of the intersections, however, there are operational and safety concerns. Thus, the existing stop-controlled intersections at CR 65, the westbound I-70 off-ramp, and US 40 were analyzed both as a signalized intersection and as a roundabout, which is planned as part of the US 40 Roundabouts project. The close spacing of the westbound off-ramp from I-70 allowed for the westbound off-ramp to be incorporated into the roundabout configuration (see Exhibit 54). Note that the exhibit presents the concept for the roundabout; the actual design plan for the improvements will occur during final design of the US 40 Roundabouts project.

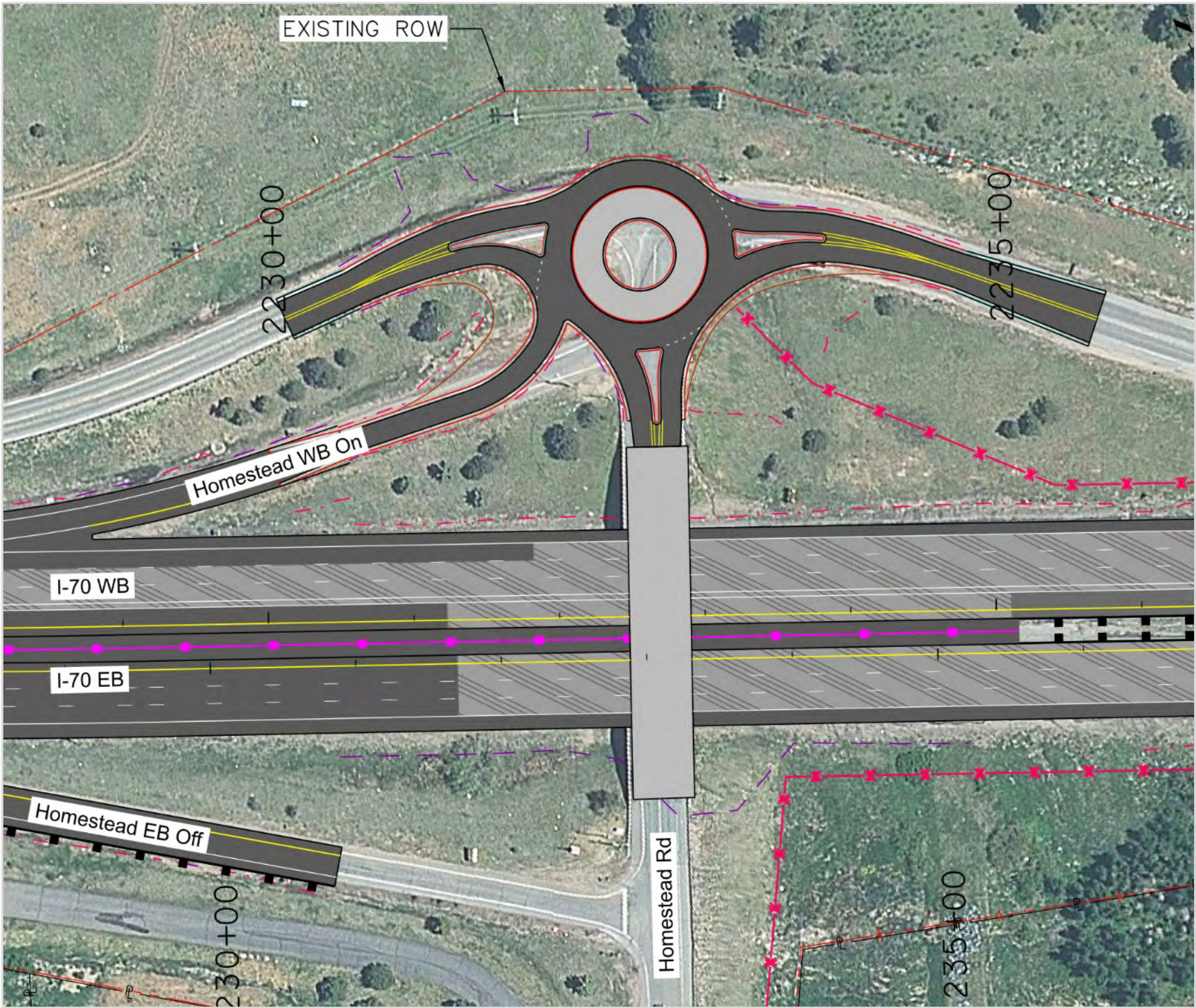
Exhibit 54. Planned Roundabout at CR 65 or Exit 248 (Beaver Brook/Floyd Hill)



5.1.1.2 Exit 247 (Hyland Hills/Floyd Hill)

Homestead Road has a similar configuration as CR 65 at the north side of the interchange; US 40, Homestead Road, and the westbound I-70 on-ramp are very closely spaced, creating operational and safety concerns. Signalizing the intersection of US 40 and Homestead Road was considered, but this would have required the addition of a westbound left-turn bay to function acceptably. A roundabout, which combines the westbound I-70 on-ramp into the roundabout, was determined to be a more appropriate improvement and is planned as part of the US 40 Roundabouts project. (see Exhibit 55). Note that the exhibit presents the concept for the roundabout; the actual design plan for the improvements will occur during final design of this project.

Exhibit 55. Planned Roundabout at Homestead Road or Exit 247 (Hyland Hills/Floyd Hill)



5.2 No Action Safety Conditions

Exhibit 56 displays the results of the HSM analysis of No Action conditions for I-70. Similar to Existing Conditions, the results indicate that most crashes on I-70 are expected to occur on the mainline, with most of the crashes being property damage only. Compared to the Existing Conditions, without improvements, the expected number of annual crashes on I-70 will increase to more than 200 incidents annually, an increase of 34 percent by 2045. More details on the results of the HSM analysis for the No Action scenario can be found in Appendix C.

The projected increase in crashes in the study area indicated a good probability that roadway improvements/enhancements should be considered in an effort to improve safety and reduce crash potential. This includes changes to I-70, the interchanges, intersections, and roadway network features within the study area.

Exhibit 56. No Action Predicted Annual HSM Crash Analysis Results (I-70 and Interchanges)

Major Road	Name	2018 Existing			2045 No Action		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
I-70	Mainline	32.6	92.7	125.3	41.1	123.7	164.8
I-70	Speed Change Lanes	4.5	17.2	21.7	6.4	22.4	28.8
Exit 248 (Beaver Brook/Floyd Hill)*	Eastbound Entrance	0.0	0.1	0.1	0.1	0.1	0.1
	Eastbound Entrance at CR 65	0.0	0.0	0.0	0.0	0.0	0.0
	Westbound Exit	0.0	0.0	0.1	0.0	0.1	0.1
	US 40 & CR 65	1.0	1.3	2.3	2.2	3.1	5.2
	Westbound Exit at CR 65	0.1	0.2	0.3	0.1	0.4	0.6
	Total	1.1	1.7	2.8	2.4	3.6	6.0
Exit 247 (Hyland Hills/Floyd Hill)*	Westbound Entrance	0.0	0.0	0.1	0.1	0.1	0.1
	US 40 & Homestead Road	0.8	1.1	1.9	1.5	2.1	3.5
	Westbound Entrance at Homestead Road	0.0	0.0	0.0	0.0	0.0	0.0
	Eastbound Exit	0.0	0.0	0.1	0.0	0.0	0.1
	Eastbound Exit at Homestead Road	0.1	0.1	0.2	0.1	0.2	0.3
	Total	0.9	1.3	2.2	1.7	2.4	4.1
Exit 244 (US 6/Golden)	Westbound Exit	0.1	0.1	0.2	0.1	0.0	0.1
	Westbound Exit at US 6	0.3	0.4	0.7	0.2	0.2	0.4
	Westbound Entrance	0.2	0.3	0.5	0.3	0.4	0.7
	Eastbound Exit	0.1	0.1	0.2	0.1	0.1	0.2
	Total	0.7	0.9	1.6	0.6	0.8	1.4
Exit 243 (Hidden Valley/Central City)	Westbound Exit	0.1	0.1	0.2	0.1	0.2	0.3
	Westbound Ramps at Central City Pkwy	0.1	0.1	0.2	0.1	0.2	0.3
	Westbound Entrance	0.0	0.0	0.1	0.0	0.0	0.1
	Eastbound Exit	0.0	0.0	0.1	0.0	0.0	0.1
	Eastbound Ramps at Central City Pkwy	0.0	0.0	0.1	0.0	0.1	0.1
	Eastbound Entrance	0.0	0.0	0.1	0.1	0.1	0.1
	Total	0.3	0.4	0.7	0.4	0.6	1.0
Interchange Total		3.0	4.3	7.3	5.1	7.4	12.5
Mainline Total		37.1	109.8	147.0	47.5	146.1	193.6
Grand Total		40.1	114.1	154.3	52.6	153.5	206.1

* Intersection was evaluated as stop controlled and not roundabout for this analysis. Roundabout design of the intersections was considered after completion of the safety analysis.

5.3 No Action Traffic Volumes and Patterns

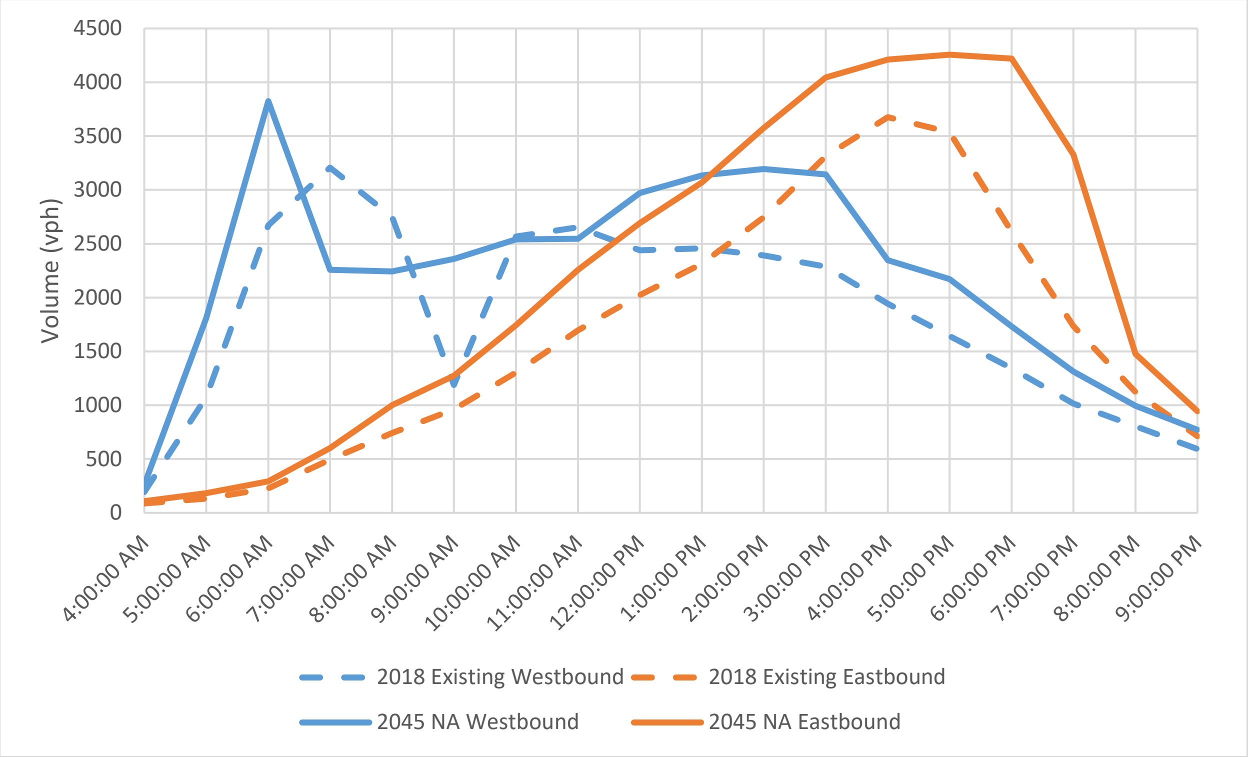
Traffic in the study area is expected to continue to follow distinct seasonal and weekly patterns. The original traffic analysis considered 2040 as the horizon year and that included using a growth factor of 1.27 to develop 2040 volumes. This was agreed upon by FHWA and CDOT as part of the traffic methodology that was developed in 2018. Late in the Project, it was decided that the Project would use 2045 as the horizon year. Thus, the future 2045 volumes were estimated by applying a growth factor (1.34) to the 2018 Existing Conditions trip tables used to develop the calibrated Existing Conditions TransModeler model. After the application of the growth factor, the roadway network in the Existing Conditions model was updated to reflect the anticipated changes that will occur before 2045, and then the dynamic traffic assignment capabilities within TransModeler were used to allow vehicles to select routes through the study area until user equilibrium was obtained. The expected 2045 No Action volume patterns for the I-70 mainline and local roads are discussed in the following sections.

5.3.1 I-70 Traffic Volumes and Patterns

Exhibit 57 and Exhibit 58 show No Action (2045) traffic volumes near the top of Floyd Hill, obtained from TransModeler, for a peak winter Saturday and Exhibit 59 and Exhibit 60 show the traffic volumes on I-70 for a summer Sunday just west of the Veterans Memorial Tunnels. The future volumes show similar patterns as Existing Conditions, but with higher overall values. Westbound in the winter reaches a peak of about 4,000 vph before dropping off sharply, a characteristic that is consistent with a facility where demand is exceeding capacity. This is primarily because the westbound lanes decrease from three to two at the top of Floyd Hill. Another factor is the rapid rate at which traffic volumes increase over a short period of time, which results in the facility not being able to process vehicles fast enough and then requiring many hours to recover. This is further shown in Exhibit 58, where the westbound volume remains constant (at capacity) across multiple hours of the day. The summer eastbound volumes peak at about 4,300 vph without a sharp decline. This is because eastbound has three lanes through the entire length of the study area, and also because the demand grows gradually through the day and not with such a drastic increase in a short time like the winter conditions. The figures also show an expected increase in traffic using the eastbound PPSL (or EL) as demand increases, but the facility does not break down due to this preserved capacity and the ability to vary the toll rate.

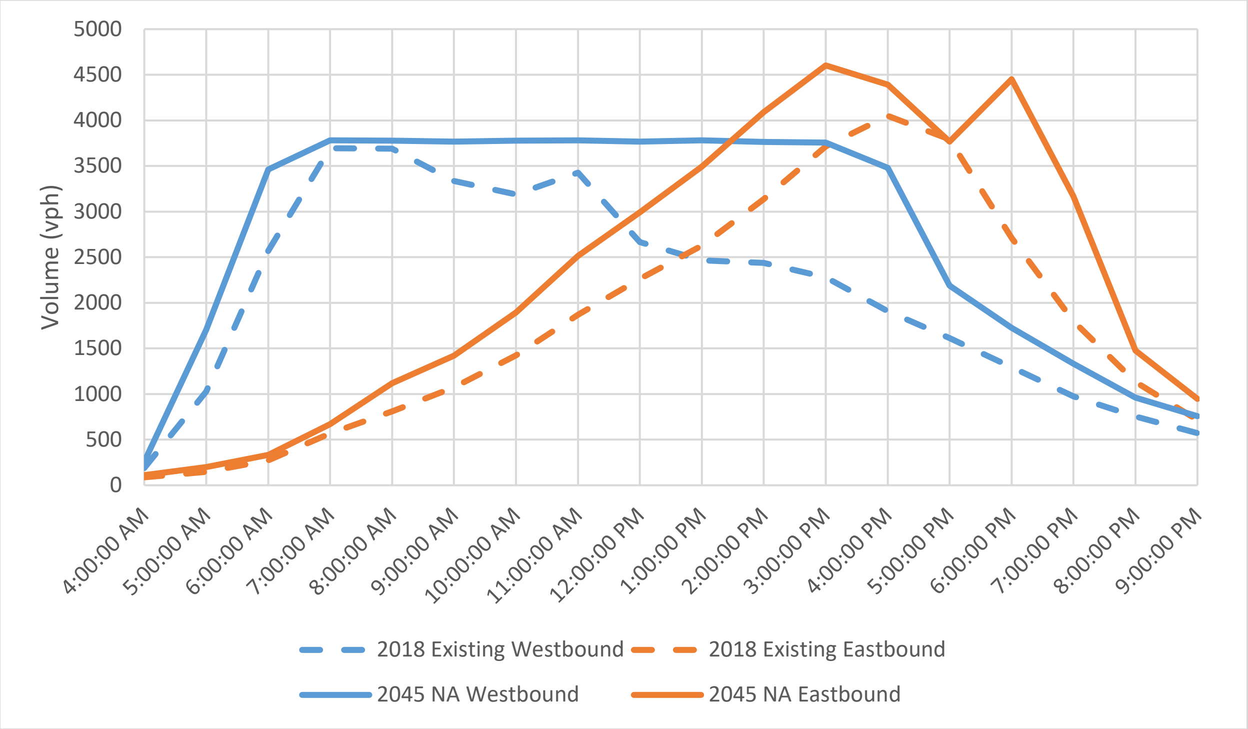
Note that the eastbound and westbound volumes are a sum of the volumes using the GPL and EL or PPSL, for a total eastbound or westbound volume on I-70 at each location.

Exhibit 57. No Action I-70 Winter Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



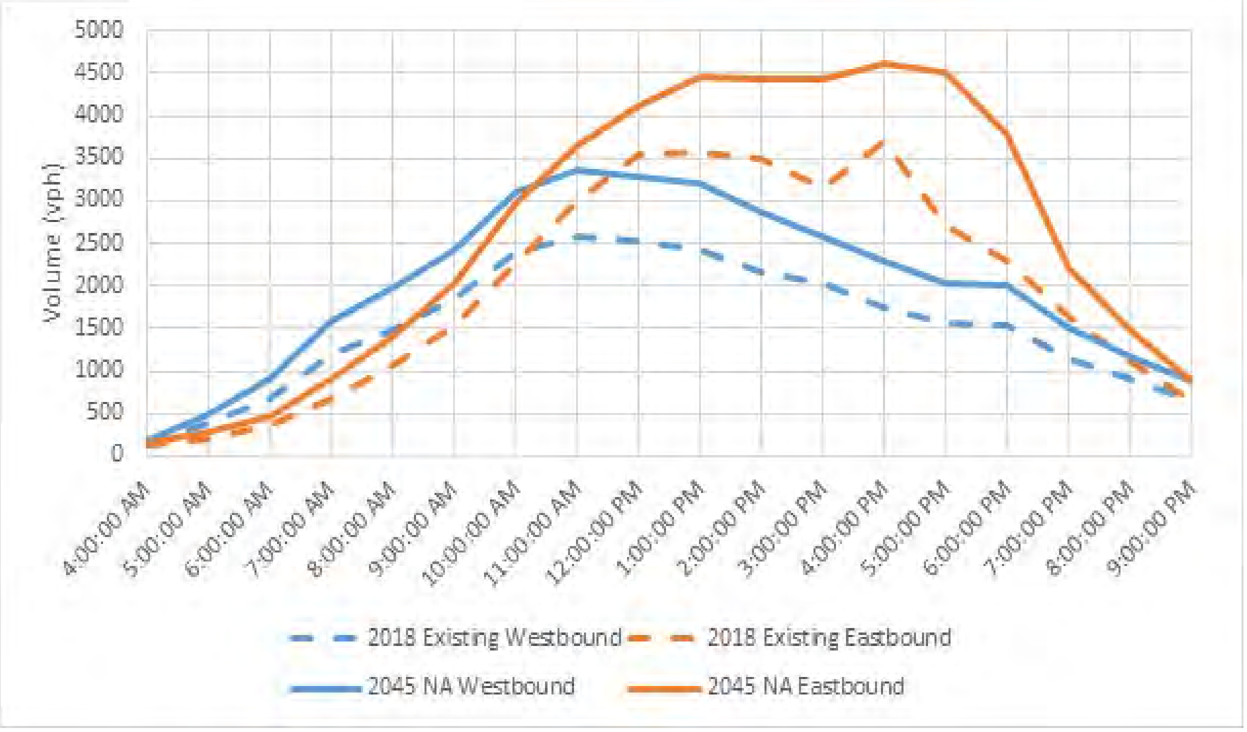
Source: TransModeler microsimulation analysis.

Exhibit 58. No Action I-70 Winter Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

Exhibit 59. **No Action I-70 Summer Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)**



Source: TransModeler microsimulation analysis.

Exhibit 60. **No Action I-70 Summer Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)**

Source: TransModeler microsimulation analysis.

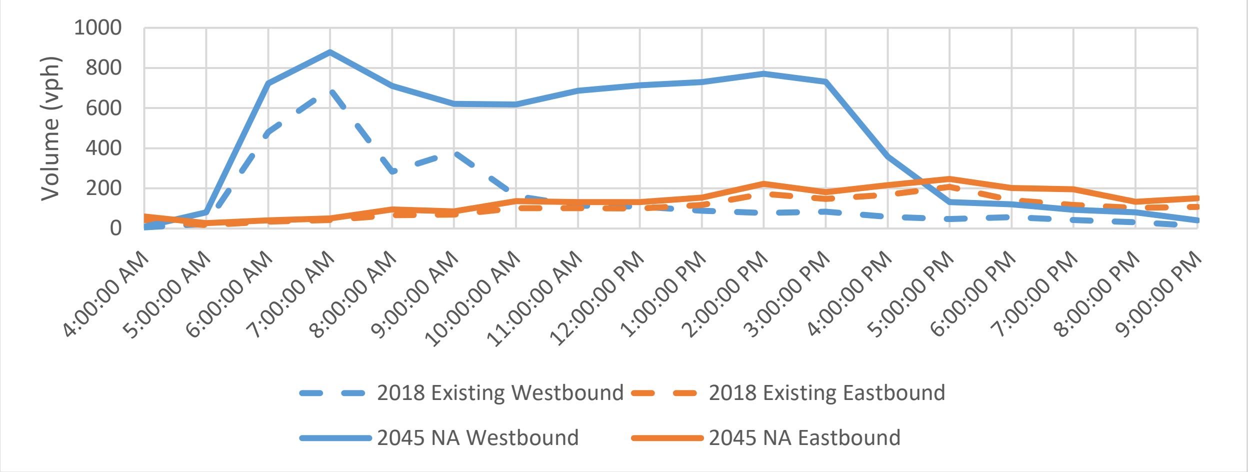
5.3.2 Local Roads Traffic Volumes and Patterns

The three local roads of primary interest as those that provide alternate routes to I-70 are US 40, CR 314, and US 6.

5.3.2.1 US 40

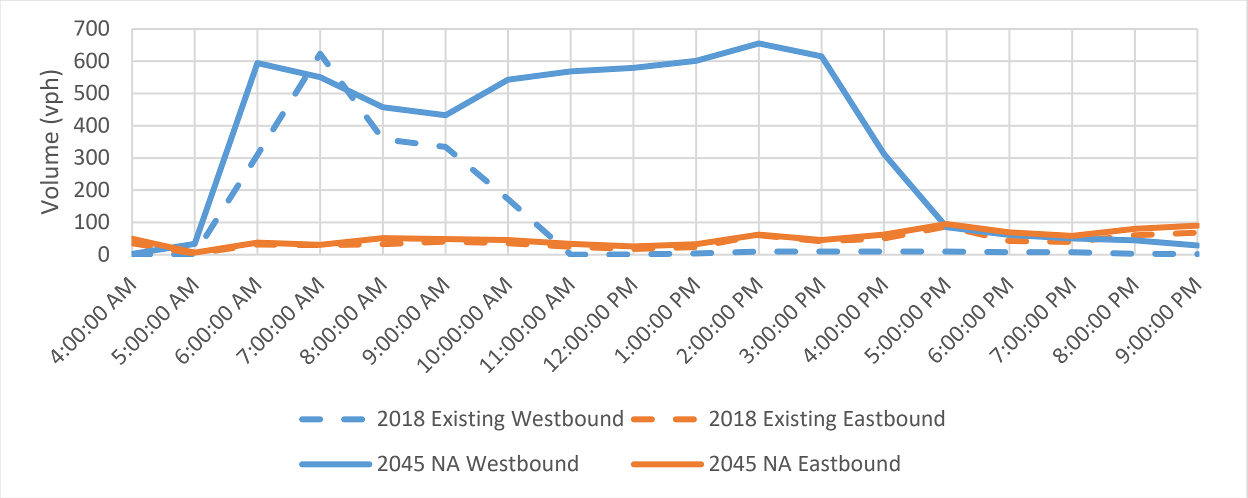
For US 40, the two locations of interest are: (1) between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill), and (2) between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden). The No Action condition volumes along US 40 are shown in Exhibit 61 and Exhibit 62 for a winter Saturday and Exhibit 63 and Exhibit 64 for a summer Sunday. The future volumes follow similar patterns as the Existing Conditions, but the peaks increase in duration. Traffic using US 40 to bypass I-70 will increase significantly in the future as I-70 experiences more hours of congestion and long delays.

Exhibit 61. No Action US 40 Winter Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)



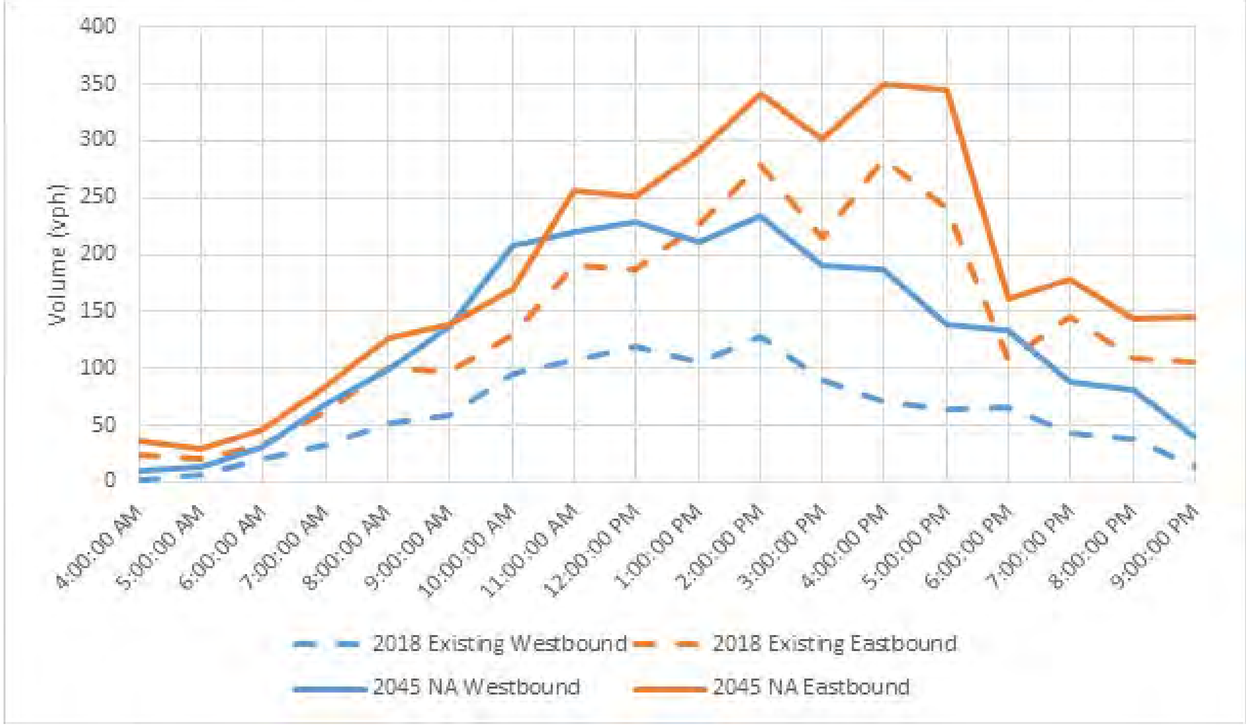
Source: TransModeler microsimulation analysis.

Exhibit 62. No Action US 40 Winter Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)



Source: TransModeler microsimulation analysis.

Exhibit 63. No Action US 40 Summer Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)



Source: TransModeler microsimulation analysis.

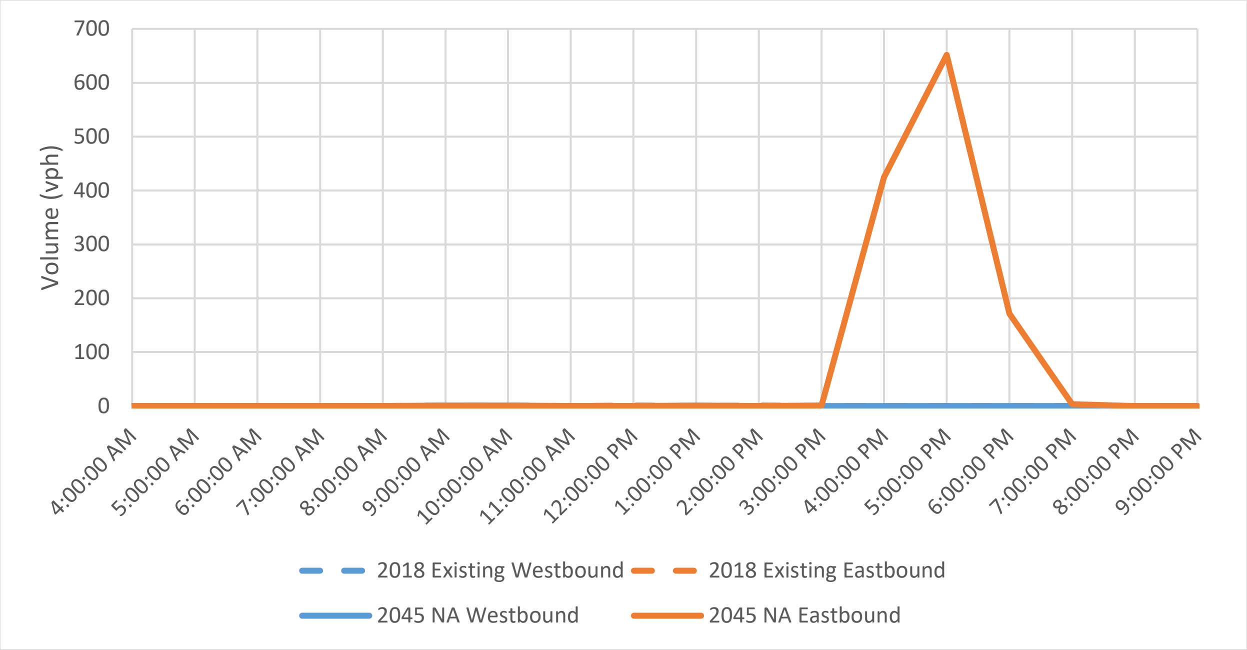
Exhibit 64. No Action US 40 Summer Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)

Source: TransModeler microsimulation analysis.

5.3.2.2 CR 314

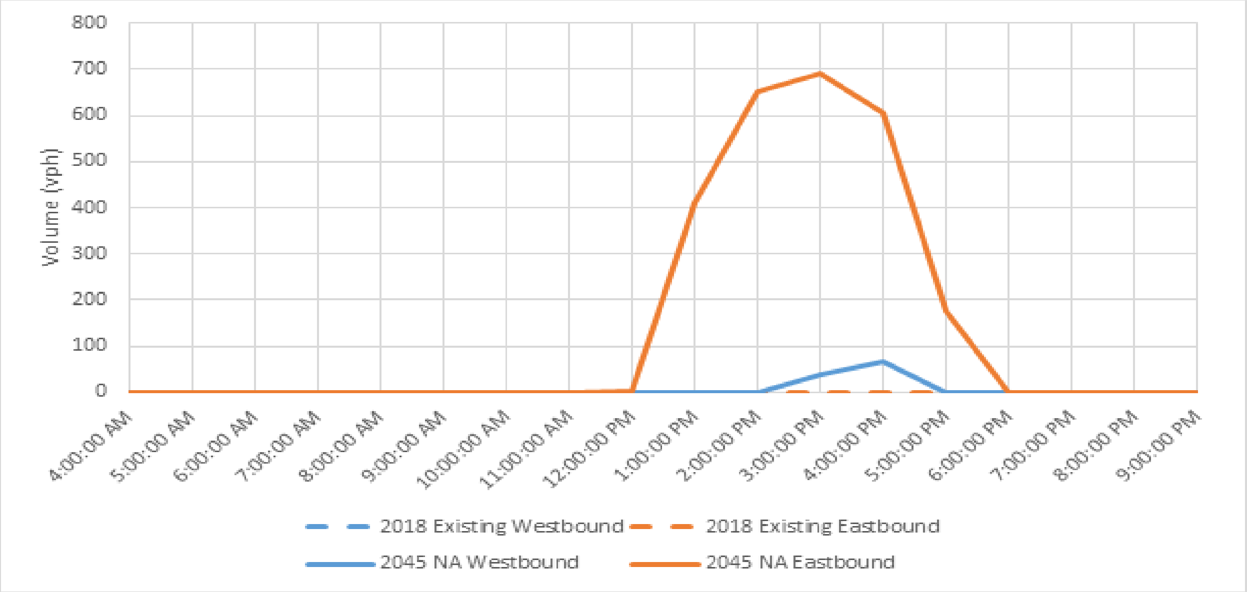
The projected 2045 No Action volume patterns on CR 314 for a winter Saturday are shown in Exhibit 65 and for a summer Sunday are shown in Exhibit 66. The future volumes show more vehicles willing to use this alternate route, after it is improved, due to the high congestion that is expected to exist on I-70.

Exhibit 65. No Action CR 314 Winter Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

Exhibit 66. No Action CR 314 Summer Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

5.3.2.3 US 6

As can be seen in Exhibit 67 and Exhibit 68, the expected No Action volume patterns on US 6 are similar to Existing Conditions, with volumes increases during all hours of the day during both peaks.

Exhibit 67. No Action US 6 Winter Volumes—East of the US 40 Intersection

Source: TransModeler microsimulation analysis.

Exhibit 68. No Action US 6 Summer Volumes—East of the US 40 Intersection

Source: TransModeler microsimulation analysis.

5.4 No Action Operational Conditions

The No Action operational characteristics are compared to the Existing Conditions in the following sections.

5.4.1 VMT and VHT

A comparison of VMT and VHT for the 2018 Existing Conditions and 2045 No Action models is shown in Exhibit 69. Both VMT and VHT are expected to increase for all modeled facilities in the study area for the No Action conditions. I-70 winter VMT increases by approximately 30 percent but VHT increases by about 120 percent due to increased congestion that is expected to occur in the future. Summer VHT on I-70 also increases by about 30 percent while VHT increases by about 50 percent. The summer is not expected to experience as much congestion as the winter and, thus, the lower increase in VHT despite a similar increase in VMT. As congestion on I-70 increases, more vehicles are expected to reroute off I-70, which is shown by the large increase in VMT/VHT on US 40, US 6, and CR 314.

Exhibit 69. No Action VMT and VHT

Facility	2018 Existing				2045 No Action[1]			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	VMT	VHT	VMT	VHT	VMT	VHT	VMT	VHT
I-70	717,959	18,409	702,106	13,074	913,755 (27%)	40,117 (118%)	916,588 (31%)	19,942 (53%)
US 6	7,771	190	4,248	102	10,659 (37%)	681 (258%)	5,298 (25%)	166 (63%)
US 40	15,715	2,636	8,309	222	49,874 (217%)	2,892 (10%)	13,581 (63%)	359 (62%)
CR 314	1	0.04	0.4	0.02	2,334 (>>100%)	152 (>>100%)	2,880 (>>100%)	111 (>>100%)

Source: TransModeler microsimulation analysis.

1. Percent difference compared to Existing and values greater than 100% shown as >>100%.

5.4.2 Throughput on I-70

The projected I-70 maximum eastbound throughput will increase from a maximum of about 600 vph or about 15-percent between 2018 and 2045. The maximum hourly westbound throughput also will increase by about 15 percent or about 500 vph. This is less than the 34-percent increase in traffic that is expected to occur during this time. This is consistent with operations in the study area degrading and periods of congestion getting longer without improvements to the transportation network.

Exhibit 70. No Action I-70 Throughput

Travel Direction	2018 Existing (vph)				2045 No Action (vph)			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241
Eastbound	3,700	4,000	3,600	3,800	4,300	4,500	4,500	4,600
Westbound	3,200	3,700	2,600	2,600	3,700	3,800	3,300	3,500

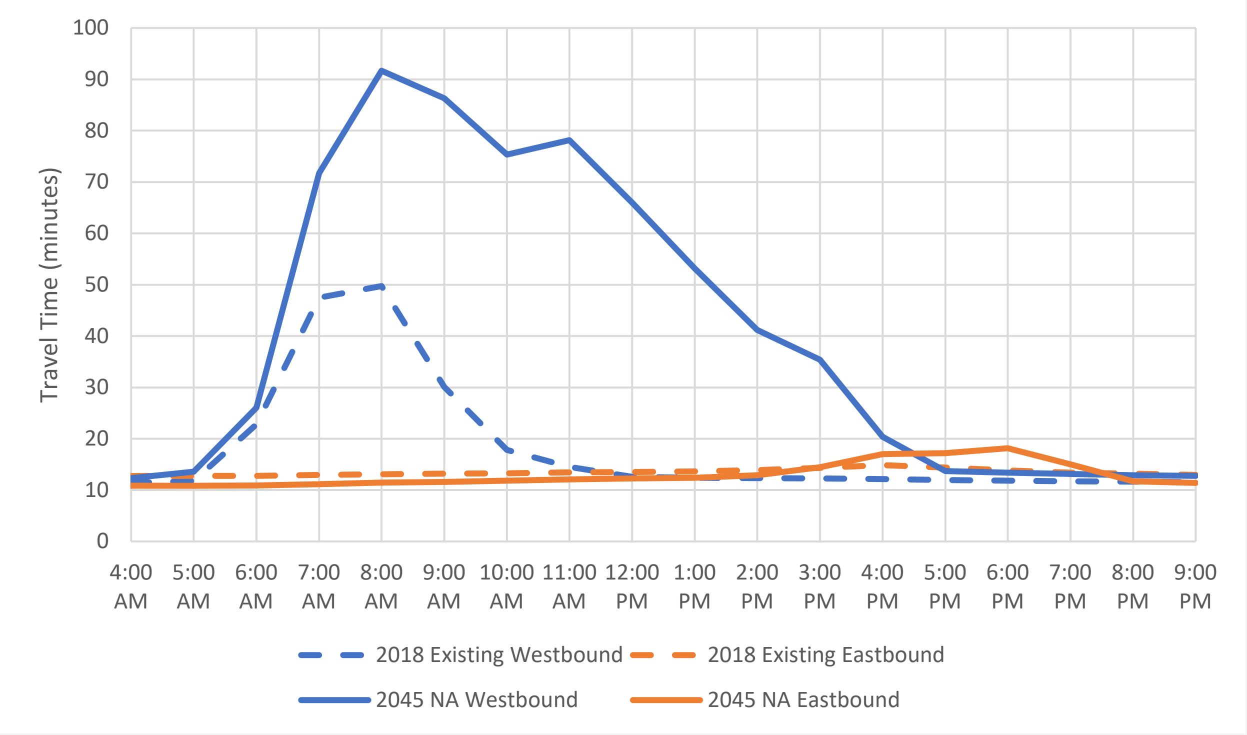
Source: Existing Conditions TransModeler microsimulation analysis.

5.4.3 Travel Times

Under 2045 No Action conditions, winter Saturdays are predicted to experience significant congestion for much of the day. Winter Saturdays in the corridor are characterized by a large morning peak in the westbound direction. As shown in Exhibit 71, the westbound travel time for 2045 No Action through the study area exceeds 90 minutes (which equates to an average travel speed of about 8 mph) at the peak time for a trip that takes slightly more than 12 minutes during free-flow conditions (at an average travel speed of 60 mph).

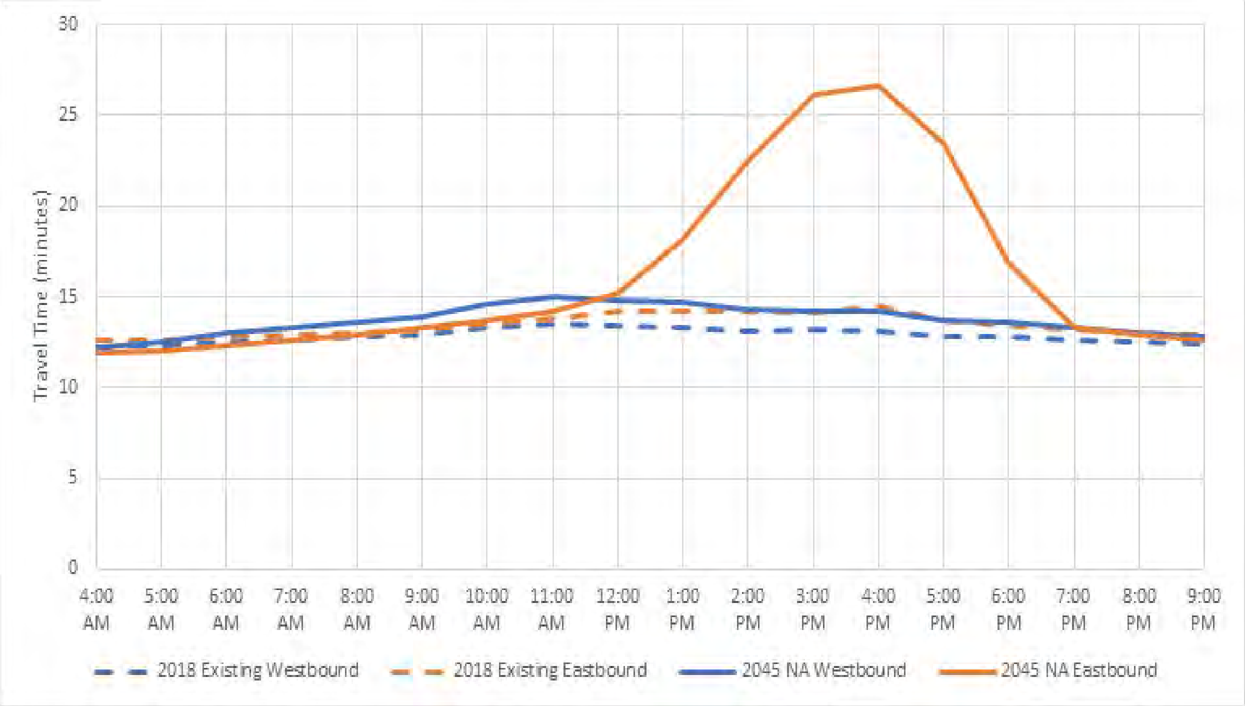
Summer Sundays have the highest eastbound volumes on the corridor. Travel time in the study area for 2045 No Action summer Sunday conditions is shown in Exhibit 72. Summer Sunday conditions see less severe peaks (traffic is spread out over more hours) than winter Saturdays, so the travel times during summer Sundays are less variable than winter Saturdays.

Exhibit 71. No Action Winter I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



Source: TransModeler microsimulation analysis.

Exhibit 72. No Action Summer I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



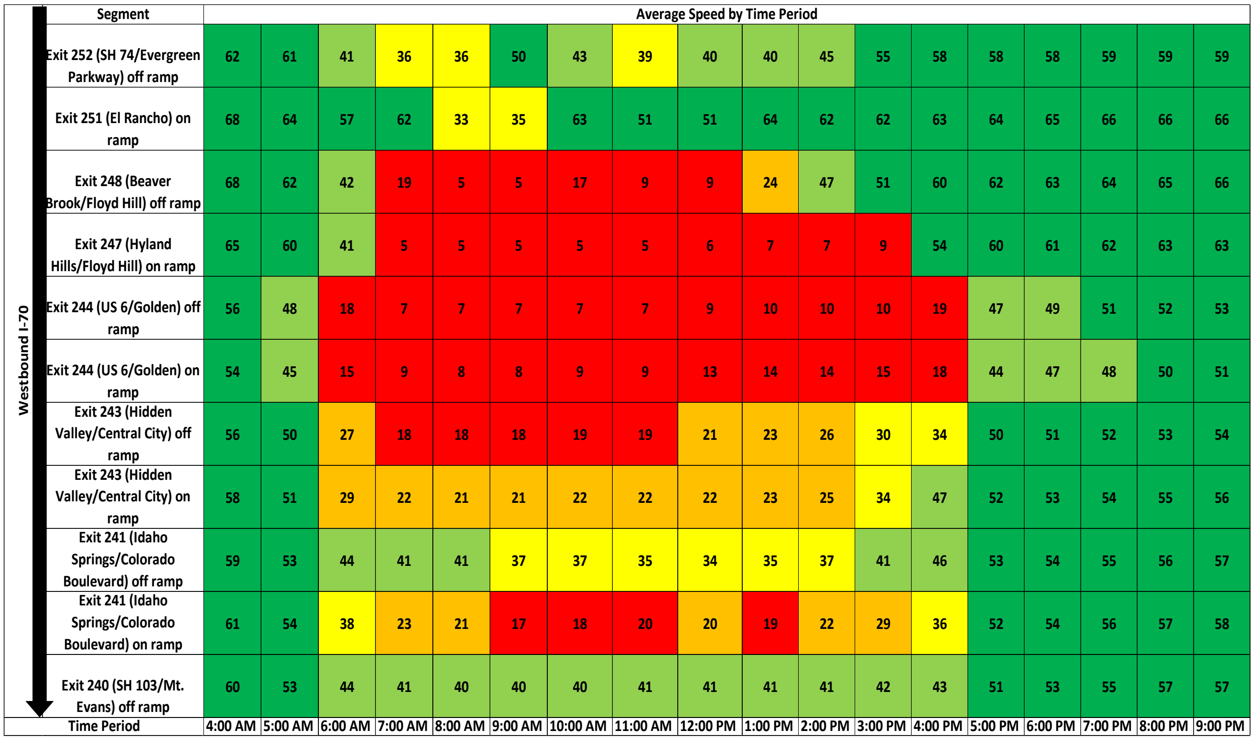
Source: TransModeler microsimulation analysis.

5.4.4 Travel Speeds and Congestion

2045 No Action winter Saturday speeds on the I-70 mainline are shown in Exhibit 73 for the westbound direction and in Exhibit 74 for the eastbound direction. The westbound speed diagram shows speeds below 25 mph occurring from the Hidden Valley/Central City westbound on-ramp as far back as the westbound Evergreen Parkway off-ramp. The average westbound speed of traffic from the top of Floyd Hill to the US 6 off-ramp is less than 20 mph for 11 hours of the day. The eastbound speeds are higher, and only fall below 20 mph for a couple hours of the day for a short distance. Eastbound speeds are lowest between the Hidden Valley/Central City interchange and the US 6/Golden interchange, largely due to the tight curves in that area.

2045 No Action summer Sunday speeds on the I-70 mainline are shown in Exhibit 75 for the westbound direction and in Exhibit 76 for the eastbound direction. Average westbound speeds exceed 40 mph throughout the study area for all modeled hours except for the section between the US 6 off- and on-ramps at the bottom of Floyd Hill. In the eastbound direction, speeds are lowest between the Hidden Valley/Central City interchange and the US 6/Golden interchange, a phenomenon also observed in the winter Saturday model.

Exhibit 73. No Action Winter Westbound Congestion Diagram

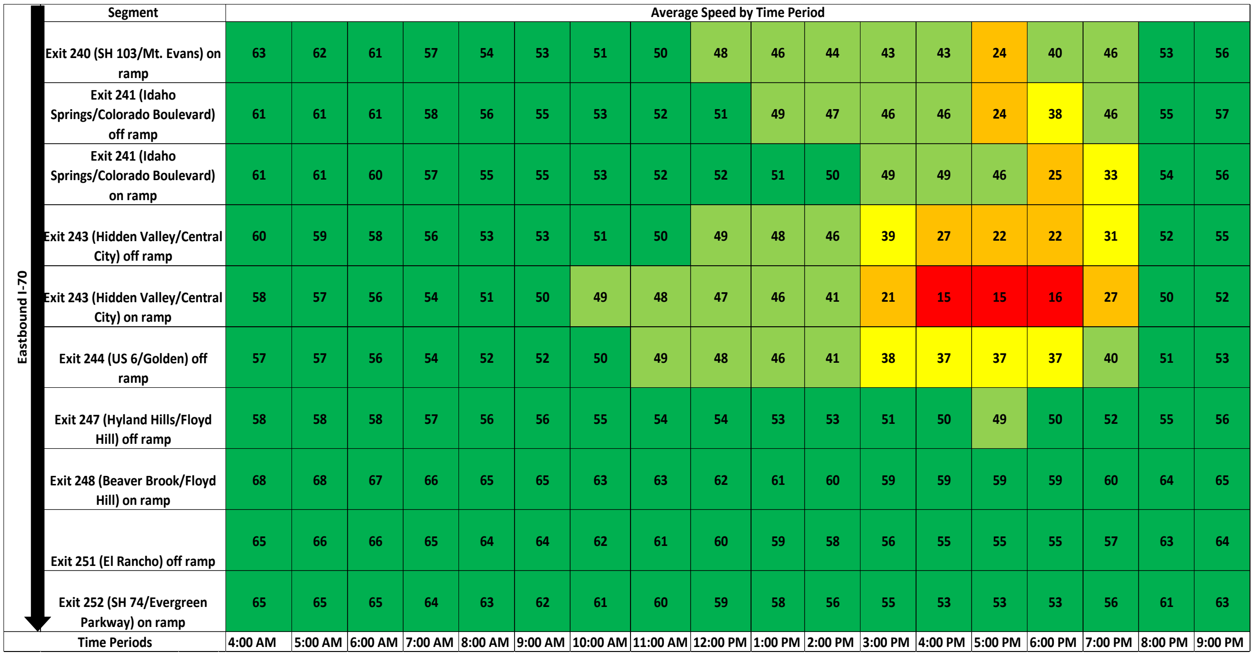


	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	62	61	41	36	36	50	43	39	40	40	45	55	58	58	58	59	59	59
	Exit 251 (El Rancho) on ramp	68	64	57	62	33	35	63	51	51	64	62	62	63	64	65	66	66	66
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	68	62	42	19	5	5	17	9	9	24	47	51	60	62	63	64	65	66
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	65	60	41	5	5	5	5	5	6	7	7	9	54	60	61	62	63	63
	Exit 244 (US 6/Golden) off ramp	56	48	18	7	7	7	7	7	9	10	10	10	19	47	49	51	52	53
	Exit 244 (US 6/Golden) on ramp	54	45	15	9	8	8	9	9	13	14	14	15	18	44	47	48	50	51
	Exit 243 (Hidden Valley/Central City) off ramp	56	50	27	18	18	18	19	19	21	23	26	30	34	50	51	52	53	54
	Exit 243 (Hidden Valley/Central City) on ramp	58	51	29	22	21	21	22	22	22	23	25	34	47	52	53	54	55	56
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	59	53	44	41	41	37	37	35	34	35	37	41	46	53	54	55	56	57
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	61	54	38	23	21	17	18	20	20	19	22	29	36	52	54	56	57	58
	Exit 240 (SH 103/Mt. Evans) off ramp	60	53	44	41	40	40	40	41	41	41	41	42	43	51	53	55	57	57
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 74. No Action Winter Eastbound Congestion Diagram



	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	63	62	61	57	54	53	51	50	48	46	44	43	43	24	40	46	53	56
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	61	61	61	58	56	55	53	52	51	49	47	46	46	24	38	46	55	57
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	61	61	60	57	55	55	53	52	52	51	50	49	49	46	25	33	54	56
	Exit 243 (Hidden Valley/Central City) off ramp	60	59	58	56	53	53	51	50	49	48	46	39	27	22	22	31	52	55
	Exit 243 (Hidden Valley/Central City) on ramp	58	57	56	54	51	50	49	48	47	46	41	21	15	15	16	27	50	52
	Exit 244 (US 6/Golden) off ramp	57	57	56	54	52	52	50	49	48	46	41	38	37	37	37	40	51	53
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	58	58	58	57	56	56	55	54	54	53	53	51	50	49	50	52	55	56
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	68	68	67	66	65	65	63	63	62	61	60	59	59	59	59	60	64	65
	Exit 251 (El Rancho) off ramp	65	66	66	65	64	64	62	61	60	59	58	56	55	55	55	57	63	64
	Exit 252 (SH 74/Evergreen Parkway) on ramp	65	65	65	64	63	62	61	60	59	58	56	55	53	53	53	56	61	63
	Time Periods	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
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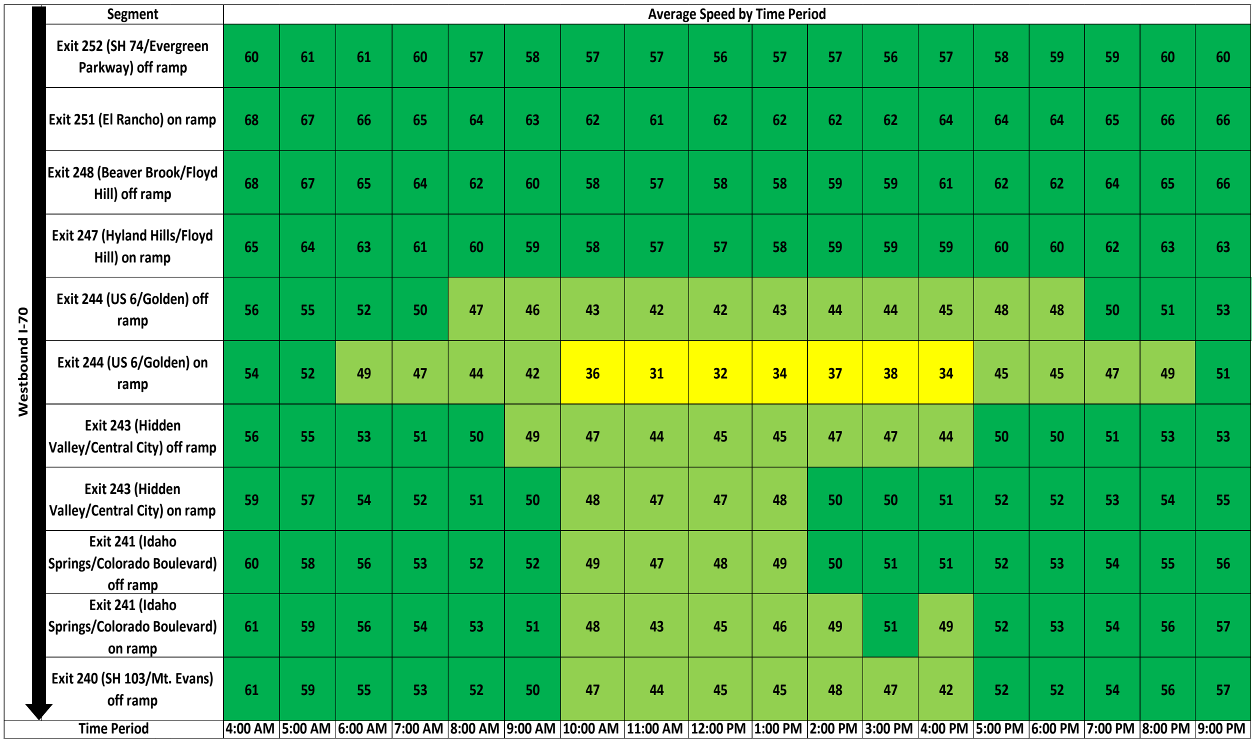
Source: TransModeler microsimulation analysis.

Exhibit 75. No Action Summer Westbound Congestion Diagram



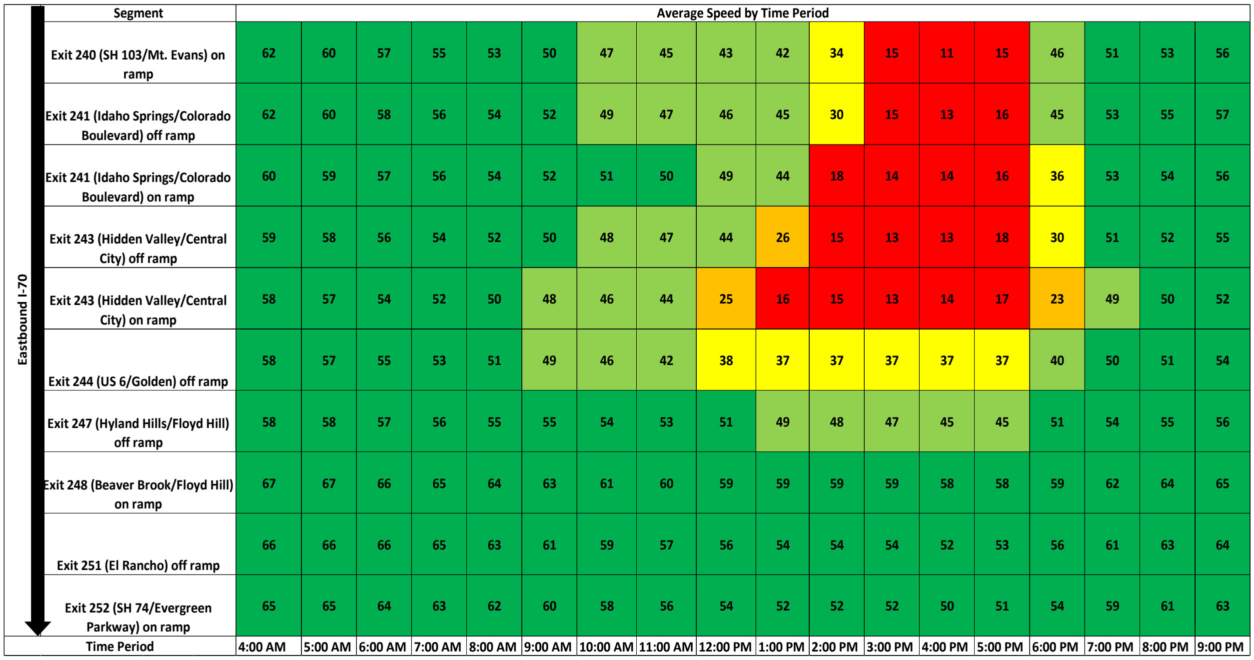
	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	60	61	61	60	57	58	57	57	56	57	57	56	57	58	59	59	60	60
	Exit 251 (El Rancho) on ramp	68	67	66	65	64	63	62	61	62	62	62	62	64	64	64	65	66	66
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	68	67	65	64	62	60	58	57	58	58	59	59	61	62	62	64	65	66
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	65	64	63	61	60	59	58	57	57	58	59	59	59	60	60	62	63	63
	Exit 244 (US 6/Golden) off ramp	56	55	52	50	47	46	43	42	42	43	44	44	45	48	48	50	51	53
	Exit 244 (US 6/Golden) on ramp	54	52	49	47	44	42	36	31	32	34	37	38	34	45	45	47	49	51
	Exit 243 (Hidden Valley/Central City) off ramp	56	55	53	51	50	49	47	44	45	45	47	47	44	50	50	51	53	53
	Exit 243 (Hidden Valley/Central City) on ramp	59	57	54	52	51	50	48	47	47	48	50	50	51	52	52	53	54	55
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	60	58	56	53	52	52	49	47	48	49	50	51	51	52	53	54	55	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	61	59	56	54	53	51	48	43	45	46	49	51	49	52	53	54	56	57
	Exit 240 (SH 103/Mt. Evans) off ramp	61	59	55	53	52	50	47	44	45	45	48	47	42	52	52	54	56	57
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph ▨ 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 76. No Action Summer Eastbound Congestion Diagram



	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	62	60	57	55	53	50	47	45	43	42	34	15	11	15	46	51	53	56
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	62	60	58	56	54	52	49	47	46	45	30	15	13	16	45	53	55	57
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	60	59	57	56	54	52	51	50	49	44	18	14	14	16	36	53	54	56
	Exit 243 (Hidden Valley/Central City) off ramp	59	58	56	54	52	50	48	47	44	26	15	13	13	18	30	51	52	55
	Exit 243 (Hidden Valley/Central City) on ramp	58	57	54	52	50	48	46	44	25	16	15	13	14	17	23	49	50	52
	Exit 244 (US 6/Golden) off ramp	58	57	55	53	51	49	46	42	38	37	37	37	37	37	40	50	51	54
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	58	58	57	56	55	55	54	53	51	49	48	47	45	45	51	54	55	56
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	67	67	66	65	64	63	61	60	59	59	59	59	58	58	59	62	64	65
	Exit 251 (El Rancho) off ramp	66	66	66	65	63	61	59	57	56	54	54	54	52	53	56	61	63	64
	Exit 252 (SH 74/Evergreen Parkway) on ramp	65	65	64	63	62	60	58	56	54	52	52	52	50	51	54	59	61	63
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

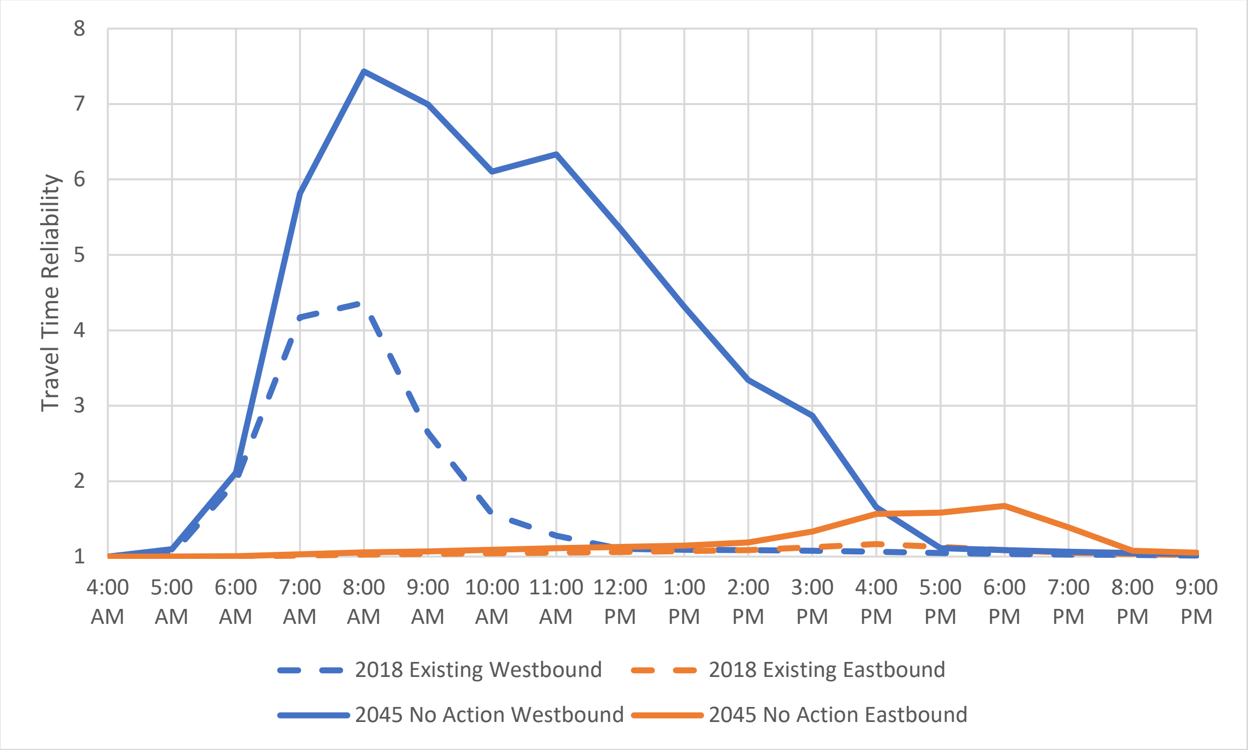
🟩 > 50 mph ▨ 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

5.4.5 Travel Time Reliability on I-70

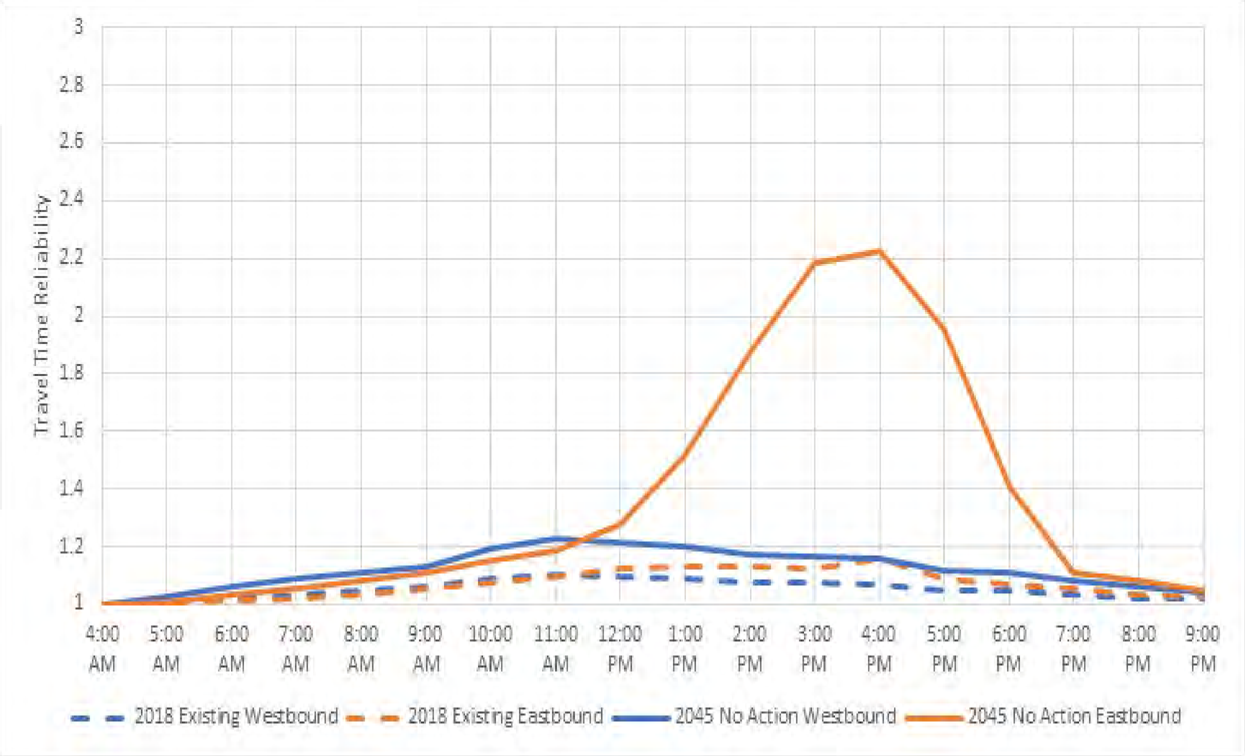
As in Existing Conditions, the No Action travel time reliability (as shown in Exhibit 77 and Exhibit 78) is more variable for winter Saturday conditions than summer Sunday conditions. The No Action westbound travel time under winter Saturday conditions does not operate at even close to free-flow conditions; in fact, it operates at worse travel times than under Existing Conditions, and the period of unreliability lasts for much longer. Eastbound travel time shows greater variance from free flow under No Action winter Saturday conditions as well. Summer Sunday eastbound travel time shows a large change in travel time under the No Action conditions model as compared to the Existing Conditions model. Westbound travel times change much less under summer Sunday conditions, though there is an increase in variability in 2045 No Action as compared to Existing Conditions.

Exhibit 77. No Action Winter Travel Time Reliability



Source: TransModeler microsimulation analysis.

Exhibit 78. No Action Summer Travel Time Reliability



Source: TransModeler microsimulation analysis.

5.4.6 Freeway Segment LOS

Freeway LOS results for the No Action analyses are shown in Exhibit 79 through Exhibit 82. As traffic increases and no improvements are made to the transportation network, I-70 will experience longer periods of congestion with failure occurring during all peaks and for most hours of the day. Westbound I-70 in the winter will experience bottleneck conditions for nearly 12 hours of the day from end to end of the study area. Westbound I-70 also will begin to experience failure conditions in the summer for many hours of the day.

Eastbound I-70 will continue to fail during the summer, with the congestion becoming more intense and extending over more hours of the day. Much of this is due to the sharp curves near the Veterans Memorial Tunnels, with conditions remaining better farther east.

Exhibit 79. No Action Winter Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	B	C	C	C	B	C	B	C	B	B	B	B	B	B	B	B	B
	6:00:00 AM	D	D	D	E	F	E	F	F	F	F	F	F	F	F	F	F	D	E	D	D	D	D	D	D
	7:00:00 AM	D	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	F	E	E	E	E	E
	8:00:00 AM	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	F	E	F	E	F	F
	9:00:00 AM	A	D	E	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	F	E	F	E	F	F
	10:00:00 AM	B	F	B	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	E	E	E
	11:00:00 AM	D	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	E	E	F
	12:00:00 PM	C	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	E	E	E
	1:00:00 PM	C	F	B	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	E	E	F
	2:00:00 PM	B	F	C	D	E	F	F	F	F	F	F	F	F	F	F	F	E	F	F	E	E	D	E	E
	3:00:00 PM	A	C	B	C	C	C	F	F	F	F	F	F	F	F	F	F	E	F	E	E	E	D	E	E
	4:00:00 PM	A	B	B	B	B	B	C	F	F	F	F	F	F	F	E	F	D	E	E	E	D	D	D	D
	5:00:00 PM	A	B	B	A	B	A	B	C	C	C	D	C	C	C	C	C	B	C	B	C	B	C	B	B
	6:00:00 PM	A	B	A	A	A	A	A	B	C	C	C	B	C	B	B	B	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	B	A	B	A	B	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 80. No Action Winter Eastbound I-70 LOS

Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	A	A	A	B	A	A	A	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	C	B	B	B	B	C	C	B	B	A	B	B	A	A	B	A	A
	11:00:00 AM	C	C	D	C	C	C	C	C	C	C	D	C	C	B	B	B	B	B	B	B	B
	12:00:00 PM	D	D	D	C	D	D	D	D	D	D	D	D	D	B	C	B	B	B	B	B	B
	1:00:00 PM	E	D	E	D	E	E	D	D	D	E	E	F	D	B	C	C	B	B	C	B	C
	2:00:00 PM	E	E	E	E	E	F	E	E	E	F	F	F	E	B	D	C	C	B	C	B	C
	3:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	C	D	C	C	B	D	C	D
	4:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	C	D	D	C	C	D	C	D
	5:00:00 PM	F	F	F	F	F	F	D	F	F	F	F	F	E	C	E	D	C	C	D	C	D
	6:00:00 PM	F	F	F	F	F	F	F	F	F	F	F	F	E	C	E	D	C	C	D	C	D
	7:00:00 PM	D	C	D	C	E	F	E	F	F	F	F	F	D	B	C	C	C	B	C	B	C
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	B	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 81. No Action Summer Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	B	B	B	C	B	C	B	C	B	B	B	B	C	B	B	B	B
	8:00:00 AM	A	B	A	A	B	A	B	B	C	C	C	C	C	C	C	C	B	C	B	C	B	B	B	B
	9:00:00 AM	A	B	B	B	B	B	B	C	D	D	D	C	D	C	C	C	C	C	C	C	C	C	B	B
	10:00:00 AM	A	B	C	B	C	B	C	D	E	E	F	E	E	D	E	D	D	D	D	D	D	C	C	C
	11:00:00 AM	B	B	C	B	C	B	C	E	E	F	F	F	F	F	E	F	D	E	E	E	D	D	D	D
	12:00:00 PM	B	B	C	B	C	B	C	E	E	F	F	F	F	E	E	E	D	D	D	D	D	D	D	D
	1:00:00 PM	A	B	C	B	C	B	C	D	E	F	F	E	E	E	E	E	D	D	D	D	D	D	D	D
	2:00:00 PM	A	B	B	B	C	B	C	D	E	E	E	D	E	D	D	D	C	D	C	D	C	C	C	C
	3:00:00 PM	A	B	B	B	B	B	B	C	D	D	E	D	D	C	D	C	C	C	C	C	C	C	C	C
	4:00:00 PM	A	B	B	B	B	B	B	C	D	D	E	D	D	D	D	C	C	C	D	D	D	C	C	C
	5:00:00 PM	A	B	B	A	B	A	B	B	C	C	C	C	C	C	C	C	B	C	B	C	B	C	B	B
	6:00:00 PM	A	B	B	A	B	A	B	B	C	C	C	C	C	C	C	C	B	B	B	C	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	A	A	A	B	B	A	A	B
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 82. No Action Summer Eastbound I-70 LOS

Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 AM	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	B	B	A	B	A	B	A
	10:00:00 AM	D	D	D	D	D	D	D	D	D	E	E	E	D	B	C	C	B	B	C	B	C	B
	11:00:00 AM	E	E	E	E	E	F	E	E	E	F	F	F	E	B	D	C	C	B	C	B	C	B
	12:00:00 PM	E	E	E	F	E	F	E	F	E	F	F	F	E	C	D	D	C	C	D	C	D	C
	1:00:00 PM	E	E	F	F	F	F	E	F	F	F	F	F	E	C	E	D	D	C	D	C	D	C
	2:00:00 PM	E	F	F	F	F	F	F	F	F	F	F	F	E	C	E	D	D	C	D	C	D	C
	3:00:00 PM	F	F	F	F	F	F	F	F	F	F	F	F	E	C	E	D	D	C	D	C	D	C
	4:00:00 PM	F	F	F	F	F	F	F	F	F	F	F	F	E	C	E	E	D	C	D	D	D	C
	5:00:00 PM	F	F	F	F	F	F	F	F	F	F	F	F	E	C	E	E	D	C	D	D	D	C
	6:00:00 PM	C	C	D	C	E	E	E	F	F	F	F	F	E	C	D	C	C	B	C	C	D	B
	7:00:00 PM	B	B	B	B	C	B	B	B	C	C	C	C	C	B	B	B	B	A	B	B	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

5.4.7 Intersection LOS and Queues

Under 2045 No Action conditions (signals were optimized), intersection performance is degraded as compared to Existing Conditions due to increased volumes in the future. 2045 No Action intersection performance is shown in Exhibit 83. Operations at the Hidden Valley/Central City interchange are most impacted by increased future volumes, with significant increases in queues and delays for both the north and south intersections at the interchange under both westbound and eastbound peak conditions.

Queues also will increase on most approaches at most intersections. More intersection approaches will experience queues that are more than several hundred feet in length. These queues will result in increased delays, increased driver frustration, and potential decrease in safety.

Exhibit 83. No Action Ramp Terminal Intersection LOS

Intersection	Approach	2018 Existing		2045 No Action	
		LOS/95% Queue (ft)			
		Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday
Colorado Blvd WB Ramps	WB Off-Ramp[3]	A/50	A/25	A/25	A/25
	EB Colorado Blvd[3]	A/25	A/75	A/50	A/0
	WB Colorado Blvd[3]	A/0	A/0	A/25	A/0
	Overall[3]	A	A	A	A
Colorado Blvd EB Ramps	EB Off-Ramp[2]	A/10	B/15	B/15	B/20
Hidden Valley WB Ramps	SB CCP[1]	B/70	B/65	B/105	B/130
	NB CCP[1]	B/20	B/75	A/10	A/10
	WB Off-Ramp[1]	C/25	C/25	D/100	D/295
	Service Road[1]	D/95	D/125	E/30	E/35
	Overall[1]	B	B	B	C
Hidden Valley EB Ramps	SB CCP[1]	A/20	B/10	A/10	C/115
	NB CCP[1]	B/10	B/70	D/15	B/10
	EB Frontage[1]	C/15	C/45	D/30	D/565
	EB Off-Ramp[1]	D/20	B/70	D/45	E/150
	Overall[1]	C	B	C	D
US 6 and WB Ramp	WB Off-Ramp[2]	B/10	B/25	C/5	A/10
US 6 and US 40	WB US 40[2]	F/650	B/10	F/750	B/20
Homestead/EB Ramp	EB Off-Ramp[2]	A/5	B/15	A/5	B/20
Homestead/US 40	NB Homestead[3]	n/a	n/a	A/0	A/0
	EB US 40[3]	A/5	B/20	A/0	A/0
	WB US 40[3]	F/530	B/20	C/10	A/0
	Overall[3]	n/a	n/a	C	A
CR 65/US 40	NB CR 65[3]	B/50	B/10	A/0	A/0
	EB US 40[3]	n/a	n/a	A/0	A/0
	WB US 40[3]	n/a	n/a	C/10	A/0
	WB Ramp[3]	F/325	B/25	A/0	A/0
	Overall[3]	n/a	n/a	C	A

Note: For stop-controlled intersections only the worst approach LOS and queue lengths are reported.

1. Signalized intersection; 2. Stop controlled intersection; 3. Roundabout intersection

5.5 No Action Summary

The expected 2045 No Action conditions in the corridor include:

- Compared to the Existing Conditions, without improvements, the expected number of crashes on I-70 will increase to more than 200 incidents annually, an increase of 34 percent by 2045.
- Future VMT and VHT are expected to increase on all roads in the study area and the local roadways that act as alternate routes to I-70 will experience significant increases in traffic.
- The peak period travel times on a winter Saturday are expected to nearly double compared to Existing Conditions and travel times will remain well above a TTI of 2.0 for more than 11 hours of the day.
- Summer Sunday travel times in the later afternoon are expected to nearly double and remain at a TTI of greater than 10.0 for five hours of the day.
- The freeway will experience LOS F with high levels of congestion in both directions of travel over many hours of the day during both the winter and summer peaks.
- Most intersections operate at LOS D or better during the peak period, but there are more approaches that are failing (LOS F) and may need mitigation compared to the Existing Conditions.

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6 Action Alternatives Analysis

The 2045 action alternative models were created from the 2045 No Action model and then incorporated planned changes related to the Project. The following sections discuss how the action alternatives transportation network features were determined, the results of the 2045 action alternative analysis, and how they compare to the No Action Alternative results.

6.1 Action Alternatives Transportation Network Characteristics

Two distinct roadway alignments are proposed as action alternatives for the I-70 Floyd Hill to Veterans Memorial Tunnels Project: the Tunnel Alternative and the Canyon Viaduct Alternative.

6.1.1 Action Alternative East and West Ends

Exhibit 84 shows the east end of the study area and Exhibit 85 shows the west end of the study area, which are the same for both the Tunnel Alternative and the Canyon Viaduct Alternative. In addition, interchange configurations are the same in both options; new roundabouts that are part of the US 40 Roundabouts project are shown on US 40, north of the Beaver Brook and Homestead Road interchanges. The action alternatives would replace the two signalized intersections at the Hidden Valley/Central City interchange with roundabouts.

Exhibit 84. East End of the Action Alternatives

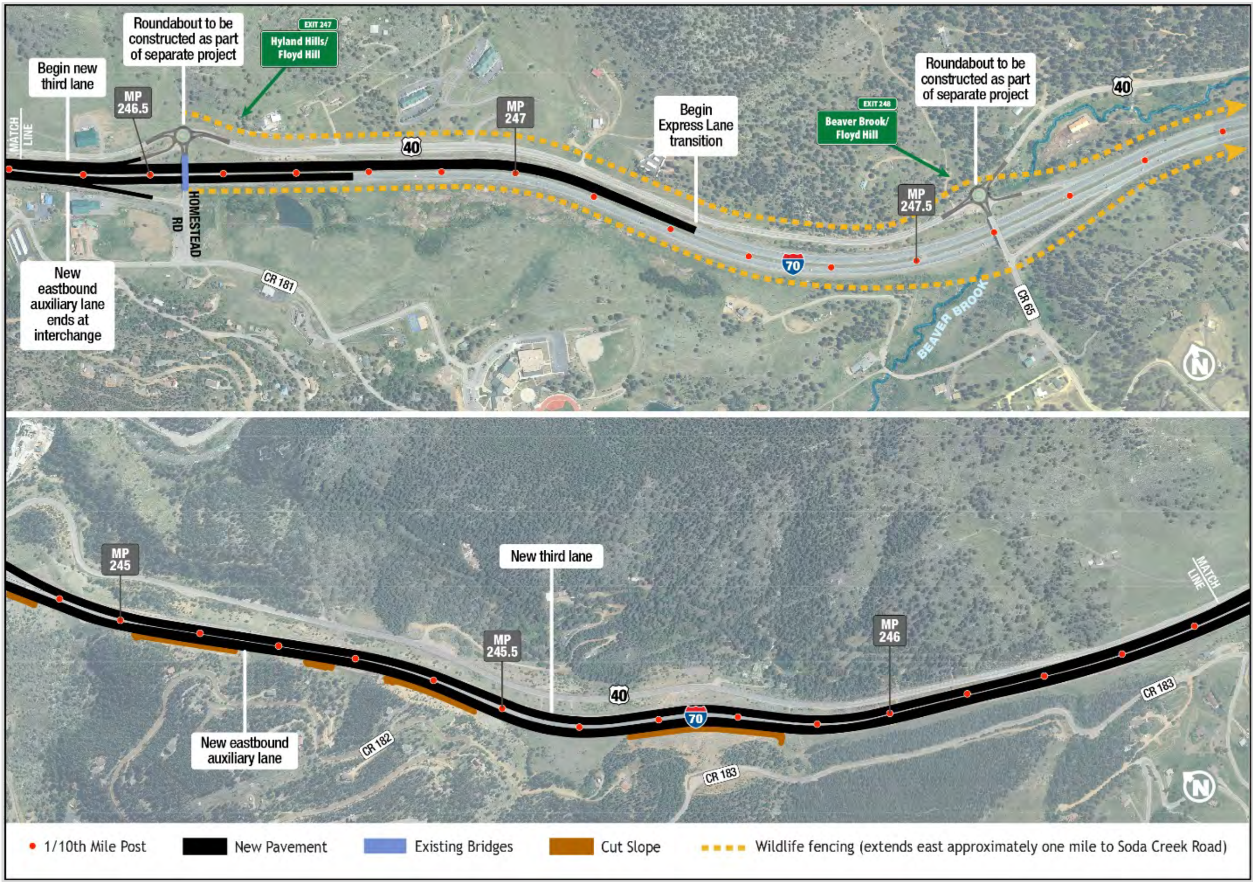
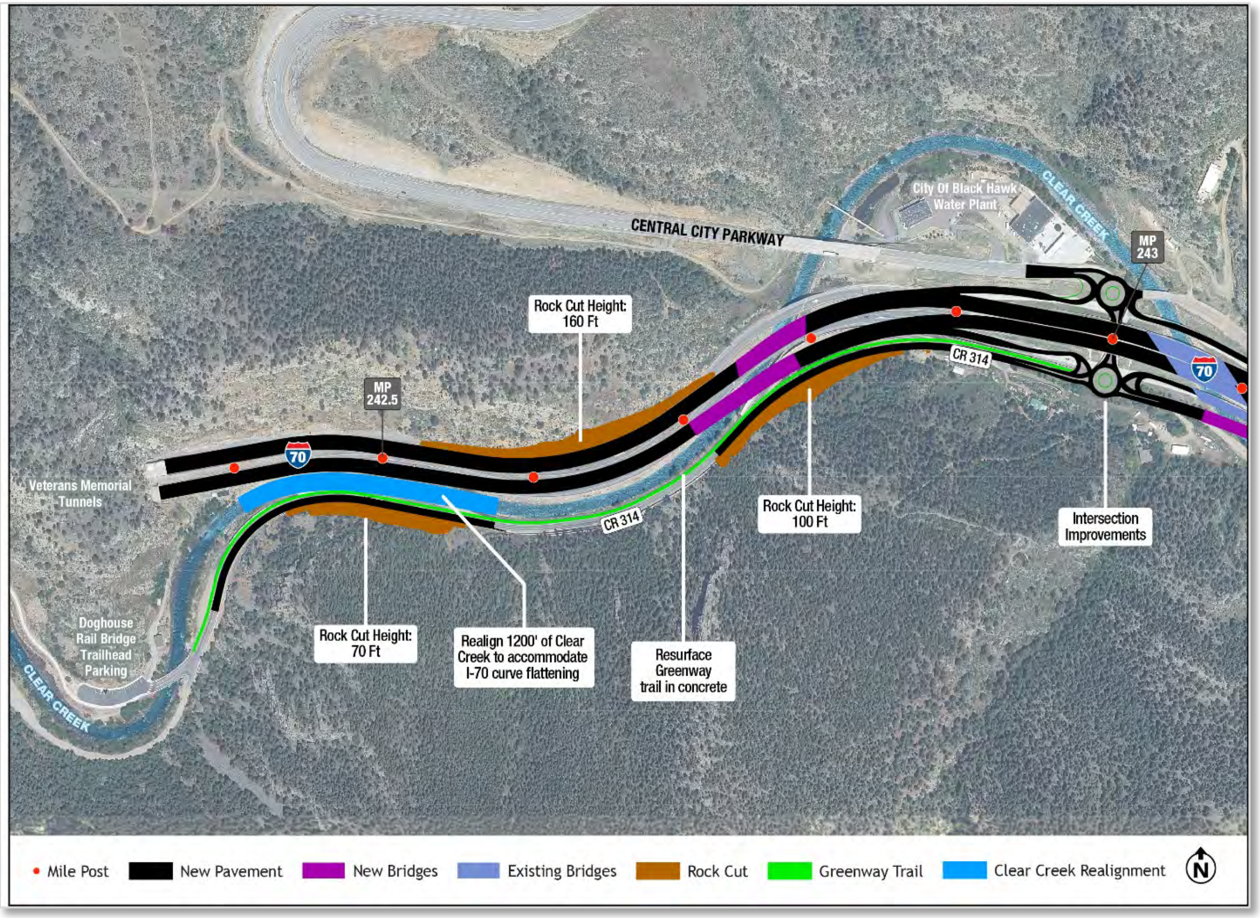


Exhibit 85. West End of the Action Alternatives



6.1.2 Action Alternative Central Section

Both action alternatives have unique Central Section improvements that include reconfiguring I-70 between Exit 244 (US 6/Golden) and Exit 243 (Hidden Valley/Central City), as well as the addition of a new frontage road connection between US 6 and the Hidden Valley/Central City interchange.

6.1.2.1 Tunnel Alternative

In the Tunnel Alternative, westbound I-70 is in a tunnel for part of the way between Exit 244 (US 6/Golden) and Exit 247 (Hyland Hills/Floyd Hill). The tunnel allows curvature to be less sharp on westbound I-70 than it is currently. Eastbound I-70 is realigned using the full existing I-70 right of way, with space to smooth curvature and address existing geometrical deficiencies. The Tunnel Alternative also includes braiding the US 6 westbound on-ramp with the westbound Hidden Valley off-ramp. US 6 is also extended to connect at the Exit 243 (Hidden Valley/Central City) interchange. The central section of the Tunnel Alternative is shown in Exhibit 86, which shows the extension of US 6 on the south side of I-70, and there is also an option where the US 6 extension is on the north side (not shown).

6.1.2.2 Canyon Viaduct Alternative

The Canyon Viaduct Alternative has both directions of I-70 on an elevated viaduct between Exit 244 (US 6/Golden) and Exit 243 (Hidden Valley/Central City). Elevating the freeway allows for smoothing of curvature and creates space below to extend US 6 to connect at the Exit 243 (Hidden Valley/Central

City) interchange. The westbound US 6 on-ramp can be accommodated farther east in the Canyon Viaduct Alternative and is not braided with the westbound Hidden Valley off-ramp. The central section of the Canyon Viaduct Alternative is shown in Exhibit 87.

Exhibit 86. Central Section of the Tunnel Alternative

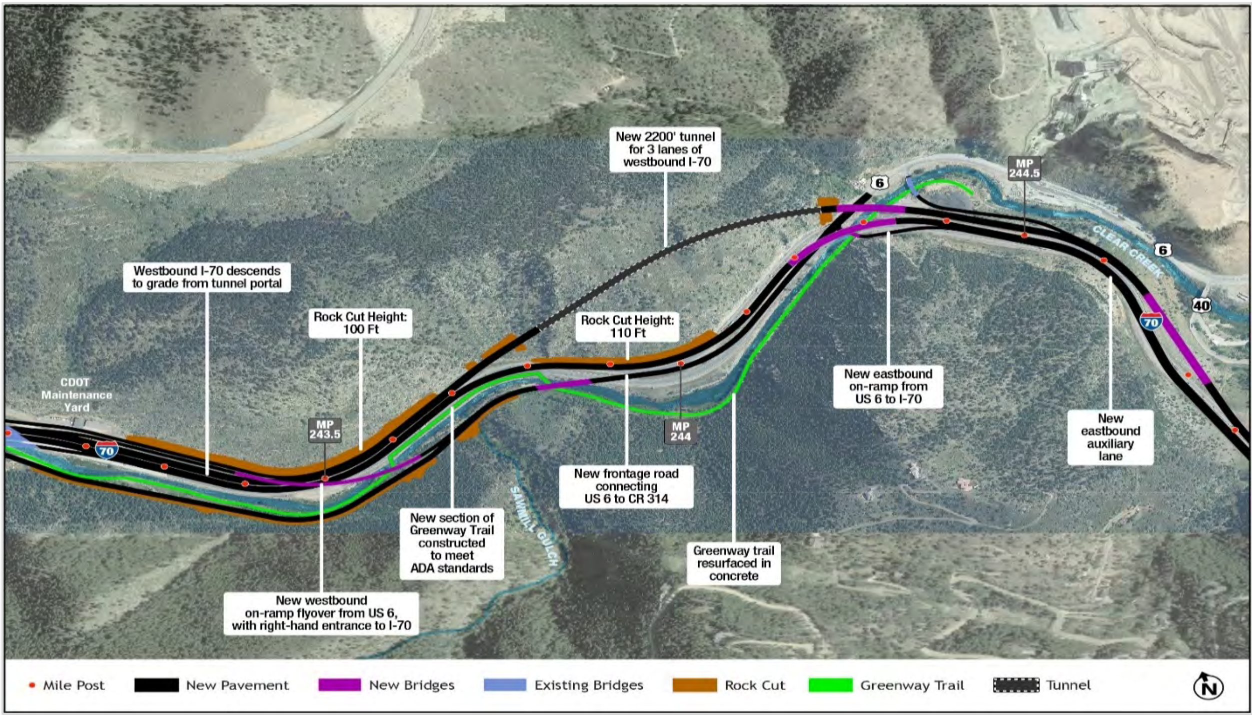
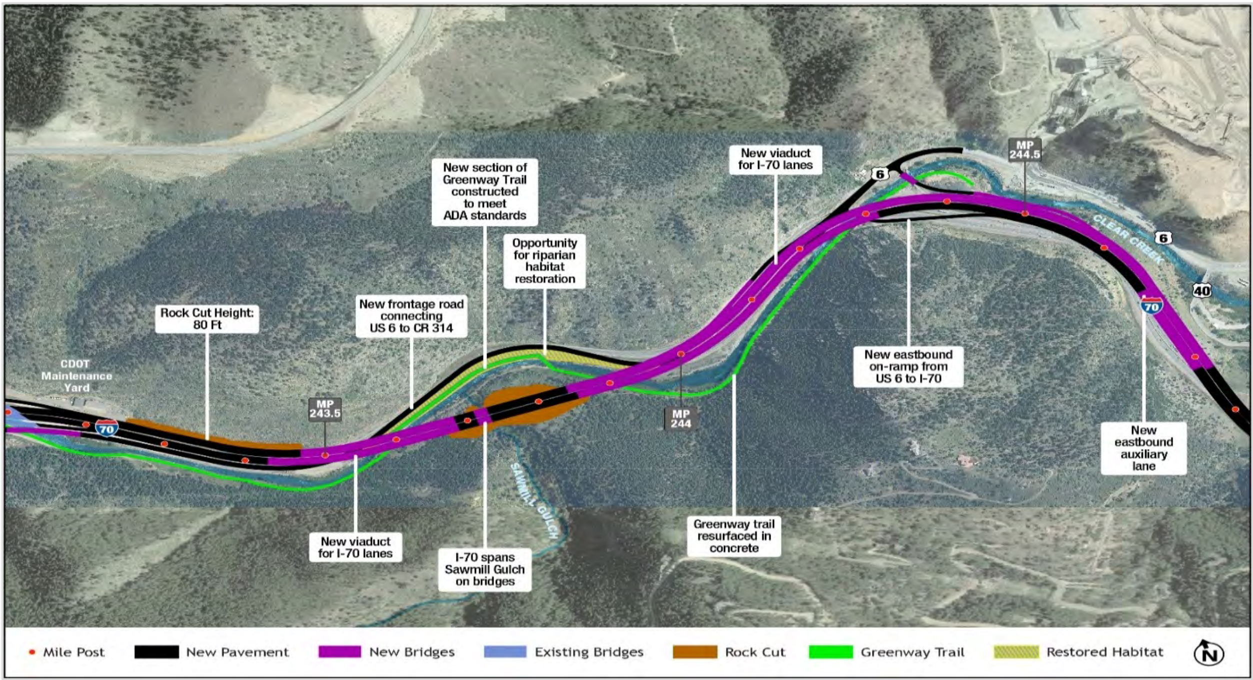


Exhibit 87. Central Section of the Canyon Viaduct Alternative



6.1.3 Third Lane Options

The existing configuration of westbound I-70 has three westbound general-purpose lanes (GPLs) until just west of Exit 247 (Hyland Hills/Floyd Hill), where the right-most GPL ends and two GPLs continue west from this location. The Project is looking at adding a third westbound lane from the location where I-70 becomes only two lanes wide and continuing that lane to the west through the Veterans Memorial Tunnels to Exit 241 (Idaho Springs/Colorado Boulevard). For the action alternatives, there are two options for the third lane: a general-purpose lane or an Express Lane.

6.1.3.1 General-Purpose Lane Options

For the options where the third westbound lane is a GPL, instead of dropping the right-most lane west of Exit 247 (Hyland Hills/Floyd Hill), the lane will continue west to Exit 241 (Idaho Springs/Colorado Boulevard). At Exit 241 (Idaho Springs/Colorado Boulevard), the right-most lane would become an exit-only lane and the westbound PPSL would be added to the left side of I-70. This is the only option that was considered for the three GPL options.

6.1.3.2 Express Lane Options

Analysis was completed to determine the best starting point for the EL and also the best configuration to consider at the west end of the Project where the EL will end and the PPSL will continue farther west.

6.1.3.2.1 Ingress/Egress Locations

In the case where the third lane will be an EL, a review of the highway characteristics between Exit 247 (Hyland Hills/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard) was conducted to determine locations for possible ingress and egress. The EL would have a ingress at its eastern limits or at the point where the EL starts. For safety reasons no ingress or egress would be allowed on the steep downgrade of Floyd Hill or between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden).

For both of the Action Alternatives, the section between Exit 244 (US 6/Golden) and Exit 243 (Hidden Valley/Central City) would either be in a tunnel for most of the distance of would be on curves with ramps entering and exiting I-70. In order to include an ingress/egress in this section the highway would have to be widened beyond the planned widths which would result in additional impacts. So no ingress/egress will be located in this section of the project.

The final segment between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard) is very curvy and has the Veterans Memorial Tunnels. There is a stretch of highway just west of the tunnels that could be used to allow ingress/egress to the EL. This section would also serve to provide the transition from the EL to the PPSL. On days when the PPSL is not open the EL lane would end and all vehicles would be required to merge right into the GPL. On days when the PPSL is open, vehicles would have the option to exit the EL to get to Idaho Springs or merge left into the start of the PPSL. Taking into consideration striping and signing requirements, weaving distances and required roadway widths required, it was determined that this section would allow egress from the EL to the left most GPL but there would not be any ingress from westbound I-70 into the EL/PPSL.

6.1.3.2.2 EL Starting Location

An analysis was completed to evaluate the best design for overlapping the start of the westbound EL with the existing westbound GPLs. In Existing Conditions, westbound I-70 has three GPL east of the Homestead Road interchange (top of Floyd Hill) and then the right lane is dropped just west of the interchange. Two options for adding a third westbound lane were identified for analysis: 3GP or 2GP + 1EL.

In the 3GP option, the three westbound GP lanes at the Homestead Road bridge will continue to the west up to Exit 241 (Idaho Springs/Colorado Boulevard), where the right-most GP lane becomes an exit-only lane and a new lane is added to the left side of westbound I-70 in the form of a PPSL. In the 2GP + 1EL option, the EL will be added as a new lane on the left side of the highway instead of having the left GP lane transition directly into an EL. This means that the right-most GP will still be dropped at the same location as Existing Conditions.

Analysis of the 2GP +1EL option considered varying the overlap lengths at the start of the EL (the distance where there would be the existing 3GP plus the new EL up to the point where the right-most GP is dropped at a location that is similar to Existing Conditions). The overlap is a combination of ingress area (dashed line where cars can enter the EL) and full lane (solid line/buffer lines that prohibits vehicles from entering the EL). The analyses considered overlaps starting just east of the Exit 247 (Hyland Hills/Floyd Hill) bridge and extending the start point to the east at approximately 0.5-mile intervals up to 2.5 miles. The EL would require overhead signing that would begin approximately 2 miles in advance (to the east) of the ingress zone, placing signs between 2 miles and 4.5 miles east of the Exit 247 (Hyland Hills/Floyd Hill) bridge. Exhibit 88 shows the approximate location of the overlaps and Exhibit 89 describes the length of the solid and dashed lines measured from the Homestead Road bridge.

Exhibit 88. Approximate EL Overlap Distances Evaluated

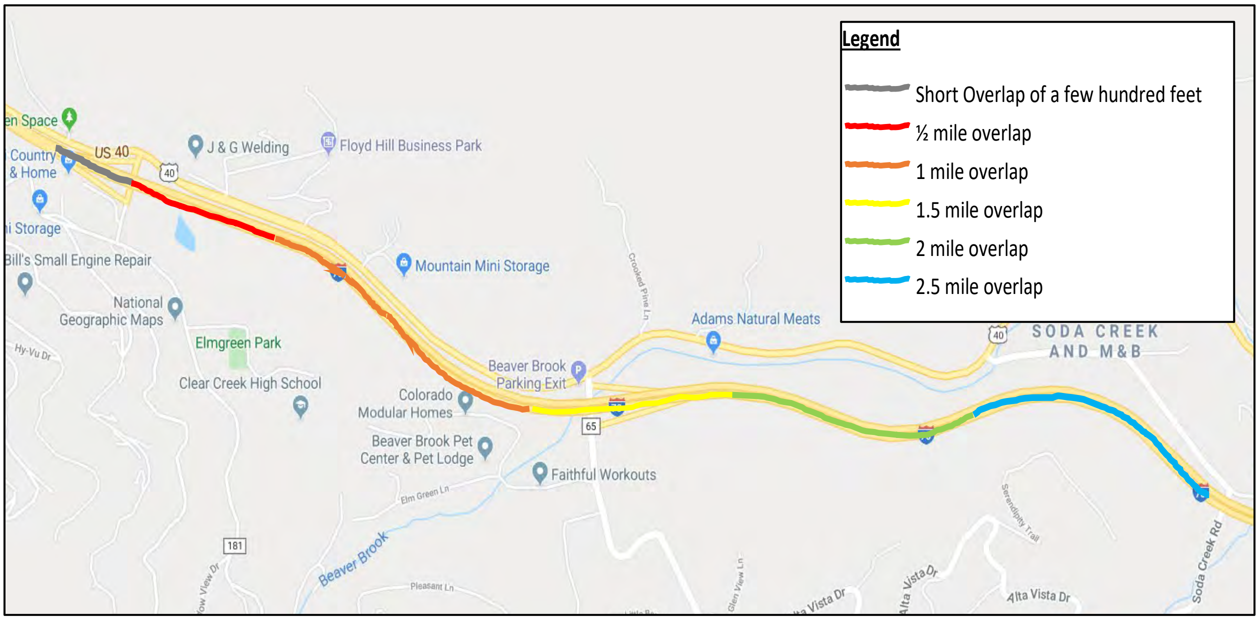


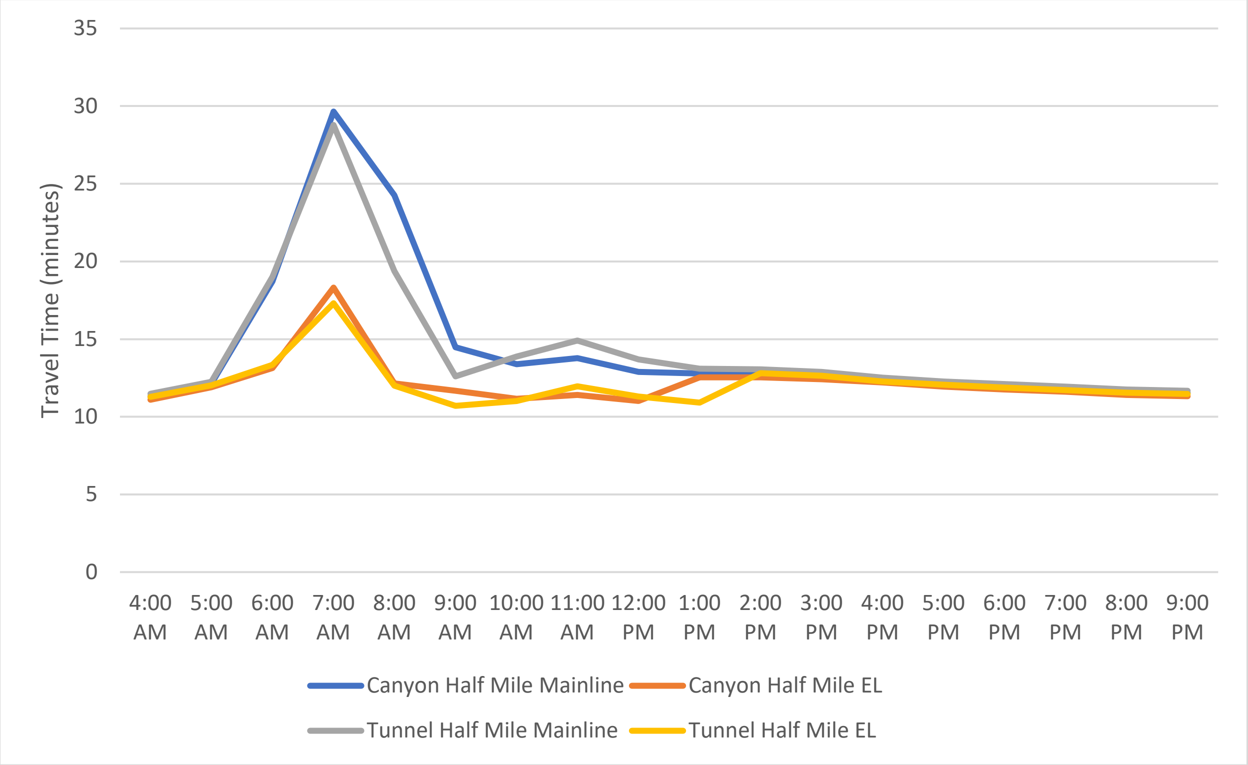
Exhibit 89. Description of Analyzed EL Overlaps

Overlap Length	EL Start (Solid Line) West of Bridge	Length of Ingress Area (Dashed Line)	Total Distance from Start of Lane Add (Dashed Line) to Bridge
Short	0 feet	1,050 feet	1,050 feet (0.20 mi)
0.5 Mile	1,800 feet	1,150 feet	2,950 feet (0.56 mi)
1 Mile	4,300 feet	1,150 feet	5,450 feet (1.03 mi)
1.5 Mile	7,500 feet	2,000 feet	9,500 feet (1.80 mi)
2 Mile	9,650 feet	1,280 feet	10,930 feet (2.07 mi)
2.5 Mile	11,750 feet	1,400 feet	13,150 feet (2.49 mi)

Each starting point for the EL was evaluated using the Canyon Viaduct Alternative model since this design results in more congestion at the bottom of Floyd Hill near the Exit 244 (US 6/Golden) interchange that extends east toward the start of the EL. The Tunnel Alternative includes a braided US 6 westbound entrance ramp and Hidden Valley exit ramp configuration that moves the start of the congestion/queuing farther to the west. Of the two action alternatives, the Canyon Viaduct Alternative is most likely to result in a queue that may extend east far enough to interact with the start of the EL.

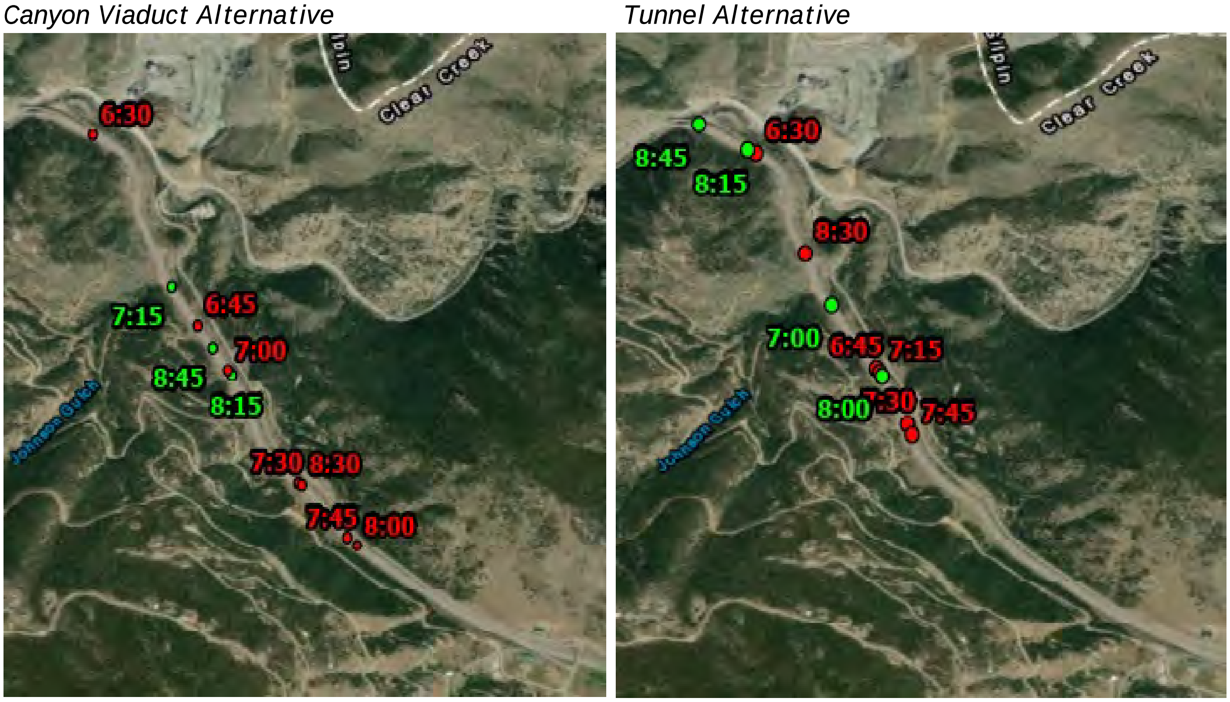
To verify this assumption, the Tunnel Alternative model was evaluated with a 0.5-mile overlap and compared to the results of the Canyon Viaduct Alternative with 0.5-mile overlap. The results for the queue analysis and travel times for the Tunnel and Canyon Viaduct Alternative 0.5-mile overlap comparison are shown in Exhibit 90 and Exhibit 91, respectively. Based on the results of the comparison, there is very little difference in the travel times for the two Alternatives, but the Canyon Viaduct Alternative does result in the longest queues near that extend farther to the east compared to the Tunnel Alternative. The queues in the Canyon Viaduct Alternative also take longer to dissipate compared to the Tunnel Alternative. Thus, the use of the Canyon Viaduct Alternative to evaluate all the EL overlaps provides the best information to determine a preferred EL overlap length.

Exhibit 90. Half-Mile EL Overlap Travel Times for Action Alternatives



Source: TransModeler microsimulation analysis.

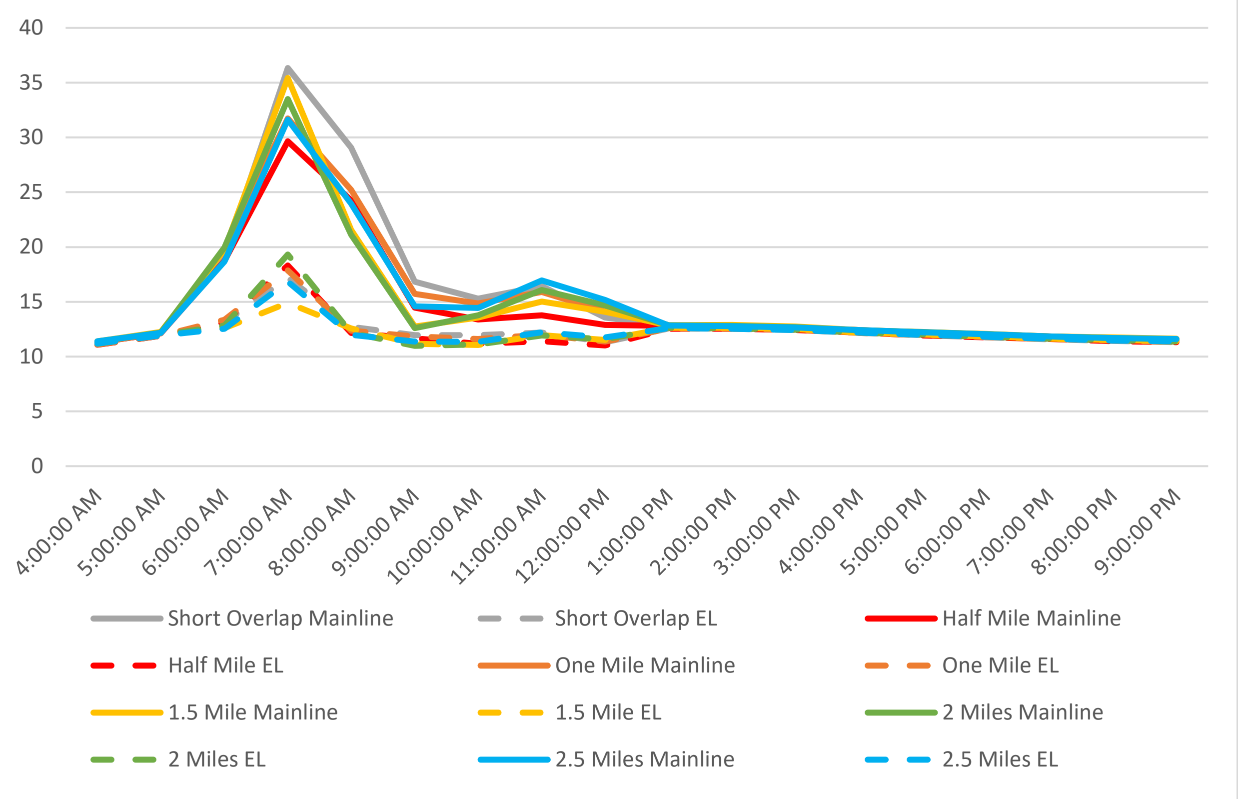
Exhibit 91. Half-Mile EL Overlap I-70 Queues for Action Alternatives



Note: The times in red are when the back of queue is increasing from west to east compared to the previous time period; the times in green are when the back of the queue is dissipating compared to the previous time period.

The different overlaps were each evaluated, and the resulting travel times are shown in Exhibit 92. The shortest overlap had the longest travel times, primarily because the start of the EL is downstream of congestion on I-70 and vehicles have to wait through the congestion before they can enter the EL. The .5-mile overlap distance had the shortest times, primarily because this location allowed vehicles to enter the EL before reaching congestion and is not located near any other merge/diverge areas related to interchanges in the area. Overlaps between 1 mile and 2.5 miles all had similar results but were not as good as the .5-mile overlap scenario. Once the EL start point was located near or east of the Exit 248 (Beaver Brook/Floyd Hill) exit ramp, vehicles are performing merge/diverge maneuvers on both sides of the highway, creating a secondary area of congestion. The difference in travel times between the different overlaps is about 6 minutes, or 20 percent spread between best and worst travel time.

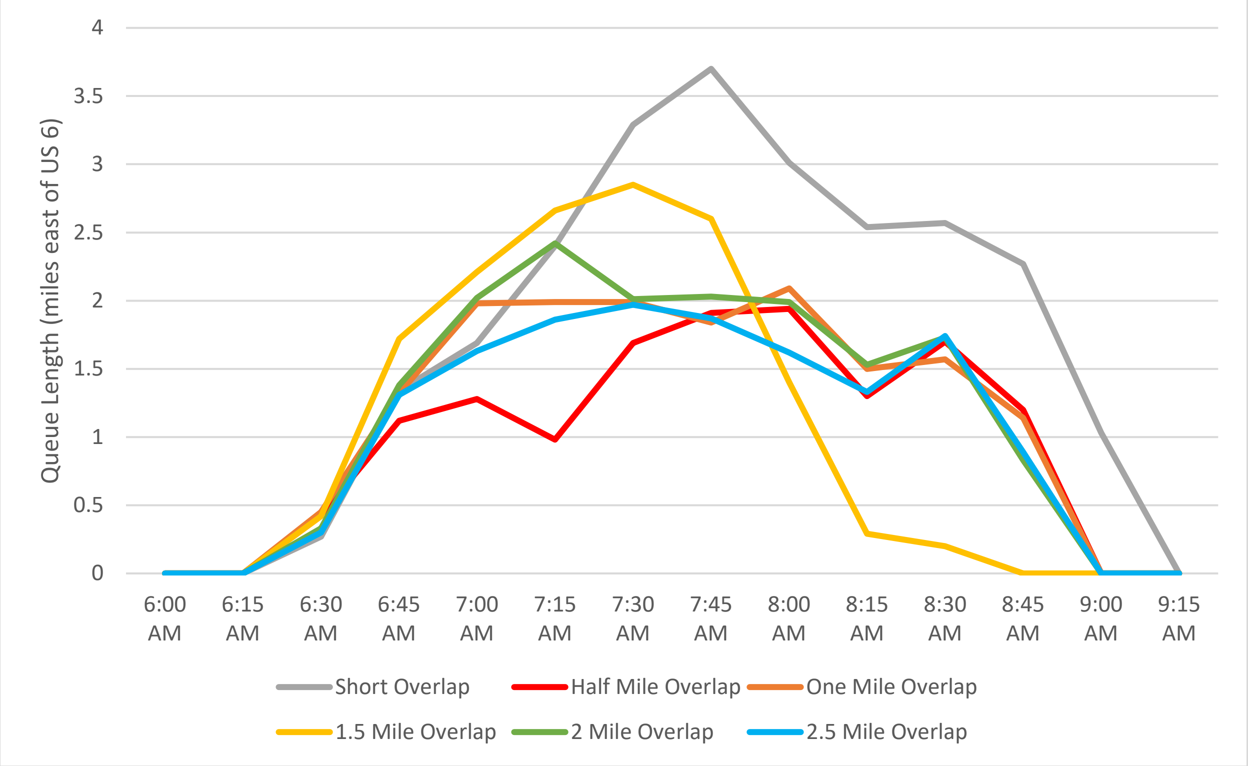
Exhibit 92. Westbound I-70 Travel Times for Evaluated EL Overlaps



Source: TransModeler microsimulation analysis.

In addition to travel times, an analysis of the queues on westbound I-70 for the different overlap lengths for the EL start point was completed. Exhibit 93 shows the temporal extent of queues on Floyd Hill for different EL start points. Westbound AM queuing occurs in three main places in the corridor: (1) at the bottom of Floyd Hill where US 6 traffic merges onto I-70, (2) at the location where the right most GP lane drops, and (3) just upstream of the EL start point as vehicles change lanes to position themselves to enter the EL. The figure shows queues starting from the bottom of Floyd Hill. The queues at the start of the EL generally are short in length and short in duration. The short overlap queues are the longest because the queuing near Exit 244 (US 6/Golden) spills into slowdown created by the EL start, creating one large queue. Variation in queues are relatively small between the 1-, 2-, and 2.5-mile models. The 1.5-mile overlap model has the queue on Floyd Hill dissipating soonest due to greater congestion at the EL start which meters traffic onto Floyd Hill. The start of the EL is close to CR 65 so there is a greater amount of lane changing occurring in the same place for the 1.5-mile model. The delay time is longer for the 1.5-mile overlap versus the 0.5-mile overlap during the peak hour. Finally, the 0.5-mile overlap model resulted in the lowest average queue on Floyd Hill.

Exhibit 93. Queue Length and Duration for Evaluated EL Overlaps



Source: TransModeler microsimulation analysis.

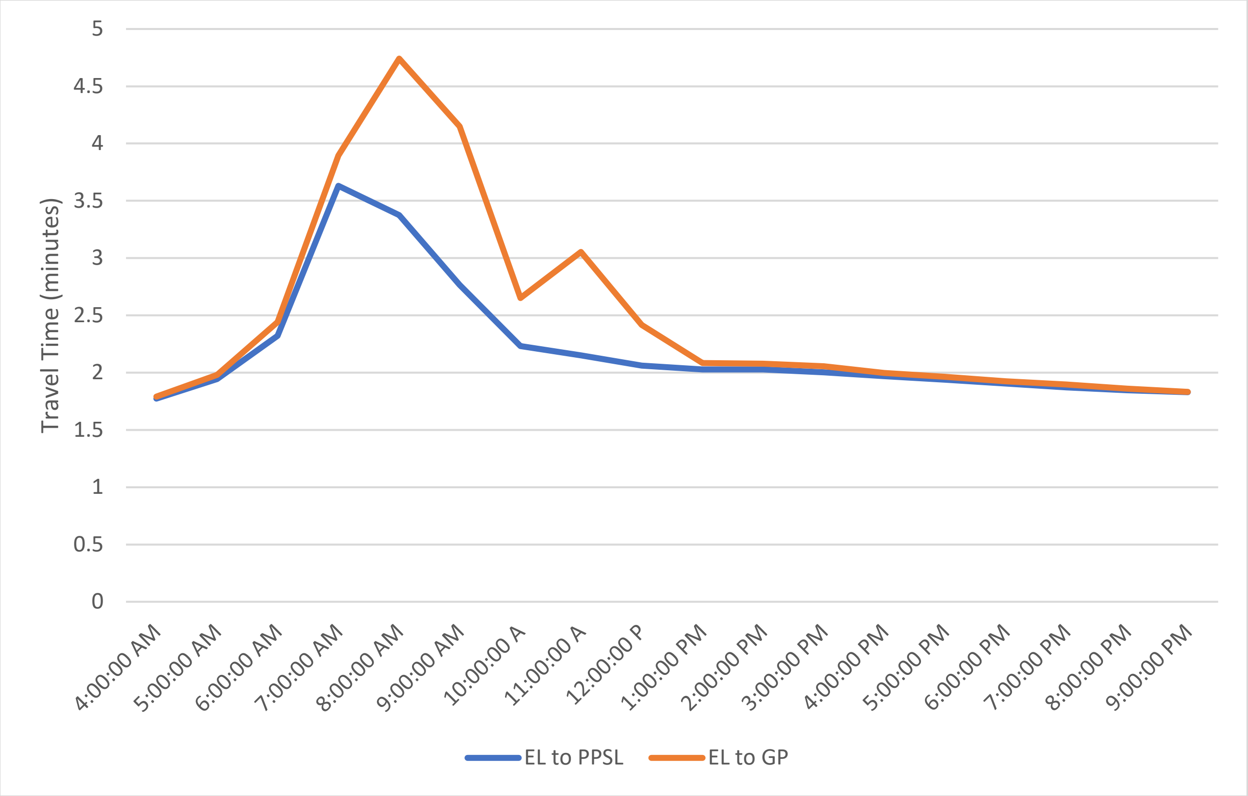
A final consideration in selecting the best EL start point was the potential impacts that widening westbound I-70 up to as much as two miles east of Exit 247 (Hyland Hills/Floyd Hill) would have on existing infrastructure, environment, and Project costs. The longer the EL is extended to the east, the more impacts it will cause, and the more cost will be associated with the Project. Based on the analysis presented of the different EL start options, starting the EL at a location roughly one-half mile east of the bridge at Exit 247 (Hyland Hills/Floyd Hill) would provide good operational results and create fewer impacts.

6.1.3.2.3 EL Termini Configuration

Two different configurations of the western end of the Express Lane were considered. One configuration has the Express Lane continuing directly into the left-most GPL west of Exit 241 (Idaho Springs/Colorado Boulevard), with the right-most GPL becoming an exit-only lane at Exit 241 (Idaho Springs/Colorado Boulevard). In this configuration, the westbound PPSL develops to the left of the left-most GP lane west of Exit 241 (Idaho Springs/Colorado Boulevard). The second configuration has the EL continuing into the westbound PPSL directly, the two GPLs continue into GPLs, and an exit lane is added to the right side for Exit 241 (Idaho Springs/Colorado Boulevard). This configuration was modeled with the EL to PPSL transition occurring just east of Exit 241 (Idaho Springs/Colorado Boulevard).

Travel times from Exit 243 (Hidden Valley/Central City)to Exit 241 (Idaho Springs/Colorado Boulevard) in the GPL are shown in Exhibit 94 for the two EL end options. The EL to GPL option results in longer travel times during peak hours than the EL to PPSL option (about 1 to 1.5 minutes longer). The longer travel time for the EL to GPL option is caused by the additional lane changing necessary due to the right GPL being dropped off at Exit 241, which is exacerbated under peak conditions. During off-peak times, there is no travel time difference between the EL to PPSL option and EL to GPL option.

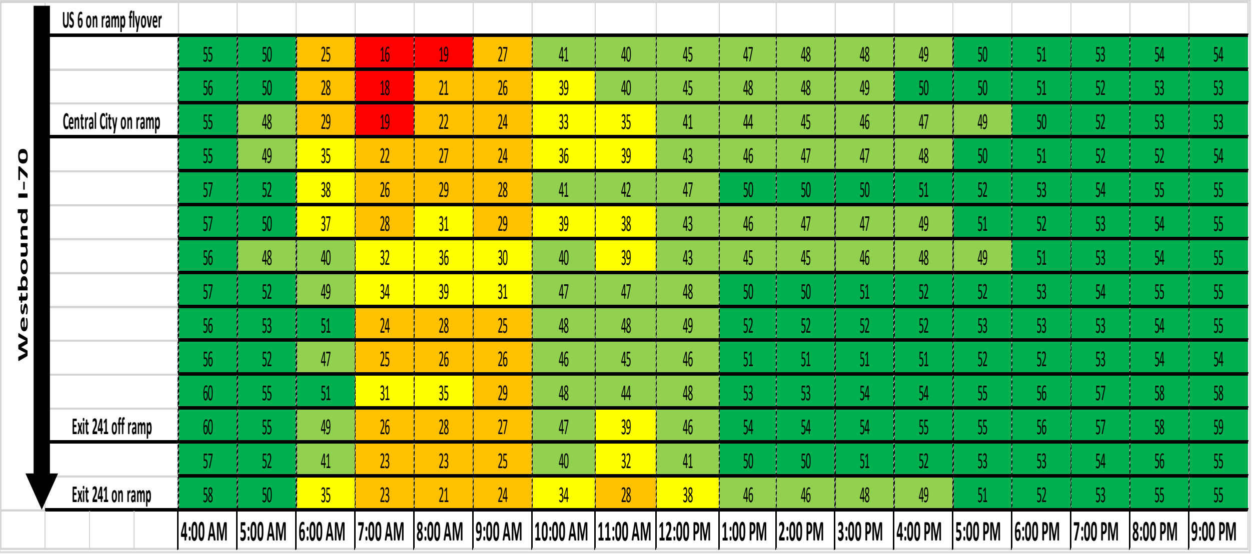
Exhibit 94. EL Termination Options - Winter Saturdays Westbound I-70 Travel Time



Source: TransModeler microsimulation analysis.

Exhibit 95 and Exhibit 96 show the speed diagrams for the EL to PPSL and EL to GPL options. Comparing the two speed diagrams, the EL to PPSL option has higher speeds at peak times compared to the EL to GPL option.

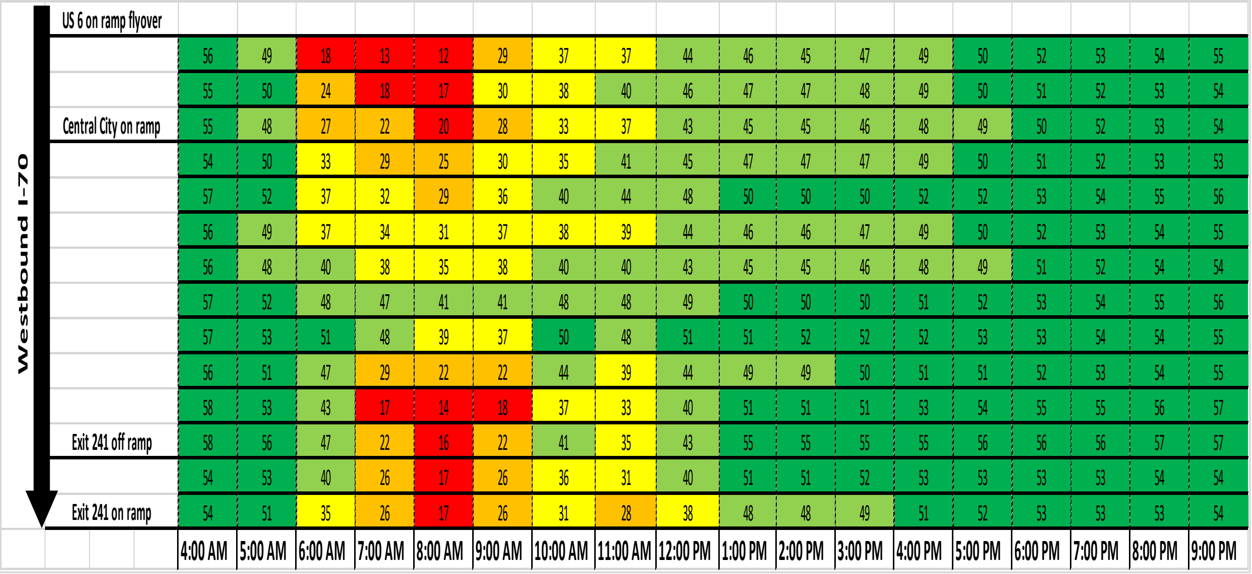
Exhibit 95. EL to PPSL Winter Saturdays Westbound I-70 Speed Diagram



	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM
US 6 on ramp flyover																		
	55	50	25	16	19	27	41	40	45	47	48	48	49	50	51	53	54	54
	56	50	28	18	21	26	39	40	45	48	48	49	50	50	51	52	53	53
Central City on ramp	55	48	29	19	22	24	33	35	41	44	45	46	47	49	50	52	53	53
	55	49	35	22	27	24	36	39	43	46	47	47	48	50	51	52	52	54
	57	52	38	26	29	28	41	42	47	50	50	50	51	52	53	54	55	55
	57	50	37	28	31	29	39	38	43	46	47	47	49	51	52	53	54	55
	56	48	40	32	36	30	40	39	43	45	45	46	48	49	51	53	54	55
	57	52	49	34	39	31	47	47	48	50	50	51	52	52	53	54	55	55
	56	53	51	24	28	25	48	48	49	52	52	52	52	53	53	53	54	55
	56	52	47	25	26	26	46	45	46	51	51	51	51	52	52	53	54	54
	60	55	51	31	35	29	48	44	48	53	53	54	54	55	56	57	58	58
Exit 241 off ramp	60	55	49	26	28	27	47	39	46	54	54	54	55	55	56	57	58	59
	57	52	41	23	23	25	40	32	41	50	50	51	52	53	53	54	56	55
Exit 241 on ramp	58	50	35	23	21	24	34	28	38	46	46	48	49	51	52	53	55	55

Source: TransModeler microsimulation analysis.

Exhibit 96. EL to GPL Winter Saturdays Westbound I-70 Speed Diagram



	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM
US 6 on ramp flyover																		
	56	49	18	13	12	29	37	37	44	46	45	47	49	50	52	53	54	55
	55	50	24	18	17	30	38	40	46	47	47	48	49	50	51	52	53	54
Central City on ramp	55	48	27	22	20	28	33	37	43	45	45	46	48	49	50	52	53	54
	54	50	33	29	25	30	35	41	45	47	47	47	49	50	51	52	53	53
	57	52	37	32	29	36	40	44	48	50	50	50	52	52	53	54	55	56
	56	49	37	34	31	37	38	39	44	46	46	47	49	50	52	53	54	55
	56	48	40	38	35	38	40	40	43	45	45	46	48	49	51	52	54	54
	57	52	48	47	41	41	48	48	49	50	50	50	51	52	53	54	55	56
	57	53	51	48	39	37	50	48	51	51	52	52	52	53	53	54	54	55
	56	51	47	29	22	22	44	39	44	49	49	50	51	51	52	53	54	55
	58	53	43	17	14	18	37	33	40	51	51	51	53	54	55	55	56	57
Exit 241 off ramp	58	56	47	22	16	22	41	35	43	55	55	55	55	56	56	56	57	57
	54	53	40	26	17	26	36	31	40	51	51	52	53	53	53	53	54	54
Exit 241 on ramp	54	51	35	26	17	26	31	28	38	48	48	49	51	52	53	53	53	54

Source: TransModeler microsimulation analysis.

Based on the results, it was recommended to have the express lane flow into the PPSL and not create a situation where the right GPL was forced to become an exit-only lane at Exit 241 (Idaho Springs/Colorado Boulevard). When the right GPL becomes an exit-only lane, the vehicles (mostly large vehicles) are forced to merge to the left at the same location where there is a significant impact to operations on I-70 resulting in congestion for long periods of time and queues that would spill back to the east from Exit 241 (Idaho Springs/Colorado Boulevard).

6.1.4 Interchange Configuration

All the interchanges in the study area were evaluated to optimize access to and from I-70. The following is a summary of the locations and evaluations that were completed to best optimize access in the study area.

6.1.4.1 US 6 Interchange

The current configuration of Exit 244 (US 6/Golden) provides three of four movements: westbound off and on, and eastbound off. In the action alternatives, the new frontage road connection between Exit 244 (US 6/Golden) and Exit 243 (Hidden Valley/Central City) results in possible rerouting of traffic through the area. To optimize access in the area and determine the best ramp configuration that will minimize impacts to the operations of I-70, US 6, and the interchanges in the area, different ramp configurations were considered.

In all alternatives, a new eastbound on-ramp is added at Exit 244 (US 6/Golden), which is not a ramp in the Existing Conditions or No Action options. This new ramp provides additional access to I-70 and was added with the goal of reducing the amount of traffic that uses US 40 to bypass I-70. In all alternatives, the analysis considered removal of the eastbound off-ramp at Exit 244 (US 6/Golden). Traffic would exit at Exit 243 (Hidden Valley/Central City) and use the frontage road to continue east on US 6. The results of this analysis are discussed in more detail in Section 6.1.6, Intersection Types. For the westbound ramps, it was decided that the westbound off-ramp would remain in place, but the different alternative alignments of I-70 would impact the westbound on-ramp.

6.1.4.1.1 Westbound US 6 On-Ramp in the Tunnel Alternative

In the Tunnel Alternative, three options were considered for the westbound on-ramp. One option had the westbound on-ramp entering I-70 east of the westbound off-ramp to Exit 243 (Hidden Valley/Central City). This was considered the braided option and is shown in Exhibit 97. The second US 6 ramp configuration modeled, referred to as non-braided (see Exhibit 98), also has a westbound on-ramp from US 6 flying over I-70, but it is not braided with the Exit 243 (Hidden Valley/Central City) westbound off-ramp. In this configuration, a continuous auxiliary lane extends approximately 1,550 feet from the US 6 on-ramp to the Hidden Valley/Central City westbound off-ramp. The third option eliminated the westbound on-ramp and routed all westbound US 6 traffic to Exit 243 (Hidden Valley/Central City), where traffic would flow through the ramp terminal intersection and use the on-ramp at this interchange to enter westbound I-70.

Exhibit 97. Braided Flyover Ramp Configuration for Tunnel Action Alternative

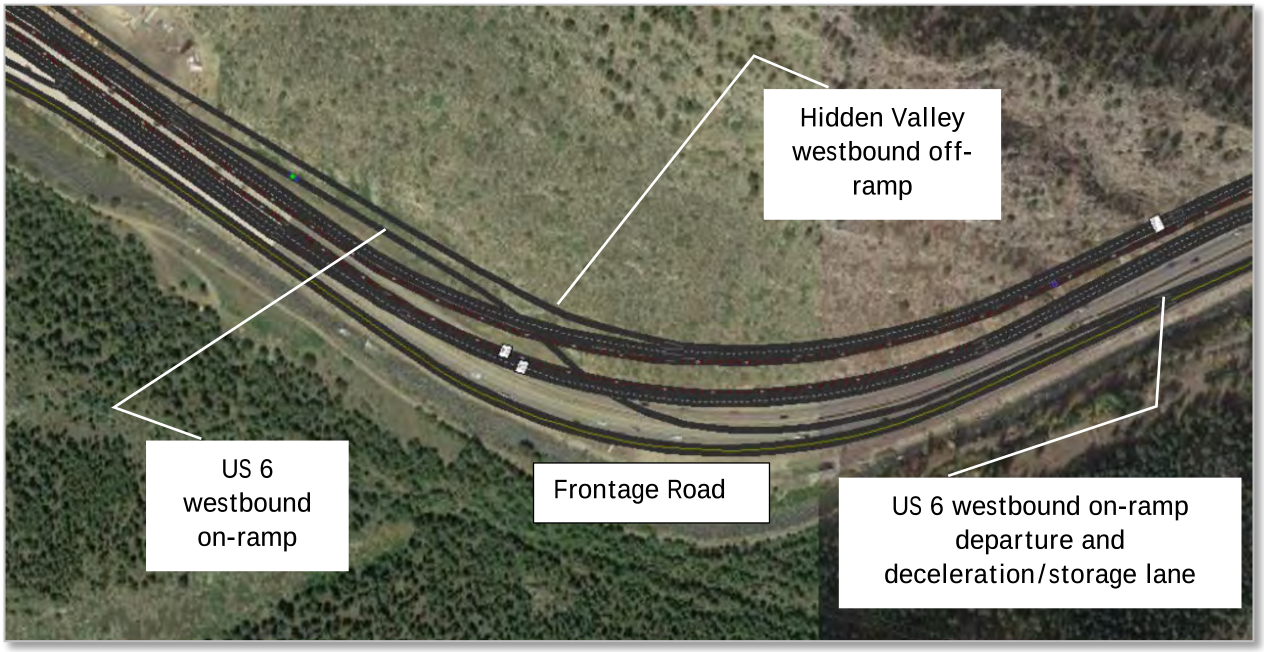
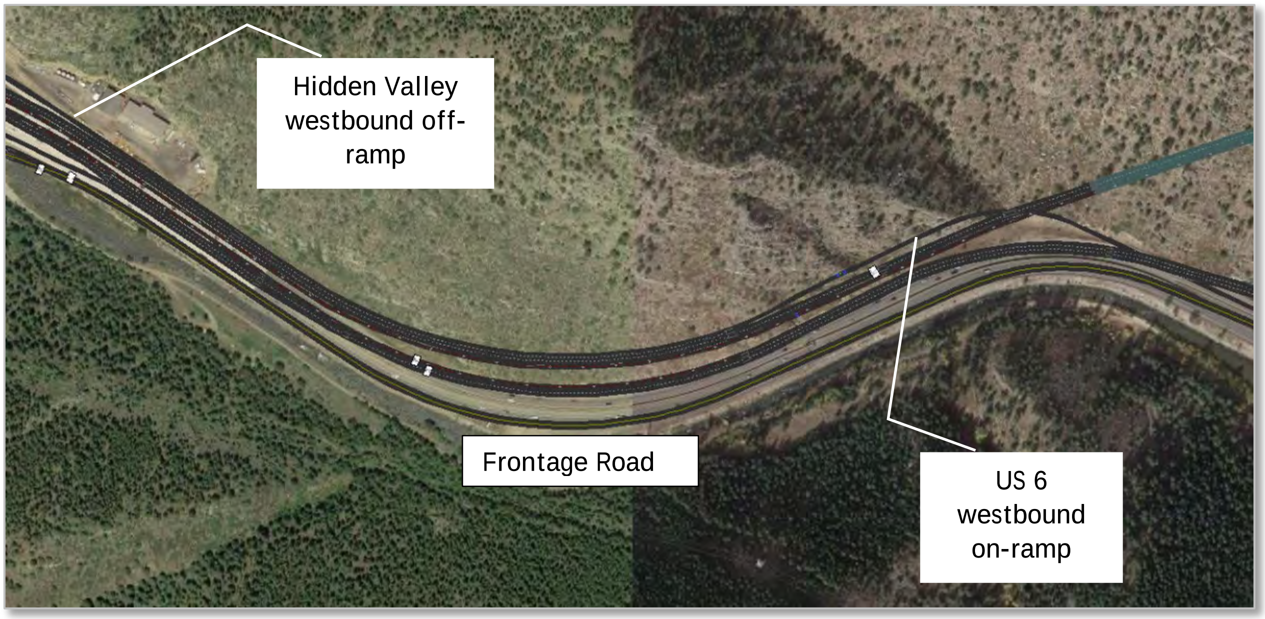
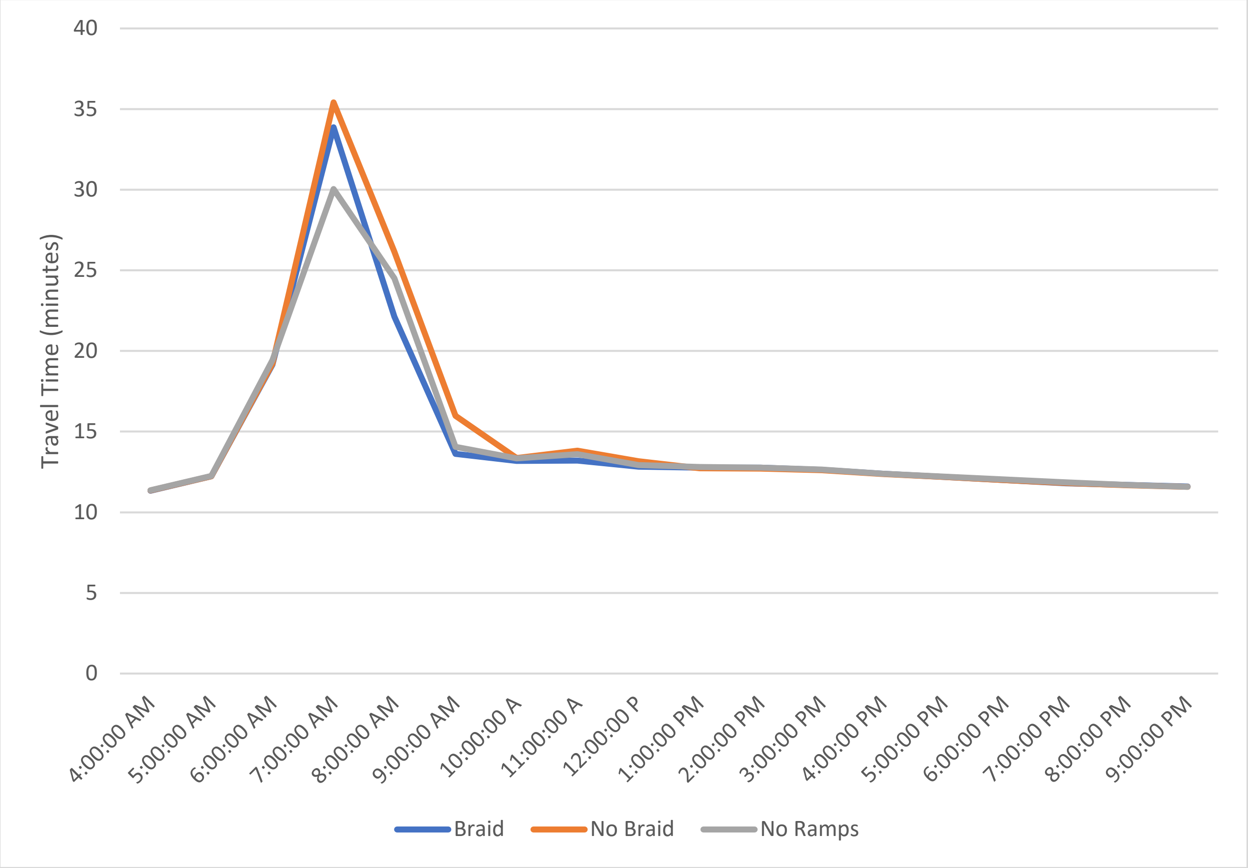


Exhibit 98. Non-Braided Ramp Configuration for Tunnel Action Alternative



Analysis of the ramp options first evaluated travel times on I-70. Exhibit 99 shows the westbound winter Saturdays travel time through the study area for the three different westbound ramp configurations at Exit 244 (US 6/Golden). The option with no westbound US 6 on-ramp has a slightly lower travel time (14 percent less), as operations on mainline I-70 are slightly improved by removing the friction associated with the merge area for this ramp. There is essentially no difference between the braided and non-braided options. This is expected since there are very few vehicles exiting at Exit 243 (Hidden Valley/Central City) during the westbound morning peak.

Exhibit 99. Ramp Alternatives Winter Saturdays Westbound I-70 WB Travel Time

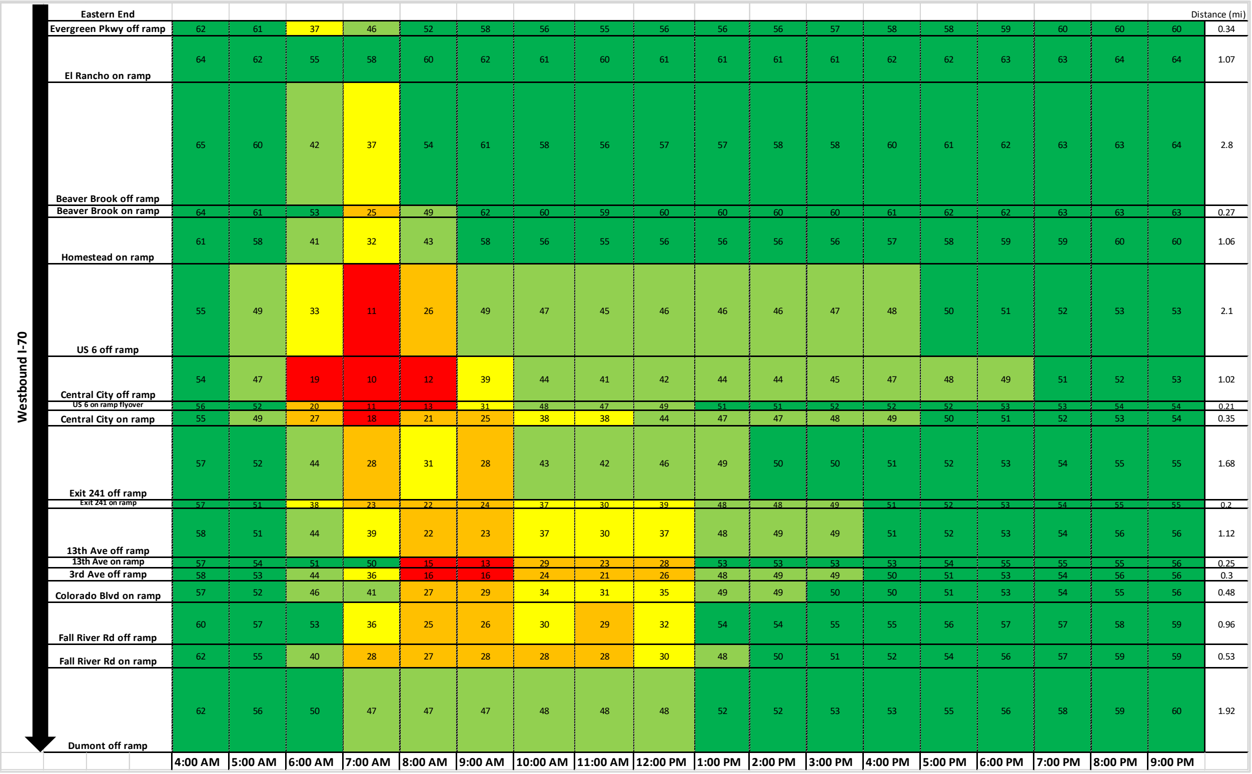


Source: TransModeler microsimulation analysis.

Next, the analysis looked at the impacts that the different ramp configurations would have on I-70 speeds and congestion. Winter Saturday westbound speed diagrams are shown in Exhibit 100, Exhibit 101, and Exhibit 102 for the braided, non-braided, and no-ramp options, respectively. Comparing the heat diagrams for the braided and non-braided options shows almost no difference between the two options. The heat diagram for the no-ramp option shows higher speeds on I-70. Higher speeds are expected on

I-70 under the no-ramp option since fewer vehicles from US 6 can enter I-70 without a dedicated ramp, which preserves the mainline at the expense of US 6.

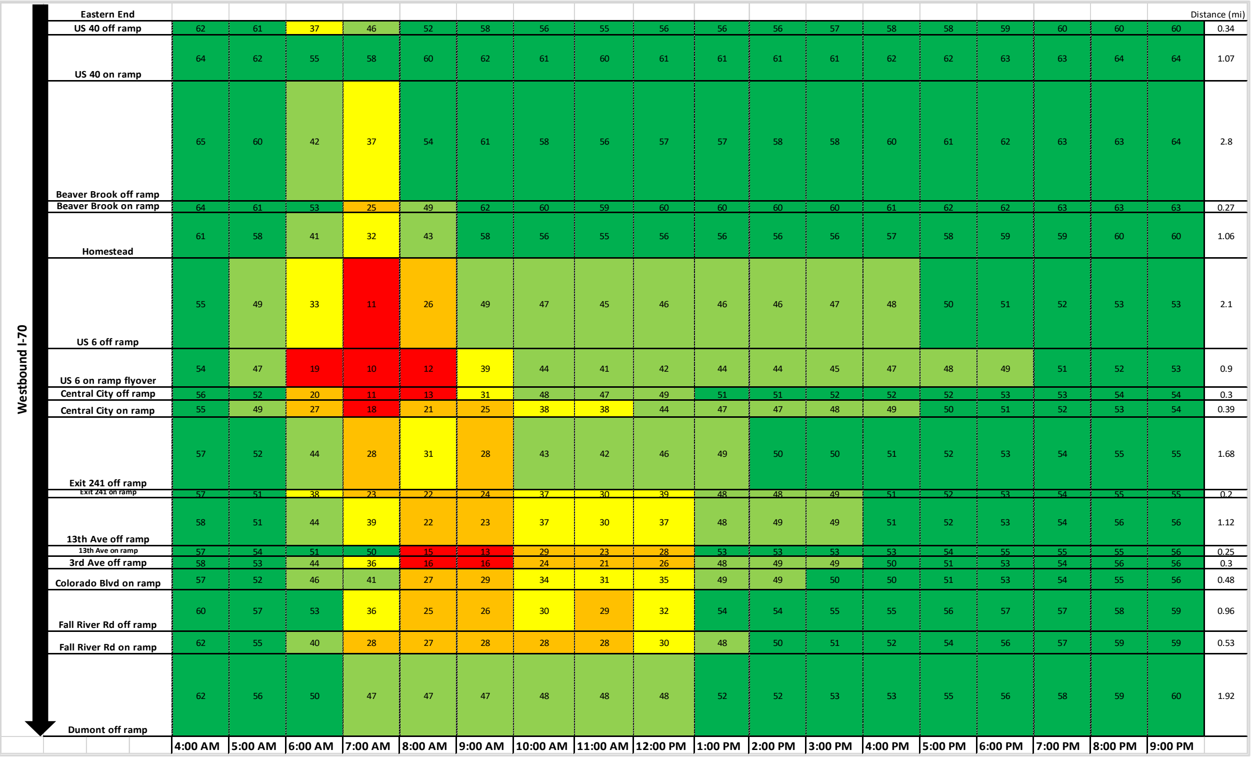
Exhibit 100. Braided Flyover Winter Saturdays Westbound I-70 Speed Diagram



Westbound I-70	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	Distance (mi)
Eastern End																			
Evergreen Pkwy off ramp	62	61	37	46	52	58	56	55	56	56	56	57	58	58	59	60	60	60	0.34
El Rancho on ramp	64	62	55	58	60	62	61	60	61	61	61	61	62	62	63	63	64	64	1.07
Beaver Brook off ramp	65	60	42	37	54	61	58	56	57	57	58	58	60	61	62	63	63	64	2.8
Beaver Brook on ramp	64	61	53	25	49	62	60	59	60	60	60	60	61	62	62	63	63	63	0.27
Homestead on ramp	61	58	41	32	43	58	56	55	56	56	56	56	57	58	59	59	60	60	1.06
US 6 off ramp	55	49	33	11	26	49	47	45	46	46	46	47	48	50	51	52	53	53	2.1
Central City off ramp	54	47	19	10	12	39	44	41	42	44	44	45	47	48	49	51	52	53	1.02
US 6 on ramp flyover	56	52	20	11	13	31	48	47	49	51	51	52	52	52	53	53	54	54	0.21
Central City on ramp	55	49	27	18	21	25	38	38	44	47	47	48	49	50	51	52	53	54	0.35
Exit 241 off ramp	57	52	44	28	31	28	43	42	46	49	50	50	51	52	53	54	55	55	1.68
Exit 241 on ramp	57	51	38	23	22	24	37	30	39	48	48	49	51	52	53	54	55	55	0.2
13th Ave off ramp	58	51	44	39	22	23	37	30	37	48	49	49	51	52	53	54	56	56	1.12
13th Ave on ramp	57	54	51	50	15	13	29	23	28	53	53	53	53	54	55	55	55	56	0.25
3rd Ave off ramp	58	53	44	36	16	16	24	21	26	48	49	49	50	51	53	54	56	56	0.3
Colorado Blvd on ramp	57	52	46	41	27	29	34	31	35	49	49	50	50	51	53	54	55	56	0.48
Fall River Rd off ramp	60	57	53	36	25	26	30	29	32	54	54	55	55	56	57	57	58	59	0.96
Fall River Rd on ramp	62	55	40	28	27	28	28	28	30	48	50	51	52	54	56	57	59	59	0.53
Dumont off ramp	62	56	50	47	47	47	48	48	48	52	52	53	53	55	56	58	59	60	1.92

Source: TransModeler microsimulation analysis.

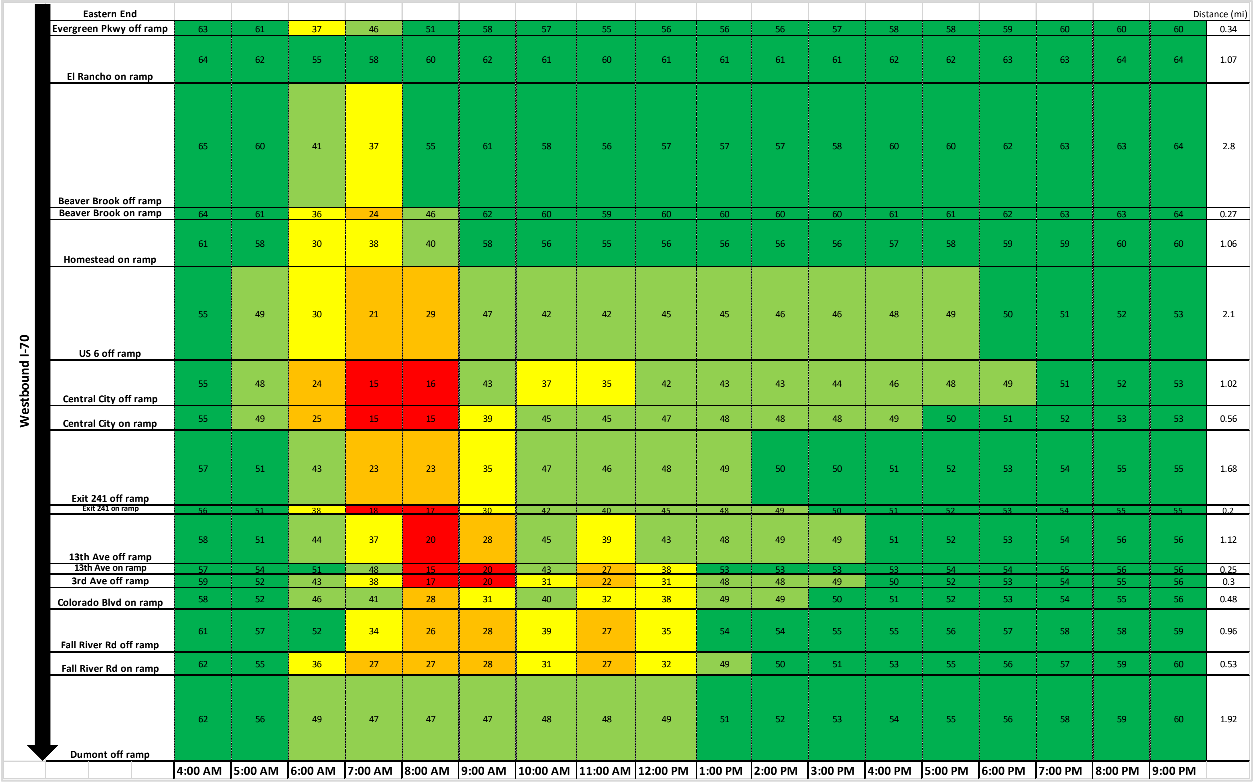
Exhibit 101. Non-Braided Winter Saturdays Westbound I-70 Speed Diagram



Westbound I-70	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	Distance (mi)
Eastern End																			
US 40 off ramp	62	61	37	46	52	58	56	55	56	56	56	57	58	58	59	60	60	60	0.34
US 40 on ramp	64	62	55	58	60	62	61	60	61	61	61	61	62	62	63	63	64	64	1.07
Beaver Brook off ramp	65	60	42	37	54	61	58	56	57	57	58	58	60	61	62	63	63	64	2.8
Beaver Brook on ramp	64	61	53	25	49	62	60	59	60	60	60	60	61	62	62	63	63	63	0.27
Homestead	61	58	41	32	43	58	56	55	56	56	56	56	57	58	59	59	60	60	1.06
US 6 off ramp	55	49	33	11	26	49	47	45	46	46	46	47	48	50	51	52	53	53	2.1
US 6 on ramp flyover	54	47	19	10	12	39	44	41	42	44	44	45	47	48	49	51	52	53	0.9
Central City off ramp	56	52	20	11	13	31	48	47	49	51	51	52	52	52	53	53	54	54	0.3
Central City on ramp	55	49	27	18	21	25	38	38	44	47	47	48	49	50	51	52	53	54	0.39
Exit 241 off ramp	57	52	44	28	31	28	43	42	46	49	50	50	51	52	53	54	55	55	1.68
Exit 241 on ramp	57	51	38	23	22	24	37	30	39	48	48	49	51	52	53	54	55	55	0.2
13th Ave off ramp	58	51	44	39	22	23	37	30	37	48	49	49	51	52	53	54	56	56	1.12
13th Ave on ramp	57	54	51	50	15	13	29	23	28	53	53	53	53	54	55	55	55	56	0.25
3rd Ave off ramp	58	53	44	36	16	16	24	21	26	48	49	49	50	51	53	54	56	56	0.3
Colorado Blvd on ramp	57	52	46	41	27	29	34	31	35	49	49	50	50	51	53	54	55	56	0.48
Fall River Rd off ramp	60	57	53	36	25	26	30	29	32	54	54	55	55	56	57	57	58	59	0.96
Fall River Rd on ramp	62	55	40	28	27	28	28	28	30	48	50	51	52	54	56	57	59	59	0.53
Dumont off ramp	62	56	50	47	47	47	48	48	48	52	52	53	53	55	56	58	59	60	1.92

Source: TransModeler microsimulation analysis.

Exhibit 102. No Ramps Winter Saturdays Westbound I-70 Speed Diagram



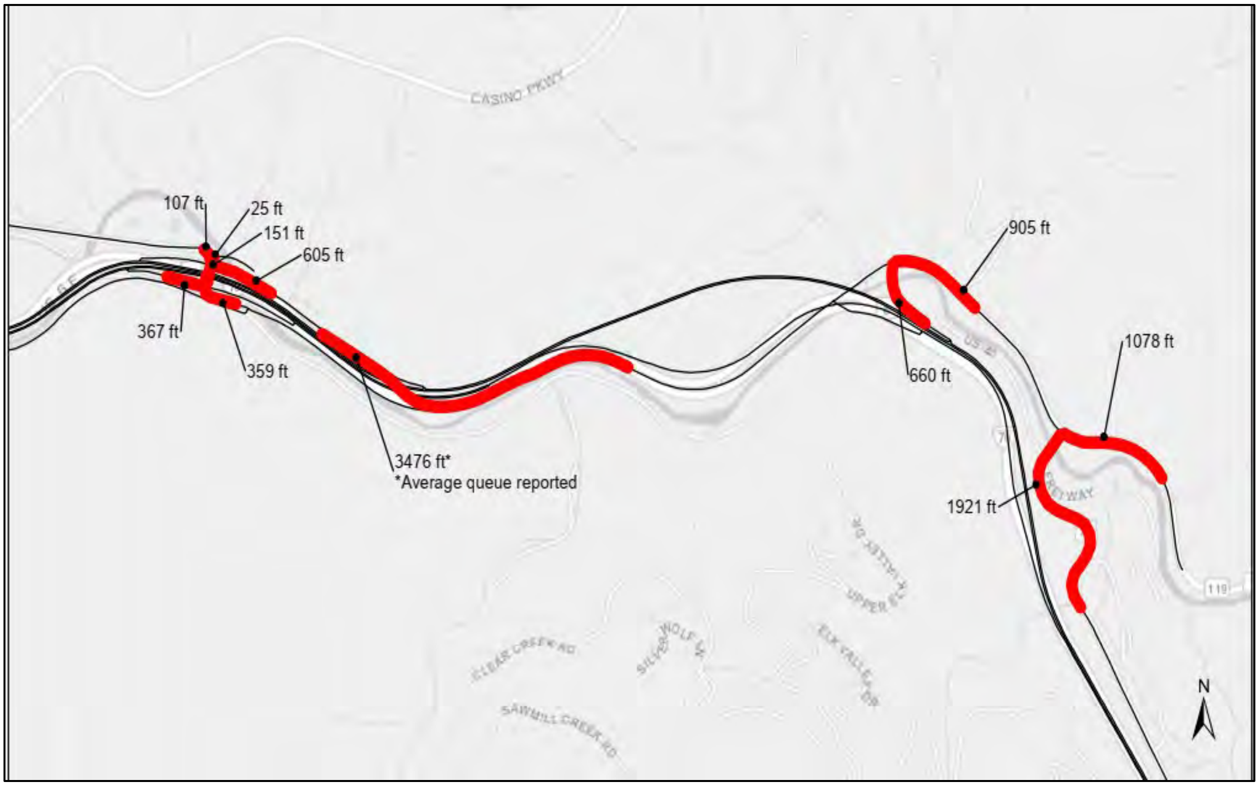
Eastern End																			Distance (mi)
Evergreen Pkwy off ramp	63	61	37	46	51	58	57	55	56	56	56	57	58	58	59	60	60	60	0.34
El Rancho on ramp	64	62	55	58	60	62	61	60	61	61	61	61	62	62	63	63	64	64	1.07
Beaver Brook off ramp	65	60	41	37	55	61	58	56	57	57	57	58	60	60	62	63	63	64	2.8
Beaver Brook on ramp	64	61	36	24	46	62	60	59	60	60	60	60	61	61	62	63	63	64	0.27
Homestead on ramp	61	58	30	38	40	58	56	55	56	56	56	56	57	58	59	59	60	60	1.06
US 6 off ramp	55	49	30	21	29	47	42	42	45	45	46	46	48	49	50	51	52	53	2.1
Central City off ramp	55	48	24	15	16	43	37	35	42	43	43	44	46	48	49	51	52	53	1.02
Central City on ramp	55	49	25	15	15	39	45	45	47	48	48	48	49	50	51	52	53	53	0.56
Exit 241 off ramp	57	51	43	23	23	35	47	46	48	49	50	50	51	52	53	54	55	55	1.68
Exit 241 on ramp	56	51	38	18	17	30	42	40	45	48	49	50	51	52	53	54	55	55	0.2
13th Ave off ramp	58	51	44	37	20	28	45	39	43	48	49	49	51	52	53	54	56	56	1.12
13th Ave on ramp	57	54	51	48	15	20	43	27	38	53	53	53	53	54	54	55	56	56	0.25
3rd Ave off ramp	59	52	43	38	17	20	31	22	31	48	48	49	50	52	53	54	55	56	0.3
Colorado Blvd on ramp	58	52	46	41	28	31	40	32	38	49	49	50	51	52	53	54	55	56	0.48
Fall River Rd off ramp	61	57	52	34	26	28	39	27	35	54	54	55	55	56	57	58	58	59	0.96
Fall River Rd on ramp	62	55	36	27	27	28	31	27	32	49	50	51	53	55	56	57	59	60	0.53
Dumont off ramp	62	56	49	47	47	47	48	48	49	51	52	53	54	55	56	58	59	60	1.92
	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	

Source: TransModeler microsimulation analysis.

Additional analysis looked at queues at the interchanges and intersections in the area of the Exit 244 (US 6/Golden) and Exit 243 (Hidden Valley/Central City) interchanges. 95th percentile queues are shown in Exhibit 103, Exhibit 104, and Exhibit 105 for the braided, non-braided, and no-ramp options, respectively. The longest queue for vehicles entering I-70 (average queue of 8,533 feet) was observed in the no-ramp option, which was expected since all US 6 traffic entering I-70 must travel through the Exit 243 (Hidden Valley/Central City) interchange. In the braided and non-braided options, US 6 traffic entering I-70 was split between the dedicated US 6 ramp and the Exit 243 (Hidden Valley/Central City) interchange. Splitting between the dedicated ramp and the interchange allows for vehicles to enter the freeway at a greater rate in the braided and non-braided options compared to the no-ramp option.

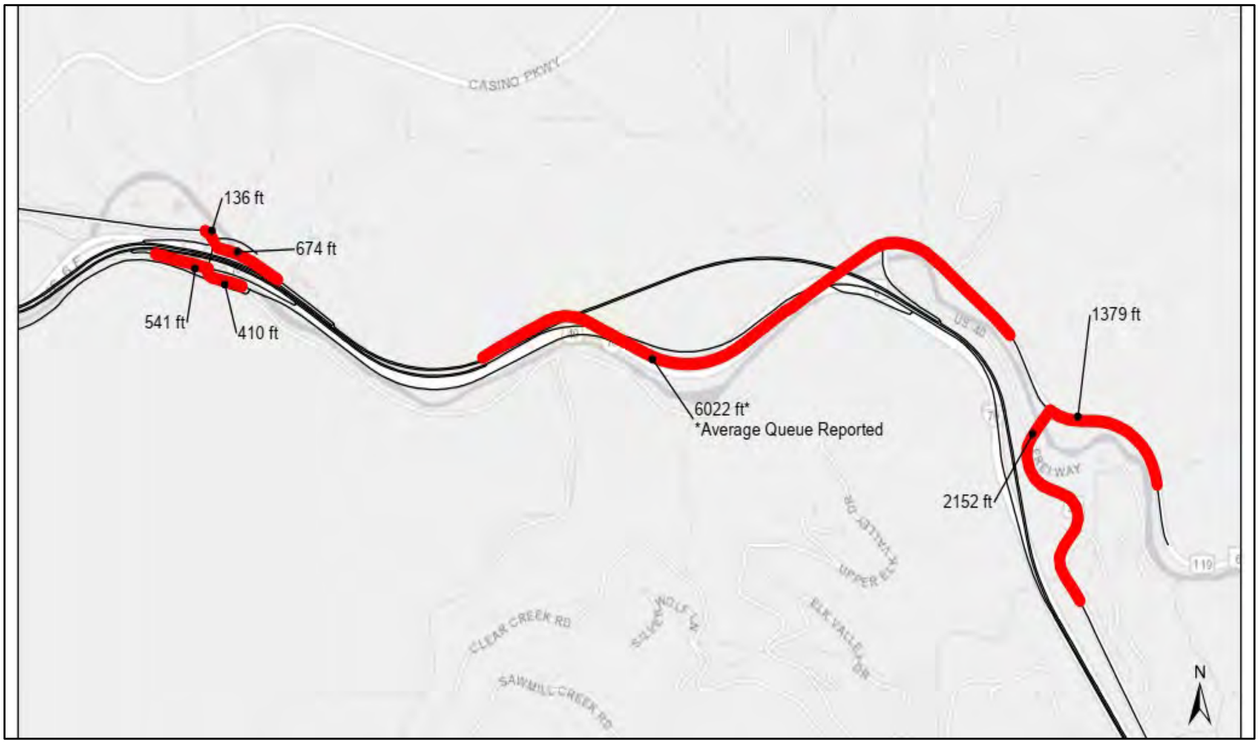
Comparing queues for the braided and non-braided options, the braided option has a considerably shorter average queue for the flyover on-ramp than the non-braided option (3,476 feet for braided, 6,022 feet for non-braided). The shorter queue of the braided option is attributed to reduced spillback. The braided option moves the westbound US 6 on-ramp farther west as compared to the location of the WB US 6 on-ramp in the non-braided option. Moving the on-ramp farther west prevents the queue from causing spillback at the upstream intersections, reducing queues in the braided option.

Exhibit 103. Braided Flyover 95th Percentile Queue Lengths



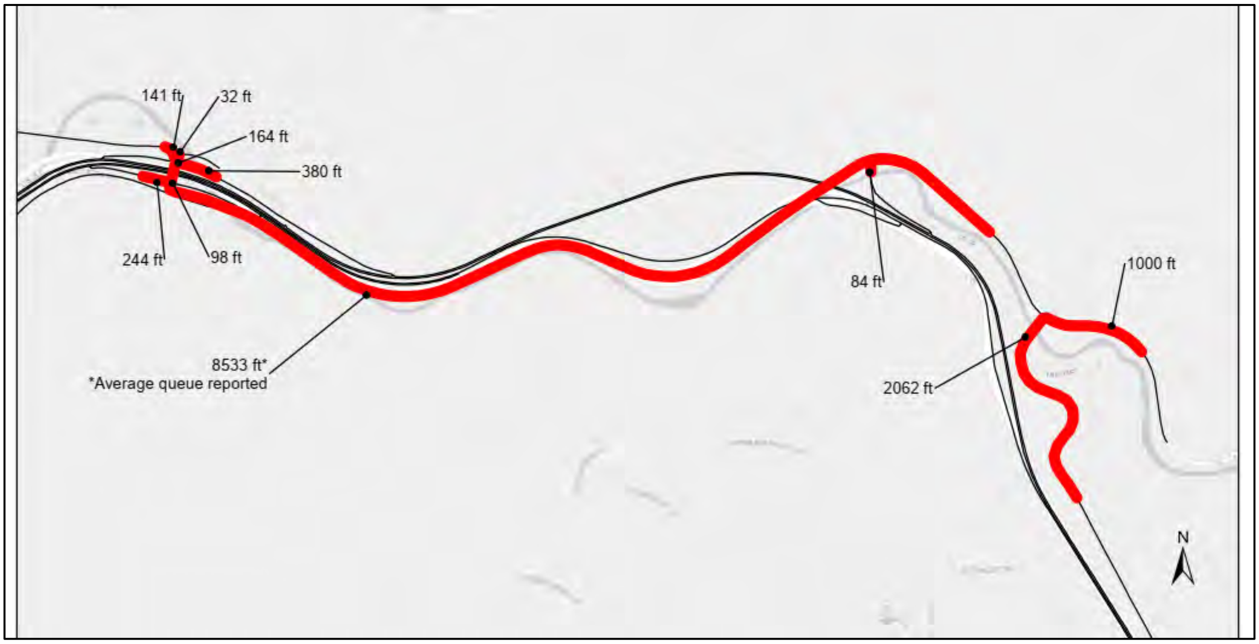
Source: TransModeler microsimulation analysis.

Exhibit 104. Non-Braided 95th Percentile Queue Lengths



Source: TransModeler microsimulation analysis.

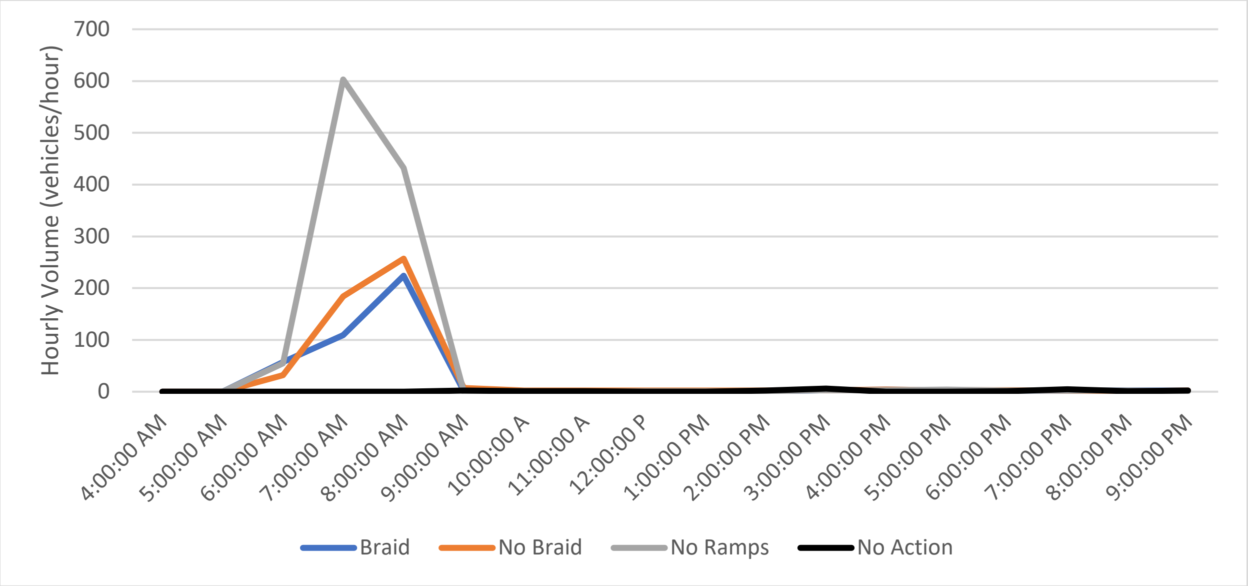
Exhibit 105. **No Westbound US 6 On-Ramp 95th Percentile Queue Lengths**



Source: TransModeler microsimulation analysis.

Finally, when congestion on I-70 is at its worst, some vehicles will choose to stay on the frontage road system to Idaho Springs before entering I-70. Exhibit 106 shows the expected volume on CR 314, the alternate route to I-70 used to travel to Idaho Springs from the Hidden Valley/Central City Interchange area, for the different westbound US 6 ramp options. The option with the most vehicles rerouting to avoid I-70 is the no-ramp option. In the no-ramp option, traffic continues into Idaho Springs to avoid long queues to enter I-70. The braided option has slightly fewer vehicles on CR 314 as compared to the non-braided option.

Exhibit 106. **Winter Saturdays Volume on CR 314 for US 6 Ramp Options**



Source: TransModeler microsimulation analysis.

Based on the modeled performance of the ramp configurations at US 6, the preferred ramp configuration is the braided option. The no-ramp option was eliminated due to excessive queuing on the US 6 frontage road and excessive delay for US 6 traffic, despite the slight improvement in mainline I-70 operations. Mainline I-70 has identical performance between the braided and non-braided options; however, the braided option has shorter queues on the US 6 frontage road and causes slightly less diversion to alternate routes. Based on these criteria, the braided option was selected for the ramp configuration at the Exit 244 (US 6/Golden) and Exit 243 (Hidden Valley/Central City) interchanges.

6.1.4.1.2 US 6 Westbound On-Ramp in the Canyon Viaduct Alternative

In the Canyon Viaduct Alternative, the westbound US 6 on-ramp enters I-70 at approximately the same location that it does today, except the ramp merges onto the right side of I-70 instead of the left side.

6.1.5 US 6 Eastbound On-Ramp Auxiliary Lane

The steep grade on eastbound I-70 between Exit 244 (US 6/Golden) and Exit 247 (Hyland Hills/Floyd Hill) causes difficulty for trucks and other heavy vehicles to maintain speed on the uphill climb. With the addition of an eastbound on-ramp from US 6, there is an opportunity to provide a continuous auxiliary lane from the eastbound on-ramp at Exit 244 (US 6/Golden) to Exit 247 (Hyland Hills/Floyd Hill). Options were considered with various lengths for the auxiliary lane between the two ramps, and the analysis even considered continuing the lane farther east beyond Exit 247 (Hyland Hills/Floyd Hill). Shorter lanes were found to cause eastbound I-70 congestion on the upgrade of Floyd Hill, which increased travel times and would introduce safety issues. This option also resulted in more traffic diverting to US 40 to avoid the congestion caused by the merging vehicles. There was no advantage to having a lane extend beyond Exit 247 (Hyland Hills/Floyd Hill) compared to when the lane was just a continuous auxiliary lane between the two interchanges. It was decided that the lane should be included in the action alternatives as a continuous auxiliary lane between the Exit 244 (US 6/Golden) and Exit 247 (Hyland Hills/Floyd Hill) interchanges.

6.1.6 Intersection Types

Improvements to ramp terminal intersections are planned as part of this Project. Based on the results of the No Action analysis, ramp terminals at Exit 243 (Hidden Valley/Central City) were considered candidates for improvements. In addition, the Exit 244 (US 6/Golden) interchange would have a new intersection for the anticipated new eastbound on-ramp. Because the Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill) ramp terminal intersections are planned to be reconstructed under the No Action Alternative, no further improvements are proposed for the ramp terminals at the Floyd Hill interchange complex.

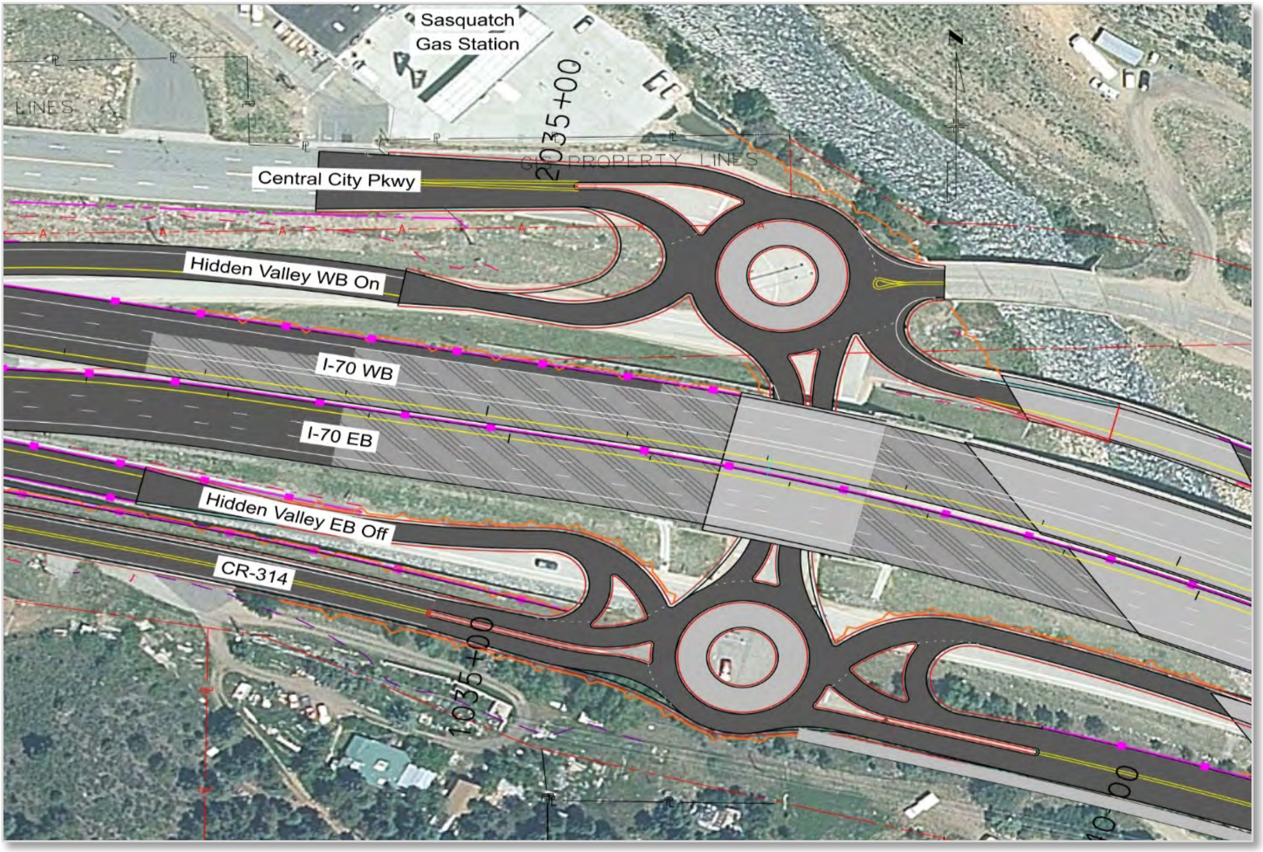
6.1.6.1 Exit 244 (US 6/Golden)

The intersections at the Exit 244 (US 6/Golden) interchange were modeled as unsignalized intersections. At the westbound off-ramp, traffic on the ramp would be stopped while traffic on US 6 would be allowed to proceed through the intersection without stopping. At the new intersection that would be created with the addition of an eastbound on-ramp, both directions of US 6 would be allowed to flow freely through the intersection, while the westbound US 6 vehicles that are turning left onto the new ramp would have to yield to on-coming traffic. The intersection would have a short left-turn lane and the eastbound approach would have a short right-turn lane to provide improved safety for vehicles turning at the intersection.

6.1.6.2 Exit 243 (Hidden Valley/Central City)

The Exit 243 (Hidden Valley/Central City) interchange is currently a tight diamond configuration with five-leg signals on both the north and south sides. Many different configurations of the ramps and frontage roads were considered, using both signalized and roundabout control of the intersections. Replacing the signals with roundabouts was considered to improve the efficiency of the interchange. The non-traditional layout of the current ramp terminal intersections is challenging to overcome through signal timing alone under future year demand. Demand at the Hidden Valley/Central City interchange increases significantly for the future year, especially at the south intersection with the new frontage road connection to US 6. Replacing the signalized intersections with roundabouts was found to greatly improve efficiency of the interchange. Roundabouts, as shown in Exhibit 107, on the north and south sides of the Hidden Valley/Central City interchange are included in the final action alternatives. Note that the exhibit is a rough representation of what roundabouts might look like at this location and it is not intended to reflect an actual design plan for the improvements (which would occur during final design).

Exhibit 107. Proposed Roundabouts at Exit 243 (Hidden Valley/Central City)



6.1.7 Two-Lane Ramp Metering for US 6 Westbound On-Ramp

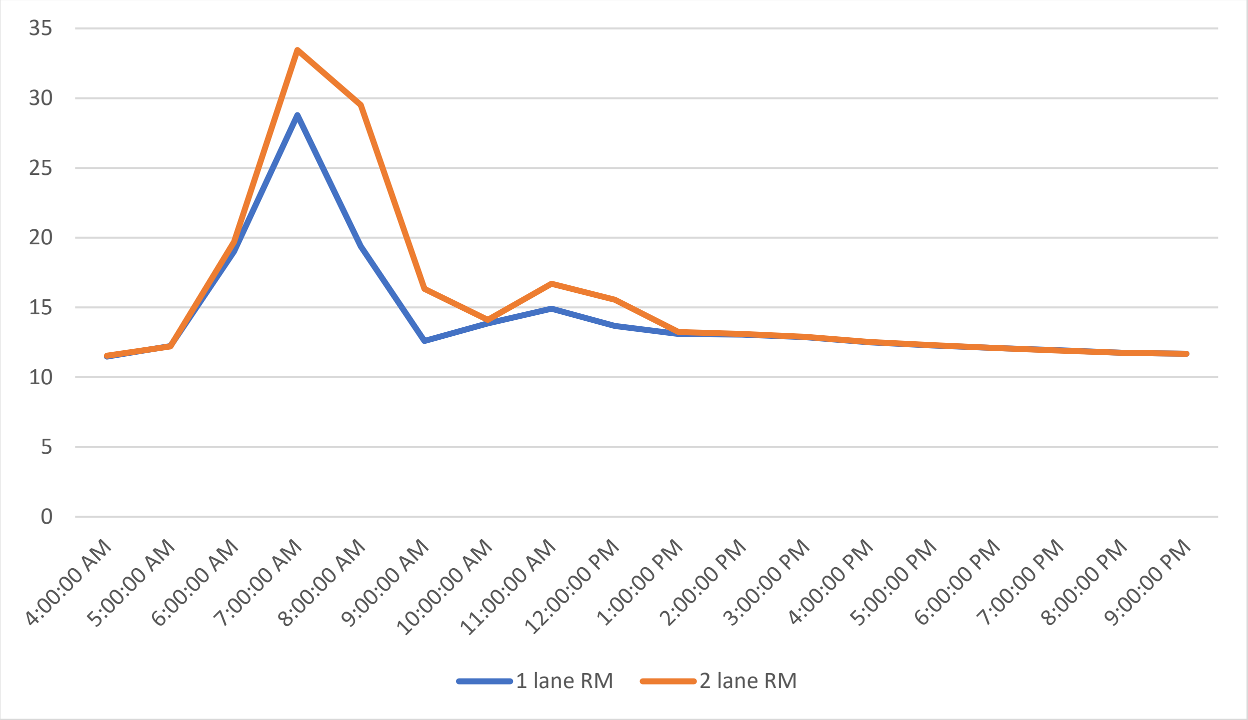
During winter Saturday peak times, the high volume of traffic entering westbound I-70 from US 6 results in queues forming at the gore of the US 6 westbound on-ramp at I-70, which spill back onto US 6, limiting local mobility. The existing US 6 on-ramp is a one-lane ramp that merges onto the left side of I-70 via a short acceleration lane. The proposed action alternatives would add ramp metering to the westbound US 6 on-ramp and acceleration lengths that are consistent with design standards. With the reconstruction of I-70 at the bottom of Floyd Hill, the possibility of expanding the westbound US 6 on-ramp to two lanes was explored.

Based on design constraints, the Canyon Viaduct Alternative can accommodate a 400-foot, two-lane section (from the gore back to the east) and the Tunnel Alternative can accommodate a two-lane section that also is about 400 feet in length (this could be more depending on the final design configuration and location of the on-ramp flyover bridge). The action alternatives were modeled to assess the impact of expanding the westbound US 6 on-ramp to have a two-lane ramp meter section. Ramp metering cycle lengths for all models with a one-lane westbound US 6 on-ramp were set based on FHWA guidance, providing the highest suggested vehicle per hour flow rate at peak times. For the two-lane ramp meter analysis, a similar approach was used, with the ramp metering cycle length set to the highest FHWA-suggested ramp metering vehicle per hour flow during peak times. This equates to a five-second cycle length for the one-lane ramp and a six-second cycle for the two-lane ramp meter during the westbound peak period. Altering the ramp metering rate will impact the operations of I-70 and queuing on the ramp. Queuing on the westbound US 6 on-ramp was observed in the models to understand the operational impact of the two-lane ramp metering. With a one-lane ramp, queues on the westbound US 6 on-ramp spill back onto US 6 for both the Tunnel Alternative and Canyon Viaduct Alternative.

Exhibit 108 and Exhibit 109 show the travel times on westbound I-70 and westbound US 6 for the one-lane and two-lane Tunnel Alternative. The Tunnel Alternative sees peak travel times on westbound I-70 increase by about five minutes with a two-lane ramp configuration versus a one-lane ramp. Expanding the US 6 on-ramp to have a two-lane ramp metering section results in a slowdown of the westbound I-70 mainline because this design allows more vehicles onto the freeway during the peak compared to the one-lane on-ramp design. Exhibit 110 and Exhibit 111 show the travel time on westbound I-70 and westbound US 6 for the one-lane and two-lane Canyon Viaduct Alternative. The Canyon Viaduct Alternative’s peak westbound I-70 travel time for the two-lane on-ramp is increased only slightly compared to the one-lane ramp design.

With two-lane ramp metering, queues at the gore of the ramp for the action alternatives are less than 200 feet at their peak and substantially reduced compared to the length of the queues in the one-lane ramp analyses. Implementing two-lane ramp metering with a longer cycle length will result in longer queues on the westbound US 6 on-ramp, with the benefit of improved operations on westbound I-70. Expanding the US 6 westbound on-ramp to two-lane ramp metering benefits the operation of US 6 as compared to using one-lane ramp metering. Travel time on US 6 improves in the peak condition with two-lane ramp metering as travel times for the action alternatives are reduced at their peak and dissipate more quickly than with one-lane ramp metering. In addition, the Canyon Viaduct Alternative has an overall lower impact to the operations on US 6, with peak travel times being much lower than the Tunnel Alternative for both the one- and two-lane ramp options.

Exhibit 108. Tunnel Alternative Ramp Meter Winter Saturday Westbound I-70 Travel Time from Evergreen Parkway to Exit 241

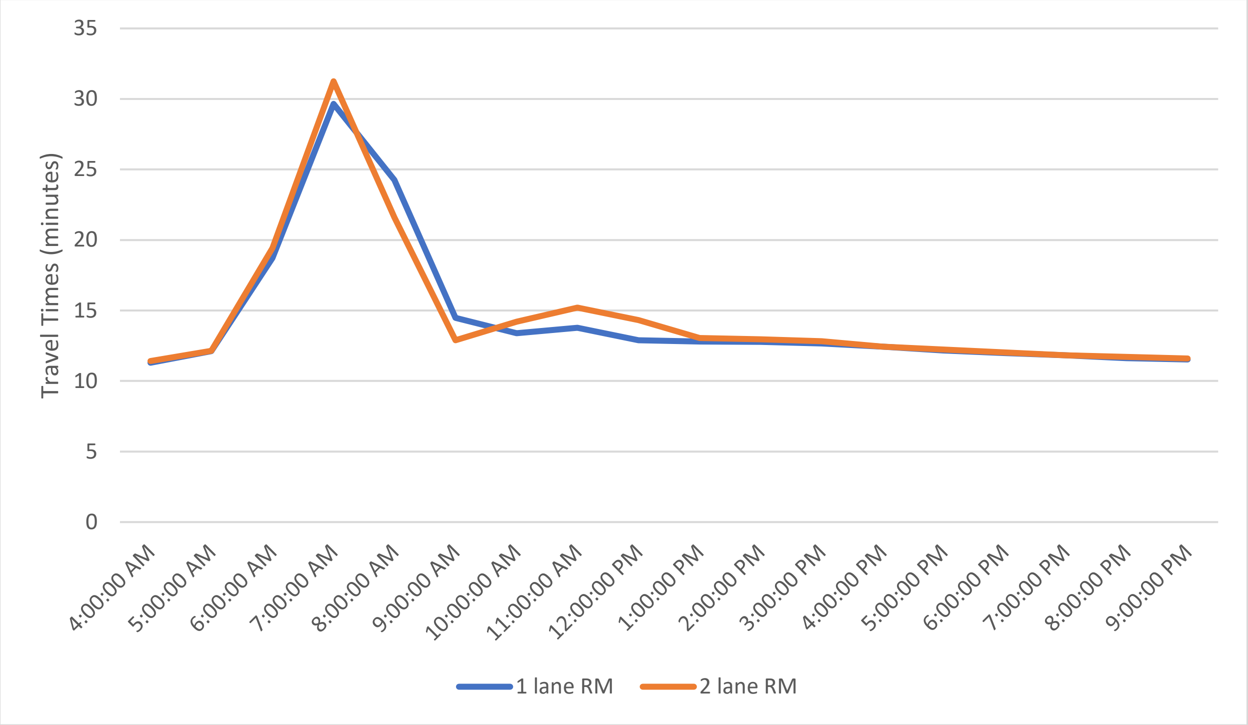


Source: TransModeler microsimulation analysis.

Exhibit 109. Tunnel Alternative Winter Saturday Westbound US 6 Travel Time from US 40 to I-70 Eastbound On-Ramp

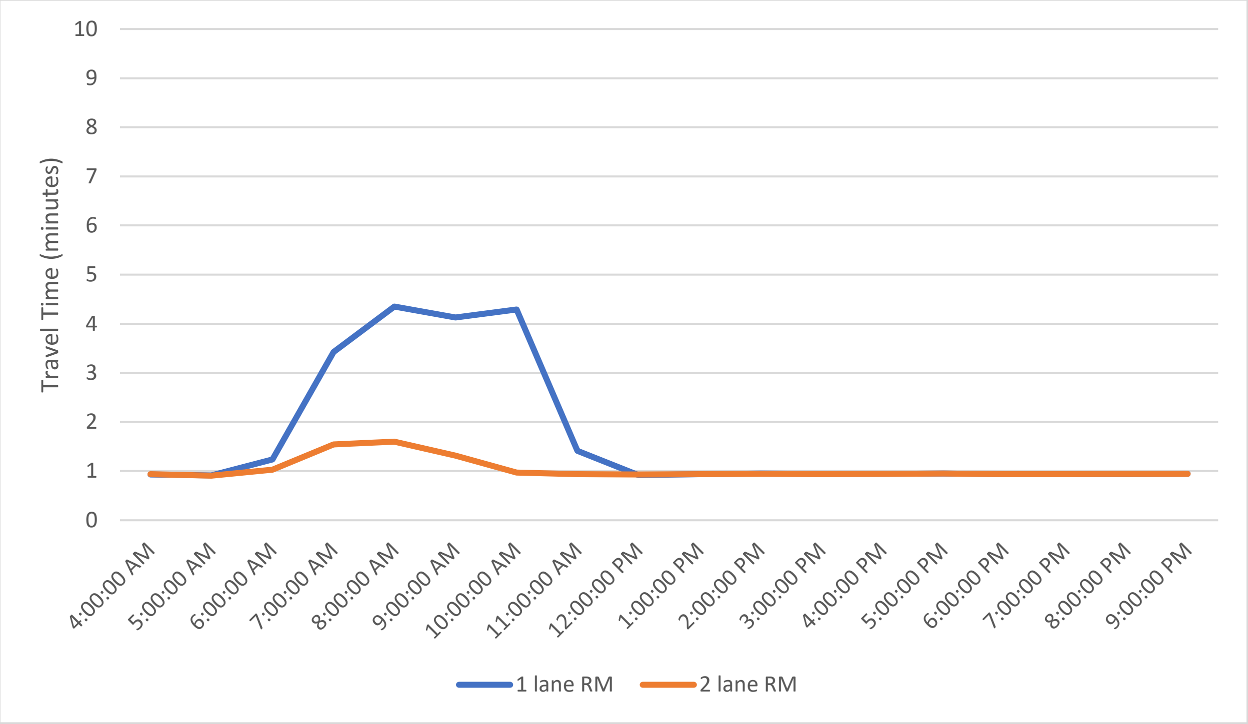
Source: TransModeler microsimulation analysis.

Exhibit 110. Canyon Viaduct Alternative Ramp Meter Winter Saturday Westbound I-70 Travel Time from Evergreen Parkway to Exit 241



Source: TransModeler microsimulation analysis.

Exhibit 111. Canyon Viaduct Alternative Winter Saturday Westbound US 6 Travel Time from US 40 to I-70 Eastbound On-Ramp



Source: TransModeler microsimulation analysis.

6.2 Action Alternatives Safety Conditions

Exhibit 112 and Exhibit 113 present the results of the HSM analysis of the action alternatives for I-70. Note that, for the HSM analysis, only the two alternatives with the third lane being an express lane were evaluated. After completing the operational analyses and prior to the HSM analysis, a decision was made that the proposed action would include an express lane as the third westbound I-70 lane.

The results indicate that most crashes on I-70 are expected to occur on the mainline, with most of the crashes being property damage only. Compared to the No Action conditions, the action alternatives are expected to result in a lower number of annual crashes on I-70.

The Canyon Viaduct Alternative is expected to perform slightly better than the Tunnel Alternative, with a reduction of 15 percent in total annual crashes in the study are compared to only 8 percent. More details on the results of the HSM analysis for action alternatives can be found in Appendix C.

Exhibit 112. Tunnel Alternative Predicted Annual HSM Crash Analysis Results (I-70 and Interchanges)

Major Road	Name	2045 No Action			2045 Tunnel Alternative		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
I-70	Mainline	41.1	123.7	164.8	39.9	124.0	163.9
I-70	Speed Change Lanes	6.4	22.4	28.8	3.1	10.6	13.6
Exit 248 (Beaver Brook/Floyd Hill)*	Eastbound Entrance	0.1	0.1	0.1	0.1	0.1	0.1
	Eastbound Entrance at CR 65	0.0	0.0	0.0	0.0	0.0	0.0
	Westbound Exit	0.0	0.1	0.1	0.1	0.1	0.1
	US 40 & CR 65	2.2	3.1	5.2	0.2	1.1	1.4
	Westbound Exit at CR 65	0.1	0.4	0.6	—	—	—
	Total	2.4	3.6	6.0	0.4	1.3	1.6
Exit 247 (Hyland Hills/Floyd Hill)*	Westbound Entrance	0.1	0.1	0.1	0.0	0.1	0.1
	US 40 & Homestead Road	1.5	2.1	3.5	0.2	1.1	1.1
	Westbound Entrance at Homestead Road	0.0	0.0	0.0	—	—	—
	Eastbound Exit	0.0	0.0	0.1	0.2	0.2	0.4
	Eastbound Exit at Homestead Road	0.1	0.2	0.3	0.4	1.3	1.7
	Total	1.7	2.4	4.1	0.0	0.0	0.1
Exit 244 (US 6/Golden)	Westbound Exit	0.1	0.0	0.1	0.0	0.0	0.1
	Westbound Exit at US 6	0.2	0.2	0.4	0.4	0.6	1.0
	Westbound Entrance	0.3	0.4	0.7	N/A	N/A	N/A
	Eastbound Exit	0.1	0.1	0.2	0.1	0.1	0.2
	Total	0.6	0.8	1.4	0.6	0.8	1.4

Major Road	Name	2045 No Action			2045 Tunnel Alternative		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
Exit 243 (Hidden Valley/Central City)	Westbound Exit	0.1	0.2	0.3	0.3	0.3	0.6
	Westbound Ramps at Central City Pkwy	0.1	0.2	0.3	0.2	1.2	1.4
	Westbound Entrance	0.0	0.0	0.1	0.1	0.1	0.2
	Eastbound Exit	0.0	0.0	0.1	0.1	0.1	0.3
	Eastbound Ramps at Central City Pkwy	0.0	0.1	0.1	0.1	1.2	1.4
	Eastbound Entrance	0.1	0.1	0.1	0.0	0.0	0.1
	Total	0.4	0.6	1.0	0.9	3.1	3.9
Interchange Total		5.1	7.4	12.5	2.1	6.5	8.6
Mainline Total		47.5	146.1	193.6	43.0	134.5	177.5
Grand Total		52.6	153.5	206.1	46.3	143.4	189.7

Source: HSM Analysis.

** These intersections were evaluated as stop controlled for No=Action conditions and not as roundabouts. The roundabouts were added subsequently to the completion of the safety analysis.*

Exhibit 113. Canyon Viaduct Alternative Predicted Annual HSM Crash Analysis Results (I-70 and Interchanges)

Major Road	Name	2045 No Action			2045 Canyon Viaduct Alternative		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
I-70	Mainline	41.1	123.7	164.8	36.4	113.3	149.7
I-70	Speed Change Lanes	6.4	22.4	28.8	3.1	10.3	13.5
Exit 248 (Beaver Brook/Floyd Hill)*	Eastbound Entrance	0.1	0.1	0.1	0.1	0.1	0.1
	Eastbound Entrance at CR 65	0.0	0.0	0.0	0.0	0.0	0.0
	Westbound Exit	0.0	0.1	0.1	0.0	0.1	0.1
	US 40 & CR 65	2.2	3.1	5.2	0.2	1.1	1.3
	Westbound Exit at CR 65	0.1	0.4	0.6	—	—	—
	Total	2.4	3.6	6.0	0.3	1.2	1.5
Exit 247 (Hyland Hills/Floyd Hill)*	Westbound Entrance	0.1	0.1	0.1	0.0	0.1	0.1
	US 40 & Homestead Road	1.5	2.1	3.5	0.2	0.9	1.1
	Westbound Entrance at Homestead Road	0.0	0.0	0.0	—	—	—
	Eastbound Exit	0.0	0.0	0.1	0.2	0.2	0.4
	Eastbound Exit at Homestead Road	0.1	0.2	0.3	0.4	1.2	1.6

Major Road	Name	2045 No Action			2045 Canyon Viaduct Alternative		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
	Total	1.7	2.4	4.1	0.2	0.3	0.5
Exit 244 (US 6/Golden)	Westbound Exit	0.1	0.0	0.1	0.4	0.6	1.0
	Westbound Exit at US 6	0.2	0.2	0.4	0.2	0.2	0.4
	Westbound Entrance	0.3	0.4	0.7	N/A	N/A	N/A
	Eastbound Exit	0.1	0.1	0.2	0.1	0.1	0.2
	Total	0.6	0.8	1.4	0.9	1.2	2.1
Exit 243 (Hidden Valley/Central City)	Westbound Exit	0.1	0.2	0.3	0.1	0.1	0.2
	Westbound Ramps at Central City Pkwy	0.1	0.2	0.3	0.2	1.2	1.4
	Westbound Entrance	0.0	0.0	0.1	0.1	0.1	0.2
	Eastbound Exit	0.0	0.0	0.1	0.1	0.1	0.2
	Eastbound Ramps at Central City Pkwy	0.0	0.1	0.1	0.1	1.2	1.3
	Eastbound Entrance	0.1	0.1	0.1	0.0	0.1	0.1
	Total	0.4	0.6	1.0	0.6	2.8	3.5
Interchange Total		5.1	7.4	12.5	2.3	6.4	8.7
Mainline Total		47.5	146.1	193.6	39.5	123.7	163.2
Grand Total		52.6	153.5	206.1	42.7	131.9	174.5

Source: HSM Analysis.

** These intersections were evaluated as stop controlled for No=Action conditions and not as roundabouts. The roundabouts were added subsequently to the completion of the safety analysis.*

To account for the fact that quantitative evaluation of the tunnel and viaduct portions of the alternatives cannot be compared using only quantitative analysis, a qualitative evaluation was conducted to assess the differences between the Tunnel Alternative and the Canyon Viaduct Alternative. The alternative comparison considered factors with a potential impact to safety and other factors specific to tunnels and viaducts. Based on the literature review, these factors may include, but are not limited to, lighting, icing of roadways, other safety factors, and driver behavior, among others. An assessment of these different factors was conducted and summarized using a rating scale to indicate which alternative yields more benefits. This assessment could be used as an additional consideration for evaluating the safety of the alternatives to support the decision-making process.

An extensive literature review was conducted as part of the qualitative evaluation to assess the differences between the Tunnel Alternative and the Canyon Viaduct Alternative. As a result of this analysis, no external Safety Performance Functions (SPFs) and/or Crash Modification Factors (CMFs) were found that could be used to supplement the quantitative analysis. However, several differentiating factors that affect safety and other aspects related to both alternatives were found. Some of the main differentiating factors between tunnels and viaducts may include, but are not limited to:

- Lighting
- Provision of complementary systems (fire safety, ventilation, etc.)

- Accessibility to emergency medical services
- Driver behavior
- Weather/Surface condition
- Higher number of crashes/high injury and fatality resulting from crashes
- Visual disturbances due to sunshine/sunset
- Fire outbreak and/or expansion of heat and smoke

Exhibit 114 shows the results of the qualitative evaluation. For the differentiating factors, the two engineering solutions were compared to identify their trade-offs. Each alternative's qualitative criteria were converted to the following five-point scale:

(+ +)	(+)	(0)	(-)	(- -)
(best performance)		(no change)		(worst performance)

For example, comparing the number of crashes, tunnels revealed a lower number of crashes compared to viaducts, so a lower score is assigned. Based on this scenario, tunnel construction was assigned a (+) sign, while viaduct construction was assigned a (-). The pros and cons were counted and reported separately in Exhibit 115.

Based on the results of the safety analysis, both qualitative and quantitative, the Canyon Viaduct Alternative is expected to perform with a higher safety rating than the Tunnel Alternative. Both action alternatives are predicted to be safer (lower annual crash numbers) compared to the No Action conditions.

Exhibit 114. Action Alternative Qualitative Evaluation Results

Categories	Differentiating Factors	Tunnel	Viaduct
Safety	Accessibility to emergency medical services	Y	N
	Driver behavior/perception reaction time	H	L
	Weather	L	H
	Surface condition	L	H
	Higher number of crashes	L	H
	High injury and fatality rate resulting from crashes	H	L
	Visual disturbances due to sunshine/sunset	H	L
	Fire outbreak can affect the structural integrity	H	L
Operations	Fire safety devices required	Y	N
	Communication systems required	Y	N
	24-hr illumination/appropriate illumination	Y	N
	Emergency access point/ventilation	Y	N

Source: HSM Analysis.
Note: Y = Yes, N = No, L = Low, H = High

Exhibit 115. Action Alternative Qualitative Evaluation Scores

Categories	Differentiating Factors	Tunnel	Viaduct
Safety	Accessibility to emergency medical services	(-)	(+)
	Driver behavior/perception reaction time	(-)	(+)
	Weather	(+)	(-)
	Surface condition	(+)	(-)
	Higher number of crashes	(+)	(-)
	High injury and fatality rate resulting from crashes	(- -)	(+)
	Visual disturbances due to sunshine/sunset	(-)	(+)
	Fire outbreak can affect the structural integrity	(- -)	(+)
Operations	Fire safety devices required	(-)	(+)
	Communication systems required	(-)	(+)
	24-hr illumination/appropriate illumination	(-)	(+)
	Emergency access point/ventilation	(-)	(+)
Sum Pros		3	9
Sum Cons		11	3

Source: HSM Analysis.

6.3 Action Alternatives Traffic Volumes and Patterns

The future volumes used for analyzing the action alternatives are the same volumes used for the No Action analysis. TransModeler was used to allow vehicles to dynamically select a preferred route through the transportation network based upon the updated roadway configurations of the action alternatives. The expected 2045 action alternatives volume patterns for the I-70 mainline and local roads are discussed in the following sections.

6.3.1 I-70 Traffic Volumes and Patterns

Exhibit 116 and Exhibit 117 show action alternatives (2045) westbound I-70 traffic volumes east of Floyd Hill and near Idaho Springs, respectively, obtained from TransModeler for a peak winter Saturday. Note that one of these locations would have a westbound EL or PPSL (near Idaho Springs) and the other would be GPL only (east of Floyd Hill). The addition of a third lane as a GPL will allow I-70 to process up to 4,440 vph during the morning peak and process more vehicles during the early afternoon compared to No Action conditions. If the third lane is an EL, the GPL lanes will process about the same volumes as the No Action conditions and the EL will process about 1,500 vph during the peak. Overall, the two options process about the same number of vehicles on I-70.

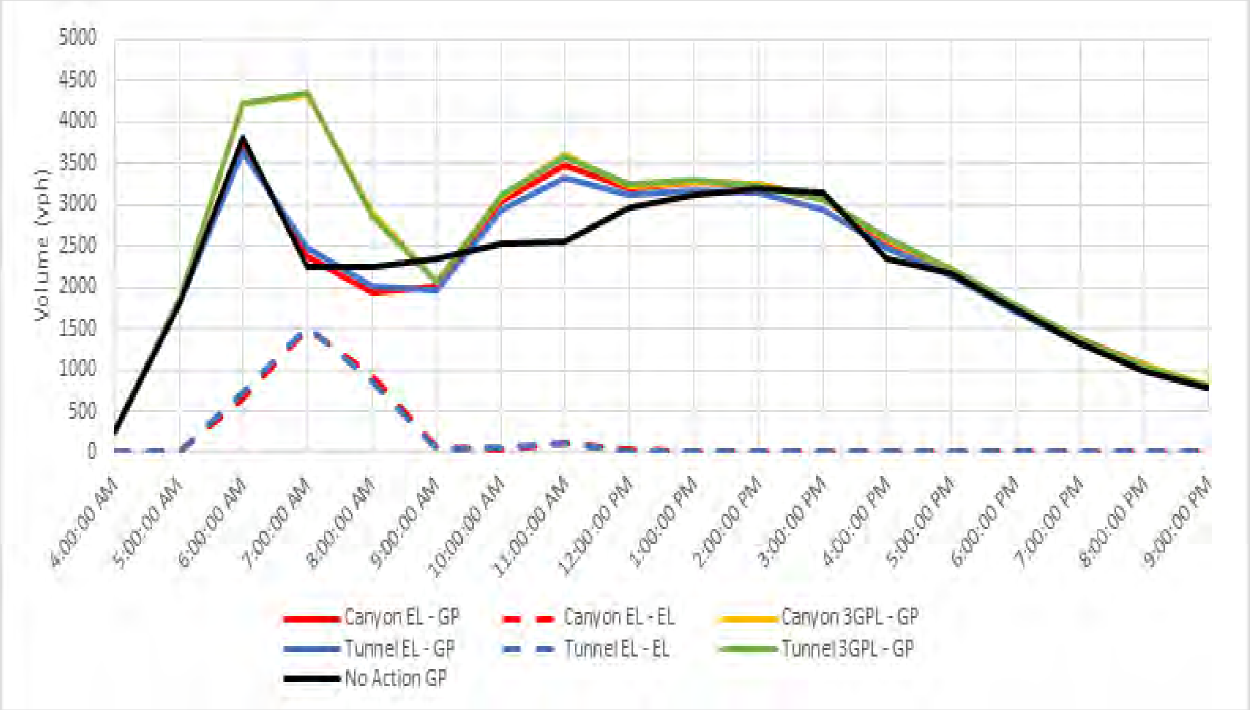
Exhibit 118 and Exhibit 119 show action alternatives (2045) eastbound I-70 traffic volumes near the top of Floyd Hill and near Idaho Springs, respectively, obtained from TransModeler for a peak winter Saturday. Note that the location near Idaho Springs has an eastbound PPSL but the location on Floyd Hill has three 3GPL without an EL or PPSL. Because there are very few changes to eastbound I-70 in the action alternatives, there is very little difference in the way they process volume compared to the No Action conditions. The action alternatives do shorten the evening peak slightly; this is mostly due to the straightening of curves that allows vehicles to operate at higher speeds. They do process slightly more vehicles as fewer vehicles divert to US 6 and US 40 but remain on I-70 for the return trip to Denver.

Exhibit 120 and Exhibit 121 show the action alternatives (2045) westbound I-70 traffic volumes near the top of Floyd Hill and near Idaho Springs, respectively, obtained from TransModeler for a peak summer Sunday. The action alternatives show almost no difference compared to the No Action for westbound summer conditions.

Exhibit 122 and Exhibit 123 show action alternatives (2045) eastbound I-70 traffic volumes near the top of Floyd Hill and near Idaho Springs, respectively, obtained from TransModeler for a peak summer Sunday. Again, the action alternatives process slightly more vehicles than the No Action condition, reduce durations of the peaks, smooth out flows across the day, and increase flows in the EL similarly to the winter eastbound conditions.

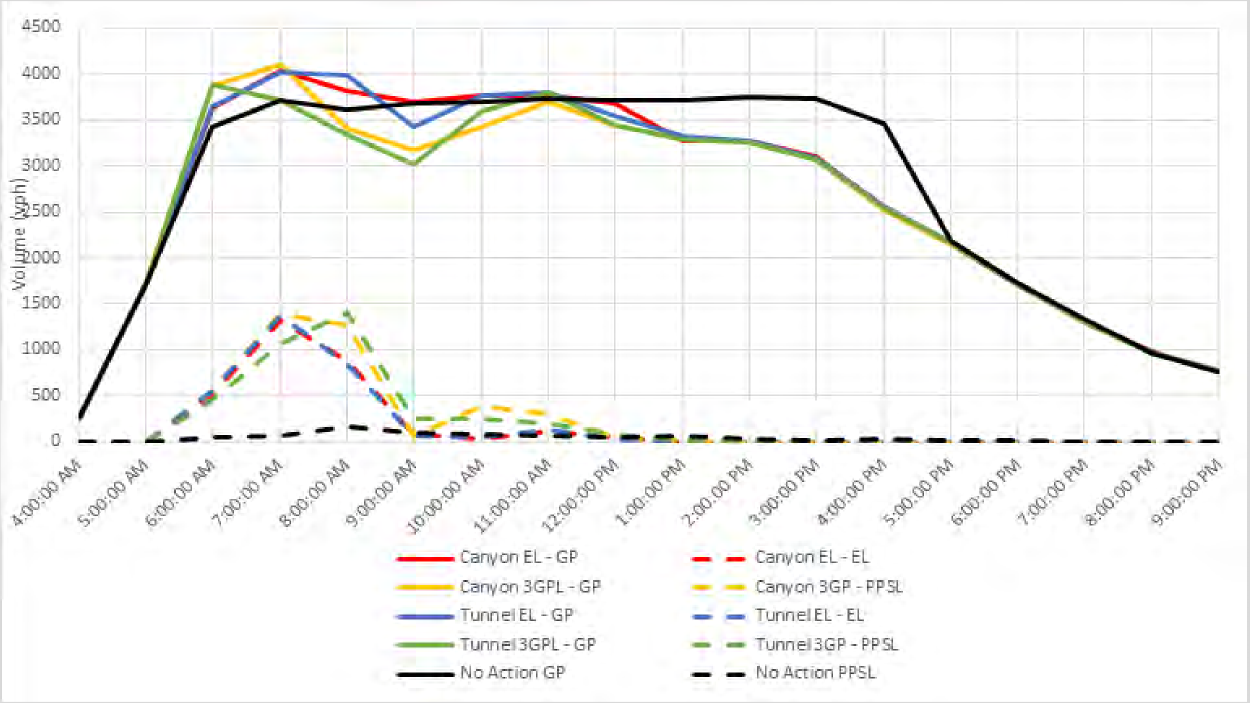
Note that the eastbound and westbound volumes are a sum of the volumes using the GPL and EL or PPSL, for a total eastbound or westbound volume on I-70 at each location.

Exhibit 116. Action Alternatives I-70 Winter Westbound Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



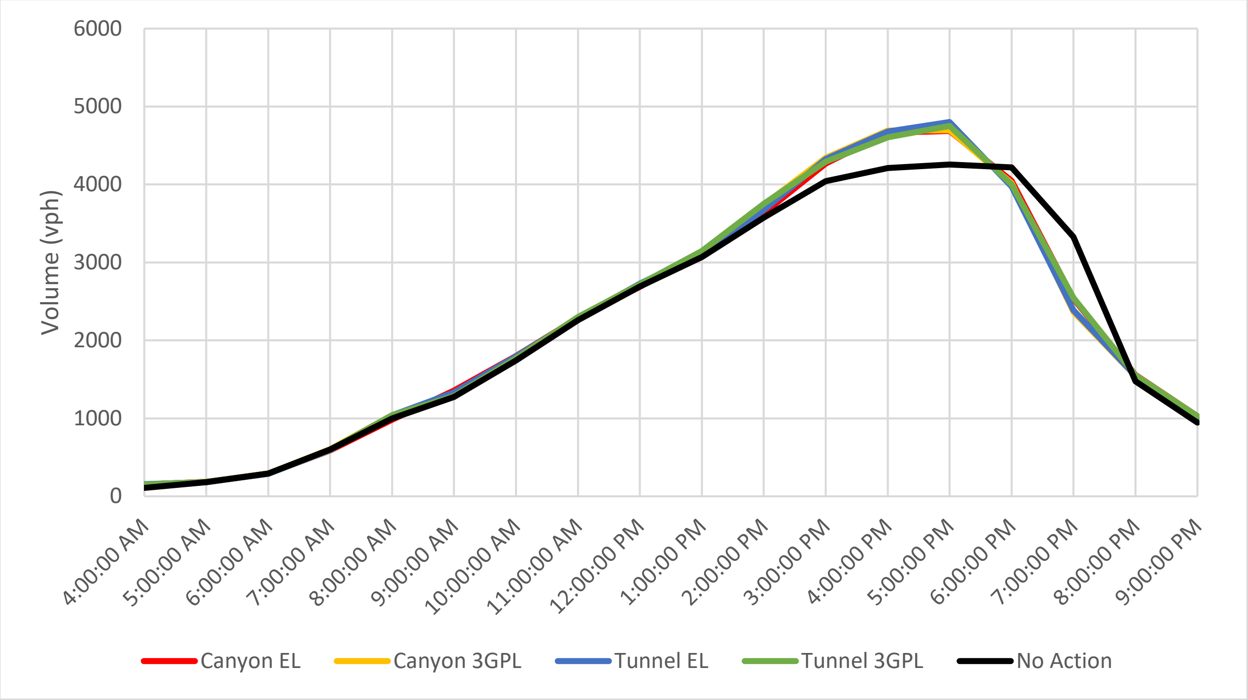
Source: TransModeler microsimulation analysis.

Exhibit 117. Action Alternatives I-70 Winter Westbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



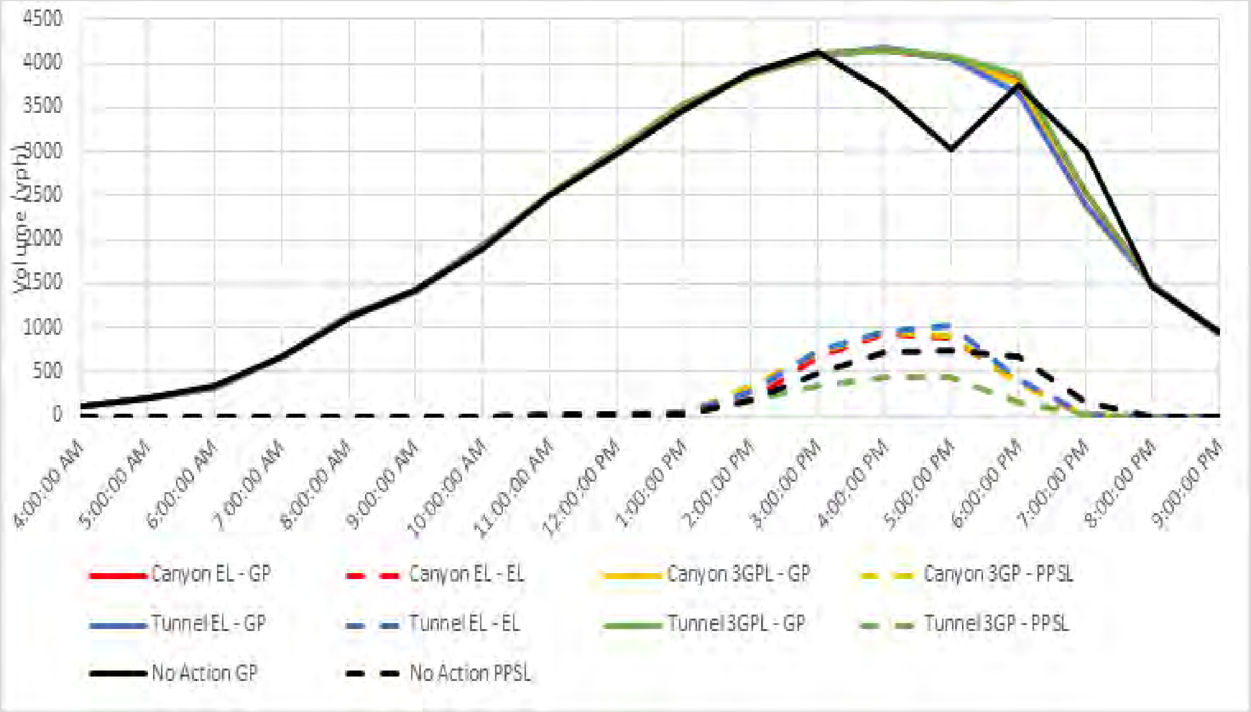
Source: TransModeler microsimulation analysis.

Exhibit 118. Action Alternatives I-70 Winter Eastbound Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



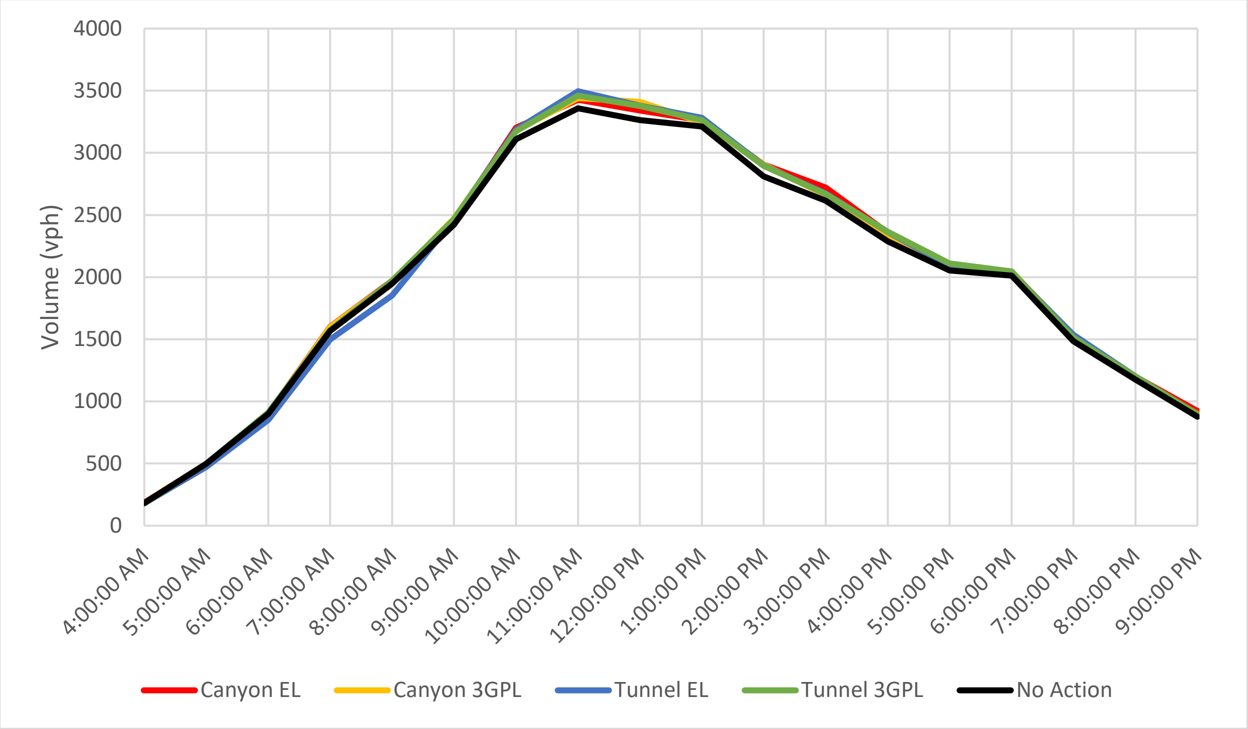
Source: TransModeler microsimulation analysis.

Exhibit 119. **Action Alternatives I-70 Winter Eastbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)**



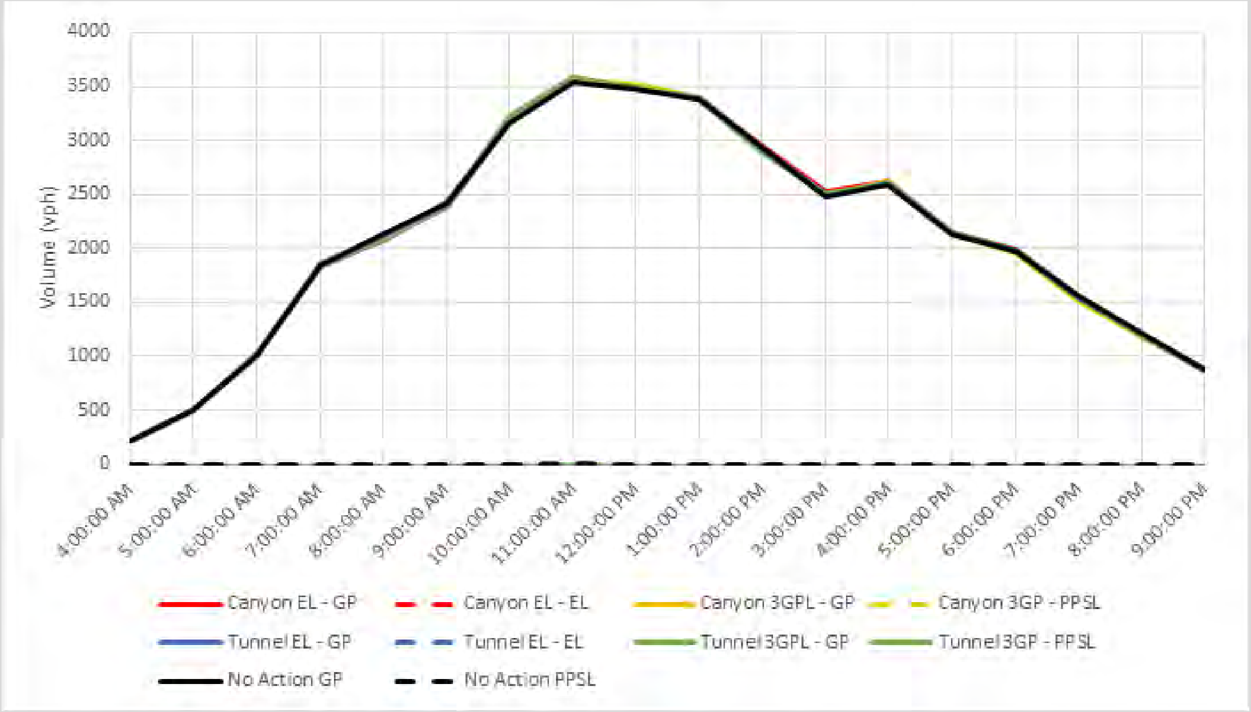
Source: TransModeler microsimulation analysis.

Exhibit 120. **Action Alternatives I-70 Summer Westbound Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)**



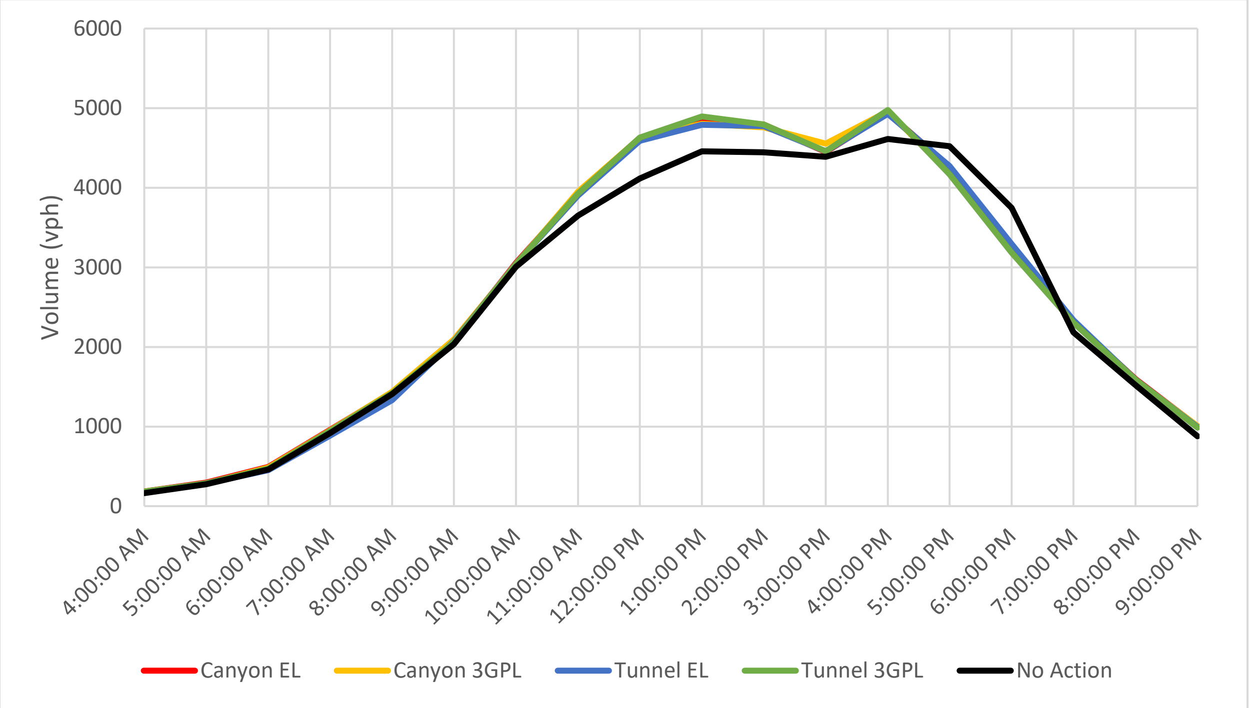
Source: TransModeler microsimulation analysis.

Exhibit 121. Action Alternatives I-70 Summer Westbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



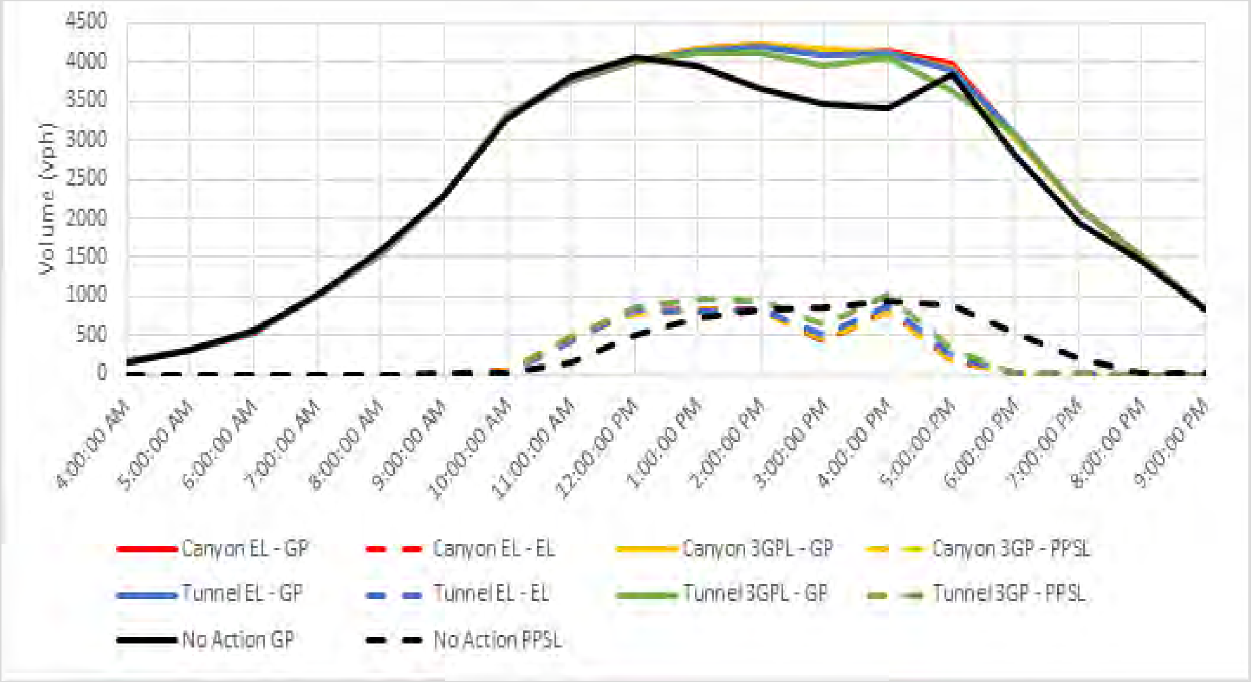
Source: TransModeler microsimulation analysis.

Exhibit 122. Action Alternatives I-70 Summer Eastbound Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



Source: TransModeler microsimulation analysis.

Exhibit 123. Action Alternatives I-70 Summer Eastbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

6.3.2 Local Road Traffic Volumes and Patterns

The local roads of primary interest as those that provide alternate routes to I-70 are US 40, CR 314, and US 6. Improvements to I-70 should help reduce traffic that diverts onto alternate routes and should help improve operations of the local road and intersections. A reduction in traffic on the local road also would improve safety and provide local residents with improved mobility.

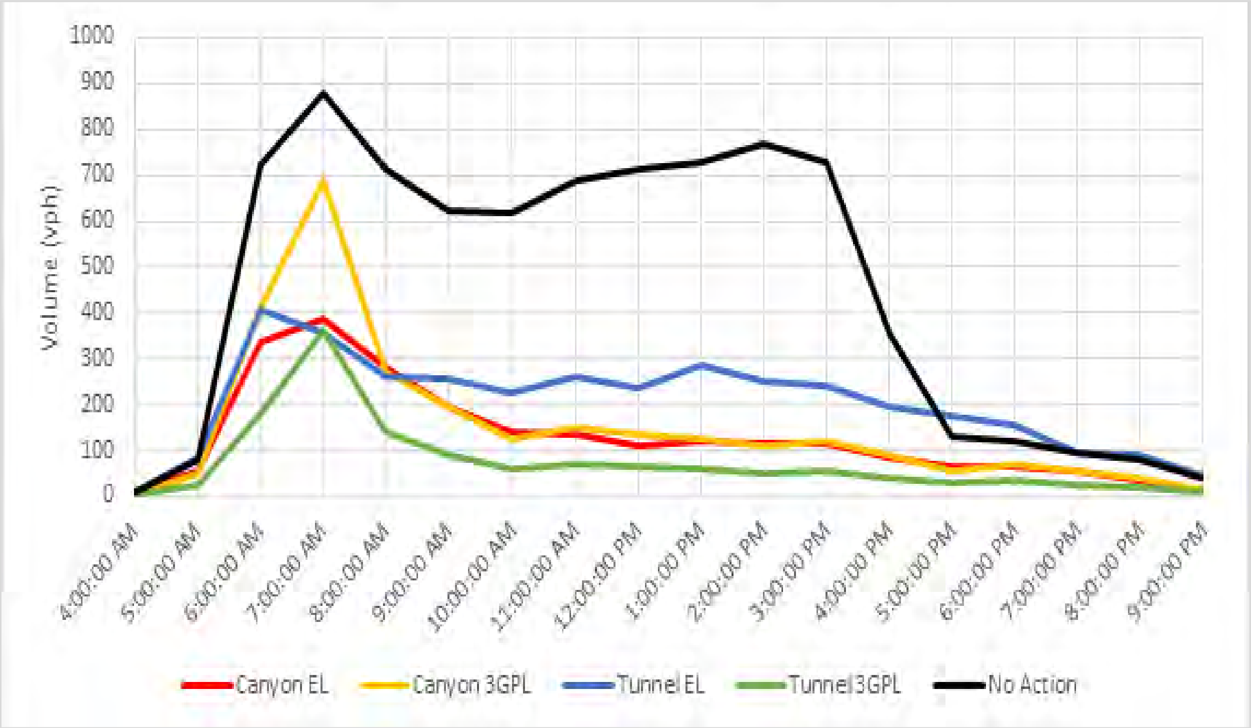
6.3.2.1 US 40

For US 40, the two locations of interest are: (1) between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill), and (2) between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden). The action alternatives westbound volumes along US 40 are shown in Exhibit 124 and Exhibit 125 for a winter Saturday and eastbound volumes are shown in Exhibit 126 and Exhibit 127. The figures show:

- All action alternatives reduce traffic volume on US 40 compared to the No Action Alternative.
- The Tunnel 3GPL option does the best job at reducing volumes but this is because the US 6 westbound on-ramp to I-70 is located farther to the west compared to the other conditions and is less desirable for vehicles to divert from I-70.
- Due to the EL alternative having slightly less capacity on I-70 (the EL has a capacity of about 1,500 vphpl compared to about 2,200 vphpl in a GPL), more vehicles may divert off I-70 in these alternatives and the volumes on US 40 are expected to increase compared to the GPL alternatives.
- All of the action alternatives reduce eastbound flows on US 40.

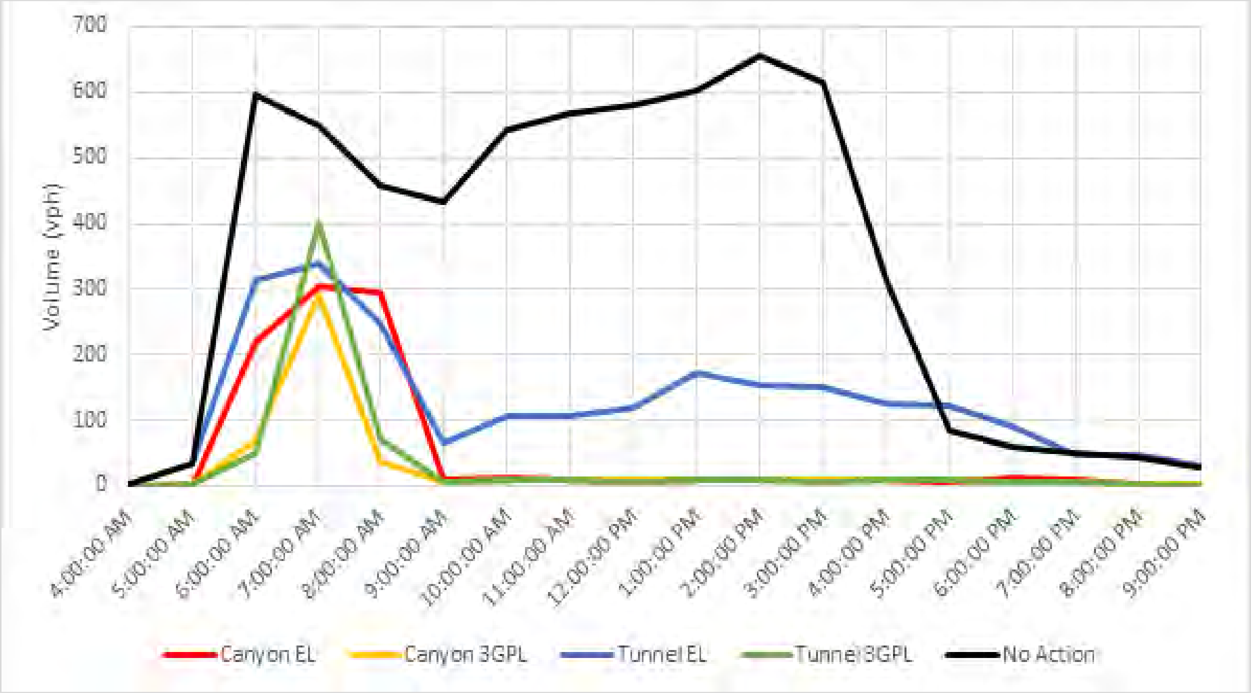
Exhibit 128 and Exhibit 129 show the action alternatives westbound volumes for a summer Sunday peak day and Exhibit 130 and Exhibit 131 show the eastbound US 40 volumes. All of the action alternatives reduce the US 40 volumes on a peak Sunday by almost an identical amount.

Exhibit 124. Action Alternatives US 40 Winter Westbound Volumes—Between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill)



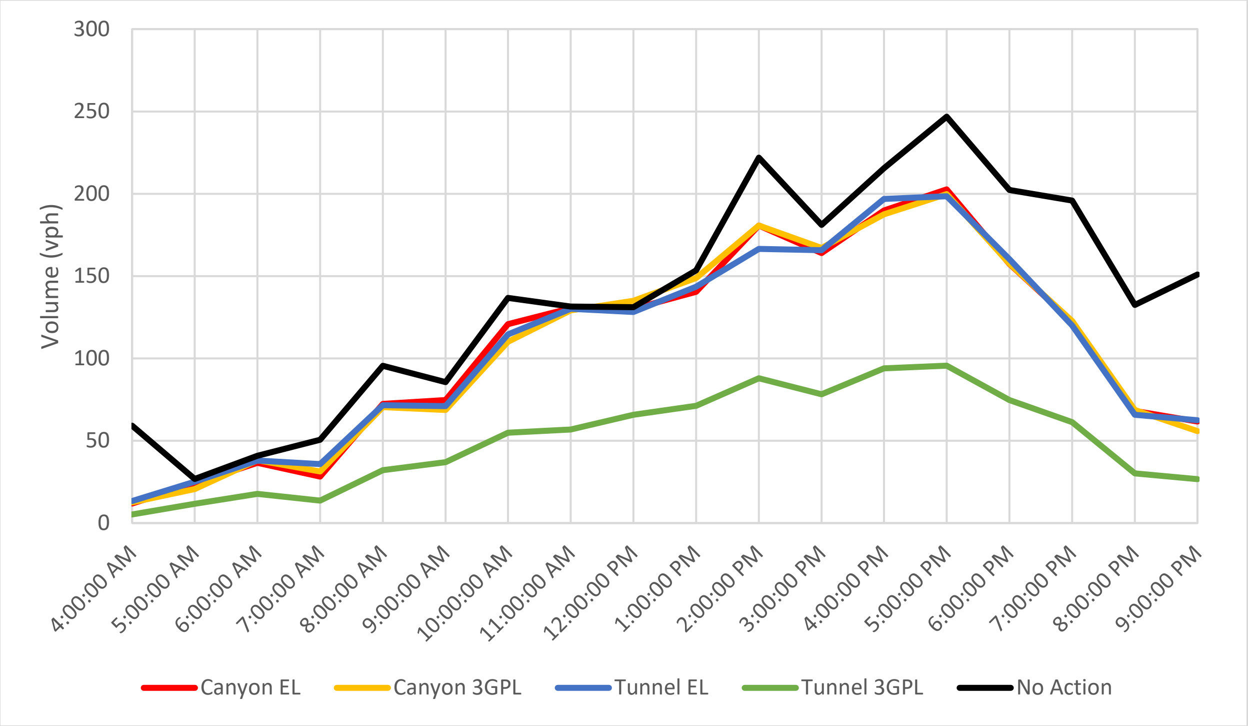
Source: TransModeler microsimulation analysis.

Exhibit 125. Action Alternatives US 40 Winter Westbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)



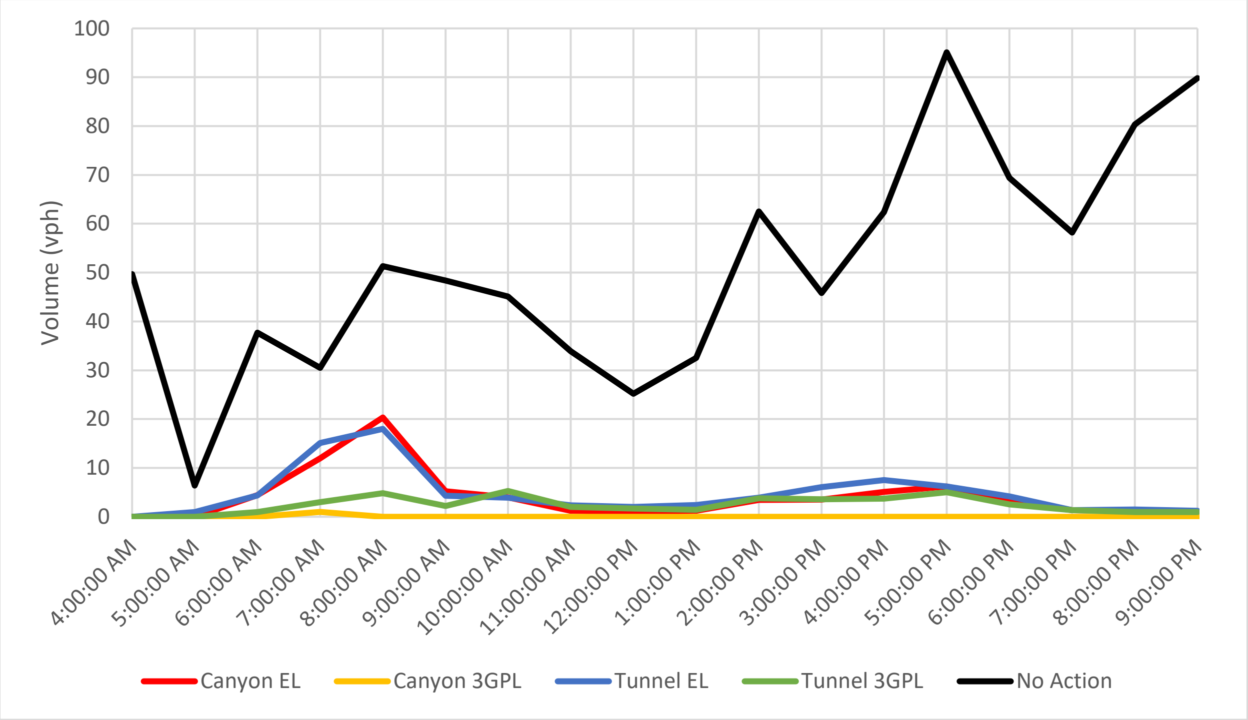
Source: TransModeler microsimulation analysis.

Exhibit 126. Action Alternatives US 40 Winter Eastbound Volumes—Between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill)



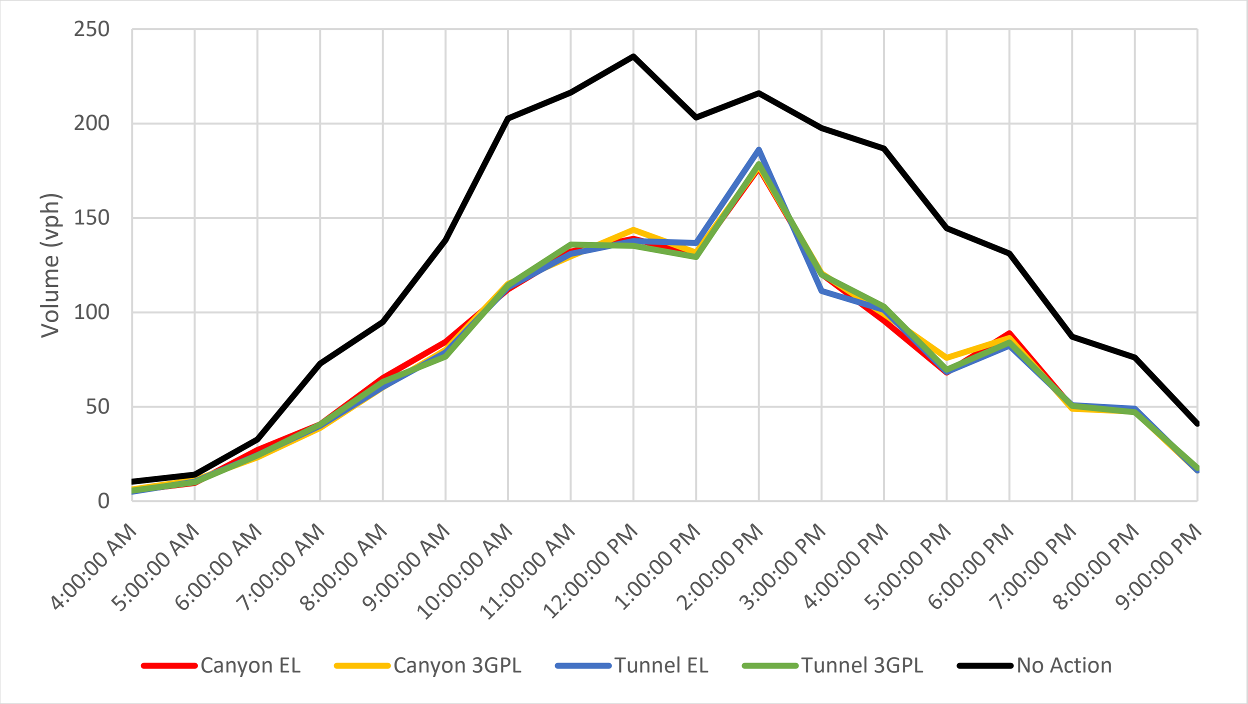
Source: TransModeler microsimulation analysis.

Exhibit 127. Action Alternatives US 40 Winter Eastbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)



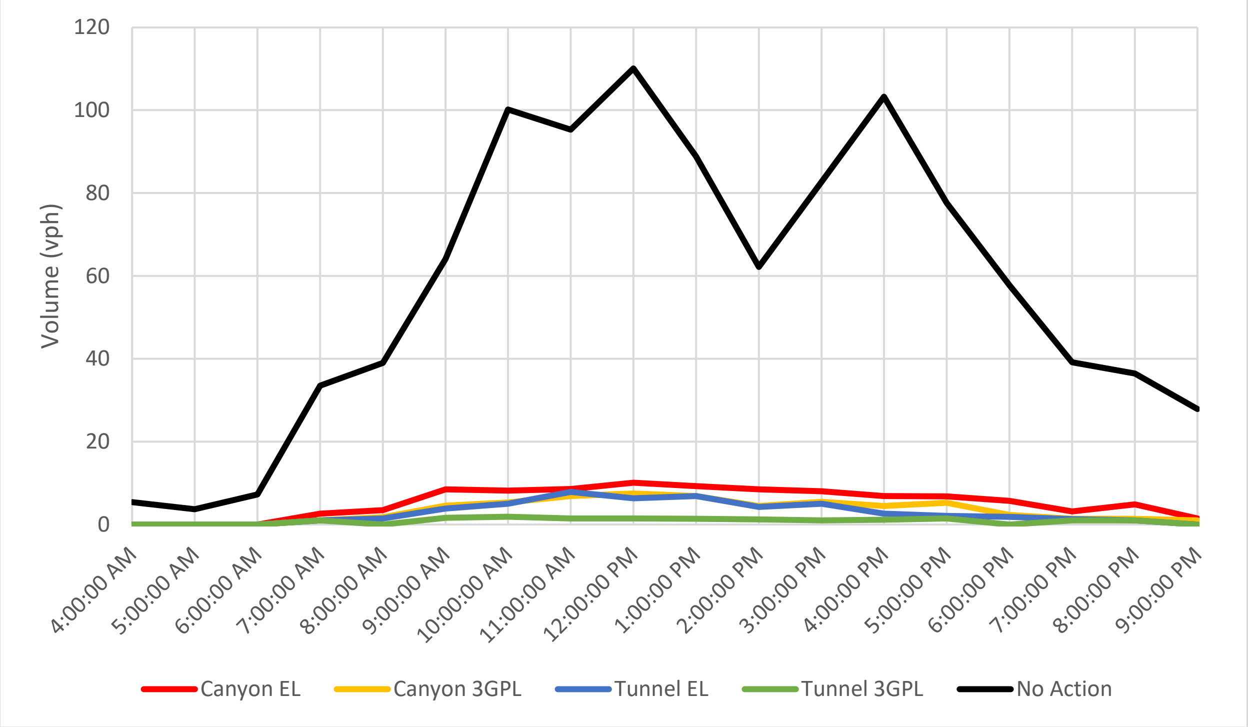
Source: TransModeler microsimulation analysis.

Exhibit 128. Action Alternatives US 40 Summer Westbound Volumes—Between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill)



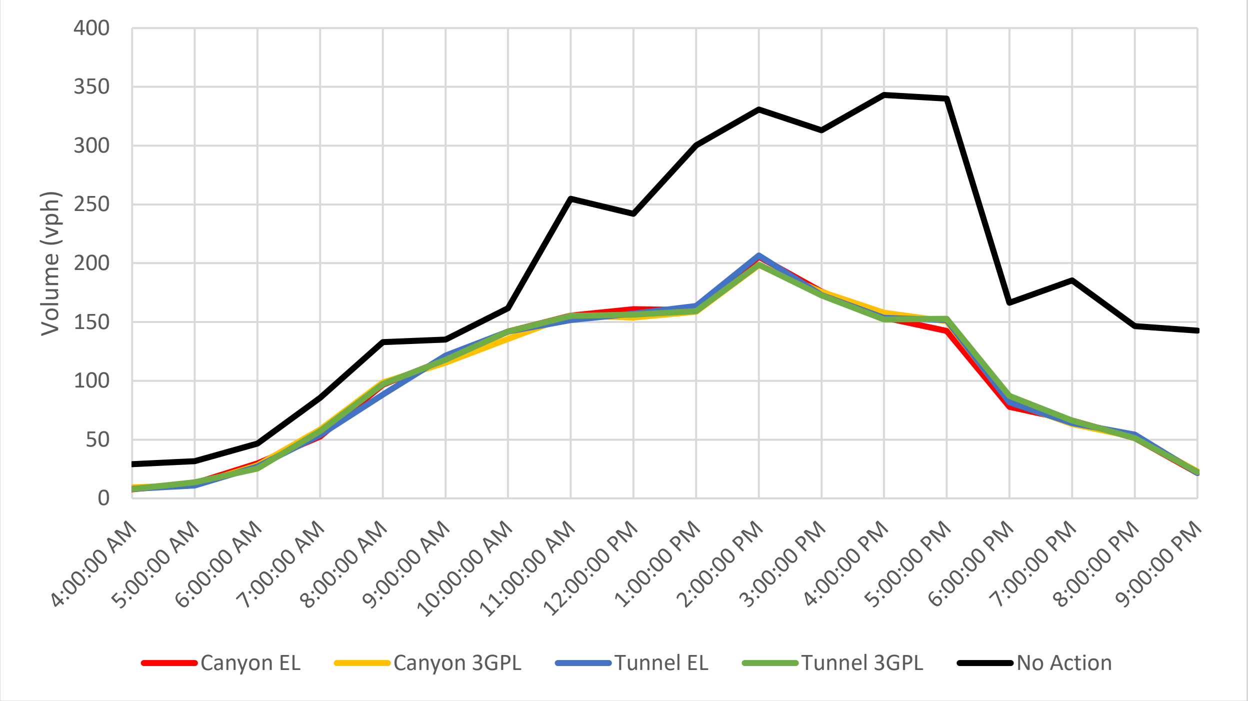
Source: TransModeler microsimulation analysis.

Exhibit 129. Action Alternatives US 40 Summer Westbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)



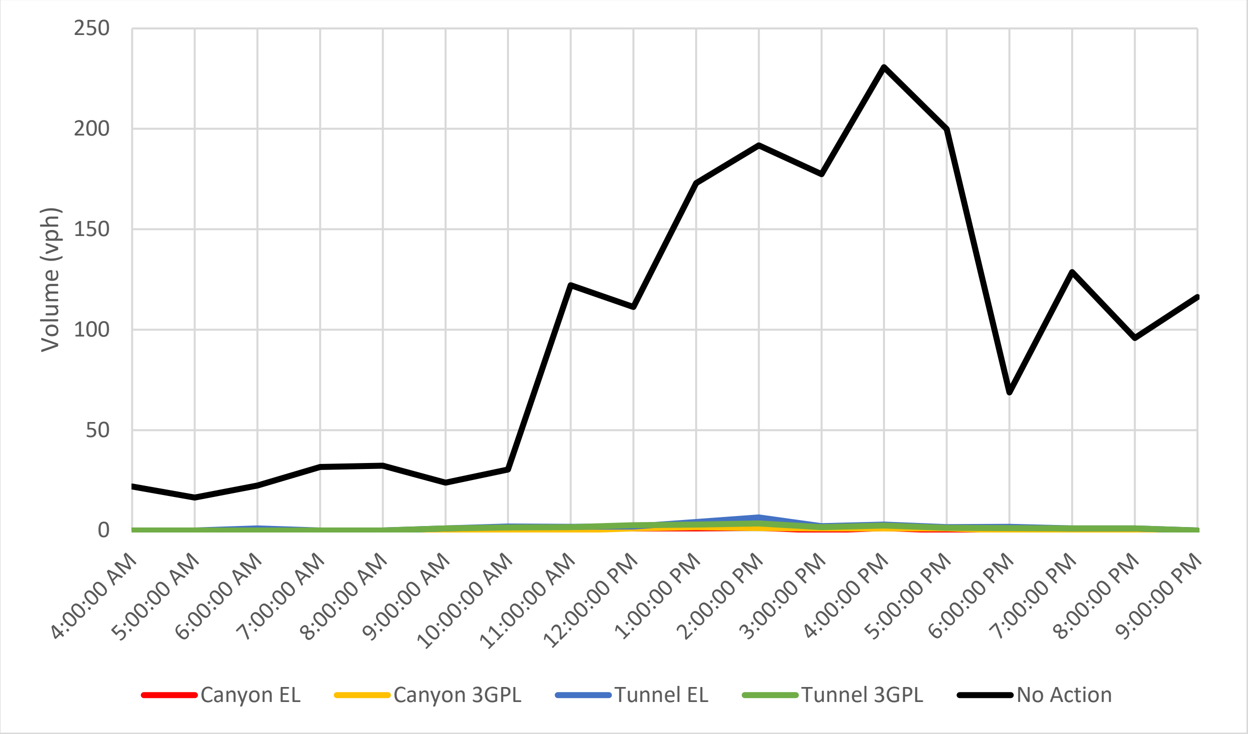
Source: TransModeler microsimulation analysis.

Exhibit 130. Action Alternatives US 40 Summer Eastbound Volumes—Between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill)



Source: TransModeler microsimulation analysis.

Exhibit 131. Action Alternatives US 40 Summer Eastbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)

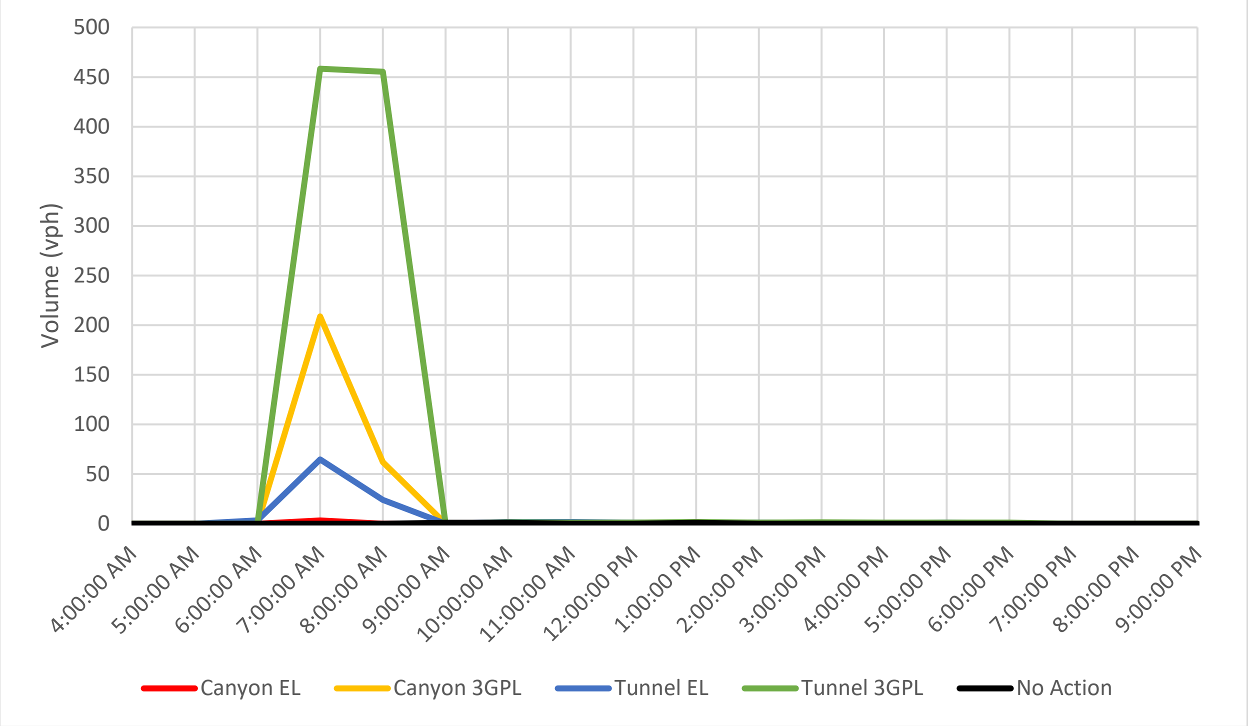


Source: TransModeler microsimulation analysis.

6.3.2.2 CR 314

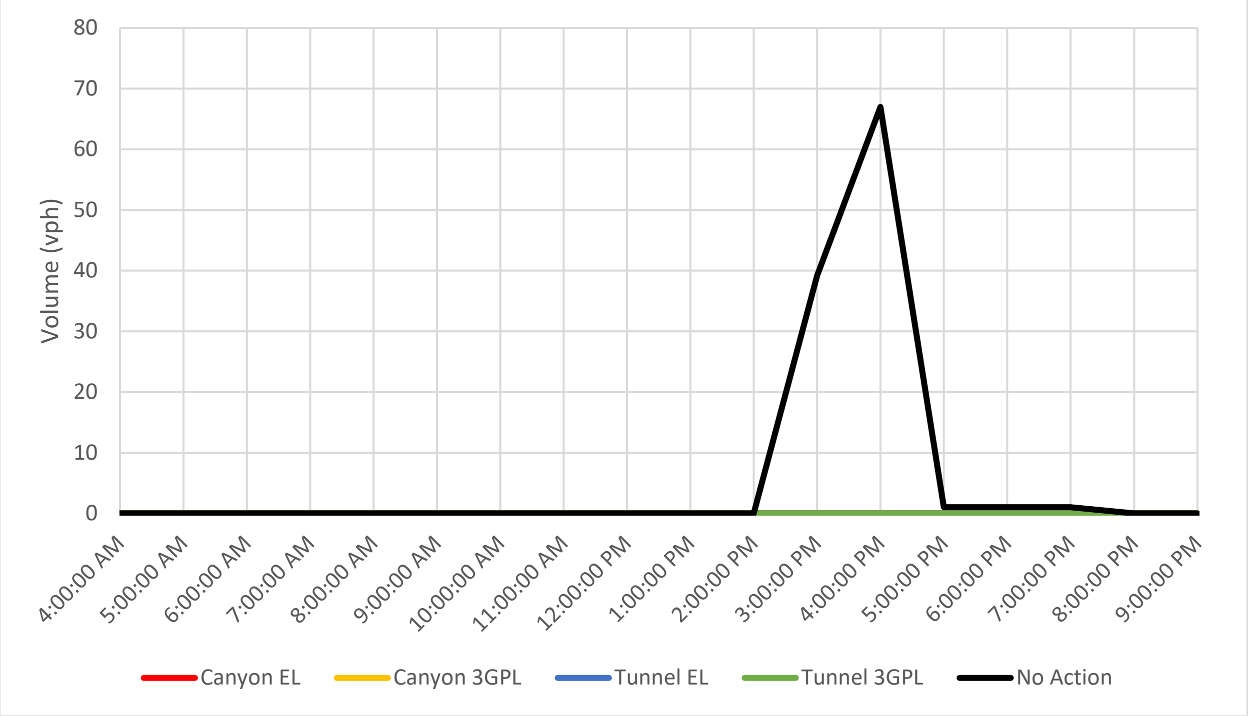
The action alternatives projected westbound volume patterns on CR 314 for a winter Saturday are shown in Exhibit 132 and for a summer Sunday in Exhibit 133 . There is some expected traffic that will use CR 314 since the roadway is being improved and there is expected to be increased congestion on I-70. The figures show the Tunnel 3GPL alternative results in the most westbound volume. This is because vehicles do not enter I-70 at the new westbound US 6 on-ramp or at the Hidden Valley ramps due to congestion in this area on I-70, so they continue on CR 314 all the way to Idaho Springs before re-entering I-70. All the action alternatives show very little or no eastbound volume using CR 314 in the winter (Exhibit 134) or the summer (Exhibit 135).

Exhibit 132. Action Alternatives CR 314 Winter Westbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



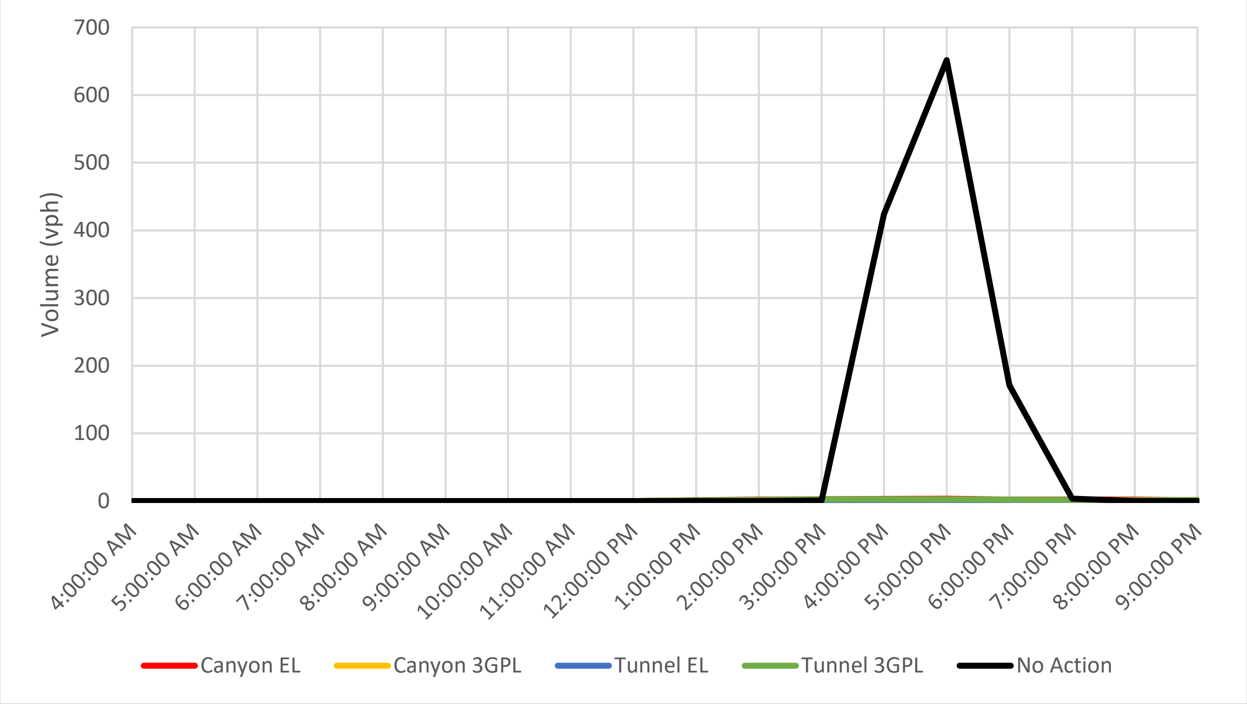
Source: TransModeler microsimulation analysis.

Exhibit 133. Action Alternatives CR 314 Summer Westbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



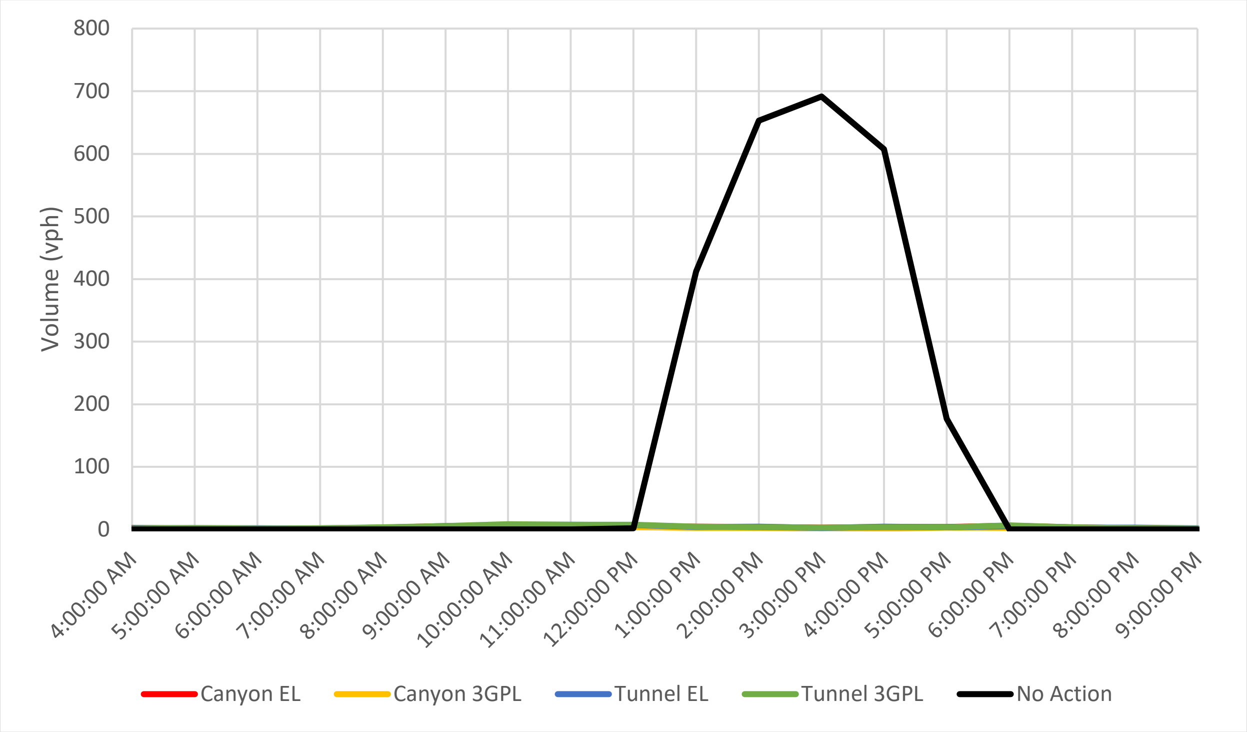
Source: TransModeler microsimulation analysis.

Exhibit 134. Action Alternatives CR 314 Winter Eastbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

Exhibit 135. Action Alternatives CR 314 Summer Eastbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)

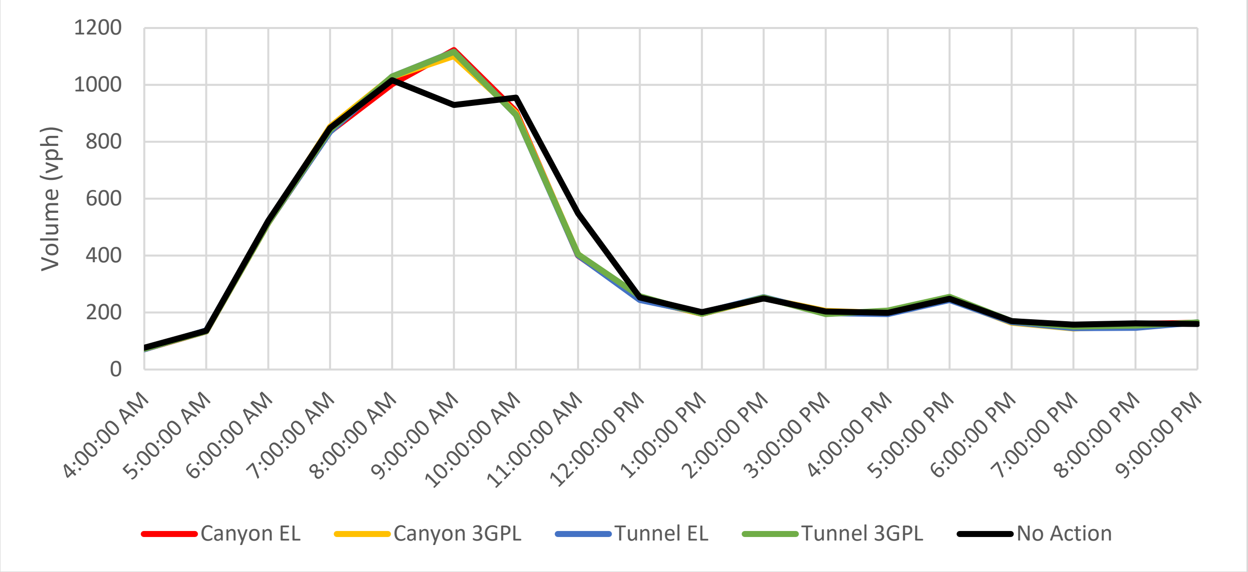


Source: TransModeler microsimulation analysis.

6.3.2.3 US 6

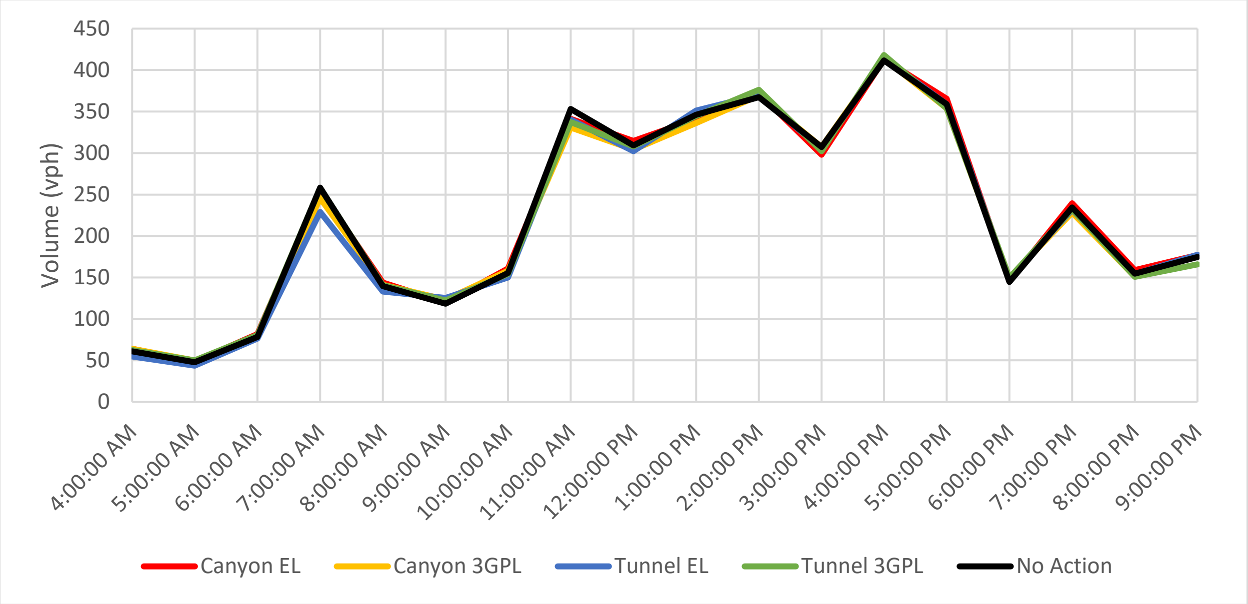
As can be seen in Exhibit 136, Exhibit 137, Exhibit 138, and Exhibit 139, the expected action alternatives volume patterns on US 6 are similar to No Action conditions with the exception that fewer vehicles are expected to use US 6 eastbound in the winter. This is an indication that more vehicles will remain on I-70 instead of exiting at Exit 243 (Hidden Valley/Central City) and using the new frontage road.

Exhibit 136. Action Alternatives US 6 Winter Westbound Volumes—East of the US 40 Intersection



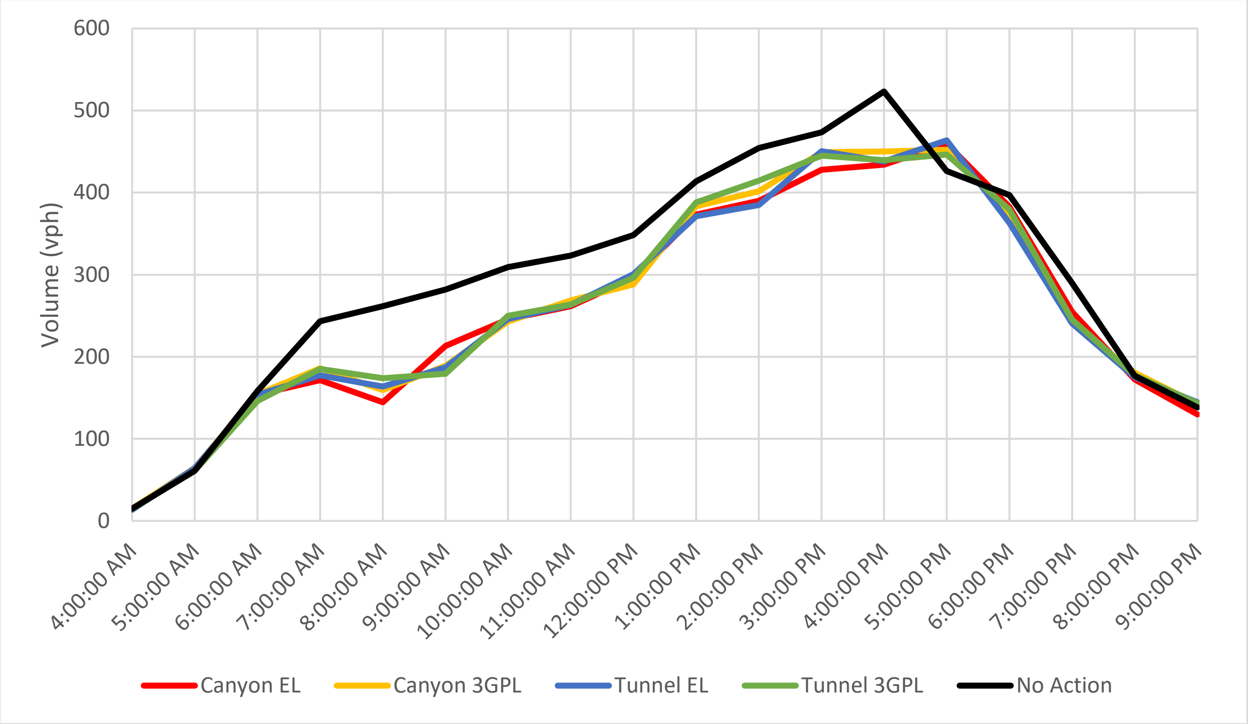
Source: TransModeler microsimulation analysis.

Exhibit 137. Action Alternatives US 6 Summer Westbound Volumes—East of the US 40 Intersection



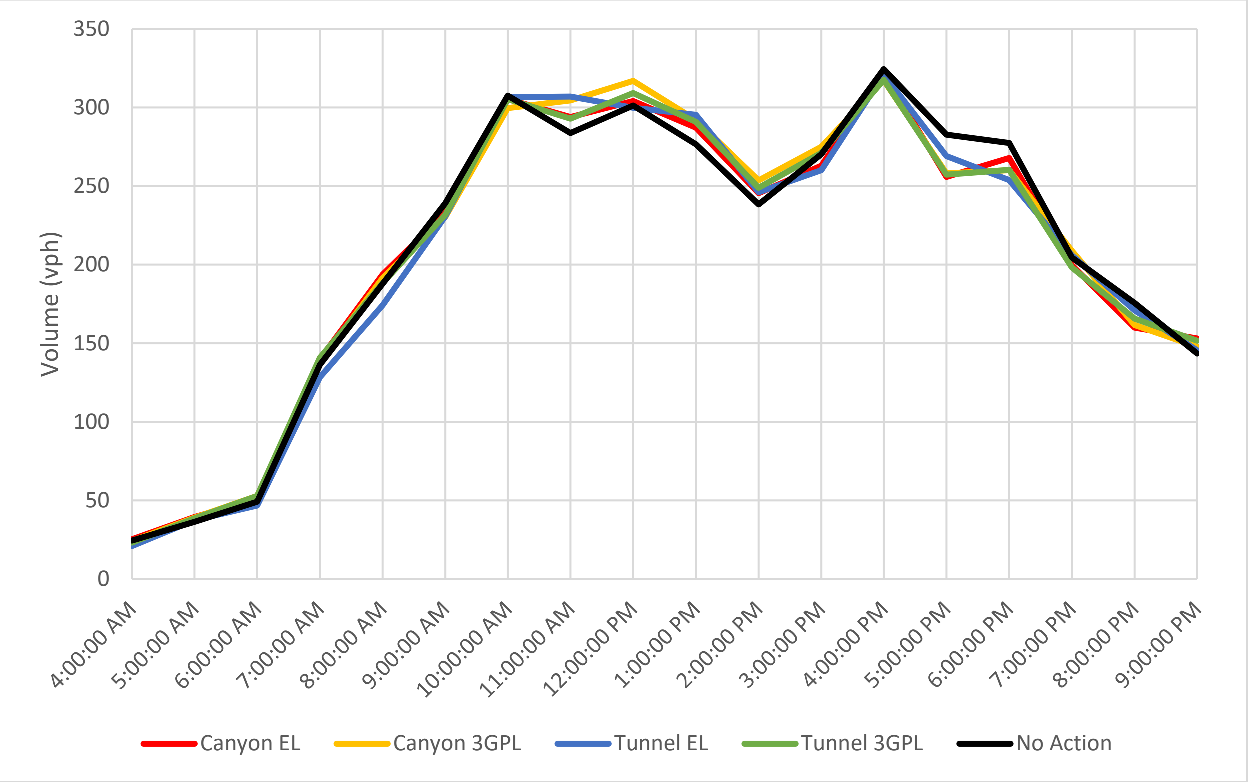
Source: TransModeler microsimulation analysis.

Exhibit 138. Action Alternatives US 6 Winter Eastbound Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

Exhibit 139. Action Alternatives US 6 Summer Eastbound Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

6.4 Action Alternatives Operational Characteristics

The action alternatives operational characteristics are compared to the No Action conditions in the following sections.

6.4.1 VMT and VHT

Comparing VMT and VHT between the No Action conditions to those for the Tunnel Alternative (Exhibit 140) and the Canyon Viaduct Alternative (Exhibit 141) shows a significant change in travel patterns. Winter Saturday VHT on I-70 drops by more than half and Winter Saturday VMT on US 40 decreases by roughly two-thirds. Changes in winter Saturday VMT and VHT indicate that congestion on I-70 decreases with the action alternatives, which in turn reduces the number of vehicles using US 40 to bypass congestion on I-70. Improvements to the Hidden Valley/Central City interchange encourage fewer vehicles to bypass on CR 314, as shown by the large drop in VMT in the Tunnel Alternative.

Exhibit 140. Tunnel Alternative VMT and VHT

Facility	2045 No Action				2045 Tunnel Alternative[1]			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	VMT	VHT	VMT	VHT	VMT	VHT	VMT	VHT
I-70	913,755	40,117	916,588	19,942	917,161 (<1%)	19,967 (-50%)	922,216 (1%)	18,662 (-6%)
US 6	10,659	681	5,298	166	8,819 (-17%)	295 (-57%)	6,042 (14%)	156 (-6%)
US 40	49,874	2,892	13,581	359	16,141 (-68%)	592 (-80%)	5,418 (-60%)	173 (-52%)
CR 314	2,334	152	4,936	668	172 (-93%)	10 (-93%)	110 (-98%)	6 (-99%)

Source: TransModeler microsimulation analysis.

1. Percent difference compared to No Action.

Exhibit 141. Canyon Viaduct Alternative VMT and VHT

Facility	2045 No Action				2045 Canyon Viaduct Alternative[1]			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	VMT	VHT	VMT	VHT	VMT	VHT	VMT	VHT
I-70	913,755	40,117	916,588	19,942	921,780 (1%)	20,190 (-50%)	925,562 (1%)	18,267 (-8%)
US 6	10,659	681	5,298	166	9,701 (-9%)	422 (-38%)	6,188 (17%)	160 (-4%)
US 40	49,874	2,892	13,581	359	13,393 (-73%)	801 (-72%)	5,298 (-61%)	168 (-53%)
CR 314	2,334	152	4,936	668	37 (-98%)	2 (-99%)	109 (-98%)	6 (-99%)

Source: TransModeler microsimulation analysis.

1. Percent difference compared to No Action condition.

6.4.2 Throughput on I-70

Throughput was evaluated at two locations on I-70 and it should be noted that one of these locations would have a westbound EL or PPSL (near Idaho Springs) and the other would be GPL only (east of Floyd Hill). Overall, the two options process about the same number of vehicles on I-70 and all will process more than the No Action conditions. This is expected since a new lane will be added to I-70. In the winter, I-70 will process up to 5,100 vph in the section near Exit 241 where the highway will have 2GPL plus a PPSL. East of Exit 247, or prior to the third lane being added, the alternatives will process up to 20 percent more volumes. The figures in Section 6.3.1 show that the third westbound lane will carry about 1,500 vph if it is an EL

Exhibit 142. Tunnel Alternative I-70 Throughput

Travel Direction	2045 No Action (vph)				2045 Tunnel Alternative (vph)			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241
Eastbound	4,300	4,500	4,500	4,600	4,700[1] 4,700[2]	5,100[1] 5,100[2]	5,000[1] 5,000[2]	4,400[1] 4,300[2]
Westbound	3,700	3,800	3,300	3,500	4,400[1] 4,300[2]	5,000 5,300[2]	3,500[1] 3,500[2]	3,500[1] 3,500[2]

Source: TransModeler microsimulation analysis.

1. GPL alternative.

2. Sum of GPL and EL in EL alternative.

Exhibit 143. Canyon Viaduct Alternative I-70 Throughput

Travel Direction	2045 No Action (vph)				2045 Canyon Viaduct Alternative (vph)			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241	East of Exit 247	East of Exit 241
Eastbound	4,300	4,500	4,500	4,600	4,700[1] 4,700[2]	5,100[1] 5,100[2]	5,000[1] 5,000[2]	5,200[1] 5,200[2]
Westbound	3,700	3,800	3,300	3,500	4,400[1] 4,300[2]	5,400[1] 5,400[2]	3,500[1] 3,500[2]	3,500[1] 3,500[2]

Source: TransModeler microsimulation analysis.

6.4.3 Travel Time

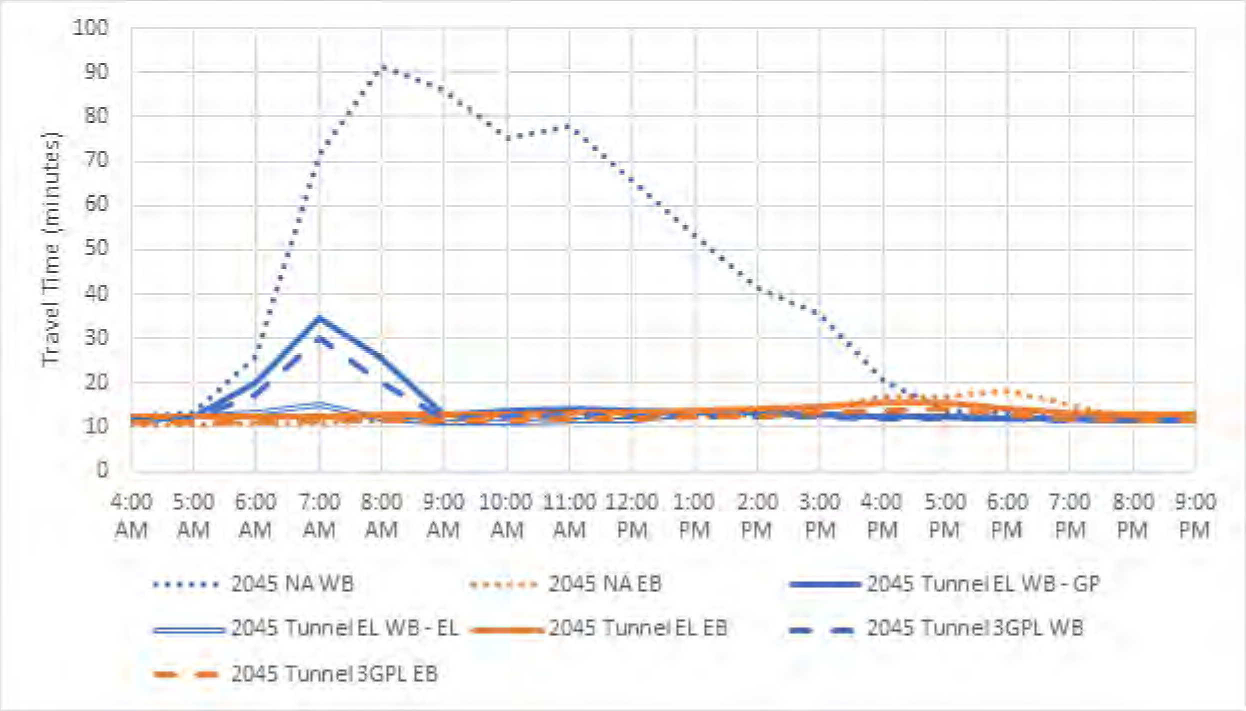
One of the key performance measures for the action alternatives is travel time. Winter Saturday travel time on mainline I-70 for the Tunnel Alternative is shown in Exhibit 144. Going westbound during the morning peak, the model with three general-purpose lanes (3GPL) has shorter travel times than the model with the third lane as an express lane (2GPL + 1EL). Both action alternatives models show an enormous improvement in westbound travel times as compared to the No Action condition. Eastbound travel times also decrease compared to the No Action condition.

Summer Sunday travel time on I-70 for the Tunnel Alternative is shown in Exhibit 145. Eastbound travel time is reduced for the action alternatives compared to the No Action condition. The duration of the eastbound peak also is shorter when compared to the No Action condition. Travel time improvements in the eastbound direction come mainly from geometrical improvements to curvature between Hidden Valley/Central City and US 6, and from the elimination of the left-side exit ramp to US 6. Summer westbound travel times improve for both Tunnel Alternative configurations (eastbound and westbound) as compared to the No Action condition.

Exhibit 146 shows the winter Saturday westbound travel times for the Canyon Viaduct Alternative. Winter westbound travel times are reduced greatly for both EL and 3GPL options as compared to the 2045 No Action condition. The EL option has higher travel times than the 3GPL option for winter westbound. Winter eastbound shows an improvement in travel times for the Canyon Viaduct Alternative, with the EL and 3GPL options performing nearly identically.

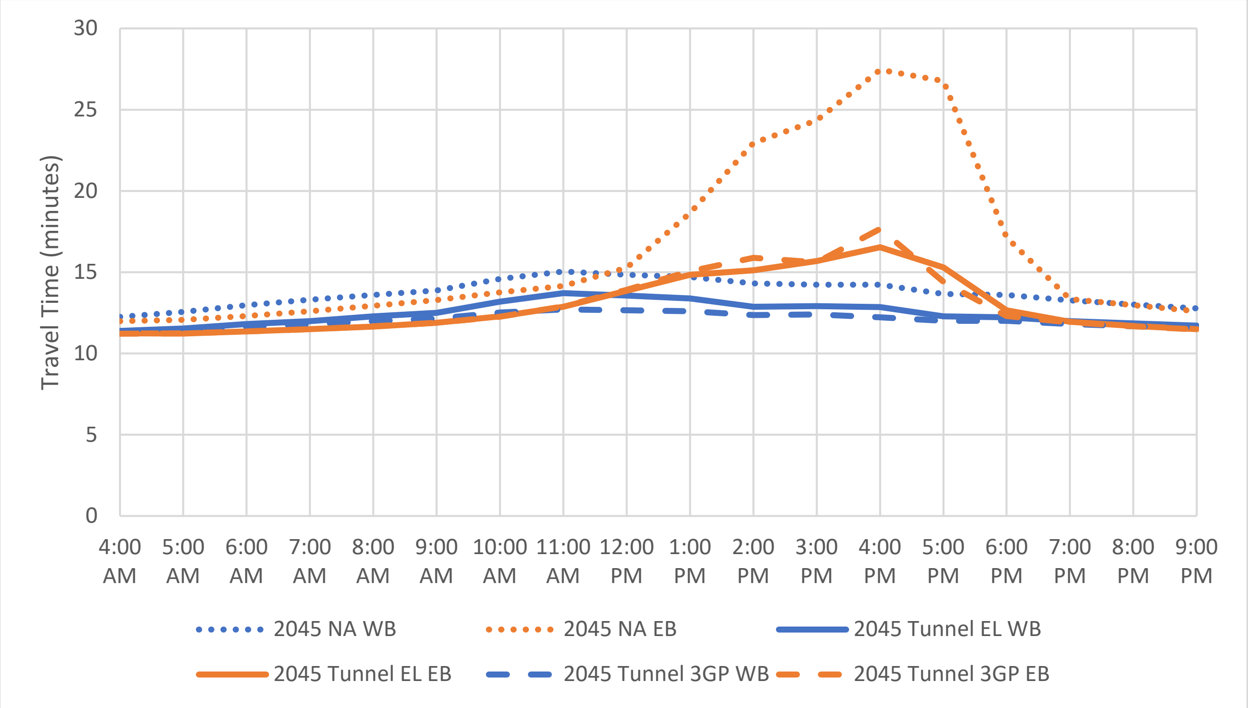
For the Canyon Viaduct Alternative, 2045 summer Sunday eastbound travel times are shown in Exhibit 147. Summer Sunday shows similar trends, with the 3GPL option having a slightly lower westbound travel time than the EL option. Eastbound, the 3GPL and the EL options perform identically, with a big reduction in travel time compared to summer No Action eastbound conditions.

Exhibit 144. Tunnel Alternative Winter Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



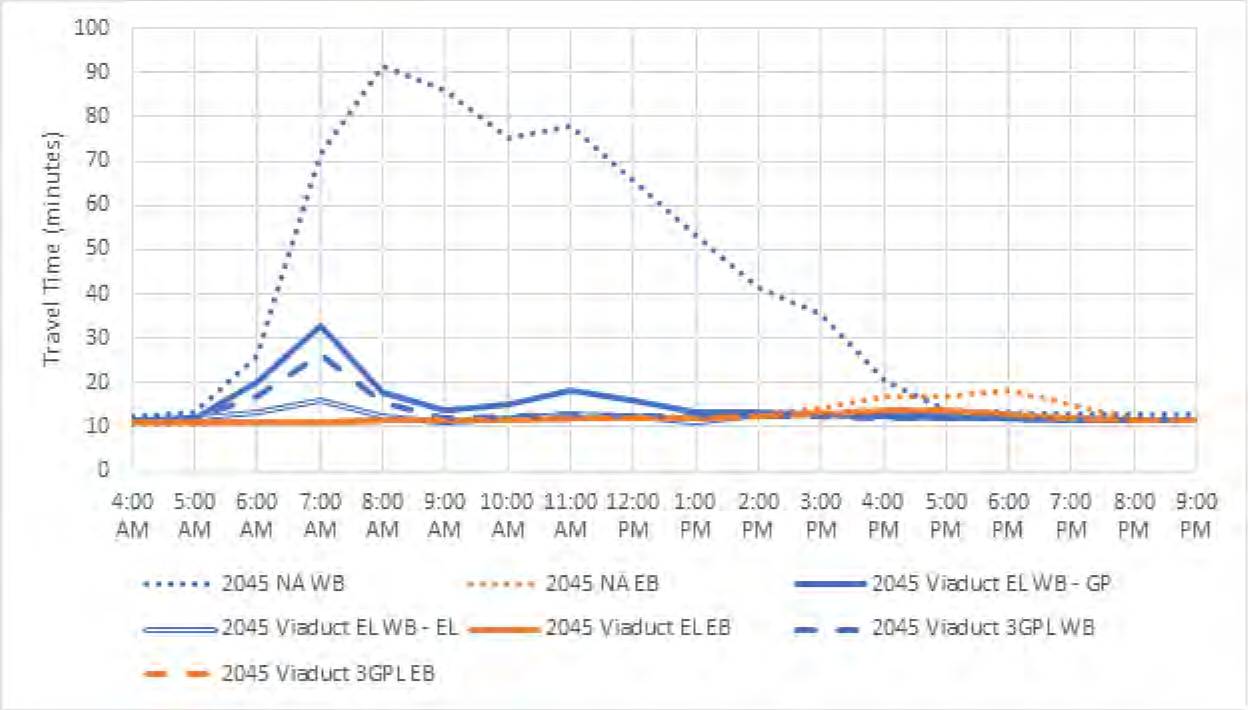
Source: TransModeler microsimulation analysis.

Exhibit 145. **Tunnel Alternative Summer Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)**



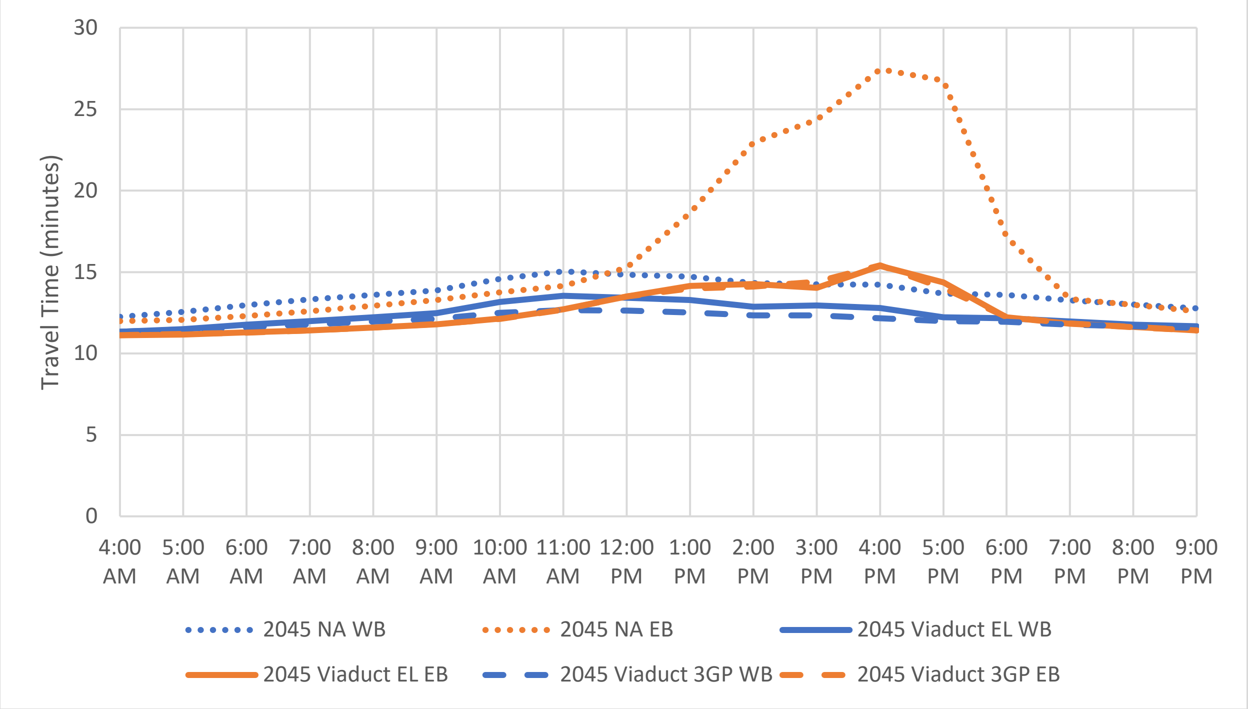
Source: TransModeler microsimulation analysis.

Exhibit 146. **Canyon Viaduct Alternative Winter Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)**



Source: TransModeler microsimulation analysis. Note: no one in WB EL

Exhibit 147. Canyon Viaduct Alternative Summer Travel Time—Between Exit 252 (SH 74/ Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



Source: TransModeler microsimulation analysis. Note: no one in WB EL

6.4.4 Travel Speeds and Congestion

Speed on I-70 provides a representation of the amount of congestion occurring on the facility at a given time.

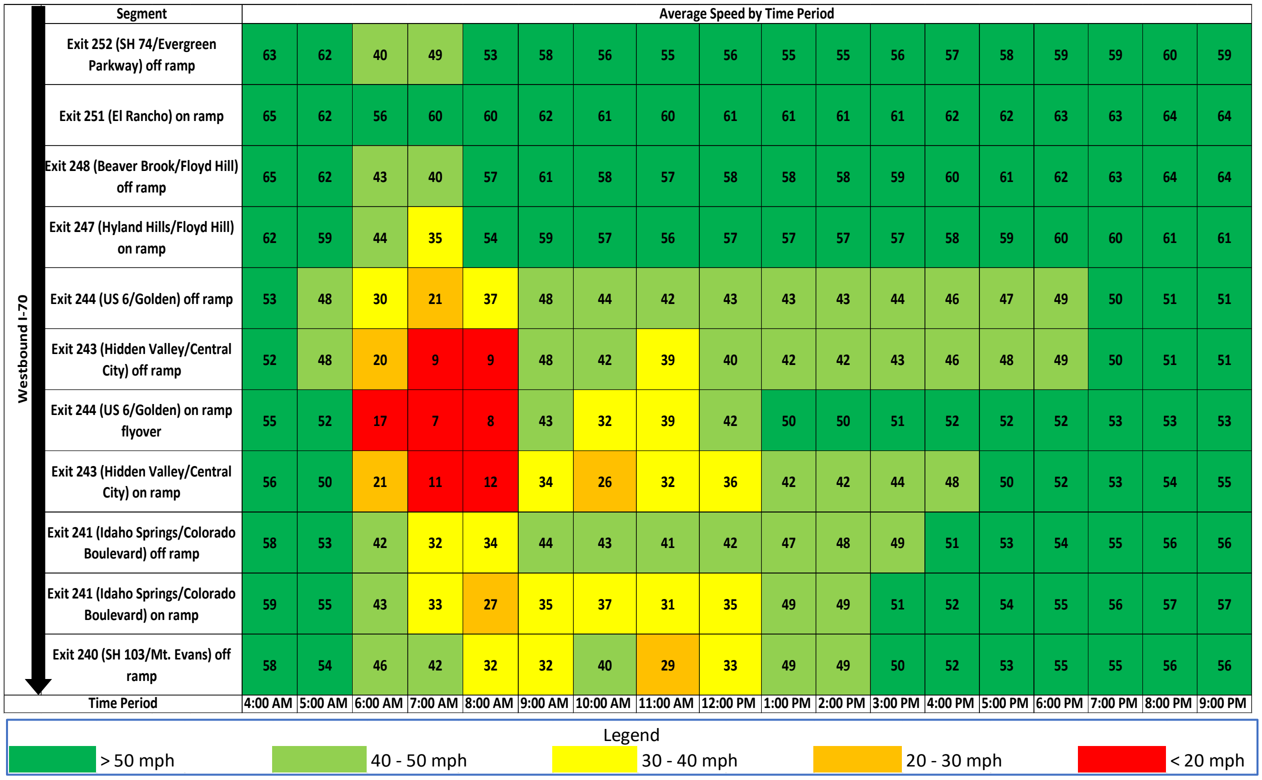
6.4.4.1 Tunnel Alternative

Speeds are shown by season, westbound third lane type, and direction. Winter westbound speeds (see Exhibit 148 and Exhibit 149) are higher in the Tunnel Alternative options than for the No Action scenario. The magnitude and duration of congestion under winter westbound conditions is greatly reduced. Westbound congestion occurs for more hours of the day for the EL option as shown by reduced speeds for longer than for the 3GPL option. Peak congestion in the westbound direction is more severe for the 3GPL option, despite clearing faster. The westbound 3GPL option has lower speeds for a longer stretch of the corridor at the peak than the westbound EL option. This is primarily because the 3GPL option has a forced right-lane drop at Exit 241, which results in more congestion and longer queues in the system compared to the EL option, which has a smoother transition at the west end of the EL where the PPSL starts.

Winter eastbound speeds (shown in Exhibit 150 and Exhibit 151) are improved for the Tunnel Alternative options over the No Action scenario. Both the magnitude and duration of congestion are reduced, largely due to geometrical improvements on eastbound I-70 between Hidden Valley/Central City and US 6. There is essentially no difference between the EL and 3GPL options eastbound, which is expected because the eastbound configuration is the same in both options.

Summer conditions for the Tunnel Alternative show a smaller difference between the 3GPL and EL options. As in winter, the EL option has slightly lower speeds than the 3GPL option. Eastbound speeds of the two options are roughly the same, as shown in Exhibit 152 and Exhibit 153 for westbound I-70 and Exhibit 154 and Exhibit 155 for eastbound I-70.

Exhibit 148. Tunnel Alternative—EL Option, Winter Westbound Congestion Diagram



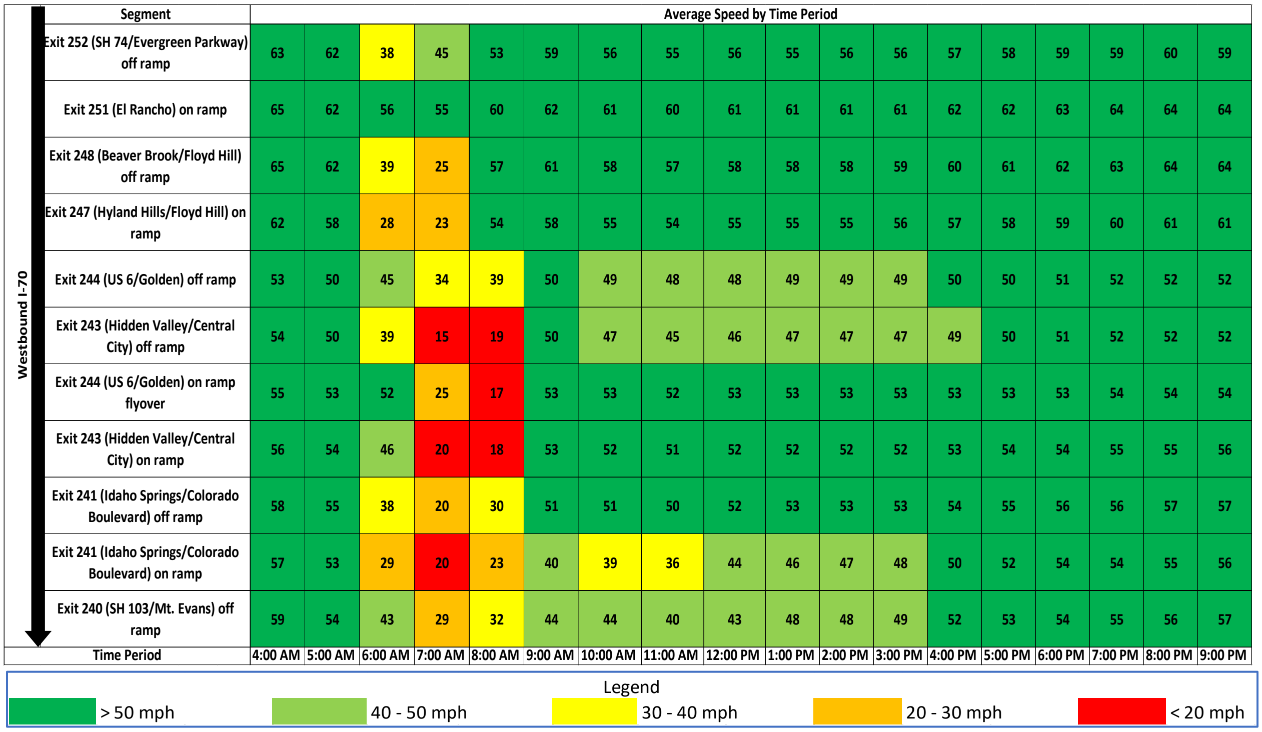
Segment	Average Speed by Time Period																	
Exit 252 (SH 74/Evergreen Parkway) off ramp	63	62	40	49	53	58	56	55	56	55	55	56	57	58	59	59	60	59
Exit 251 (El Rancho) on ramp	65	62	56	60	60	62	61	60	61	61	61	61	62	62	63	63	64	64
Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	62	43	40	57	61	58	57	58	58	58	59	60	61	62	63	64	64
Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	59	44	35	54	59	57	56	57	57	57	57	58	59	60	60	61	61
Exit 244 (US 6/Golden) off ramp	53	48	30	21	37	48	44	42	43	43	43	44	46	47	49	50	51	51
Exit 243 (Hidden Valley/Central City) off ramp	52	48	20	9	9	48	42	39	40	42	42	43	46	48	49	50	51	51
Exit 244 (US 6/Golden) on ramp flyover	55	52	17	7	8	43	32	39	42	50	50	51	52	52	52	53	53	53
Exit 243 (Hidden Valley/Central City) on ramp	56	50	21	11	12	34	26	32	36	42	42	44	48	50	52	53	54	55
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	53	42	32	34	44	43	41	42	47	48	49	51	53	54	55	56	56
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	59	55	43	33	27	35	37	31	35	49	49	51	52	54	55	56	57	57
Exit 240 (SH 103/Mt. Evans) off ramp	58	54	46	42	32	32	40	29	33	49	49	50	52	53	55	55	56	56
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 149. Tunnel Alternative—3GPL Option, Winter Westbound Congestion Diagram



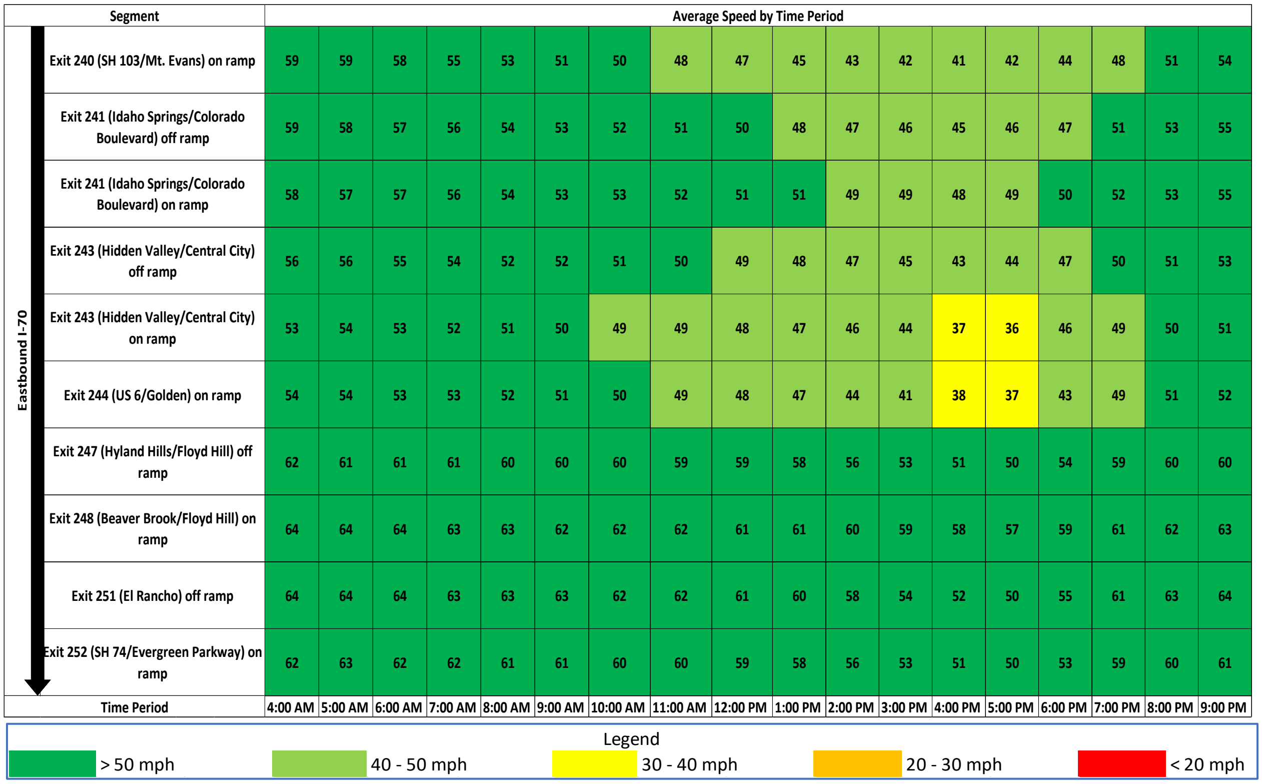
	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	63	62	38	45	53	59	56	55	56	55	56	56	57	58	59	59	60	59
	Exit 251 (El Rancho) on ramp	65	62	56	55	60	62	61	60	61	61	61	61	62	62	63	64	64	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	62	39	25	57	61	58	57	58	58	58	59	60	61	62	63	64	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	58	28	23	54	58	55	54	55	55	55	56	57	58	59	60	61	61
	Exit 244 (US 6/Golden) off ramp	53	50	45	34	39	50	49	48	48	49	49	49	50	50	51	52	52	52
	Exit 243 (Hidden Valley/Central City) off ramp	54	50	39	15	19	50	47	45	46	47	47	47	49	50	51	52	52	52
	Exit 244 (US 6/Golden) on ramp flyover	55	53	52	25	17	53	53	52	53	53	53	53	53	53	53	54	54	54
	Exit 243 (Hidden Valley/Central City) on ramp	56	54	46	20	18	53	52	51	52	52	52	52	53	54	54	55	55	56
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	55	38	20	30	51	51	50	52	53	53	53	54	55	56	56	57	57
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	53	29	20	23	40	39	36	44	46	47	48	50	52	54	54	55	56
	Exit 240 (SH 103/Mt. Evans) off ramp	59	54	43	29	32	44	44	40	43	48	48	49	52	53	54	55	56	57
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 150. Tunnel Alternative—EL Option, Winter Eastbound Congestion Diagram



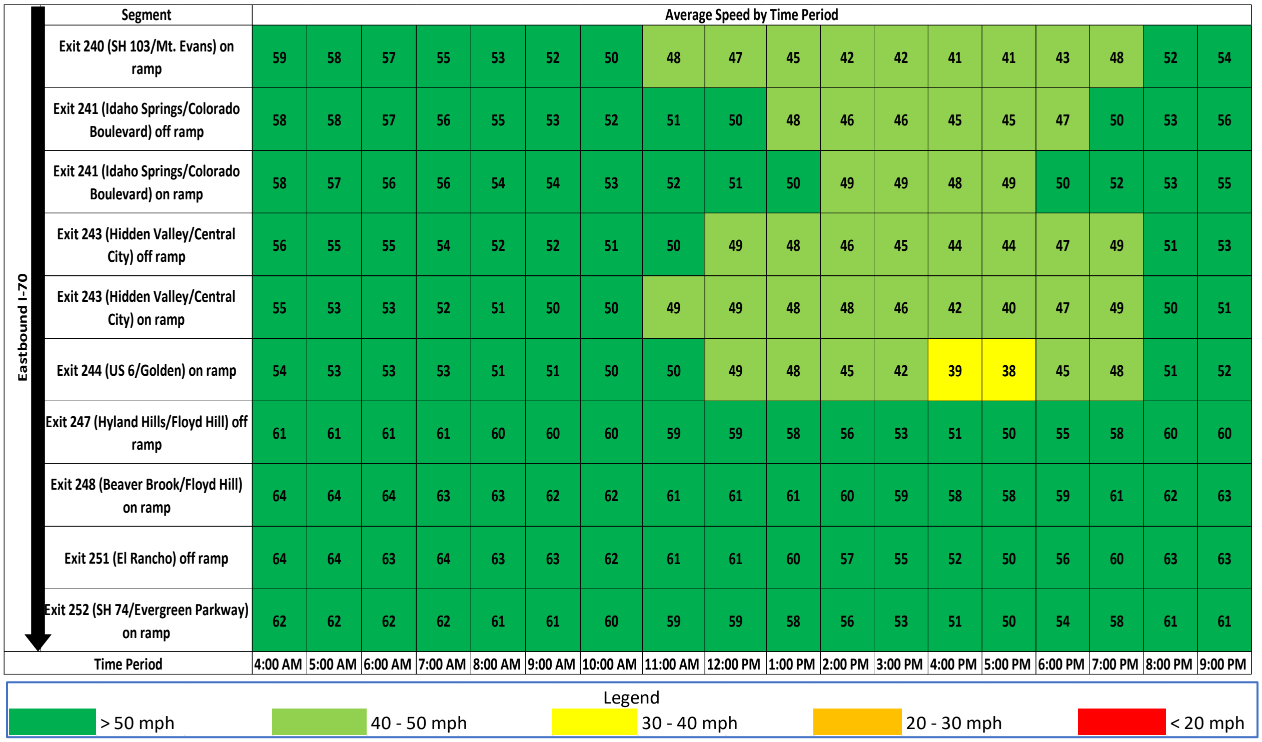
	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	59	59	58	55	53	51	50	48	47	45	43	42	41	42	44	48	51	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	59	58	57	56	54	53	52	51	50	48	47	46	45	46	47	51	53	55
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	57	57	56	54	53	53	52	51	51	49	49	48	49	50	52	53	55
	Exit 243 (Hidden Valley/Central City) off ramp	56	56	55	54	52	52	51	50	49	48	47	45	43	44	47	50	51	53
	Exit 243 (Hidden Valley/Central City) on ramp	53	54	53	52	51	50	49	49	48	47	46	44	37	36	46	49	50	51
	Exit 244 (US 6/Golden) on ramp	54	54	53	53	52	51	50	49	48	47	44	41	38	37	43	49	51	52
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	62	61	61	61	60	60	60	59	59	58	56	53	51	50	54	59	60	60
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	64	63	63	62	62	62	61	61	60	59	58	57	59	61	62	63
	Exit 251 (El Rancho) off ramp	64	64	64	63	63	63	62	62	61	60	58	54	52	50	55	61	63	64
	Exit 252 (SH 74/Evergreen Parkway) on ramp	62	63	62	62	61	61	60	60	59	58	56	53	51	50	53	59	60	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 151. Tunnel Alternative—3GPL Option, Winter Eastbound Congestion Diagram

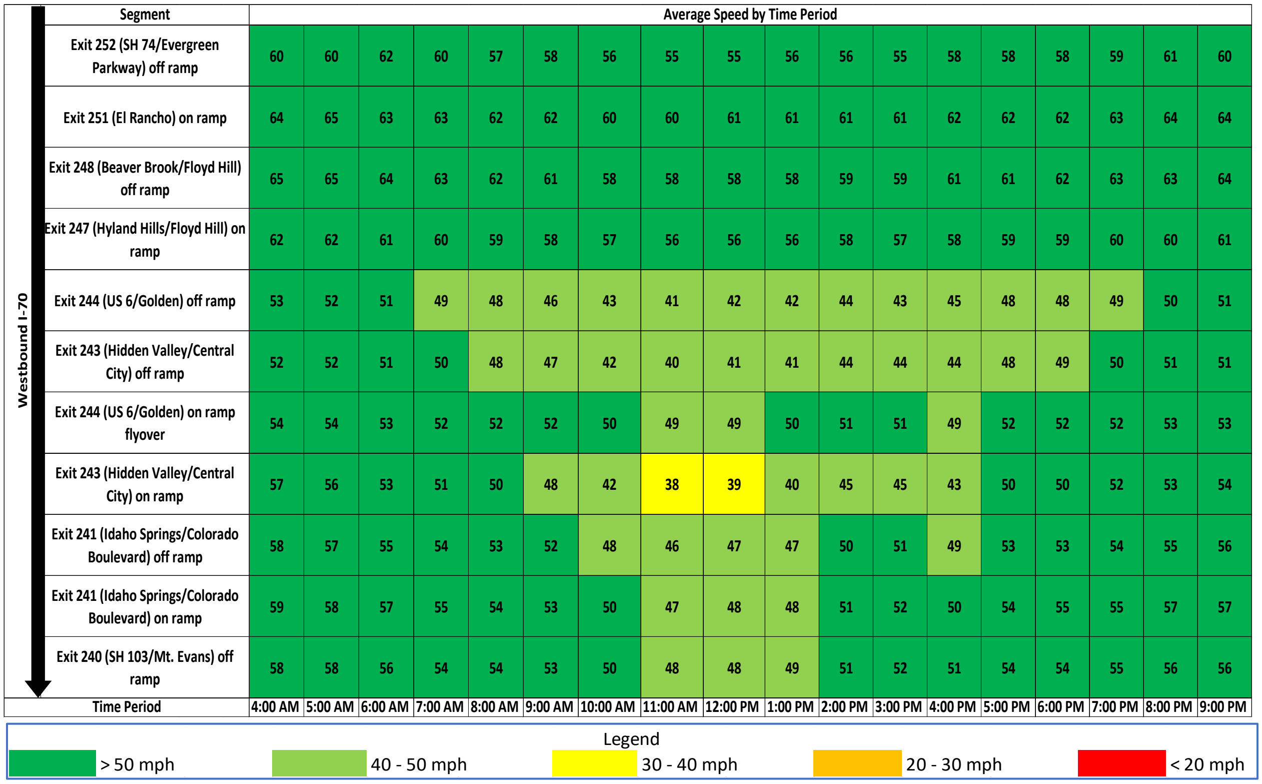


	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	59	58	57	55	53	52	50	48	47	45	42	42	41	41	43	48	52	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	58	57	56	55	53	52	51	50	48	46	46	45	45	47	50	53	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	57	56	56	54	54	53	52	51	50	49	49	48	49	50	52	53	55
	Exit 243 (Hidden Valley/Central City) off ramp	56	55	55	54	52	52	51	50	49	48	46	45	44	44	47	49	51	53
	Exit 243 (Hidden Valley/Central City) on ramp	55	53	53	52	51	50	50	49	49	48	48	46	42	40	47	49	50	51
	Exit 244 (US 6/Golden) on ramp	54	53	53	53	51	51	50	50	49	48	45	42	39	38	45	48	51	52
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	61	61	61	61	60	60	60	59	59	58	56	53	51	50	55	58	60	60
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	64	63	63	62	62	61	61	61	60	59	58	58	59	61	62	63
	Exit 251 (El Rancho) off ramp	64	64	63	64	63	63	62	61	61	60	57	55	52	50	56	60	63	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	62	62	62	62	61	61	60	59	59	58	56	53	51	50	54	58	61	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 152. Tunnel Alternative—EL Option, Summer Westbound Congestion Diagram

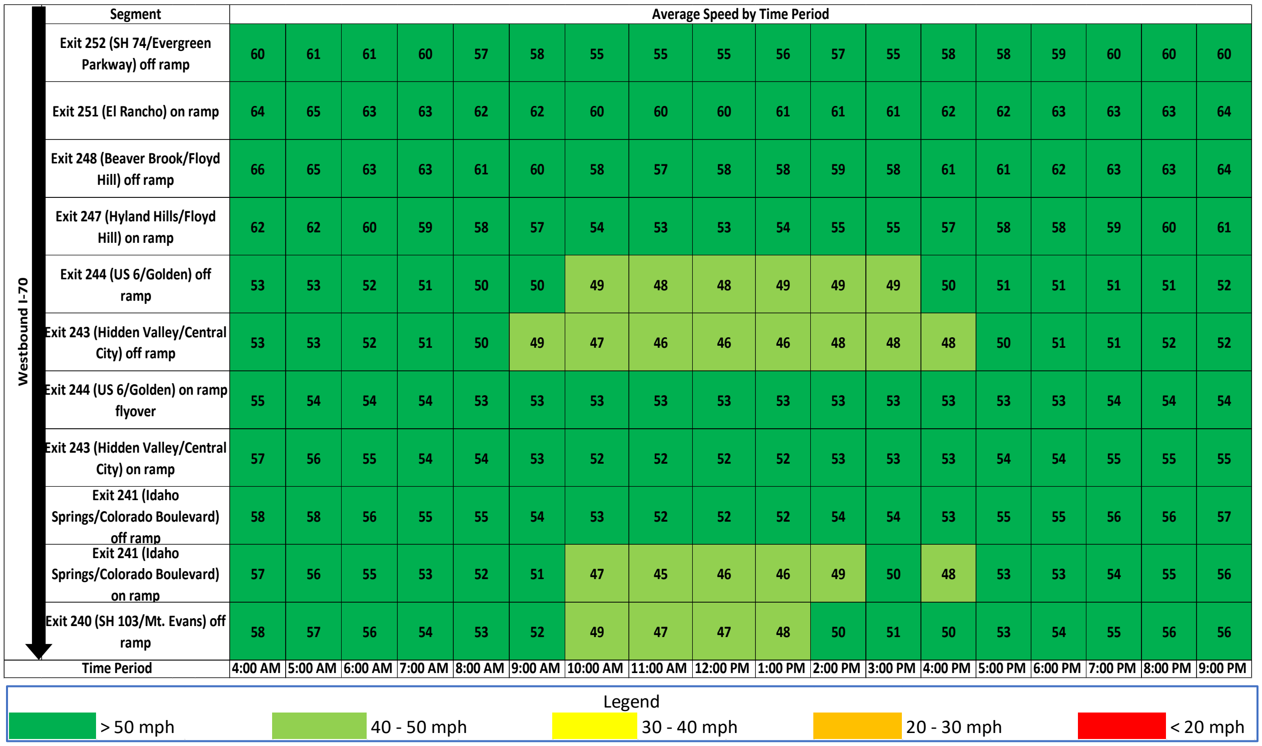


	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	60	60	62	60	57	58	56	55	55	56	56	55	58	58	58	59	61	60
	Exit 251 (El Rancho) on ramp	64	65	63	63	62	62	60	60	61	61	61	61	62	62	62	63	64	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	65	64	63	62	61	58	58	58	58	59	59	61	61	62	63	63	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	62	61	60	59	58	57	56	56	56	58	57	58	59	59	60	60	61
	Exit 244 (US 6/Golden) off ramp	53	52	51	49	48	46	43	41	42	42	44	43	45	48	48	49	50	51
	Exit 243 (Hidden Valley/Central City) off ramp	52	52	51	50	48	47	42	40	41	41	44	44	44	48	49	50	51	51
	Exit 244 (US 6/Golden) on ramp flyover	54	54	53	52	52	52	50	49	49	50	51	51	49	52	52	52	53	53
	Exit 243 (Hidden Valley/Central City) on ramp	57	56	53	51	50	48	42	38	39	40	45	45	43	50	50	52	53	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	57	55	54	53	52	48	46	47	47	50	51	49	53	53	54	55	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	59	58	57	55	54	53	50	47	48	48	51	52	50	54	55	55	57	57
	Exit 240 (SH 103/Mt. Evans) off ramp	58	58	56	54	54	53	50	48	48	49	51	52	51	54	54	55	56	56
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 153. Tunnel Alternative—3GPL Option, Summer Westbound Congestion Diagram

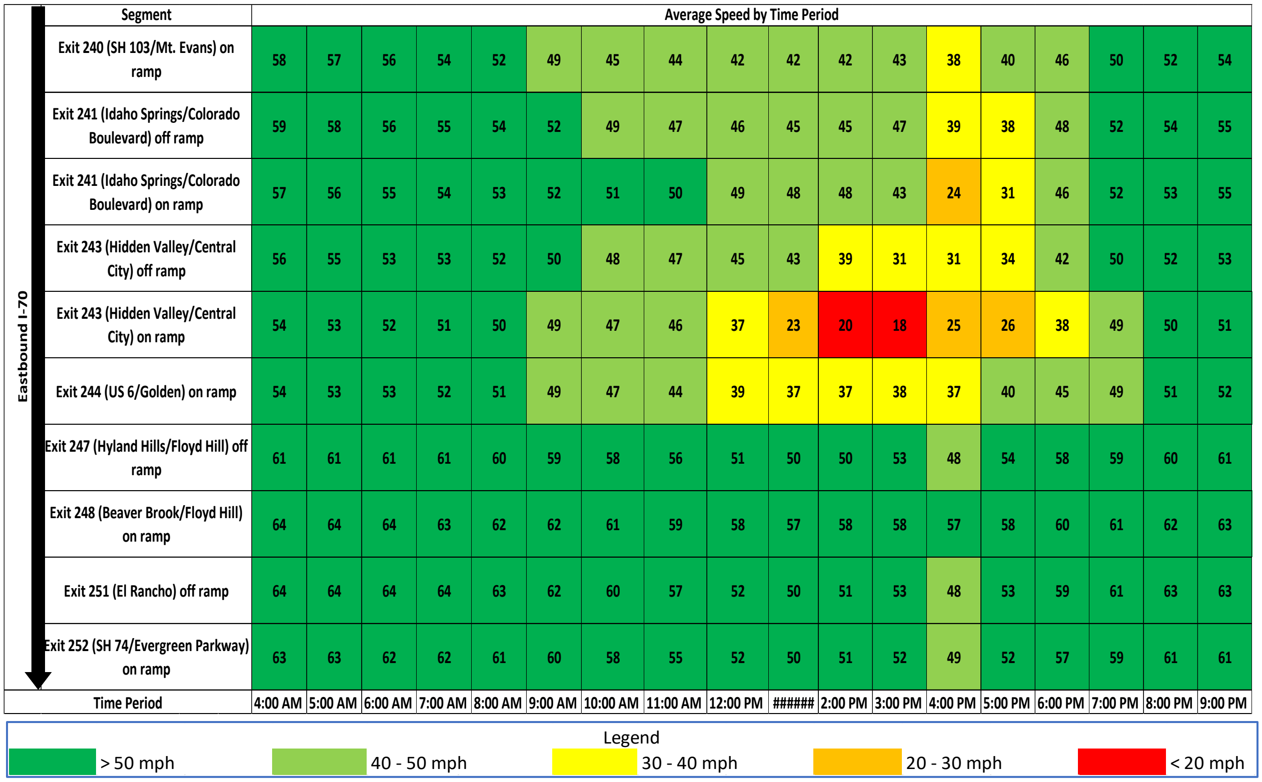


	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	60	61	61	60	57	58	55	55	55	56	57	55	58	58	59	60	60	60
	Exit 251 (El Rancho) on ramp	64	65	63	63	62	62	60	60	60	61	61	61	62	62	63	63	63	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	66	65	63	63	61	60	58	57	58	58	59	58	61	61	62	63	63	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	62	60	59	58	57	54	53	53	54	55	55	57	58	58	59	60	61
	Exit 244 (US 6/Golden) off ramp	53	53	52	51	50	50	49	48	48	49	49	49	50	51	51	51	51	52
	Exit 243 (Hidden Valley/Central City) off ramp	53	53	52	51	50	49	47	46	46	46	48	48	48	50	51	51	52	52
	Exit 244 (US 6/Golden) on ramp flyover	55	54	54	54	53	53	53	53	53	53	53	53	53	53	53	54	54	54
	Exit 243 (Hidden Valley/Central City) on ramp	57	56	55	54	54	53	52	52	52	52	53	53	53	54	54	55	55	55
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	58	56	55	55	54	53	52	52	52	54	54	53	55	55	56	56	57
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	56	55	53	52	51	47	45	46	46	49	50	48	53	53	54	55	56
	Exit 240 (SH 103/Mt. Evans) off ramp	58	57	56	54	53	52	49	47	47	48	50	51	50	53	54	55	56	56
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 154. Tunnel Alternative—EL Option, Summer Eastbound Congestion Diagram

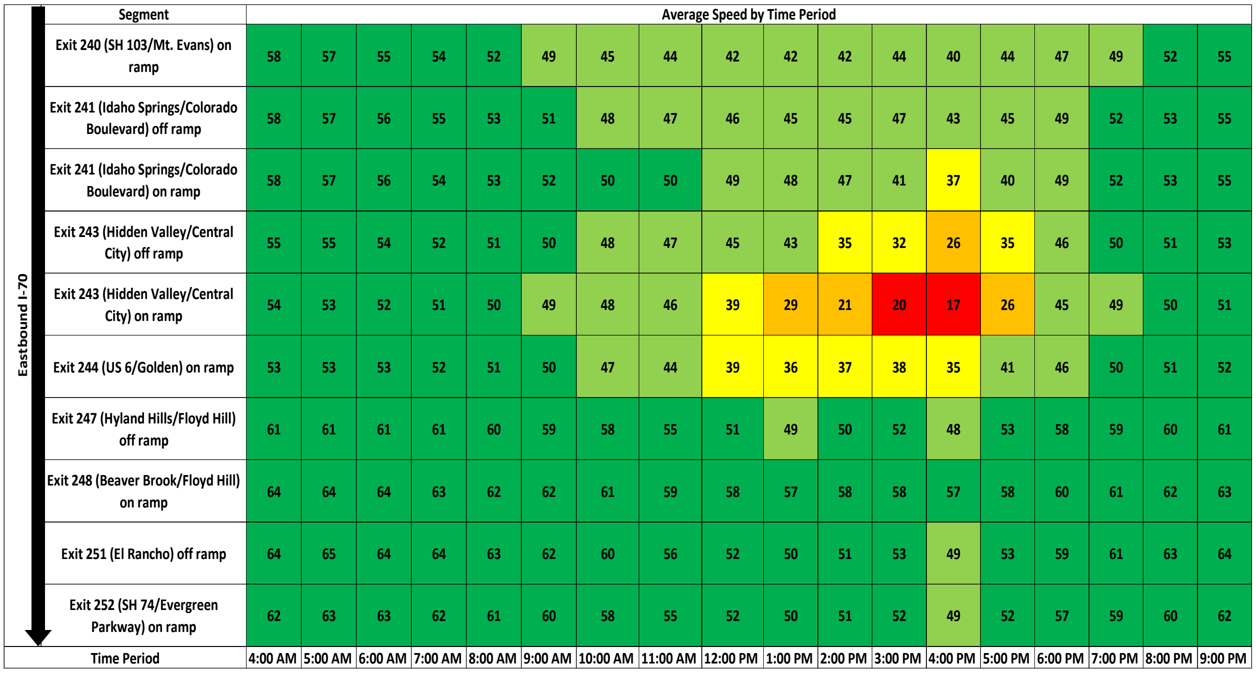


	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	58	57	56	54	52	49	45	44	42	42	42	43	38	40	46	50	52	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	59	58	56	55	54	52	49	47	46	45	45	47	39	38	48	52	54	55
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	56	55	54	53	52	51	50	49	48	48	43	24	31	46	52	53	55
	Exit 243 (Hidden Valley/Central City) off ramp	56	55	53	53	52	50	48	47	45	43	39	31	31	34	42	50	52	53
	Exit 243 (Hidden Valley/Central City) on ramp	54	53	52	51	50	49	47	46	37	23	20	18	25	26	38	49	50	51
	Exit 244 (US 6/Golden) on ramp	54	53	53	52	51	49	47	44	39	37	37	38	37	40	45	49	51	52
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	61	61	61	61	60	59	58	56	51	50	50	53	48	54	58	59	60	61
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	64	63	62	62	61	59	58	57	58	58	57	58	60	61	62	63
	Exit 251 (El Rancho) off ramp	64	64	64	64	63	62	60	57	52	50	51	53	48	53	59	61	63	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	63	63	62	62	61	60	58	55	52	50	51	52	49	52	57	59	61	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	######	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 155. Tunnel Alternative—3GPL Option, Summer Eastbound Congestion Diagram



Segment	Average Speed by Time Period																	
Exit 240 (SH 103/Mt. Evans) on ramp	58	57	55	54	52	49	45	44	42	42	42	44	40	44	47	49	52	55
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	57	56	55	53	51	48	47	46	45	45	47	43	45	49	52	53	55
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	57	56	54	53	52	50	50	49	48	47	41	37	40	49	52	53	55
Exit 243 (Hidden Valley/Central City) off ramp	55	55	54	52	51	50	48	47	45	43	35	32	26	35	46	50	51	53
Exit 243 (Hidden Valley/Central City) on ramp	54	53	52	51	50	49	48	46	39	29	21	20	17	26	45	49	50	51
Exit 244 (US 6/Golden) on ramp	53	53	53	52	51	50	47	44	39	36	37	38	35	41	46	50	51	52
Exit 247 (Hyland Hills/Floyd Hill) off ramp	61	61	61	61	60	59	58	55	51	49	50	52	48	53	58	59	60	61
Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	64	63	62	62	61	59	58	57	58	58	57	58	60	61	62	63
Exit 251 (El Rancho) off ramp	64	65	64	64	63	62	60	56	52	50	51	53	49	53	59	61	63	64
Exit 252 (SH 74/Evergreen Parkway) on ramp	62	63	63	62	61	60	58	55	52	50	51	52	49	52	57	59	60	62
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

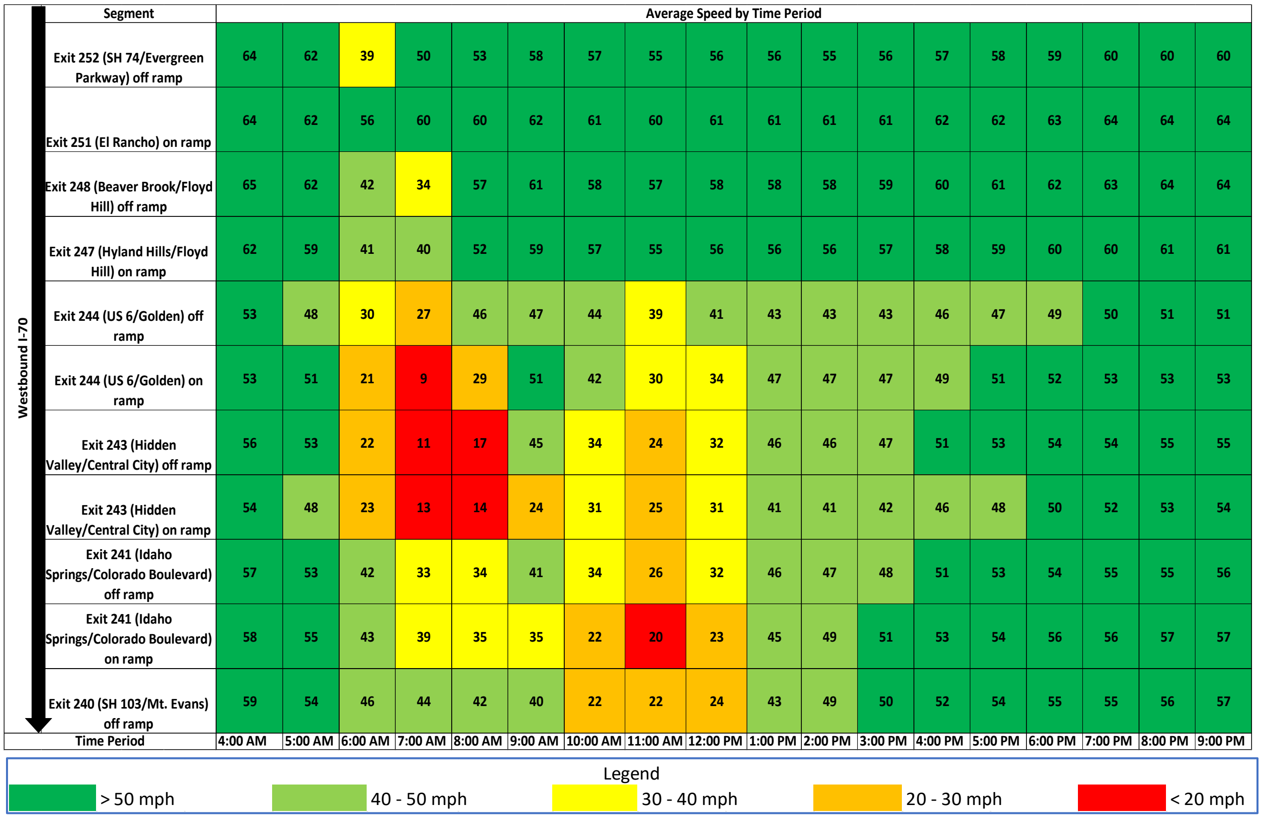
Source: TransModeler microsimulation analysis.

6.4.4.2 Canyon Viaduct Alternative

Winter speeds for the Canyon Viaduct Alternative are shown in Exhibit 156 and Exhibit 157 for westbound I-70 and in Exhibit 158 and Exhibit 159 for eastbound I-70. Westbound winter speeds are greatly improved for the Canyon Viaduct Alternative with both the EL and 3GPL options compared to the No Action scenario. The severity of the westbound peak is much lower, and operations recover much more quickly in the Canyon Viaduct Alternative. The EL option for the viaduct has lower speeds at the westbound peak for more of the corridor and takes longer to recover. Eastbound, performance of the EL and 3GPL options is nearly identical and shows a significant improvement over the No Action scenario.

Summer speeds for the Canyon Viaduct Alternative are shown in Exhibit 160 and Exhibit 161 for westbound I-70 and Exhibit 162 and Exhibit 163 for eastbound I-70. Westbound speeds are slightly higher for the 3GPL option. Eastbound shows a slight improvement for the 3GPL option, but the difference is so small it is not a significant enough difference to distinguish between the performance of the two options.

Exhibit 156. Canyon Viaduct Alternative—EL Option, Winter Westbound Congestion Diagram

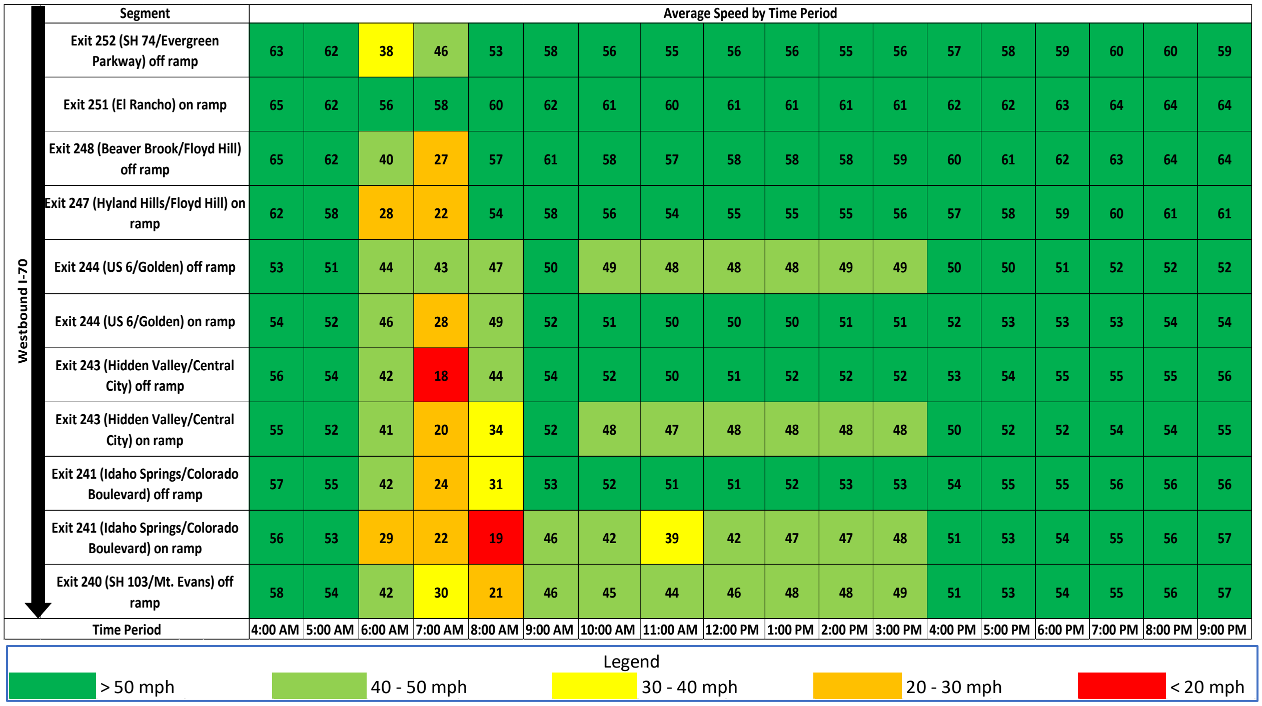


Segment	Average Speed by Time Period																	
Exit 252 (SH 74/Evergreen Parkway) off ramp	64	62	39	50	53	58	57	55	56	56	55	56	57	58	59	60	60	60
Exit 251 (El Rancho) on ramp	64	62	56	60	60	62	61	60	61	61	61	61	62	62	63	64	64	64
Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	62	42	34	57	61	58	57	58	58	58	59	60	61	62	63	64	64
Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	59	41	40	52	59	57	55	56	56	56	57	58	59	60	60	61	61
Exit 244 (US 6/Golden) off ramp	53	48	30	27	46	47	44	39	41	43	43	43	46	47	49	50	51	51
Exit 244 (US 6/Golden) on ramp	53	51	21	9	29	51	42	30	34	47	47	47	49	51	52	53	53	53
Exit 243 (Hidden Valley/Central City) off ramp	56	53	22	11	17	45	34	24	32	46	46	47	51	53	54	54	55	55
Exit 243 (Hidden Valley/Central City) on ramp	54	48	23	13	14	24	31	25	31	41	41	42	46	48	50	52	53	54
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	57	53	42	33	34	41	34	26	32	46	47	48	51	53	54	55	55	56
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	55	43	39	35	35	22	20	23	45	49	51	53	54	56	56	57	57
Exit 240 (SH 103/Mt. Evans) off ramp	59	54	46	44	42	40	22	22	24	43	49	50	52	54	55	55	56	57
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 157. Canyon Viaduct Alternative—3GPL Option, Winter Westbound Congestion Diagram



Segment	Average Speed by Time Period																	
Exit 252 (SH 74/Evergreen Parkway) off ramp	63	62	38	46	53	58	56	55	56	56	55	56	57	58	59	60	60	59
Exit 251 (El Rancho) on ramp	65	62	56	58	60	62	61	60	61	61	61	61	62	62	63	64	64	64
Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	62	40	27	57	61	58	57	58	58	58	59	60	61	62	63	64	64
Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	58	28	22	54	58	56	54	55	55	55	56	57	58	59	60	61	61
Exit 244 (US 6/Golden) off ramp	53	51	44	43	47	50	49	48	48	48	49	49	50	50	51	52	52	52
Exit 244 (US 6/Golden) on ramp	54	52	46	28	49	52	51	50	50	50	51	51	52	53	53	53	54	54
Exit 243 (Hidden Valley/Central City) off ramp	56	54	42	18	44	54	52	50	51	52	52	52	53	54	55	55	55	56
Exit 243 (Hidden Valley/Central City) on ramp	55	52	41	20	34	52	48	47	48	48	48	48	50	52	52	54	54	55
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	57	55	42	24	31	53	52	51	51	52	53	53	54	55	55	56	56	56
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	56	53	29	22	19	46	42	39	42	47	47	48	51	53	54	55	56	57
Exit 240 (SH 103/Mt. Evans) off ramp	58	54	42	30	21	46	45	44	46	48	48	49	51	53	54	55	56	57
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 158. Canyon Viaduct Alternative—EL Option, Winter Eastbound Congestion Diagram

	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	59	59	58	56	53	51	50	48	47	45	42	42	41	42	43	48	51	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	59	58	57	56	55	54	52	51	50	48	47	46	46	46	47	50	53	55
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	57	57	56	54	54	53	52	51	51	50	49	48	49	50	51	53	55
	Exit 243 (Hidden Valley/Central City) off ramp	56	55	55	54	52	52	51	50	49	48	46	44	43	44	47	49	51	53
	Exit 243 (Hidden Valley/Central City) on ramp	54	54	53	52	51	50	50	49	48	48	47	46	46	46	47	49	50	51
	Exit 244 (US 6/Golden) on ramp	57	56	56	55	54	54	53	52	51	50	48	45	42	43	46	51	53	54
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	62	62	62	62	61	61	60	60	59	59	57	54	51	51	55	59	60	61
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	64	63	63	62	62	61	61	61	60	59	58	58	59	61	62	63
	Exit 251 (El Rancho) off ramp	64	64	64	63	63	63	62	61	61	60	58	55	52	51	55	60	63	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	63	63	62	62	62	61	60	60	59	58	56	53	51	50	54	58	60	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	######	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 159. Canyon Viaduct Alternative—3GPL Option, Winter Eastbound Congestion Diagram

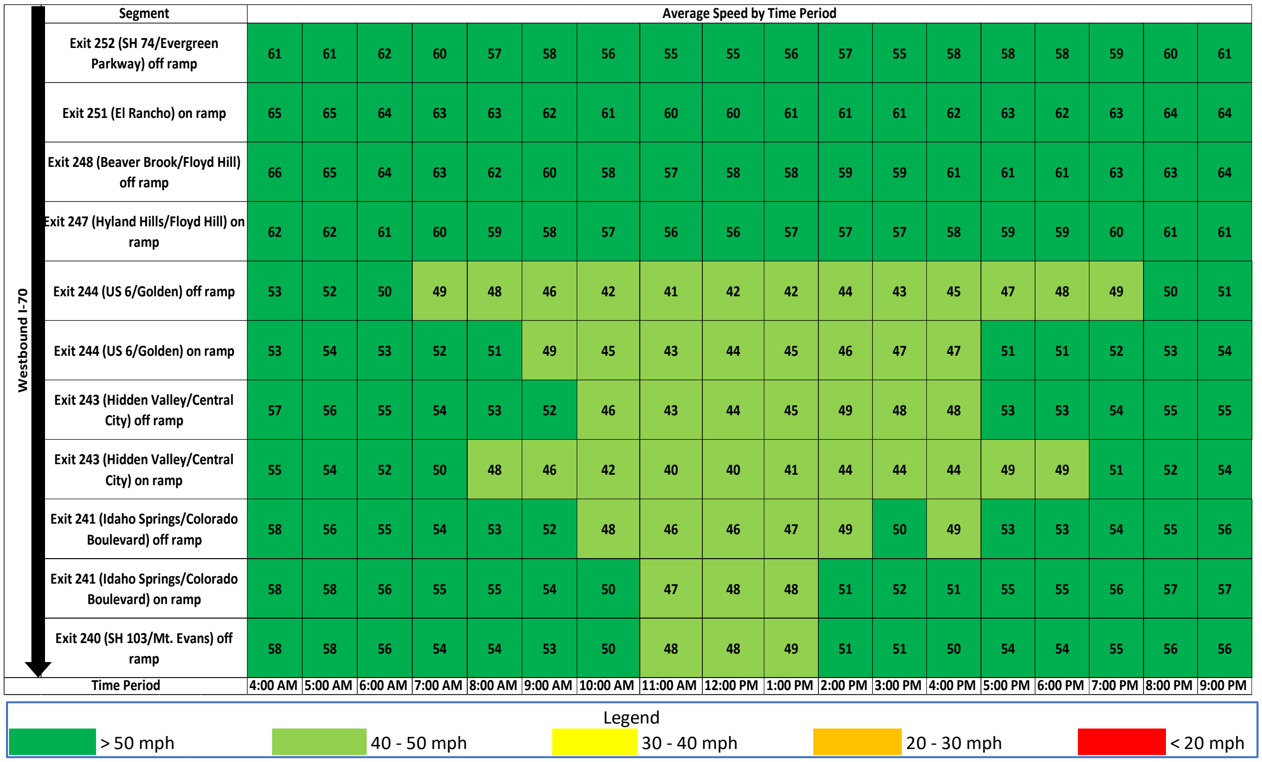
	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	59	58	58	56	53	52	50	48	47	45	43	42	41	41	43	49	52	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	59	58	57	56	54	54	52	51	50	48	47	46	45	46	47	51	54	55
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	57	57	55	54	54	53	52	51	51	49	49	48	49	50	52	53	55
	Exit 243 (Hidden Valley/Central City) off ramp	56	55	55	54	52	52	51	50	49	48	46	44	43	44	47	50	51	53
	Exit 243 (Hidden Valley/Central City) on ramp	54	54	53	52	51	51	50	49	49	48	48	47	47	47	48	49	50	51
	Exit 244 (US 6/Golden) on ramp	57	56	56	55	54	53	52	52	51	50	49	46	43	43	47	52	53	54
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	62	62	62	61	61	61	60	60	59	59	57	53	51	51	55	60	60	61
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	63	64	64	63	63	62	62	61	61	61	60	59	58	58	59	61	62	63
	Exit 251 (El Rancho) off ramp	64	64	64	64	63	63	62	61	61	60	57	54	51	51	55	61	63	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	62	63	63	62	61	61	60	59	59	58	56	53	51	50	53	59	61	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	######	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 160. Canyon Viaduct Alternative—EL Option, Summer Westbound Congestion Diagram



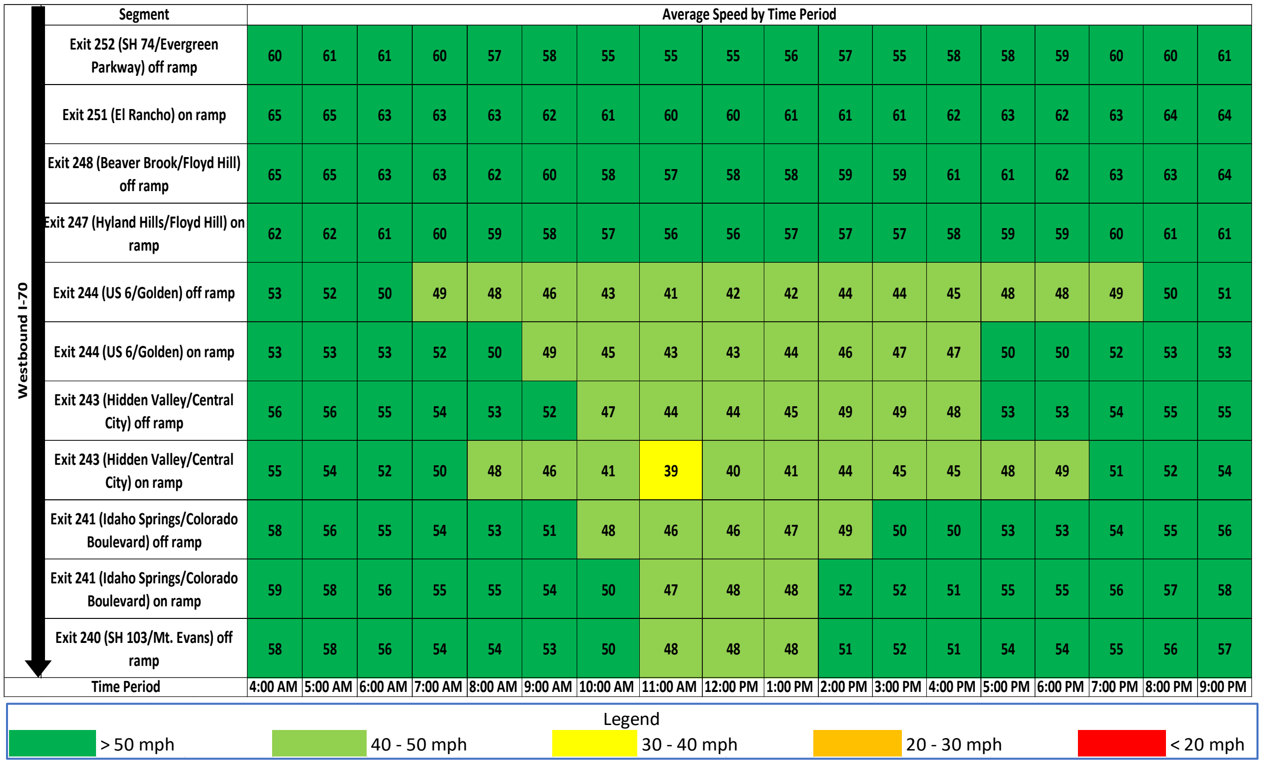
	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	61	61	62	60	57	58	56	55	55	56	57	55	58	58	58	59	60	61
	Exit 251 (El Rancho) on ramp	65	65	64	63	63	62	61	60	60	61	61	61	62	63	62	63	64	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	66	65	64	63	62	60	58	57	58	58	59	59	61	61	61	63	63	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	62	61	60	59	58	57	56	56	57	57	57	58	59	59	60	61	61
	Exit 244 (US 6/Golden) off ramp	53	52	50	49	48	46	42	41	42	42	44	43	45	47	48	49	50	51
	Exit 244 (US 6/Golden) on ramp	53	54	53	52	51	49	45	43	44	45	46	47	47	51	51	52	53	54
	Exit 243 (Hidden Valley/Central City) off ramp	57	56	55	54	53	52	46	43	44	45	49	48	48	53	53	54	55	55
	Exit 243 (Hidden Valley/Central City) on ramp	55	54	52	50	48	46	42	40	40	41	44	44	44	49	49	51	52	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	56	55	54	53	52	48	46	46	47	49	50	49	53	53	54	55	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	58	56	55	55	54	50	47	48	48	51	52	51	55	55	56	57	57
	Exit 240 (SH 103/Mt. Evans) off ramp	58	58	56	54	54	53	50	48	48	49	51	51	50	54	54	55	56	56
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 161. Canyon Viaduct Alternative—3GPL Option, Summer Westbound Congestion Diagram



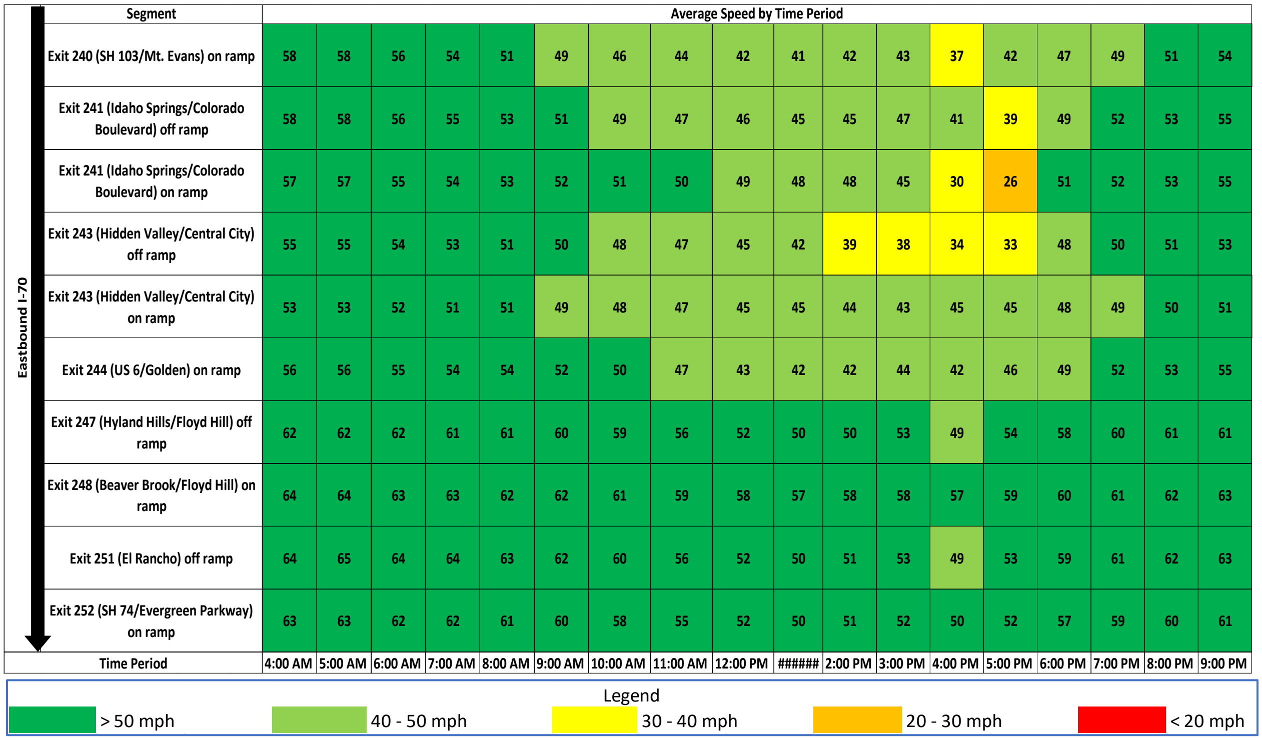
	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	60	61	61	60	57	58	55	55	55	56	57	55	58	58	59	60	60	61
	Exit 251 (El Rancho) on ramp	65	65	63	63	63	62	61	60	60	61	61	61	62	63	62	63	64	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	65	63	63	62	60	58	57	58	58	59	59	61	61	62	63	63	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	62	61	60	59	58	57	56	56	57	57	57	58	59	59	60	61	61
	Exit 244 (US 6/Golden) off ramp	53	52	50	49	48	46	43	41	42	42	44	44	45	48	48	49	50	51
	Exit 244 (US 6/Golden) on ramp	53	53	53	52	50	49	45	43	43	44	46	47	47	50	50	52	53	53
	Exit 243 (Hidden Valley/Central City) off ramp	56	56	55	54	53	52	47	44	44	45	49	49	48	53	53	54	55	55
	Exit 243 (Hidden Valley/Central City) on ramp	55	54	52	50	48	46	41	39	40	41	44	45	45	48	49	51	52	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	56	55	54	53	51	48	46	46	47	49	50	50	53	53	54	55	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	59	58	56	55	55	54	50	47	48	48	52	52	51	55	55	56	57	58
	Exit 240 (SH 103/Mt. Evans) off ramp	58	58	56	54	54	53	50	48	48	48	51	52	51	54	54	55	56	57
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 162. Canyon Viaduct Alternative—EL Option, Summer Eastbound Congestion Diagram



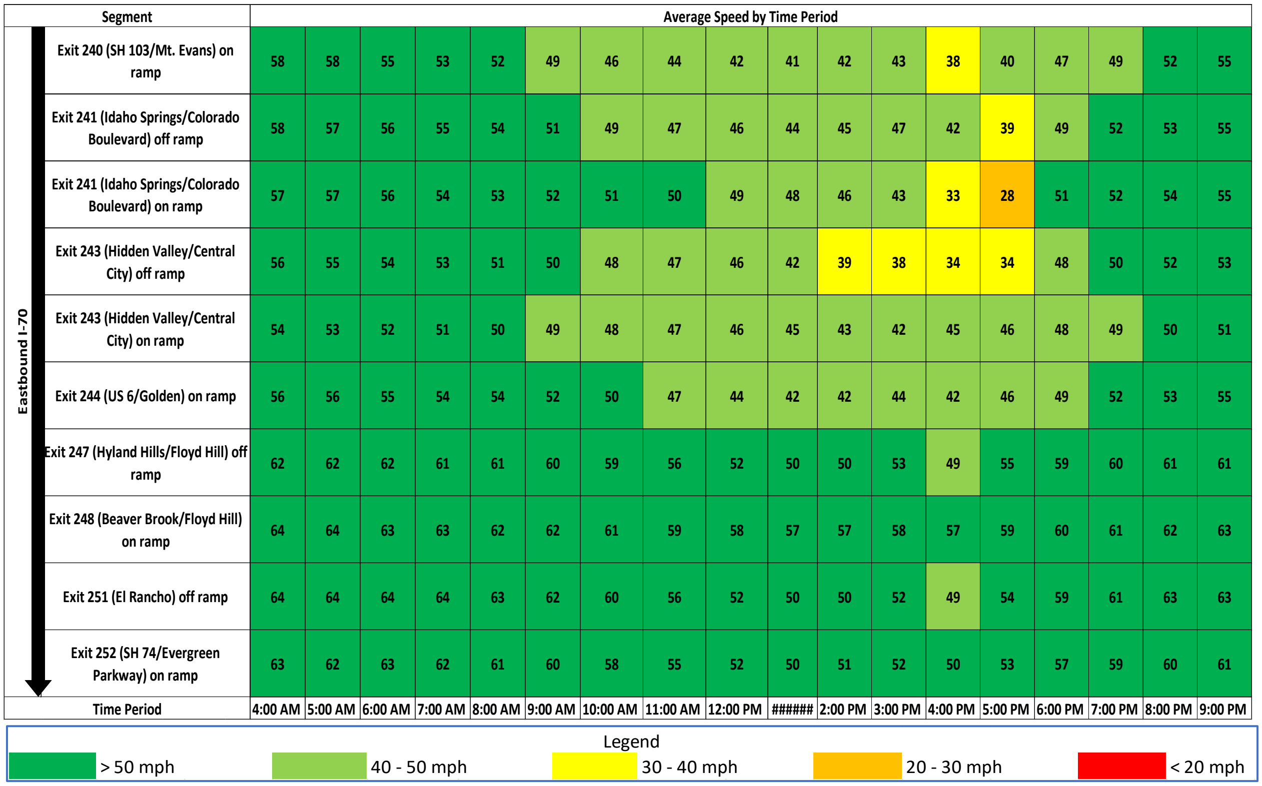
	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	58	58	56	54	51	49	46	44	42	41	42	43	37	42	47	49	51	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	58	56	55	53	51	49	47	46	45	45	47	41	39	49	52	53	55
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	57	55	54	53	52	51	50	49	48	48	45	30	26	51	52	53	55
	Exit 243 (Hidden Valley/Central City) off ramp	55	55	54	53	51	50	48	47	45	42	39	38	34	33	48	50	51	53
	Exit 243 (Hidden Valley/Central City) on ramp	53	53	52	51	51	49	48	47	45	45	44	43	45	45	48	49	50	51
	Exit 244 (US 6/Golden) on ramp	56	56	55	54	54	52	50	47	43	42	42	44	42	46	49	52	53	55
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	62	62	62	61	61	60	59	56	52	50	50	53	49	54	58	60	61	61
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	63	63	62	62	61	59	58	57	58	58	57	59	60	61	62	63
	Exit 251 (El Rancho) off ramp	64	65	64	64	63	62	60	56	52	50	51	53	49	53	59	61	62	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	63	63	62	62	61	60	58	55	52	50	51	52	50	52	57	59	60	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	######	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 163. Canyon Viaduct Alternative—3GPL Option, Summer Eastbound Congestion Diagram



	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	58	58	55	53	52	49	46	44	42	41	42	43	38	40	47	49	52	55
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	57	56	55	54	51	49	47	46	44	45	47	42	39	49	52	53	55
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	57	56	54	53	52	51	50	49	48	46	43	33	28	51	52	54	55
	Exit 243 (Hidden Valley/Central City) off ramp	56	55	54	53	51	50	48	47	46	42	39	38	34	34	48	50	52	53
	Exit 243 (Hidden Valley/Central City) on ramp	54	53	52	51	50	49	48	47	46	45	43	42	45	46	48	49	50	51
	Exit 244 (US 6/Golden) on ramp	56	56	55	54	54	52	50	47	44	42	42	44	42	46	49	52	53	55
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	62	62	62	61	61	60	59	56	52	50	50	53	49	55	59	60	61	61
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	63	63	62	62	61	59	58	57	57	58	57	59	60	61	62	63
	Exit 251 (El Rancho) off ramp	64	64	64	64	63	62	60	56	52	50	50	52	49	54	59	61	63	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	63	62	63	62	61	60	58	55	52	50	51	52	50	53	57	59	60	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	######	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

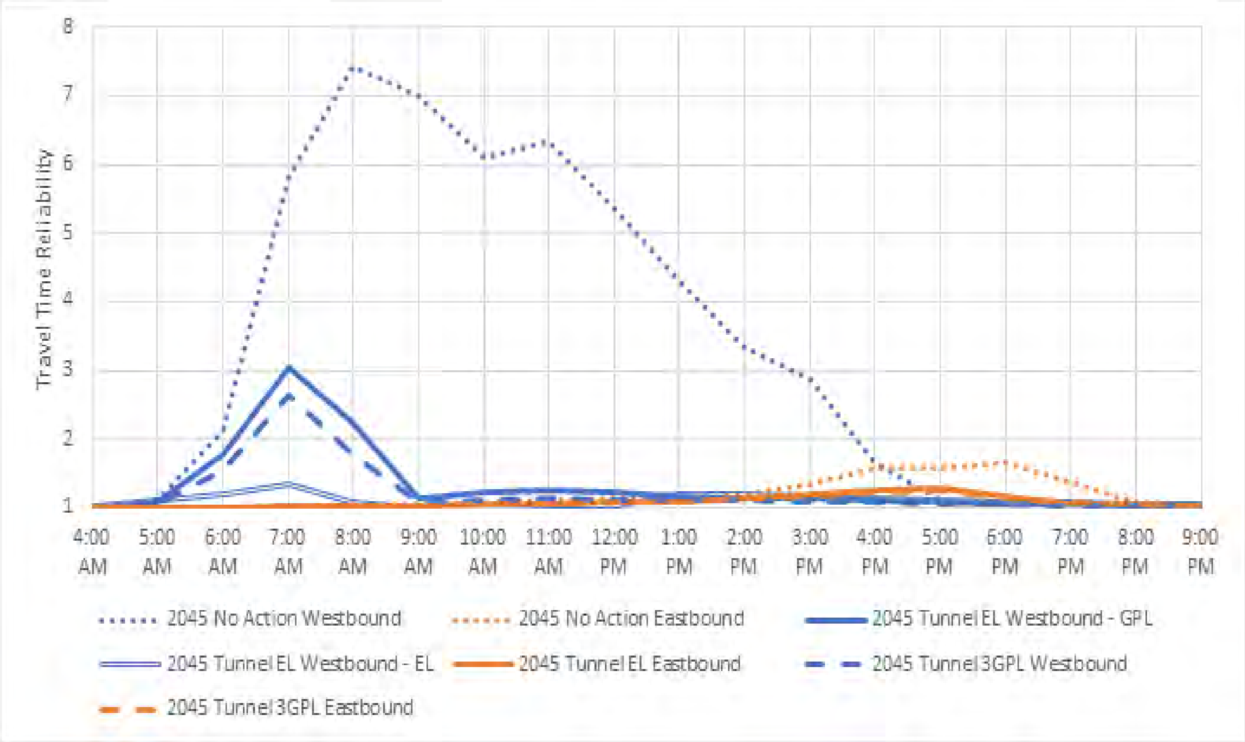
Source: TransModeler microsimulation analysis.

6.4.5 Travel Time Reliability on I-70

Travel time reliability expressed as the ratio of travel time to free-flow travel time is shown in Exhibit 164 and Exhibit 165 for the Tunnel Alternative. Westbound winter Saturday travel time reliability improves dramatically in the Tunnel Alternative. Westbound travel time reliability is better for the 3GPL option than for the EL option for both winter and summer conditions. Eastbound shows less variability between 3GPL and EL options for both winter and summer conditions.

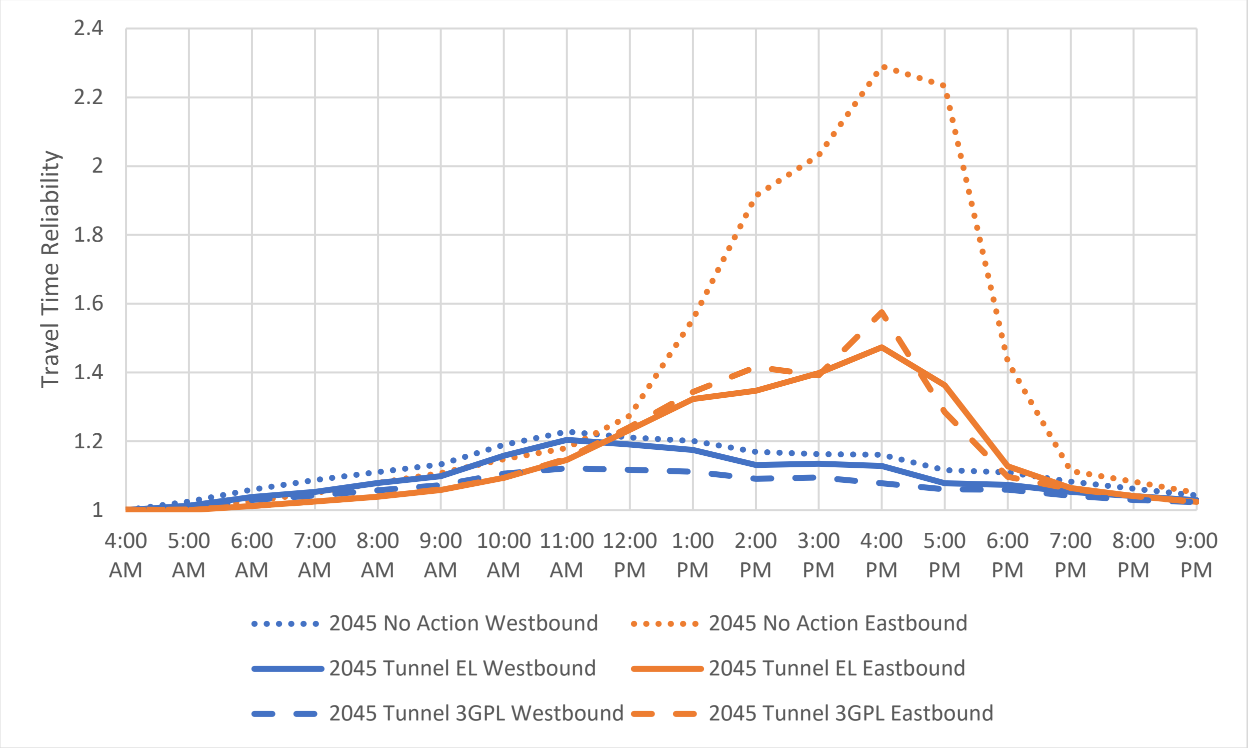
Travel time reliability for the Canyon Viaduct Alternative expressed as the ratio of travel time to free-flow travel time is shown in Exhibit 166 and Exhibit 167. Westbound, the EL option has greater variability than the 3GPL option. Eastbound travel time reliability is the same for the EL and 3GPL options under winter and summer conditions.

Exhibit 164. Tunnel Alternative Winter Travel Time Reliability



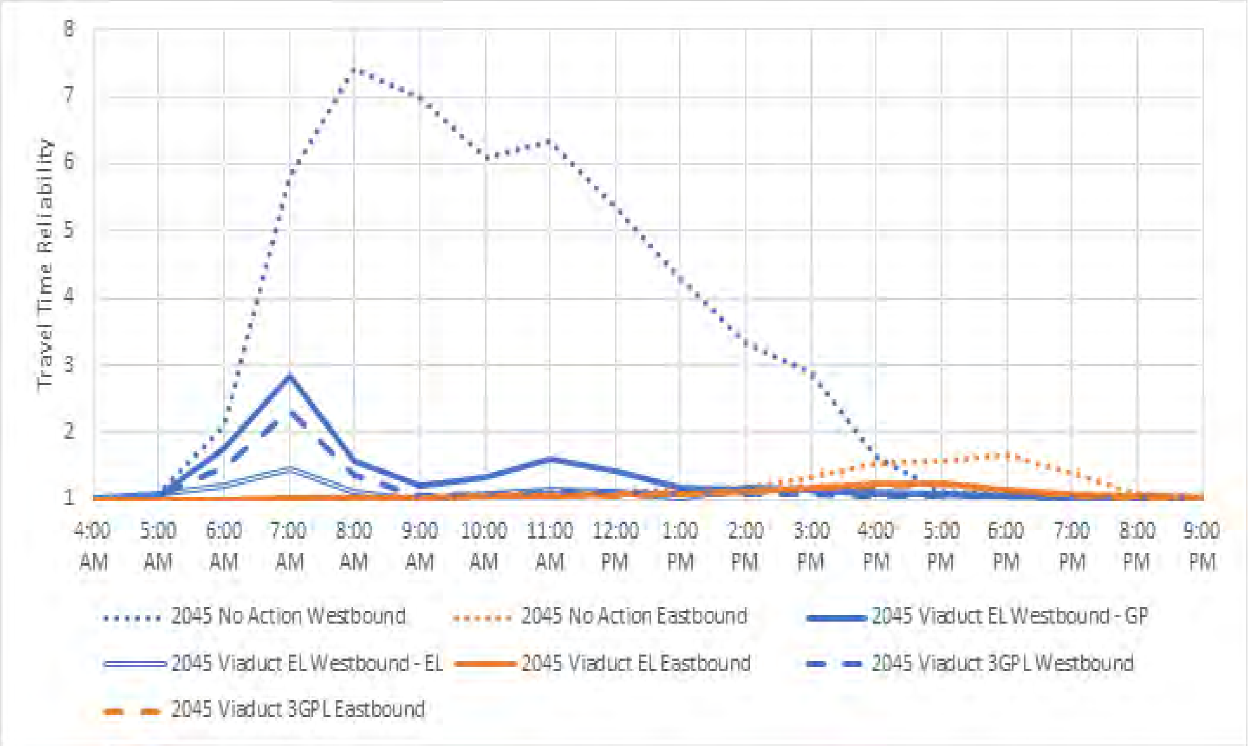
Source: TransModeler microsimulation analysis.

Exhibit 165. Tunnel Alternative Summer Travel Time Reliability



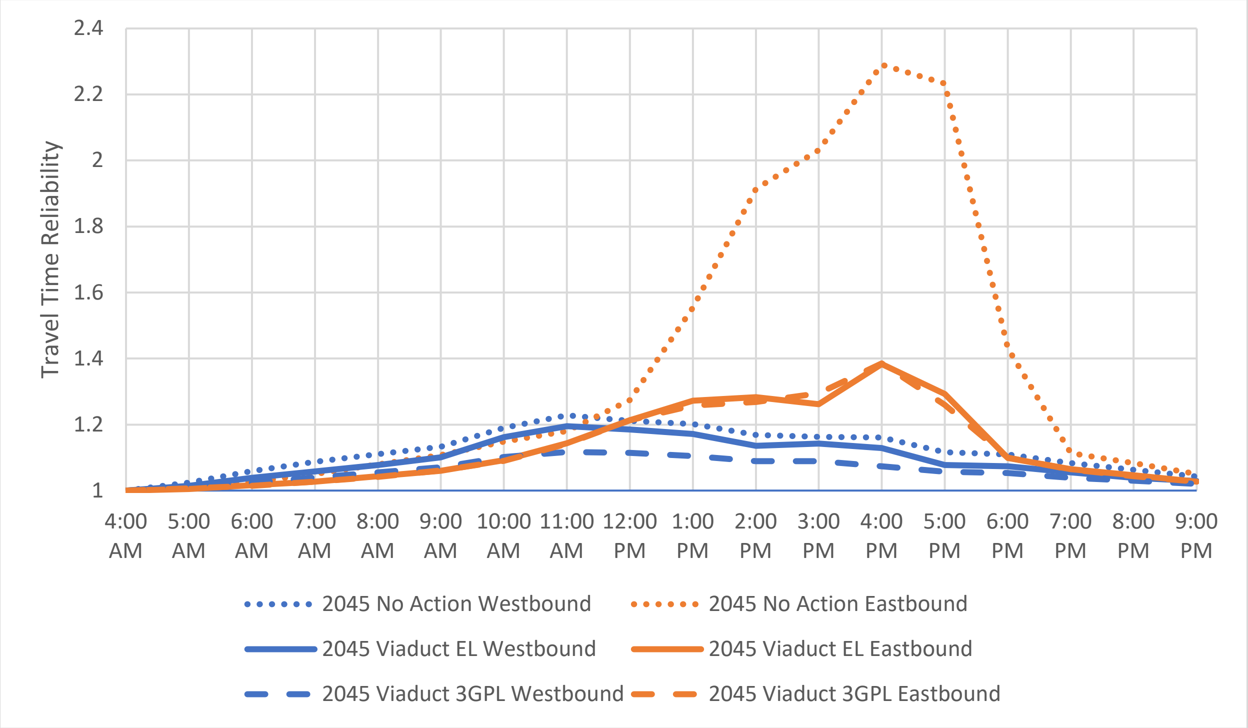
Source: TransModeler microsimulation analysis.

Exhibit 166. Canyon Viaduct Alternative Winter Travel Time Reliability



Source: TransModeler microsimulation analysis.

Exhibit 167. Canyon Viaduct Alternative Summer Travel Time Reliability



Source: TransModeler microsimulation analysis.

6.4.6 Freeway Segment LOS

Exhibit 168 and Exhibit 169 show the freeway segment LOS for the Tunnel Alternative with EL option under winter conditions. While the LOS is expected to be poor in the westbound direction for a large part of the day, the overall magnitude and duration of the westbound congestion is significantly better under than No Action conditions. The eastbound direction does show some minor improvements compared to No Action conditions, primarily because the improvements address the sharp curves and allow more vehicles to travel smoothly through the area.

Exhibit 168. Tunnel Alternative (EL) Winter Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	B	C	C	C	B	B	B	C	B	C	B	B	B	B	B	B	B
	6:00:00 AM	F	D	D	D	E	E	D	F	F	F	F	F	F	F	F	F	F	E	D	E	D	D	E	E
	7:00:00 AM	D	C	C	C	E	F	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	F
	8:00:00 AM	C	C	B	B	C	B	B	E	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	9:00:00 AM	B	B	B	A	B	A	B	C	C	C	C	C	D	F	F	F	E	F	F	F	F	F	F	F
	10:00:00 AM	C	B	C	B	C	B	C	D	E	E	E	E	F	F	F	F	F	F	F	E	F	F	F	F
	11:00:00 AM	C	C	C	B	C	B	C	E	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	12:00:00 PM	C	B	C	B	C	B	C	D	E	F	E	F	E	F	F	F	F	F	F	F	F	F	F	F
	1:00:00 PM	C	C	C	B	C	B	C	D	E	E	E	F	D	E	E	E	E	D	D	E	D	D	D	D
	2:00:00 PM	C	C	C	B	C	B	C	D	E	E	E	F	D	D	E	E	E	D	D	D	D	D	D	D
	3:00:00 PM	C	B	B	B	C	B	C	D	E	E	E	E	D	D	E	D	E	D	C	D	C	D	D	D
	4:00:00 PM	B	B	B	B	B	B	B	C	D	D	D	D	C	C	D	C	D	C	C	D	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	C	C	C	C	C	C	B	C	C	C	C	B	C	B	C	B	C
	6:00:00 PM	A	B	A	A	A	A	A	B	C	C	C	B	B	B	C	B	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 169. Tunnel Alternative (EL) Winter Eastbound I-70 LOS

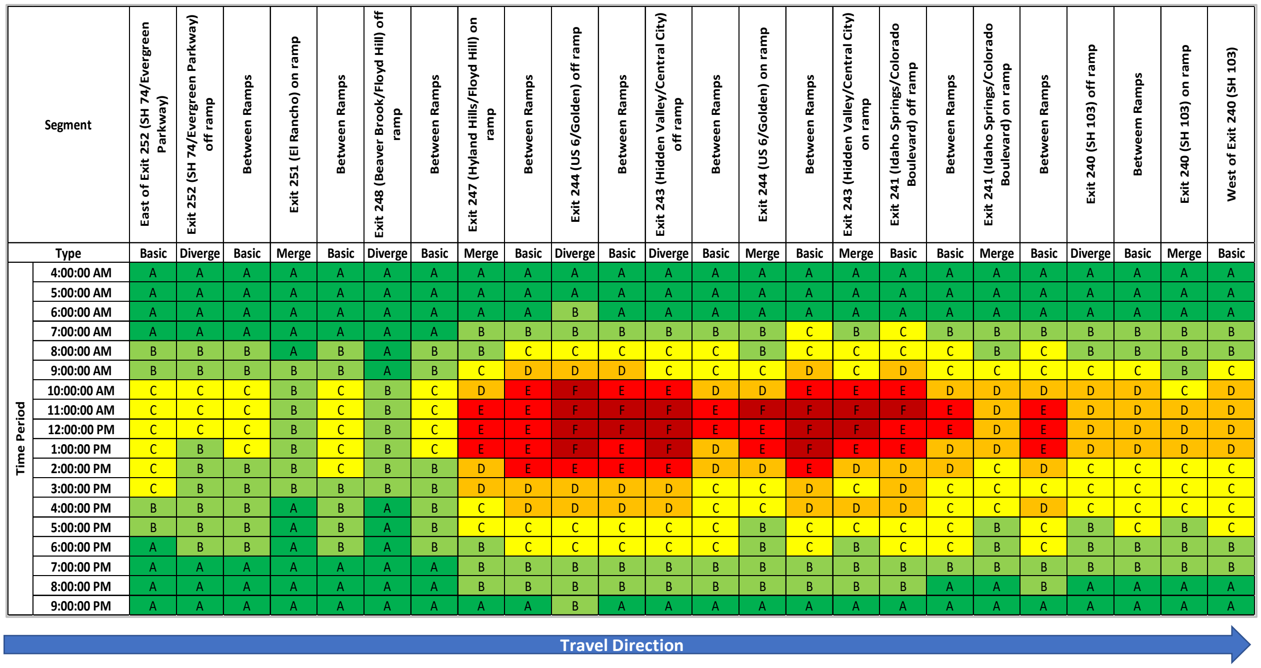
Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	A	B	B	B	A	B	A	B	B	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	C	B	B	B	B	C	C	B	B	A	A	A	A	B	A	B	A
	11:00:00 AM	C	C	C	C	D	C	C	C	C	C	C	C	C	B	B	B	A	B	A	B	A
	12:00:00 PM	D	D	D	D	D	D	D	D	D	D	D	D	C	B	B	B	B	B	B	B	B
	1:00:00 PM	E	D	E	D	E	E	D	D	D	E	E	E	D	B	C	C	B	C	B	C	B
	2:00:00 PM	E	E	E	E	E	F	E	E	E	F	E	F	D	B	C	C	B	C	B	C	B
	3:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	E	C	D	D	B	D	C	D	C
	4:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	D	D	D	C	D	C	D	C
	5:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	F	D	D	D	C	E	D	D	C
	6:00:00 PM	E	D	E	E	E	E	D	E	E	F	E	F	D	C	C	C	B	D	C	D	B
	7:00:00 PM	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	B	A	B	A	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 170 and Exhibit 171 show the freeway segment LOS for the Tunnel Alternative with EL option under summer conditions. The westbound direction shows minor improvements, mostly due to straightening of curves, but the freeway also is processing more vehicles without further degrading. The eastbound direction does show improvements compared to the No Action condition, primarily because the improvements address the sharp curves and allow more vehicles to travel smoothly through the area.

Exhibit 170. Tunnel Alternative (EL) Summer Westbound I-70 LOS

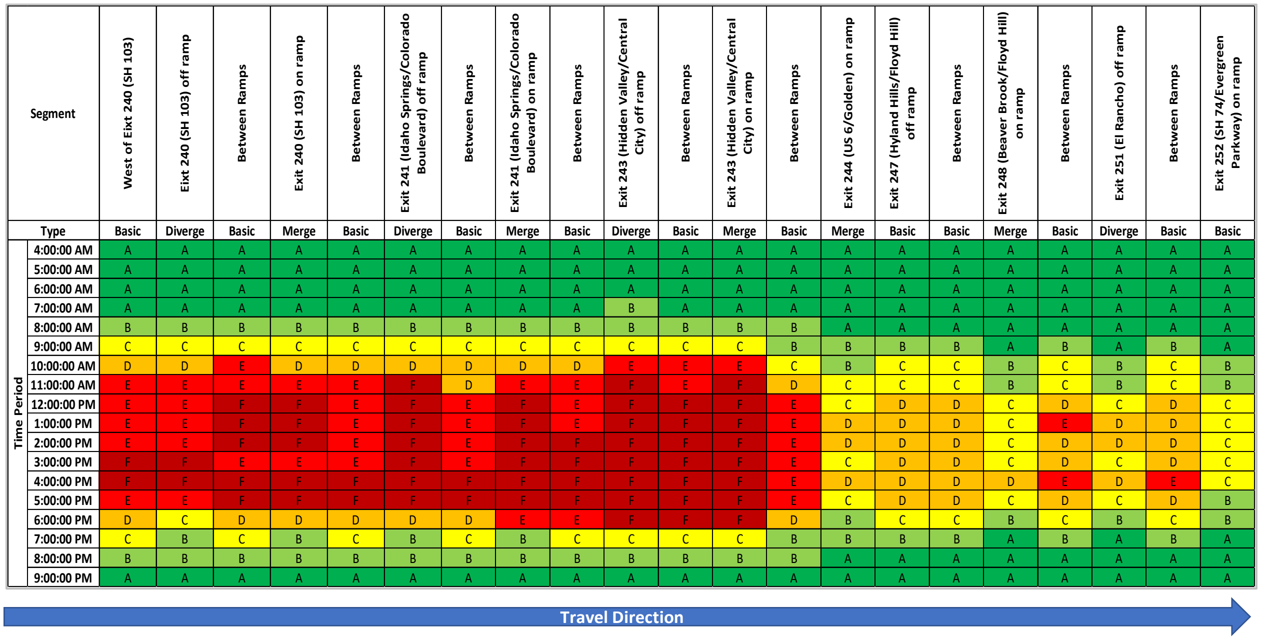


Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	C	B	C	B	B	B	B	B	B	B
	8:00:00 AM	B	B	B	A	B	A	B	B	C	C	C	C	C	B	C	C	C	C	B	C	B	B	B	B
	9:00:00 AM	B	B	B	B	B	A	B	C	D	D	D	C	C	C	D	C	D	C	C	C	C	C	B	C
	10:00:00 AM	C	C	C	B	C	B	C	D	E	F	E	E	D	D	E	E	E	D	D	D	D	D	C	D
	11:00:00 AM	C	C	C	B	C	B	C	E	E	F	F	F	E	F	F	F	F	E	D	E	D	D	D	D
	12:00:00 PM	C	C	C	B	C	B	C	E	E	F	F	F	E	E	F	F	E	E	D	E	D	D	D	D
	1:00:00 PM	C	B	C	B	C	B	C	E	E	F	E	F	D	E	F	E	E	D	D	E	D	D	D	D
	2:00:00 PM	C	B	B	B	C	B	B	D	E	E	E	E	D	D	E	D	D	D	C	D	C	C	C	C
	3:00:00 PM	C	B	B	B	B	B	B	D	D	D	D	D	C	C	D	C	D	C	C	C	C	C	C	C
	4:00:00 PM	B	B	B	A	B	A	B	C	D	D	D	D	C	C	D	D	D	C	C	D	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	C	C	C	C	C	C	B	C	C	C	C	B	C	B	C	B	C
	6:00:00 PM	A	B	B	A	B	A	B	B	C	C	C	C	C	B	C	B	C	C	B	C	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	A	A	B	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 171. Tunnel Alternative (EL) Summer Eastbound I-70 LOS



Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	9:00:00 AM	C	C	C	C	C	C	C	C	C	C	C	C	B	B	B	B	A	B	A	B	A
	10:00:00 AM	D	D	E	D	D	D	D	D	D	E	E	E	C	B	C	C	B	C	B	C	B
	11:00:00 AM	E	E	E	E	E	F	D	E	E	F	E	F	D	C	C	C	B	C	B	C	B
	12:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	E	C	D	D	C	D	C	D	C
	1:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	E	D	D	D	C	E	D	D	C
	2:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	D	D	D	C	D	D	D	C
	3:00:00 PM	F	F	E	E	E	F	E	F	F	F	F	F	E	C	D	D	C	D	C	D	C
	4:00:00 PM	F	F	F	F	F	F	F	F	F	F	F	F	E	D	D	D	D	E	D	E	C
	5:00:00 PM	E	E	F	F	F	F	F	F	F	F	F	F	E	C	D	D	C	D	C	D	B
	6:00:00 PM	D	C	D	D	D	D	D	E	E	F	F	F	D	B	C	C	B	C	B	C	B
	7:00:00 PM	C	B	C	B	C	B	C	B	C	C	C	C	B	B	B	B	A	B	A	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 172and Exhibit 173 show the freeway segment LOS for the Tunnel Alternative with the 3GPL option under winter conditions. This option almost eliminates the occurrence of LOS F to the east of Exit 241 (Idaho Springs/Colorado Boulevard), where there would be three lanes, but west of Exit 241 (Idaho Springs/Colorado Boulevard), there would be higher congestion because there would only be 2 GPL + PPSL in this area. The eastbound direction does show some minor improvements compared to the

No Action condition, primarily because the improvements address the sharp curves and allow more vehicles to travel smoothly through the area.

Exhibit 172. Tunnel Alternative (3GPL) Winter Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	B	B	B	B	B	B	B
	6:00:00 AM	F	E	D	E	F	F	F	C	D	C	E	C	D	C	E	D	E	F	E	E	E	E	F	E
	7:00:00 AM	E	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	8:00:00 AM	C	C	B	B	C	B	C	D	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	9:00:00 AM	B	B	B	A	B	A	B	B	B	B	B	A	B	B	C	C	C	E	D	E	D	E	F	F
	10:00:00 AM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	D	C	D	F	E	E	E	E	F	F
	11:00:00 AM	C	C	C	B	C	B	C	C	D	B	D	B	C	B	D	C	D	F	F	E	F	F	F	F
	12:00:00 PM	C	B	C	B	C	B	C	B	C	B	D	B	C	B	C	B	C	E	E	E	E	F	F	F
	1:00:00 PM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	E	D	E	D	D	D	D
	2:00:00 PM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	D	D
	3:00:00 PM	C	B	B	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	C	D	C	D	D	D
	4:00:00 PM	B	B	B	B	B	B	B	B	C	B	C	B	B	A	B	B	B	C	C	C	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	B	B	B	B	A	B	A	B	B	B	C	B	C	B	C	B	C
	6:00:00 PM	A	B	A	A	A	A	B	A	B	A	B	A	A	A	B	A	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 173. Tunnel Alternative(3GPL) Winter Eastbound I-70 LOS

Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	A	B	B	B	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	C	B	B	B	B	C	C	B	B	A	A	A	A	B	A	A	A
	11:00:00 AM	D	C	D	C	D	C	C	C	C	D	C	C	C	B	B	B	A	B	A	B	B
	12:00:00 PM	D	D	D	D	D	D	D	D	D	D	D	D	C	B	B	B	B	B	B	B	B
	1:00:00 PM	E	D	E	D	E	E	D	D	D	E	E	E	D	B	C	C	B	C	B	C	B
	2:00:00 PM	E	E	E	E	E	F	E	E	E	F	E	F	D	C	C	C	B	C	B	C	B
	3:00:00 PM	E	E	F	F	E	F	E	F	E	F	E	F	E	C	C	D	B	D	C	D	C
	4:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	D	D	D	C	D	C	D	C
	5:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	E	D	D	D	C	D	D	D	C
	6:00:00 PM	E	E	F	E	E	F	E	E	E	F	E	F	D	C	C	C	B	D	C	D	B
	7:00:00 PM	C	C	C	C	C	C	C	C	C	D	D	C	C	B	B	B	A	B	B	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 174 and Exhibit 175 show the freeway segment LOS for the Tunnel Alternative with the 3GPL option under summer conditions. This alternative does the best job of improving westbound LOS on I-70. The eastbound direction does show improvements compared to the No Action condition, primarily because the improvements address the sharp curves and allow more vehicles to travel smoothly through the area.

Exhibit 174. Tunnel Alternative (3GPL) Summer Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	B	A	B	A	A	A	B	A	B	C	B	C	B	B	B	B
	8:00:00 AM	B	B	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	C	B	C	C	C	B	B
	9:00:00 AM	B	B	B	B	B	A	B	B	C	B	B	A	B	A	B	B	B	C	C	C	C	C	B	C
	10:00:00 AM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	C	D
	11:00:00 AM	C	C	C	B	C	B	C	B	D	B	D	B	C	B	C	C	C	E	D	E	E	E	D	D
	12:00:00 PM	C	C	C	B	C	B	C	B	D	B	D	B	C	B	C	B	C	E	D	E	E	D	D	D
	1:00:00 PM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	E	D	E	E	D	D	D
	2:00:00 PM	B	B	B	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	C	D	D	D	C	C
	3:00:00 PM	C	B	B	B	B	B	C	B	C	B	C	B	B	B	B	B	B	C	C	C	C	C	C	C
	4:00:00 PM	B	B	B	A	B	A	B	B	C	B	C	B	B	B	B	B	B	C	C	D	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	B	B	B	B	A	B	A	B	B	B	C	B	C	C	C	B	C
	6:00:00 PM	B	B	B	A	B	A	B	A	B	B	B	A	B	A	B	A	B	C	B	C	B	C	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	B	B	A	B	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 175. Tunnel Alternative (3GPL) Summer Eastbound I-70 LOS

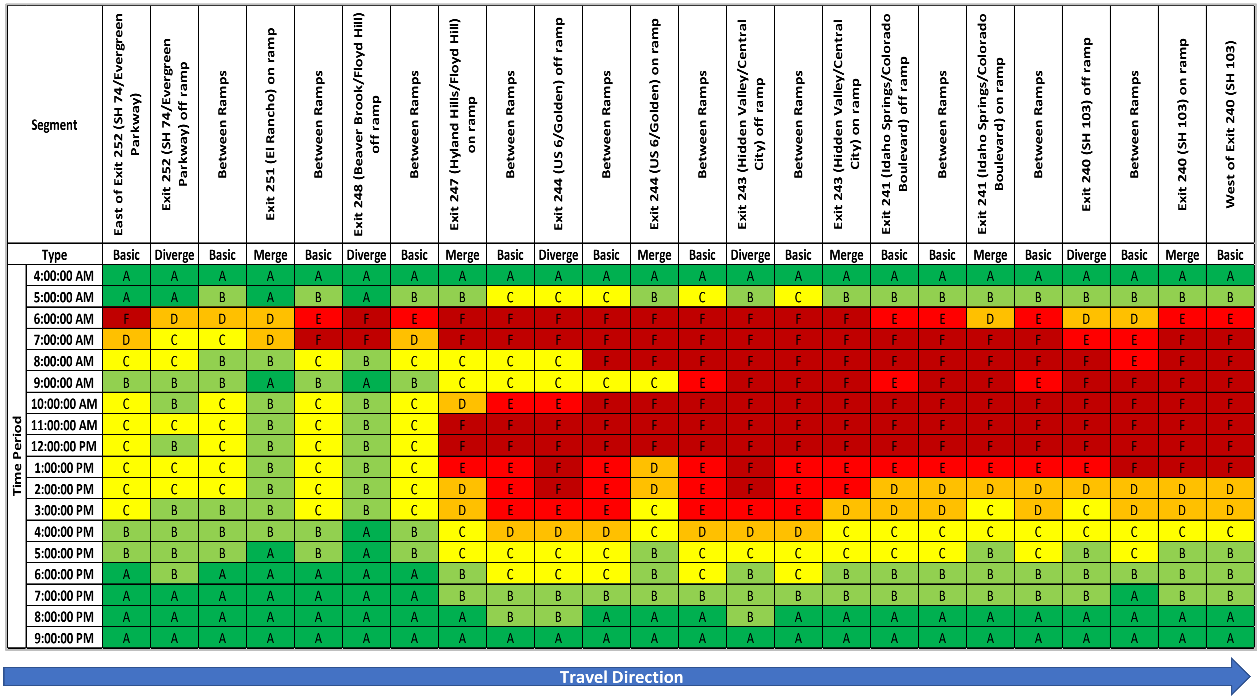
Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	B	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 AM	C	C	C	C	C	C	C	C	C	C	C	C	B	B	B	B	A	B	A	B	A
	10:00:00 AM	D	D	E	D	E	E	D	D	D	E	D	E	C	B	B	B	B	C	B	C	B
	11:00:00 AM	E	E	E	E	E	F	D	E	E	F	E	F	D	C	C	C	B	D	B	C	B
	12:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	E	D	D	D	C	D	C	D	C
	1:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	F	D	D	D	C	E	D	D	C
	2:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	F	D	D	D	C	D	D	D	C
	3:00:00 PM	E	F	E	E	E	E	E	F	F	F	F	F	E	C	D	D	C	D	C	D	C
	4:00:00 PM	E	F	F	F	F	F	F	F	F	F	F	F	F	D	D	D	C	E	D	E	C
	5:00:00 PM	D	D	E	E	E	F	F	F	F	F	F	F	E	C	D	D	C	D	C	D	B
	6:00:00 PM	D	C	D	D	D	D	D	D	D	F	E	F	D	B	C	C	B	C	B	C	B
	7:00:00 PM	C	B	C	B	C	C	C	B	C	C	C	C	B	B	B	B	A	B	A	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 176 and Exhibit 177 show the freeway segment LOS for the Canyon Viaduct Alternative with the EL option under winter conditions. This alternative has similar results as the Tunnel Alternative with the EL option.

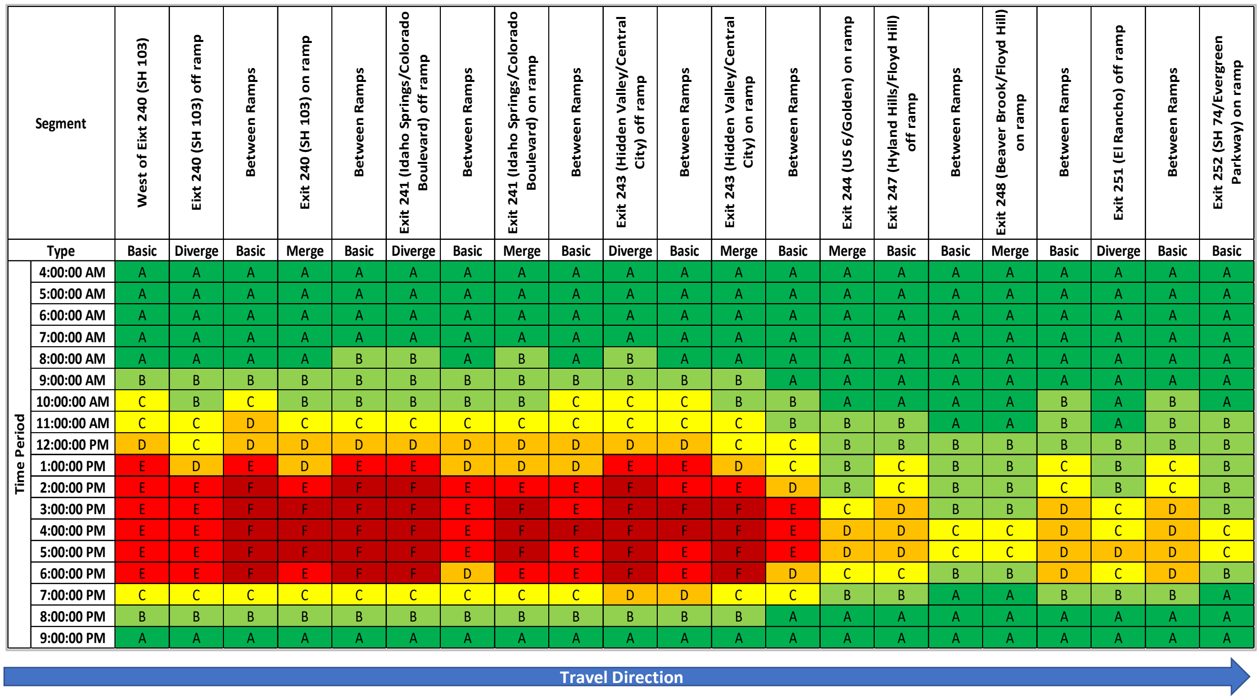
Exhibit 176. Canyon Viaduct (EL) Alternative Winter Westbound I-70 LOS



	Segment	East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
	Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	B	C	C	C	B	C	B	C	B	B	B	B	B	B	B	B	B
	6:00:00 AM	F	D	D	D	E	F	E	F	F	F	F	F	F	F	F	F	E	E	D	E	D	D	E	E
	7:00:00 AM	D	C	C	D	F	F	D	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	F	F
	8:00:00 AM	C	C	B	B	C	B	C	C	C	C	F	F	F	F	F	F	F	F	F	F	F	E	F	F
	9:00:00 AM	B	B	B	A	B	A	B	C	C	C	C	C	E	F	F	F	E	F	F	E	F	F	F	F
	10:00:00 AM	C	B	C	B	C	B	C	D	E	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	11:00:00 AM	C	C	C	B	C	B	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	12:00:00 PM	C	B	C	B	C	B	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	1:00:00 PM	C	C	C	B	C	B	C	E	E	F	E	D	E	F	E	E	E	E	E	E	E	F	F	F
	2:00:00 PM	C	C	C	B	C	B	C	D	E	F	E	D	E	F	E	E	D	D	D	D	D	D	D	D
	3:00:00 PM	C	B	B	B	C	B	C	D	E	E	E	C	E	E	E	D	D	D	C	D	C	D	D	D
	4:00:00 PM	B	B	B	B	B	A	B	C	D	D	D	C	D	D	D	C	C	C	C	C	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	C	C	C	C	B	C	C	C	C	C	C	B	C	B	C	B	B
	6:00:00 PM	A	B	A	A	A	A	A	B	C	C	C	B	C	B	C	B	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	B	B	A	A	A	B	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Source: TransModeler microsimulation analysis.

Exhibit 177. Canyon Viaduct (EL) Alternative Winter Eastbound I-70 LOS



	Segment	West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
	Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	A	A	B	B	A	B	A	B	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	B	B	B	B	C	C	C	B	B	A	A	A	A	B	A	B	A
	11:00:00 AM	C	C	D	C	C	C	C	C	C	C	C	C	B	B	B	A	A	B	A	B	B
	12:00:00 PM	D	C	D	D	D	D	D	D	D	D	D	C	C	B	B	B	B	B	B	B	B
	1:00:00 PM	E	D	E	D	E	E	D	D	D	E	E	D	C	B	C	B	B	C	B	C	B
	2:00:00 PM	E	E	F	E	F	F	E	E	E	F	E	E	D	B	C	B	B	C	B	C	B
	3:00:00 PM	E	E	F	F	F	F	E	F	E	F	F	F	E	C	D	B	B	D	C	D	B
	4:00:00 PM	E	E	F	F	F	F	E	F	F	F	F	F	E	D	D	C	C	D	C	D	C
	5:00:00 PM	E	E	F	F	F	F	E	F	E	F	E	F	E	D	D	C	C	D	D	D	C
	6:00:00 PM	E	E	F	E	F	F	D	E	E	F	E	F	D	C	C	B	B	D	C	D	B
	7:00:00 PM	C	C	C	C	C	C	C	C	C	D	D	C	C	B	B	A	A	B	B	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Source: TransModeler microsimulation analysis.

Exhibit 178 and Exhibit 179 show the freeway segment LOS for the Canyon Viaduct Alternative with the EL option under summer conditions. The results are similar to the Tunnel Alternative with EL, but with more congestion in the area around the bottom of Floyd Hill due to the differences in ramp configurations.

Exhibit 178. Canyon Viaduct (EL) Alternative Summer Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	C	B	B	B	B	B	B	B	B	B
	8:00:00 AM	B	B	B	A	B	A	B	B	C	C	C	B	C	C	C	B	C	C	B	C	B	B	B	B
	9:00:00 AM	B	B	B	B	B	A	B	C	D	D	D	B	D	C	D	C	C	C	C	C	C	C	B	B
	10:00:00 AM	C	C	C	B	C	B	C	D	E	F	E	D	E	F	E	D	D	D	D	D	D	D	C	C
	11:00:00 AM	C	C	C	B	C	B	C	E	E	F	E	D	E	F	F	F	E	E	D	E	D	D	D	D
	12:00:00 PM	C	C	C	B	C	B	C	E	E	F	E	D	E	F	F	F	E	E	D	E	D	D	D	D
	1:00:00 PM	C	C	C	B	C	B	C	E	E	F	E	D	E	F	E	E	E	E	D	E	D	D	D	D
	2:00:00 PM	B	B	B	B	C	B	C	D	E	E	E	C	D	E	E	D	D	D	C	D	C	C	C	C
	3:00:00 PM	B	B	B	B	B	B	B	D	D	D	D	C	D	D	D	C	C	C	C	C	C	C	C	C
	4:00:00 PM	B	B	B	A	B	A	B	C	D	D	D	C	D	D	D	C	D	C	C	D	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	C	C	C	C	B	C	C	C	B	C	C	B	C	B	C	B	B
	6:00:00 PM	B	B	B	A	B	A	B	B	C	C	C	B	C	C	C	B	C	B	B	C	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	A	B	B	B	B	A	A	A	B	B	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 179. Canyon Viaduct (EL) Alternative Summer Eastbound I-70 LOS

Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 AM	C	C	C	C	C	C	C	C	C	C	C	C	B	B	B	B	A	B	A	B	A
	10:00:00 AM	D	D	E	D	D	D	D	D	D	E	D	D	C	B	C	C	B	C	B	C	B
	11:00:00 AM	E	E	E	E	E	F	E	E	E	F	E	F	D	C	C	C	B	D	B	C	B
	12:00:00 PM	E	E	F	F	E	F	E	F	E	F	F	F	E	C	D	D	C	D	C	D	C
	1:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	D	D	D	C	E	D	D	C
	2:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	D	D	D	C	D	D	D	C
	3:00:00 PM	F	F	E	E	E	F	E	F	F	F	F	F	E	C	D	D	C	D	C	D	C
	4:00:00 PM	F	F	F	F	F	F	F	F	F	F	F	F	E	D	D	D	C	E	D	D	C
	5:00:00 PM	E	E	E	F	F	F	F	F	F	F	F	F	D	C	D	D	B	D	C	D	B
	6:00:00 PM	D	C	D	D	D	D	D	D	D	D	D	D	C	B	C	C	B	C	B	C	B
	7:00:00 PM	C	B	C	B	C	C	C	B	C	C	C	C	B	B	B	B	A	B	A	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 180 and Exhibit 181 show the freeway segment LOS for the Canyon Viaduct Alternative with the 3GPL option under winter conditions. This alternative has similar results as the Tunnel Alternative with the 3GPL option.

Exhibit 180. Canyon Viaduct (3GPL) Alternative Winter Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	B	B	B	B	B	B	B
	6:00:00 AM	F	E	D	E	F	F	F	C	E	C	D	C	E	D	E	C	E	F	E	E	E	E	F	F
	7:00:00 AM	E	C	C	F	F	F	F	D	E	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	8:00:00 AM	C	C	C	B	C	B	C	B	C	B	C	C	D	D	E	E	F	F	F	F	F	F	F	F
	9:00:00 AM	B	B	B	A	B	A	B	B	B	A	B	B	C	B	C	B	C	D	D	D	D	D	E	E
	10:00:00 AM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	D	B	D	E	E	E	D	E	F	F
	11:00:00 AM	C	C	C	B	C	B	C	C	D	B	D	B	D	C	D	C	D	F	E	E	E	E	F	F
	12:00:00 PM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	E	D	E	D	D	E	F
	1:00:00 PM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	E	D	E	D	D	E	E
	2:00:00 PM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	D	D
	3:00:00 PM	B	B	B	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	D	D
	4:00:00 PM	B	B	B	B	B	B	B	B	C	B	C	B	C	B	C	B	C	D	C	D	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	B	B	B	B	A	B	A	B	A	B	C	B	C	B	C	B	B
	6:00:00 PM	A	B	A	A	A	A	B	A	B	A	B	A	B	A	B	A	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 181. Canyon Viaduct (3GPL) Alternative Winter Eastbound I-70 LOS

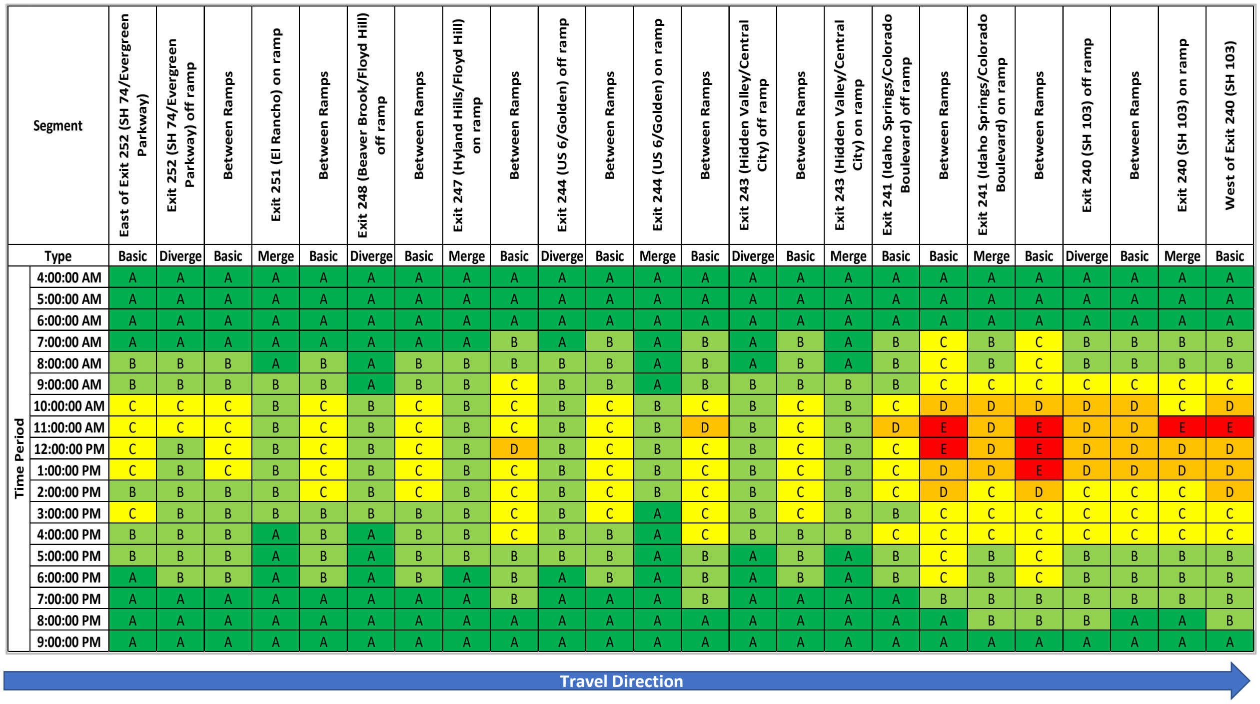
Segment		West of Exit 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	C	C	B	B	B	C	C	B	B	A	A	A	A	B	A	B	A
	11:00:00 AM	C	C	D	C	C	C	C	C	C	D	C	C	B	B	B	B	A	B	A	B	B
	12:00:00 PM	D	D	E	D	D	D	D	D	D	D	D	D	C	B	B	B	B	C	B	B	B
	1:00:00 PM	D	D	E	D	E	E	D	D	D	E	E	D	C	B	B	B	B	C	B	C	B
	2:00:00 PM	E	E	E	E	F	F	E	E	E	F	E	E	D	C	C	C	B	C	B	C	B
	3:00:00 PM	E	E	F	F	F	F	E	F	E	F	E	E	E	C	C	C	B	D	C	D	C
	4:00:00 PM	E	E	F	F	F	F	E	F	F	F	E	F	E	D	D	D	C	D	C	D	C
	5:00:00 PM	E	E	F	E	F	F	E	F	E	F	E	E	E	C	D	D	C	D	C	D	C
	6:00:00 PM	E	D	E	D	E	E	D	D	E	F	E	D	D	C	C	C	B	D	C	D	B
	7:00:00 PM	C	C	C	C	C	C	C	C	C	C	C	C	B	B	B	B	A	B	A	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 182 and Exhibit 183 show the freeway segment LOS for the Canyon Viaduct Alternative with the 3GPL option under summer conditions. This alternative has similar results as the Tunnel Alternative with the 3GPL option.

Exhibit 182. Canyon Viaduct (3GPL) Alternative Summer Westbound I-70 LOS

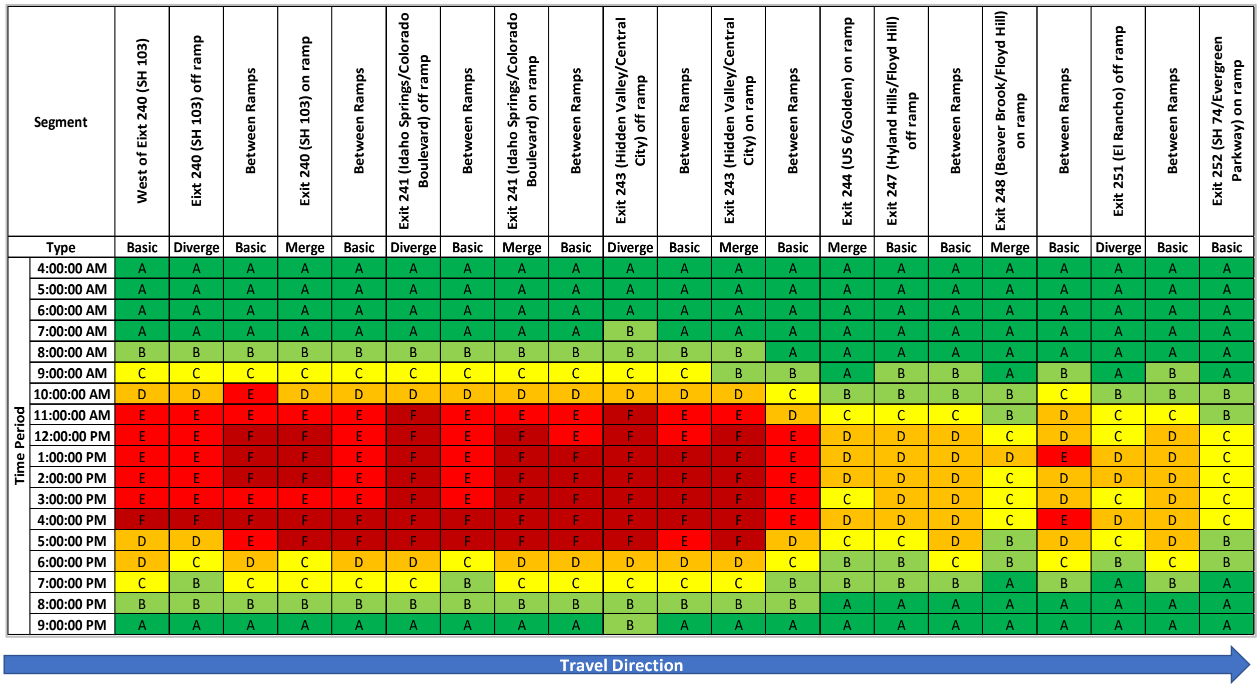


Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	B	A	B	A	B	A	B	A	B	C	B	C	B	B	B	B
	8:00:00 AM	B	B	B	A	B	A	B	B	B	B	B	A	B	A	B	A	B	C	B	C	B	B	B	B
	9:00:00 AM	B	B	B	B	B	A	B	B	C	B	B	A	B	B	B	B	B	C	C	C	C	C	C	C
	10:00:00 AM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	C	D
	11:00:00 AM	C	C	C	B	C	B	C	B	C	B	C	B	D	B	C	B	D	E	D	E	D	D	E	E
	12:00:00 PM	C	B	C	B	C	B	C	B	D	B	C	B	C	B	C	B	C	E	D	E	D	D	D	D
	1:00:00 PM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	E	D	D	D	D
	2:00:00 PM	B	B	B	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	C	D	C	C	C	D
	3:00:00 PM	C	B	B	B	B	B	B	B	C	B	C	A	C	B	C	B	B	C	C	C	C	C	C	C
	4:00:00 PM	B	B	B	A	B	A	B	B	C	B	B	A	C	B	B	B	C	C	C	C	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	B	B	B	B	A	B	A	B	A	B	C	B	C	B	B	B	B
	6:00:00 PM	A	B	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	C	B	C	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	B	A	A	A	B	A	A	A	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	A	A	B
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 183. Canyon Viaduct (3GPL) Alternative Summer Eastbound I-70 LOS



Segment		West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A
	9:00:00 AM	C	C	C	C	C	C	C	C	C	C	C	B	B	A	B	B	A	B	A	B	A
	10:00:00 AM	D	D	E	D	D	D	D	D	D	D	D	D	C	B	B	B	B	C	B	B	B
	11:00:00 AM	E	E	E	E	E	F	E	E	E	F	E	E	D	C	C	C	B	D	C	C	B
	12:00:00 PM	E	E	F	F	E	F	E	F	E	F	E	F	E	D	D	D	C	D	C	D	C
	1:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	D	D	D	D	E	D	D	C
	2:00:00 PM	E	E	F	F	E	F	E	F	F	F	F	F	E	D	D	D	C	D	D	D	C
	3:00:00 PM	E	E	E	E	E	F	E	F	F	F	F	F	E	C	D	D	C	D	C	D	C
	4:00:00 PM	F	F	F	F	F	F	F	F	F	F	F	F	E	D	D	D	C	E	D	D	C
	5:00:00 PM	D	D	E	F	F	F	F	F	F	F	E	F	D	C	C	D	B	D	C	D	B
	6:00:00 PM	D	C	D	C	D	D	C	D	D	D	D	D	C	B	B	C	B	C	B	C	B
	7:00:00 PM	C	B	C	C	C	C	B	C	C	C	C	C	B	B	B	B	A	B	A	B	A
	8:00:00 PM	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

6.4.7 Intersection LOS

Ramp terminal intersection LOS for the Tunnel Alternative is shown in Exhibit 184. Operations improve greatly at the Hidden Valley/Central City interchange in the Tunnel Alternative. Replacing the signalized intersections at Hidden Valley with roundabouts improves all movements to LOS A and drastically reduces queues. Roundabouts at CR 65 and Homestead Road that are to be constructed as part of the US 40 Roundabouts project provide LOS A or LOS B for all approaches and were not considered for additional improvements.

Ramp terminal intersection LOS for the Canyon Viaduct Alternative is shown in Exhibit 185. Changing the signalized intersections at the Hidden Valley/Central City interchange to roundabouts greatly improves LOS and queues for all approaches.

Exhibit 184. Tunnel Alternative Ramp Terminal Intersection LOS

Intersection	Approach	LOS/95% Queue (ft)					
		2045 No Action		2045 Tunnel Alternative, EL		2045 Tunnel Alternative, 3GPL	
		Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday
Colorado Blvd WB Ramps[3]	WB Off-Ramp	A/25	A/25	A/25	A/25	A/2	A/25
	EB Colorado Blvd	A/50	A/0	A/50	A/25	C/150	A/0
	WB Colorado Blvd	A/25	A/0	A/75	A/25	E/375	A/25
	Overall	A	A	A	A	D	A
Colorado Blvd EB Ramps[2]	EB Off-Ramp	B/15	B/20	B/15	B/35	C/20	B/40
Hidden Valley WB Ramps[3]	SB CCP	B/105	B/130	A/0	A/25	A/0	A/25
	NB CCP	A/10	A/10	A/75	A/0	B/125	A/0
	WB Off-Ramp	D/100	D/295	A/25	A/25	D/175	A/25
	Service Road	E/30	E/35	A/0	A/0	B/0	A/0
	Overall	B	C	A	A	C	A
Hidden Valley EB Ramps[3]	SB CCP	A/10	C/115	A/0	A/25	A/25	A/25
	NB CCP	D/15	B/10	A/75	A/0	D/400	A/0
	EB Frontage	D/30	D/565	A/0	A/0	A/0	A/0
	EB Off-Ramp	D/45	E/150	A/0	A/25	A/25	A/25
	Overall	C	D	A	A	D	A
US 6 and WB Ramp[2]	WB Off-Ramp	C/5	A/10	B/10	B/20	B/5	A/5
US 6 and US 40[2]	US 40	F/750	B/20	F/375	B/10	F/525	B/5
Homestead/ EB Ramp[2]	EB Off-Ramp	A/5	B/20	A/5	B/40	A/5	B/40

Intersection	Approach	LOS/95% Queue (ft)					
		2045 No Action		2045 Tunnel Alternative, EL		2045 Tunnel Alternative, 3GPL	
		Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday
Homestead/ US 40[3]	NB Homestead	A/0	A/0	A/0	A/25	A/0	A/25
	EB US 40	A/0	A/0	A/0	A/10	A/0	A/0
	WB US 40	C/10	A/0	A/25	A/25	B/150	A/25
	Overall	C	A	A	A	B	A
CR 65/US 40[3]	NB CR 65	A/0	A/0	A/25	A/0	A/25	A/0
	EB US 40	A/0	A/0	A/0	A/25	A/0	A/25
	WB US 40	C/10	A/0	A/0	A/0	A/0	A/0
	WB Ramp	A/0	A/0	A/25	A/25	B/100	A/25
	Overall	C	A	A	A	A	A

Note: For stop-controlled intersections, only the worst approach LOS and queue lengths are reported.

1. Signalized intersection; 2. Stop controlled intersection; 3. Roundabout intersection

Exhibit 185. Canyon Viaduct Alternative Ramp Terminal Intersection LOS

Intersection	Approach	LOS/95% Queues (ft)					
		2045 No Action		2045 Canyon Viaduct Alternative -EL		2045 Canyon Viaduct Alternative -3GPL	
		Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday
Colorado Blvd WB Ramps[3]	WB Off-Ramp	A/25	A/25	A/50	A/25	A/50	A/25
	EB Colorado Blvd	A/50	A/0	A/50	A/25	B/75	A/0
	WB Colorado Blvd	A/25	A/0	B/75	A/25	B/75	A/25
	Overall	A	A	A	A	A	A
Colorado Blvd EB Ramps[2]	EB Off-Ramp	B/15	B/20	B/15	B/35	B/10	B/25
Hidden Valley WB Ramps[4]	SB CCP	B/105	B/130	A/0	A/25	A/0	A/25
	NB CCP	A/10	A/10	C/200	A/0	A/50	A/0
	WB Off-Ramp	D/100	D/295	B/25	A/25	A/0	A/25
	Service Road	E/30	E/35	B/0	A/0	A/0	A/0
	Overall	B	C	C	A	A	A

Intersection	Approach	LOS/95% Queues (ft)					
		2045 No Action		2045 Canyon Viaduct Alternative -EL		2045 Canyon Viaduct Alternative -3GPL	
		Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday	Winter Saturday	Summer Sunday
Hidden Valley EB Ramps[3]	SB CCP	A/10	C/115	A/0	A/25	A/0	A/25
	NB CCP	D/15	B/10	E/400	A/0	A/75	A/0
	EB Frontage	D/30	D/565	A/0	A/0	A/0	A/0
	EB Off-Ramp	D/45	E/150	A/0	A/1	A/0	A/50
	Overall	C	D	D	A	A	A
US 6 and WB Ramp[2]	WB Off-Ramp	C/5	A/10	B/10	B/20	B/5	B/0
US 6 and US 40[2]	US 40	F/750	B/20	F/500	B/5	B/25	B/5
Homestead/EB Ramp[2]	EB Off-Ramp	A/5	B/20	A/5	B/35	A/5	B/25
Homestead/US 40[3]	NB Homestead	A/0	A/0	A/0	A/25	A/0	A/25
	EB US 40	A/0	A/0	A/0	A/0	A/0	A/0
	WB US 40	C/10	A/0	A/50	A/25	A/75	A/25
	Overall	C	A	A	A	A	A
CR 65/US 40[3]	NB CR 65	A/0	A/0	A/25	A/0	A/25	A/0
	EB US 40	A/0	A/0	A/0	A/25	A/0	A/25
	WB US 40	C/10	A/0	A/0	A/0	A/25	A/0
	WB Ramp	A/0	A/0	A/25	A/25	A/50	A/25
	Overall	C	A	A	A	A	A

Note: For stop-controlled intersections only the worst approach LOS and queue lengths are reported.

1. Signalized intersection; 2. Stop controlled intersection; 3. Roundabout intersection

6.5 Action Alternatives Summary

The expected 2045 action alternatives conditions in the corridor include:

- Based on the results of the safety analysis, both qualitative and quantitative, the Canyon Viaduct Alternative is expected to perform with a higher safety rating than the Tunnel Alternative.
- Both action alternatives are predicted to perform better than the No Action scenario in terms of lowering the number of annual crash events.
- I-70 VMT is expected to increase and VHT is expected to significantly decrease for the action alternatives.
- The local roadways that act as alternate routes to I-70 will experience significant decreases in traffic in the action alternatives as fewer vehicles seek to reroute off I-70 and will remain on the mainline.
- The action alternatives are expected to significantly reduce travel time on the corridor compared to the No Action scenario.

- The length of the peak periods for the action alternatives is projected to be shorter than for the No Action conditions.
- The length and duration of congestion on I-70 will be reduced with the action alternatives compared to the No Action conditions.
- The proposed intersection changes will result in acceptable LOS and operations with both action alternatives.
- Using the eastbound off-ramp at Exit 243 (Hidden Valley/Central City) to get traffic onto eastbound US 6 is expected to prevent queue spillback on the ramp or safety concerns at the I-70 gore.

7 Additional Analysis

The managed lane is planned to cease operation by 2035, per a Memorandum of Understanding (MOU) between CDOT, the FHWA, and the Colorado High Performance Transportation Enterprise (HPTE), unless modified by a different project. The new MOU will govern both the new westbound PPSL project, and it will govern the existing eastbound PPSL project that was approved by the County Commissioners in 2014. According to the MOU, both westbound and eastbound shoulder lanes will be operated as a single "toll facility." However, because of the uncertainty about whether the PPSL actually would be removed from I-70, an analysis of the future No Action and action alternatives conditions was completed in which the eastbound and westbound PPSL would be removed from I-70. The following sections briefly discuss the results of the additional analyses. Note that not all measures of effectiveness that were evaluated in the previous action alternatives section were completed for this analysis. For example, a safety analysis, intersection LOS evaluation, and I-70 throughput study were not completed. The emphasis of this analysis was to focus on the impacts to I-70 and volumes on the local roads that indicate diversion is occurring.

7.1 No Action with No PPSL Analysis

This section evaluates the No Action conditions if the eastbound and westbound PPSL are removed and compares it to results for the Existing Condition and the No Action with PPSL condition.

7.1.1 Transportation Network Characteristics

For this analysis, the same transportation network used in the 2045 No Action analysis was used with the exception that the existing eastbound PPSL and planned westbound PPSL were removed. Thus, for all analyses, eastbound I-70 is two lanes wide from the western limits of the traffic analysis modeled area to the Exit 241 (Idaho Springs/Colorado Boulevard) interchange. Eastbound I-70 is three lanes wide from the Exit 241 (Idaho Springs/Colorado Boulevard) interchange all the way to the eastern limits of the traffic analysis modeled area. In addition, westbound I-70 includes two GPLs from the top of Floyd Hill to the western limits of the study area.

7.1.2 Safety Conditions

A safety analysis was not completed for these conditions.

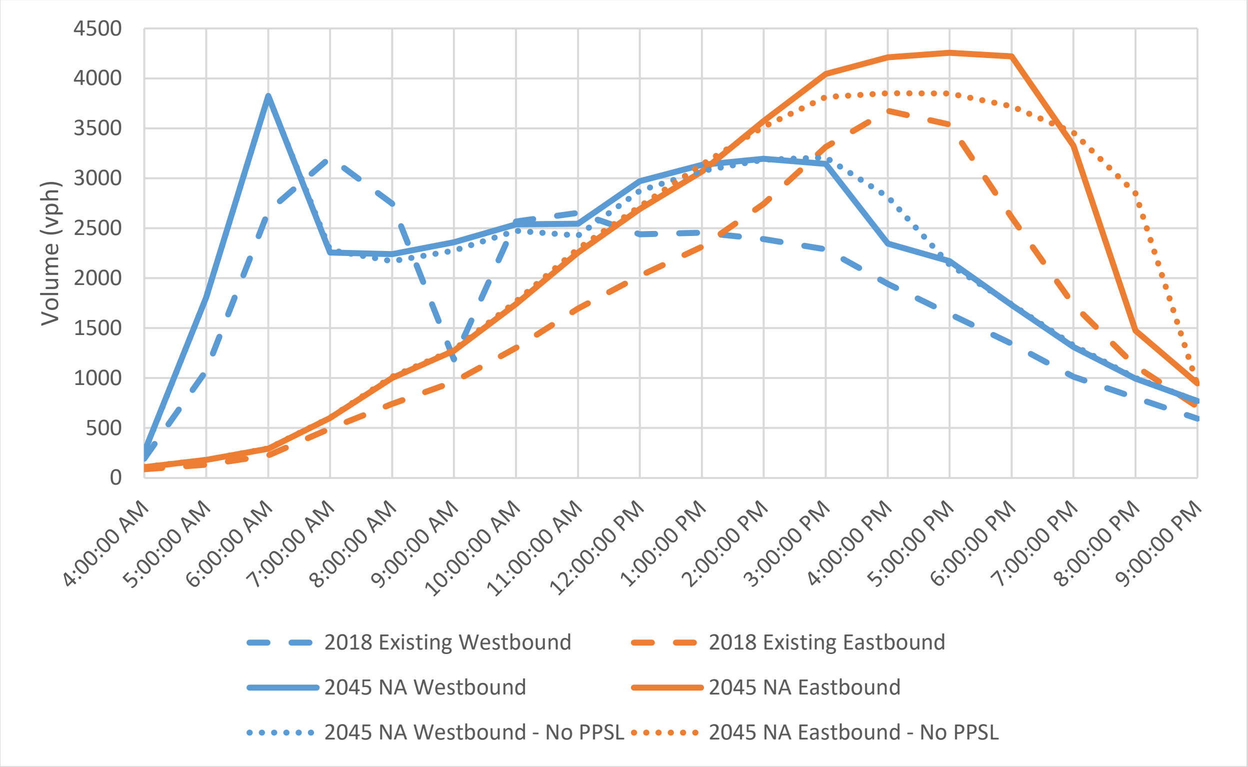
7.1.3 Traffic Volumes and Patterns

The same traffic tables used in the No Action analysis were used to complete this additional analysis. The dynamic traffic assignment capabilities within TransModeler were used to allow vehicles to select routes through the study area until user equilibrium was obtained. The expected 2045 No Action with no PPSL volume patterns for the I-70 mainline and local roads are discussed in the following sections.

7.1.3.1 I-70 Traffic Volumes and Patterns

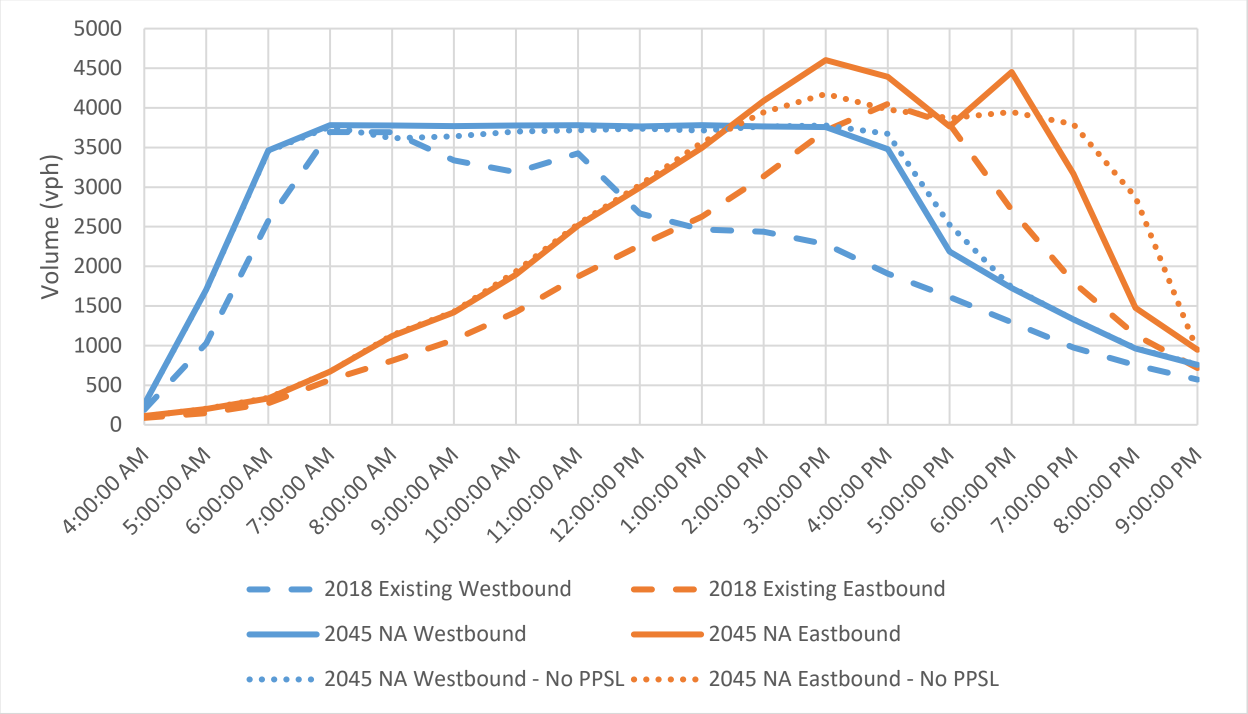
Exhibit 186 and Exhibit 187 show No Action with no PPSL traffic volumes near the top of Floyd Hill, obtained from TransModeler, for a peak winter Saturday and Exhibit 188 and Exhibit 189 show the traffic volumes on I-70 for a summer Sunday just west of the Veterans Memorial Tunnels. The removal of the PPSL will not have a significant impact to westbound volume on I-70, primarily because the PPSL starts at the Veterans Memorial Tunnels, which is west of where congestion occurs. In the eastbound direction, I-70 will not be able to process as many vehicles, which will result in the peak periods spreading out and extending longer into the evening hours.

Exhibit 186. No Action-No PPSL I-70 Winter Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



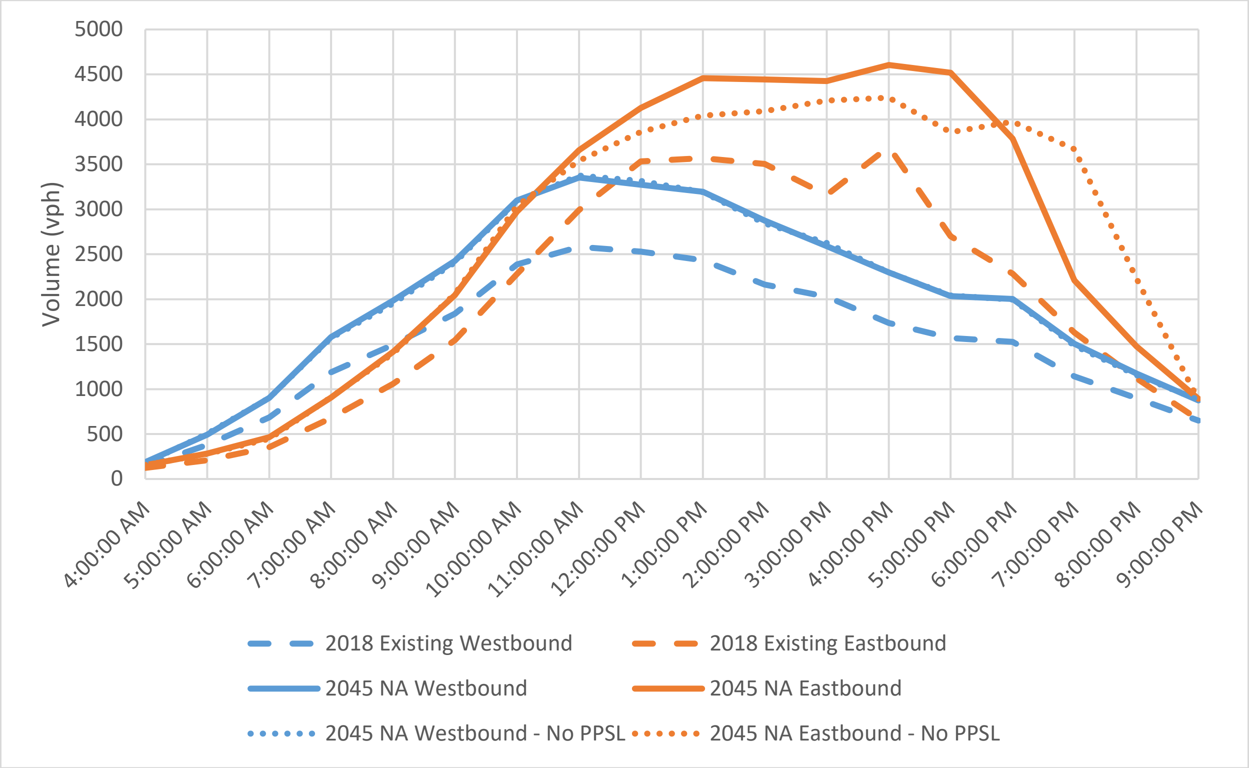
Source: TransModeler microsimulation analysis.

Exhibit 187. No Action-No PPSL I-70 Winter Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



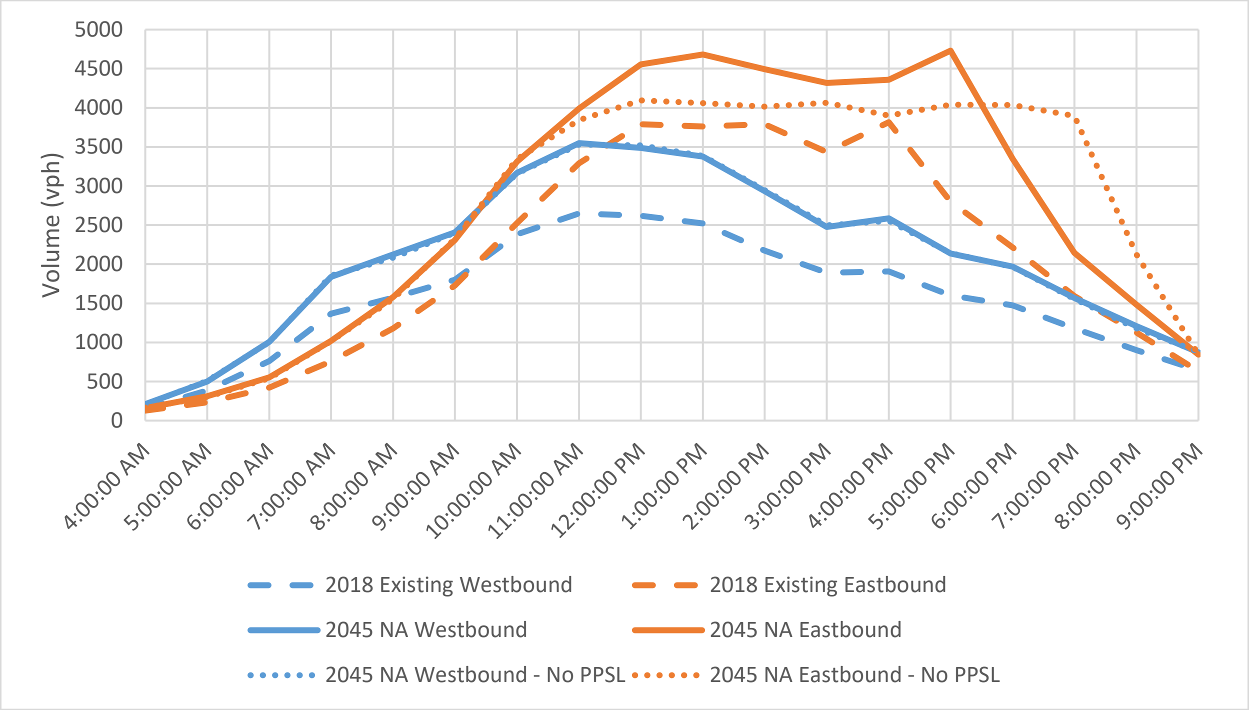
Source: TransModeler microsimulation analysis.

Exhibit 188. No Action-No PPSL I-70 Summer Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



Source: TransModeler microsimulation analysis.

Exhibit 189. No Action-No PPSL I-70 Summer Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

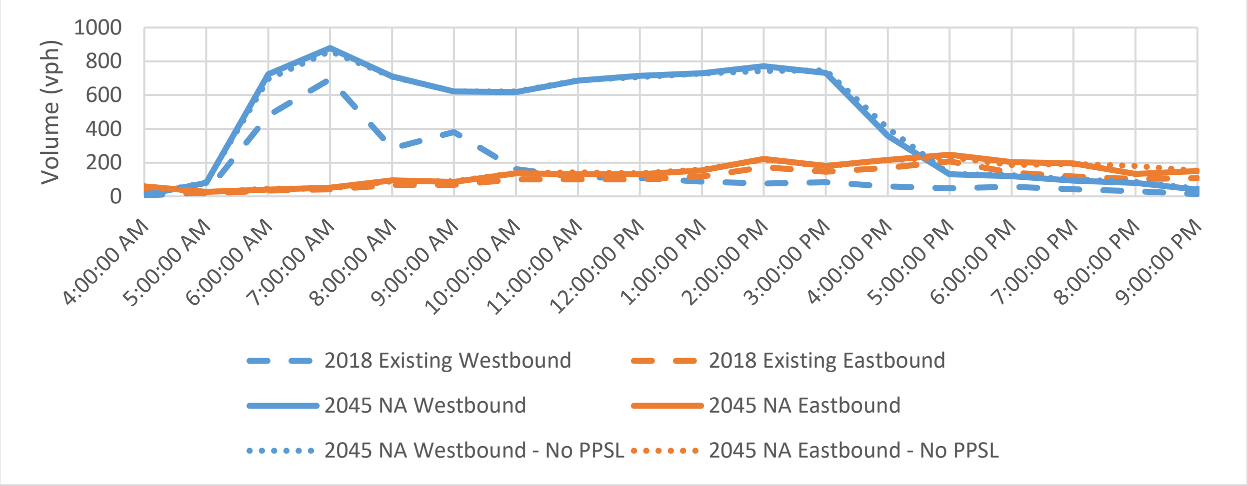
7.1.3.2 Local Roads Traffic Volumes and Patterns

The three local roads of primary interest as those that provide alternate routes to I-70 are US 40, CR 314, and US 6.

7.1.3.2.1 US 40

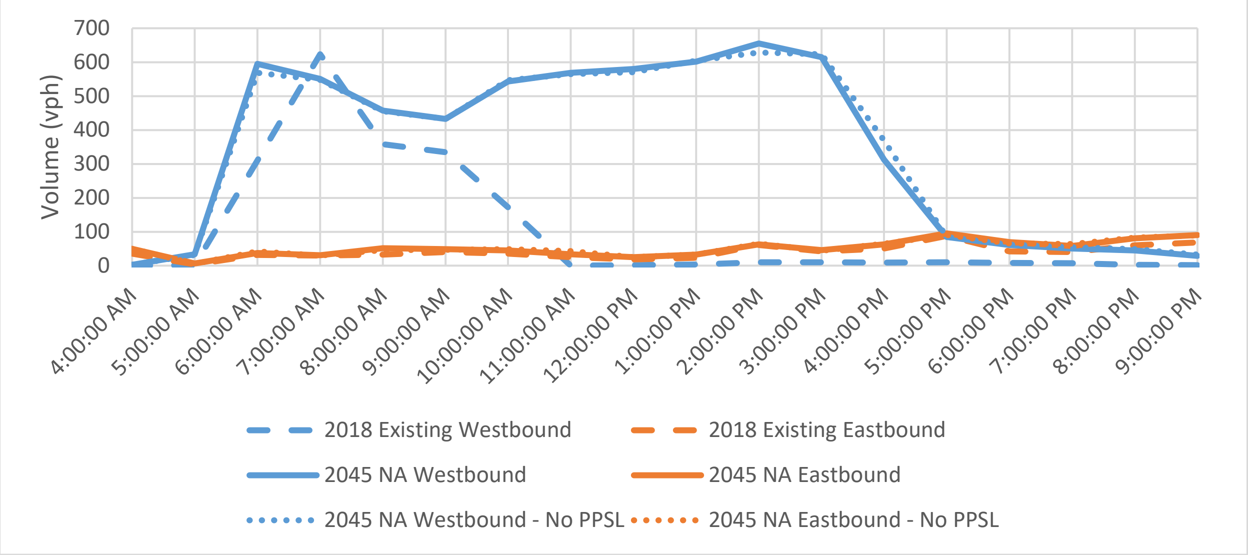
For US 40, the two locations of interest are: (1) between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill), and (2) between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden). The No Action with no PPSL volumes along US 40 are shown in Exhibit 190 and Exhibit 191 for a winter Saturday and Exhibit 192 and Exhibit 193 for a summer Sunday. Removal of the PPSL will not adversely impact traffic volumes on US 40.

Exhibit 190. No Action-No PPSL US 40 Winter Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)



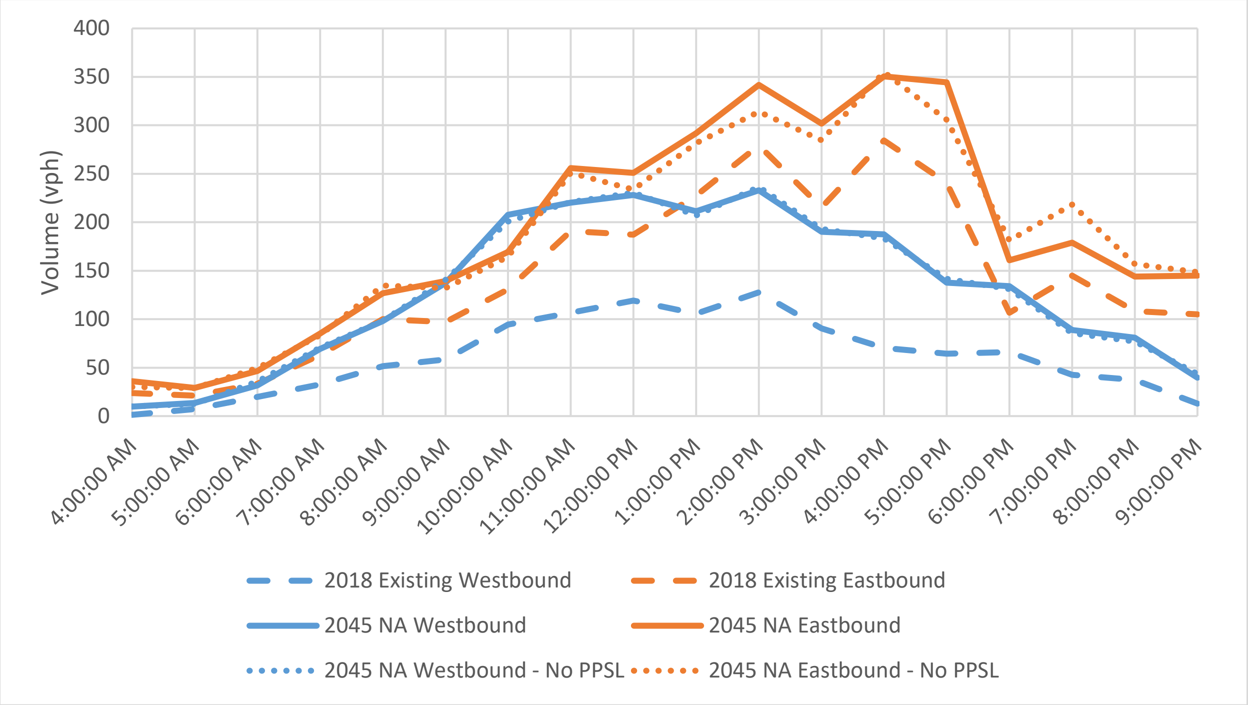
Source: TransModeler microsimulation analysis.

Exhibit 191. No Action-No PPSL US 40 Winter Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)



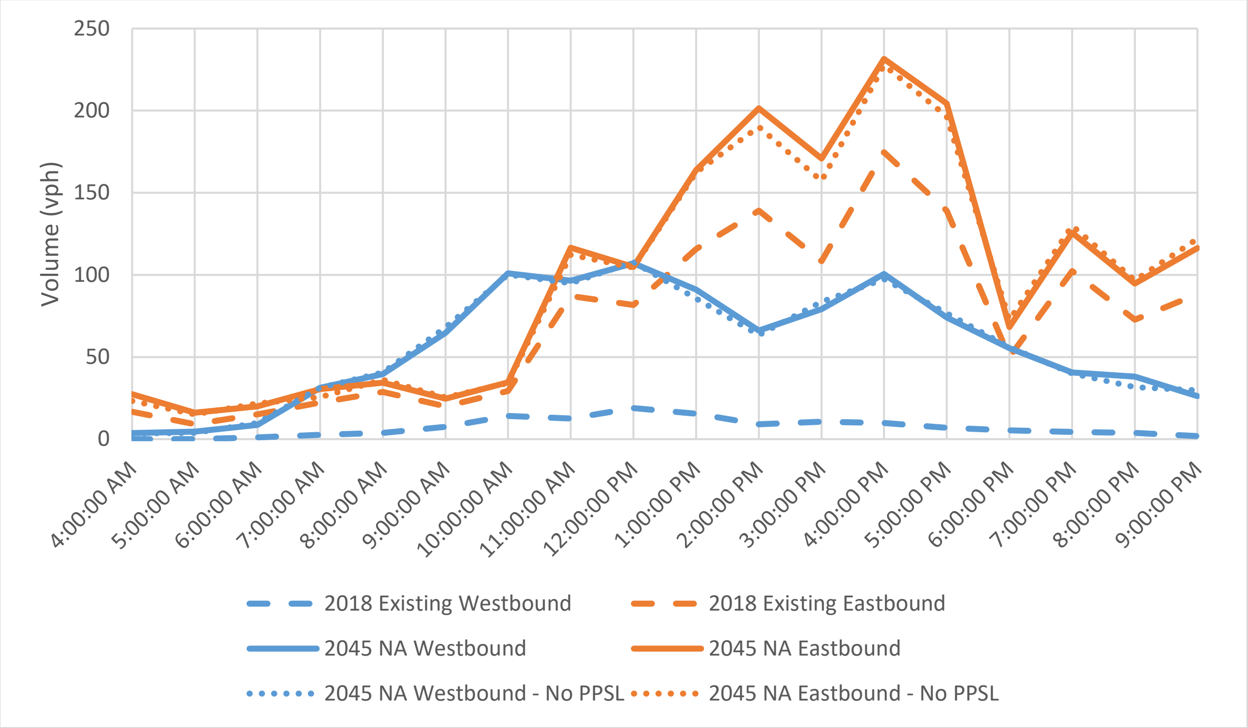
Source: TransModeler microsimulation analysis.

Exhibit 192. No Action-No PPSL US 40 Summer Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)



Source: TransModeler microsimulation analysis.

Exhibit 193. No Action-No PPSL US 40 Summer Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)

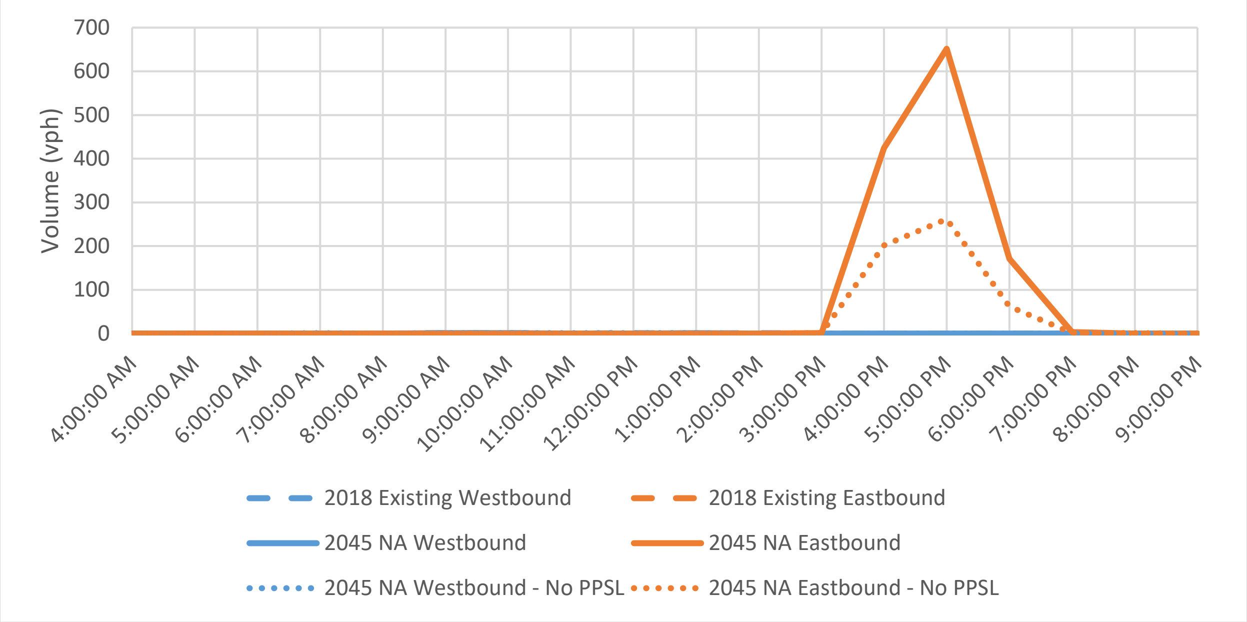


Source: TransModeler microsimulation analysis.

7.1.3.2.2 CR 314

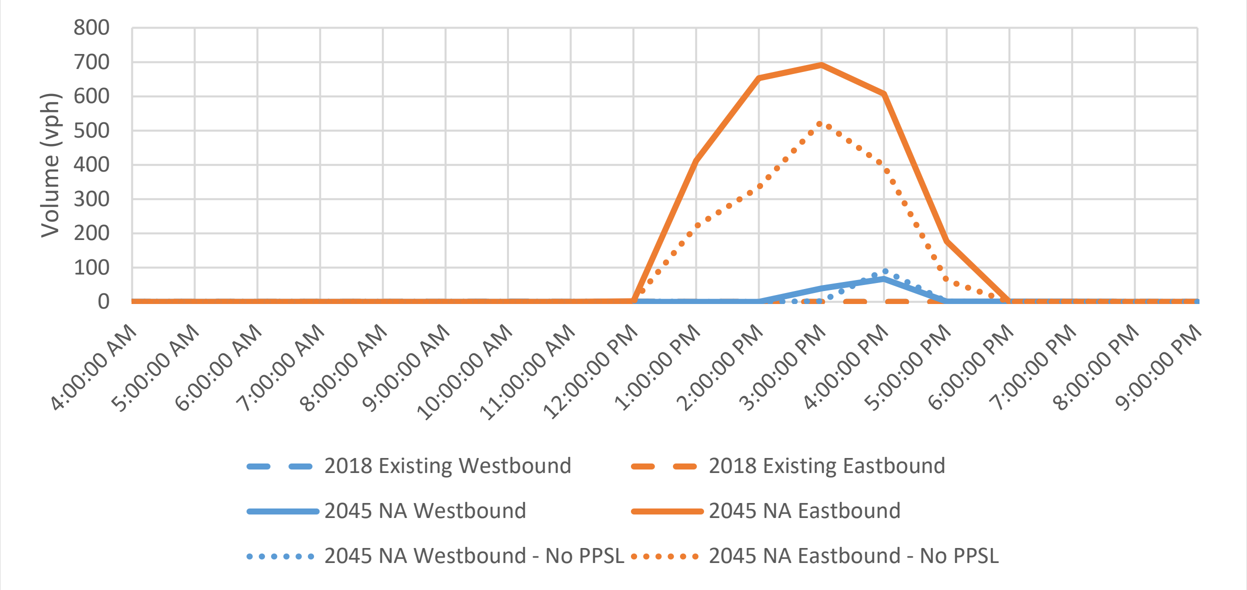
The projected 2045 No Action with no PPSL volume patterns on CR 314 for a winter Saturday are shown in Exhibit 194 and for a summer Sunday are shown in Exhibit 195. The volumes on CR 314 are reduced by the removal of the PPSL primarily because traffic is metered at bottlenecks that occur east and west of this location, so vehicles do not gain any advantage by using this alternate route.

Exhibit 194. No Action-No PPSL CR 314 Winter Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

Exhibit 195. No Action-No PPSL CR 314 Summer Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)

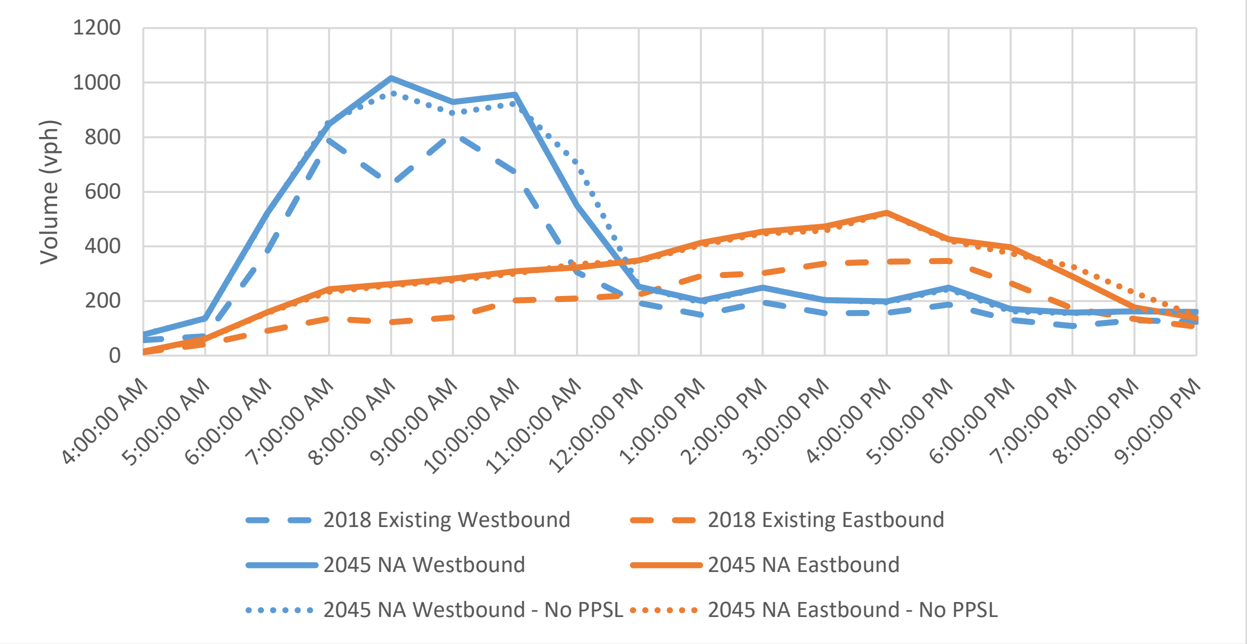


Source: TransModeler microsimulation analysis.

7.1.3.2.3 US 6

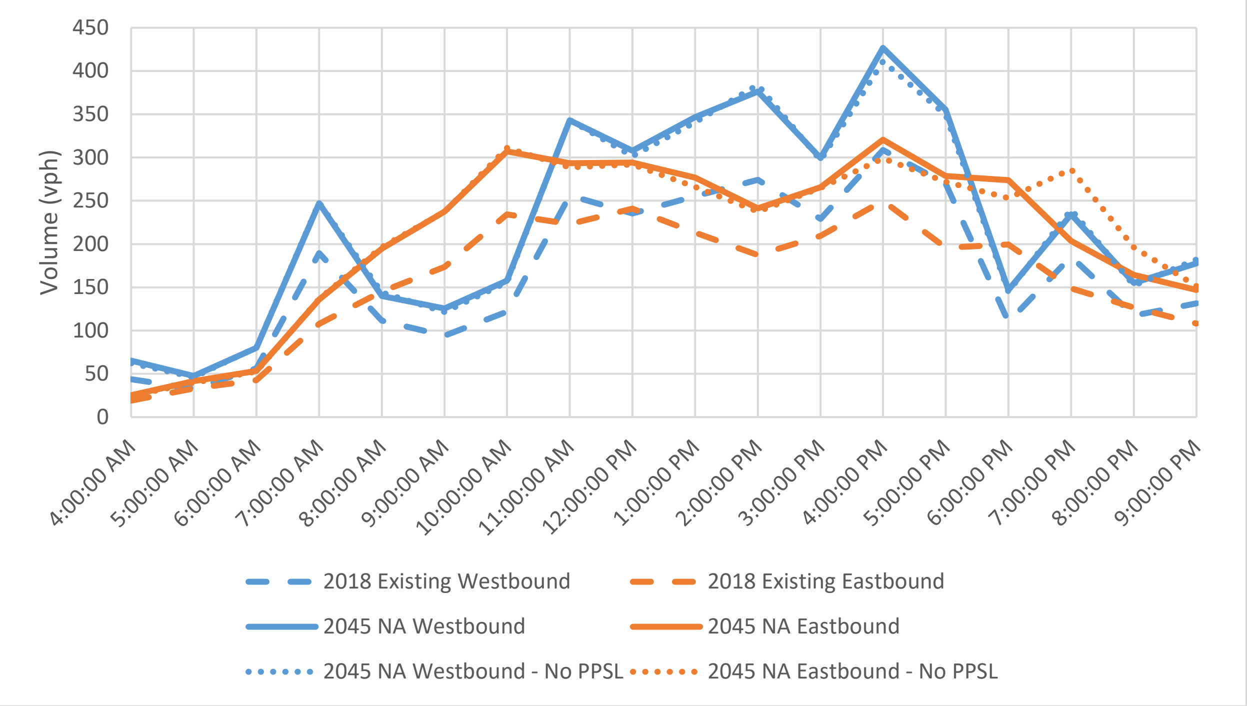
As can be seen in Exhibit 196 and Exhibit 197, the expected No Action with no PPSL volume patterns on US 6 are not significantly changed if the PPSL are removed.

Exhibit 196. No Action-No PPSL US 6 Winter Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

Exhibit 197. No Action-No PPSL US 6 Summer Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

7.1.4 No Action with No PPSL Operational Conditions

The No Action operational characteristics are compared to the Existing Conditions in the following sections.

7.1.4.1 VMT and VHT

A comparison of VMT and VHT for the 2045 No Action conditions with a PPSL and 2045 No Action conditions without a PPSL models is shown in Exhibit 198. In general, the removal of the PPSL will result in higher VMT and VHT on I-70 for both the winter and summer peaks. This is because the removal of the PPSL impacts the peak direction ability of the highway to process vehicles, westbound in winter and eastbound in the summer. This results in an increase in congestion on I-70. Most of the other facilities do not experience much change in VMT and VHT except for CR 314. This facility sees a large decrease in the measures during the winter peak, primarily due to a decrease in eastbound traffic that is using this roadway. Removal of the eastbound PPSL results in upstream metering of traffic so there is less congestion in the area around Exit 243 (Hidden Valley/Central City) so vehicles do not use the frontage roads to avoid congestion, they just remain on I-70.

Exhibit 198. No Action-No PPSL VMT and VHT

Facility	2045 No Action with PPSL				2045 No Action without PPSL[1]			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	VMT	VHT	VMT	VHT	VMT	VHT	VMT	VHT
I-70	913,755	40,117	916,588	19,942	925,791 (1%)	43,433 (8%)	935,470 (2%)	24,163 (21%)
US 6	10,659	681	5,298	166	10,655 (<-1%)	726 (7%)	5,331 (<1%)	166 (0%)
US 40	49,874	2,892	13,581	359	49,989 (<1%)	3,357 (2%)	13,467 (<-1%)	356 (<-1%)
CR 314	2,334	152	2,880	111	983 (-58%)	33 (-78%)	3,048 (6%)	115 (1%)

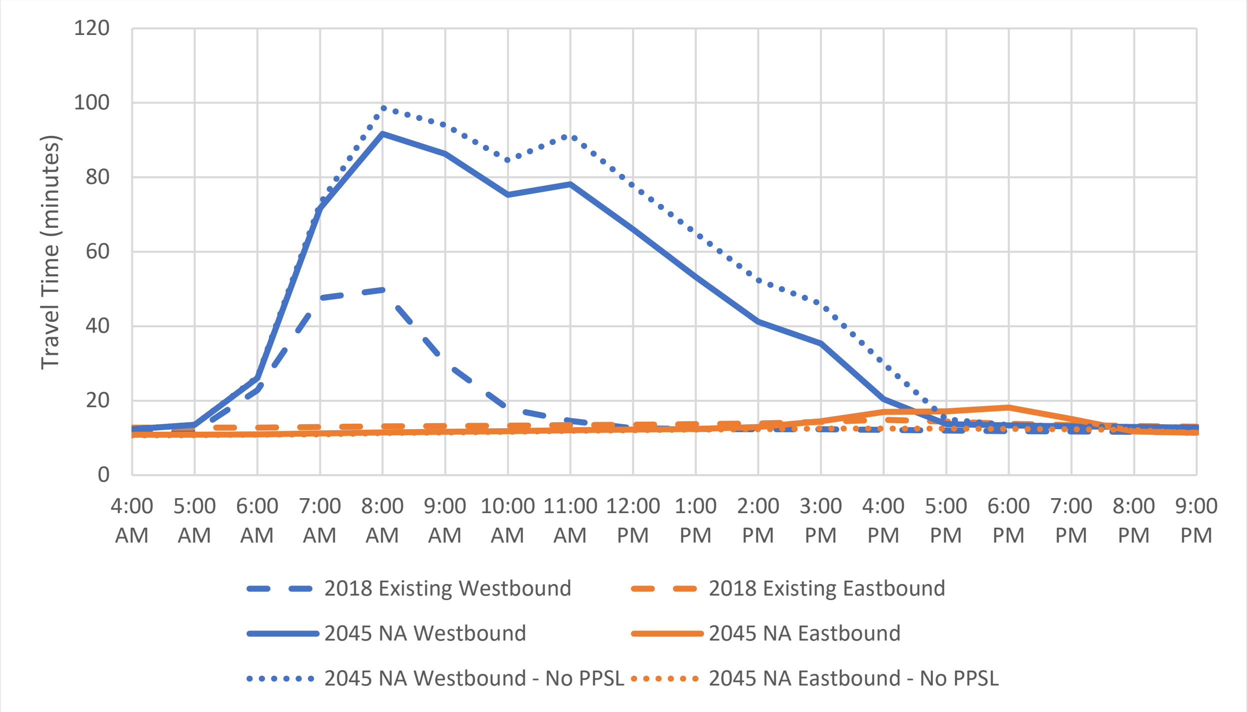
Source: TransModeler microsimulation analysis.

1. Percent difference compared to No Action with PPSL and values greater than 100% shown as >>100%.

7.1.4.2 Travel Times

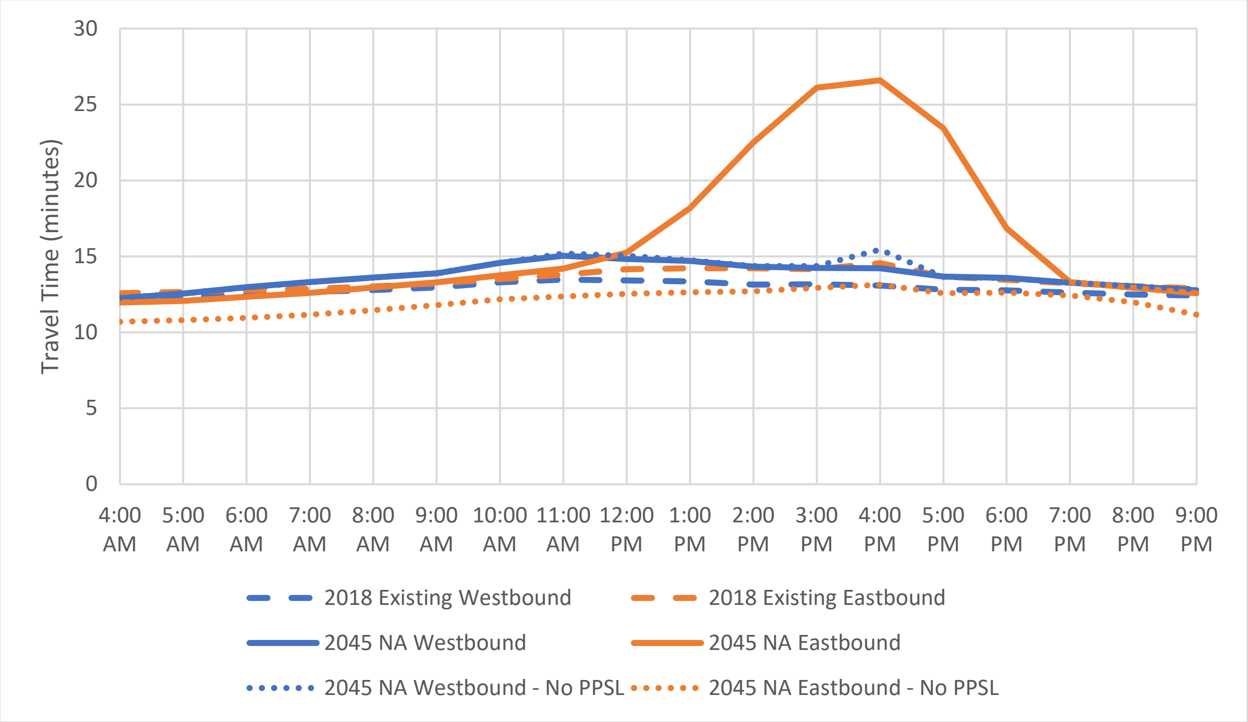
Exhibit 199 shows expected winter travel times on I-70 and Exhibit 200 shows the summer travel times when the PPSL are removed. Travel times for peak westbound conditions (winter) will increase because the PPSL is removed, which will result in more congestion on I-70 due to a reduction in capacity. During the eastbound peak (summer), eastbound travel times actually will improve slightly because the bottleneck for eastbound traffic will be to the west (at US 40, where the PPSL starts today). Traffic will be metered at this point and will flow more smoothly through the study area because volumes will be lower.

Exhibit 199. **No Action-No PPSL Winter I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)**



Source: TransModeler microsimulation analysis.

Exhibit 200. **No Action-No PPSL Summer I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)**

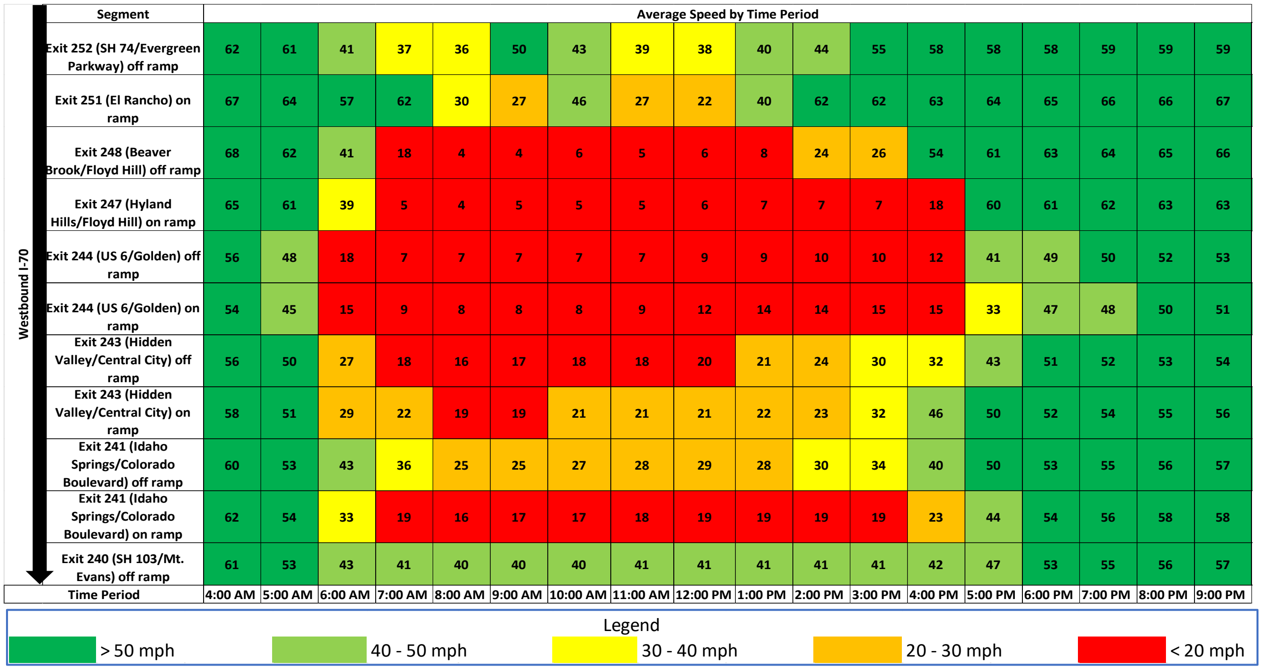


Source: TransModeler microsimulation analysis.

7.1.4.3 I-70 Travel Speeds and Congestion

Speeds on the I-70 mainline for the No Action with no PPSL winter Saturday condition are shown in Exhibit 201 for the westbound direction and in Exhibit 202 for the eastbound direction. Speeds on the I-70 mainline for the No Action with no PPSL summer Sunday condition are shown in Exhibit 203 for the westbound direction and in Exhibit 204 for the eastbound direction. Overall, removal of the PPSL will improve congestion on I-70 in the study area slightly because bottlenecks occur upstream in both directions, resulting in fewer vehicles and smoother flows.

Exhibit 201. No Action-No PPSL Winter Westbound Congestion Diagram



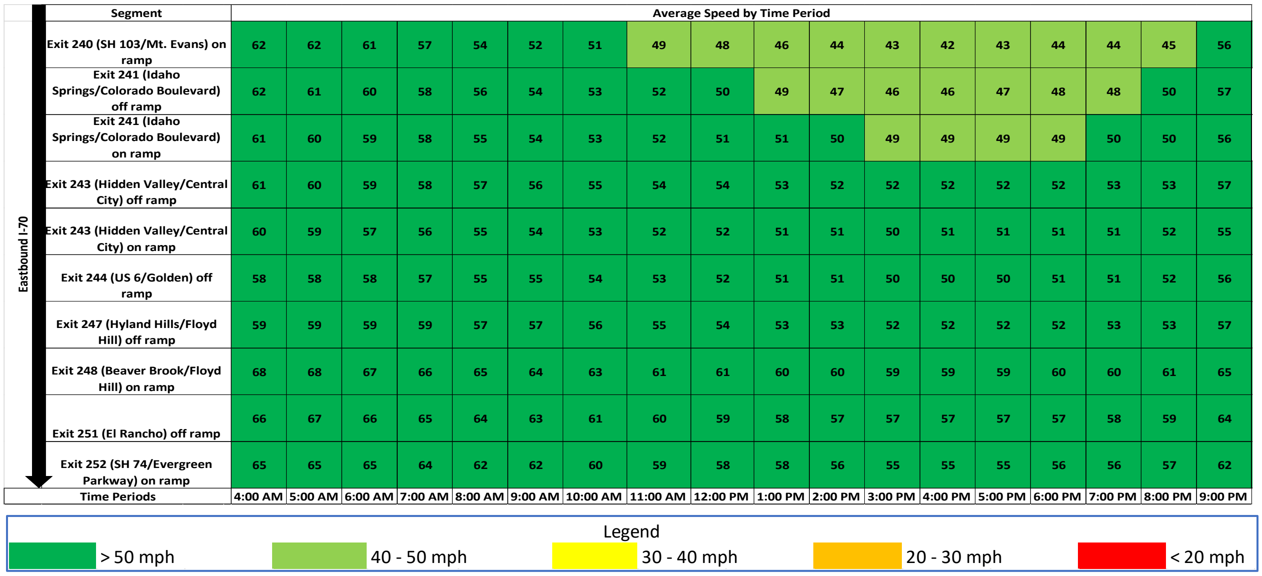
Segment	Average Speed by Time Period																	
Exit 252 (SH 74/Evergreen Parkway) off ramp	62	61	41	37	36	50	43	39	38	40	44	55	58	58	58	59	59	59
Exit 251 (El Rancho) on ramp	67	64	57	62	30	27	46	27	22	40	62	62	63	64	65	66	66	67
Exit 248 (Beaver Brook/Floyd Hill) off ramp	68	62	41	18	4	4	6	5	6	8	24	26	54	61	63	64	65	66
Exit 247 (Hyland Hills/Floyd Hill) on ramp	65	61	39	5	4	5	5	5	6	7	7	7	18	60	61	62	63	63
Exit 244 (US 6/Golden) off ramp	56	48	18	7	7	7	7	7	9	9	10	10	12	41	49	50	52	53
Exit 244 (US 6/Golden) on ramp	54	45	15	9	8	8	8	9	12	14	14	15	15	33	47	48	50	51
Exit 243 (Hidden Valley/Central City) off ramp	56	50	27	18	16	17	18	18	20	21	24	30	32	43	51	52	53	54
Exit 243 (Hidden Valley/Central City) on ramp	58	51	29	22	19	19	21	21	21	22	23	32	46	50	52	54	55	56
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	60	53	43	36	25	25	27	28	29	28	30	34	40	50	53	55	56	57
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	62	54	33	19	16	17	17	18	19	19	19	19	23	44	54	56	58	58
Exit 240 (SH 103/Mt. Evans) off ramp	61	53	43	41	40	40	40	41	41	41	41	41	42	47	53	55	56	57
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 202. No Action-No PPSL Winter Eastbound Congestion Diagram



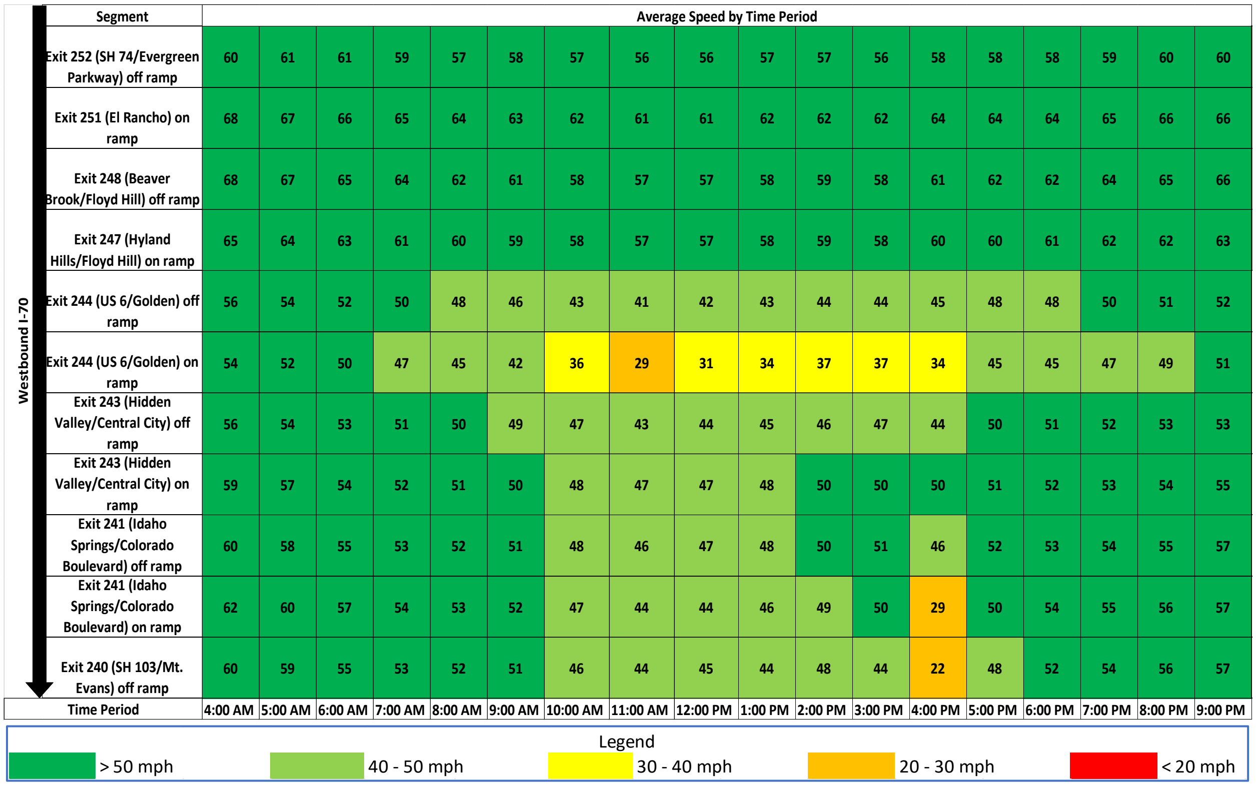
Segment	Average Speed by Time Period																	
Exit 240 (SH 103/Mt. Evans) on ramp	62	62	61	57	54	52	51	49	48	46	44	43	42	43	44	44	45	56
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	62	61	60	58	56	54	53	52	50	49	47	46	46	47	48	48	50	57
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	61	60	59	58	55	54	53	52	51	51	50	49	49	49	49	50	50	56
Exit 243 (Hidden Valley/Central City) off ramp	61	60	59	58	57	56	55	54	54	53	52	52	52	52	52	53	53	57
Exit 243 (Hidden Valley/Central City) on ramp	60	59	57	56	55	54	53	52	52	51	51	50	51	51	51	51	52	55
Exit 244 (US 6/Golden) off ramp	58	58	58	57	55	55	54	53	52	51	51	50	50	50	51	51	52	56
Exit 247 (Hyland Hills/Floyd Hill) off ramp	59	59	59	59	57	57	56	55	54	53	53	52	52	52	52	53	53	57
Exit 248 (Beaver Brook/Floyd Hill) on ramp	68	68	67	66	65	64	63	61	61	60	60	59	59	59	60	60	61	65
Exit 251 (El Rancho) off ramp	66	67	66	65	64	63	61	60	59	58	57	57	57	57	57	58	59	64
Exit 252 (SH 74/Evergreen Parkway) on ramp	65	65	65	64	62	62	60	59	58	58	56	55	55	55	56	56	57	62
Time Periods	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 203. No Action-No PPSL Summer Westbound Congestion Diagram



Westbound I-70

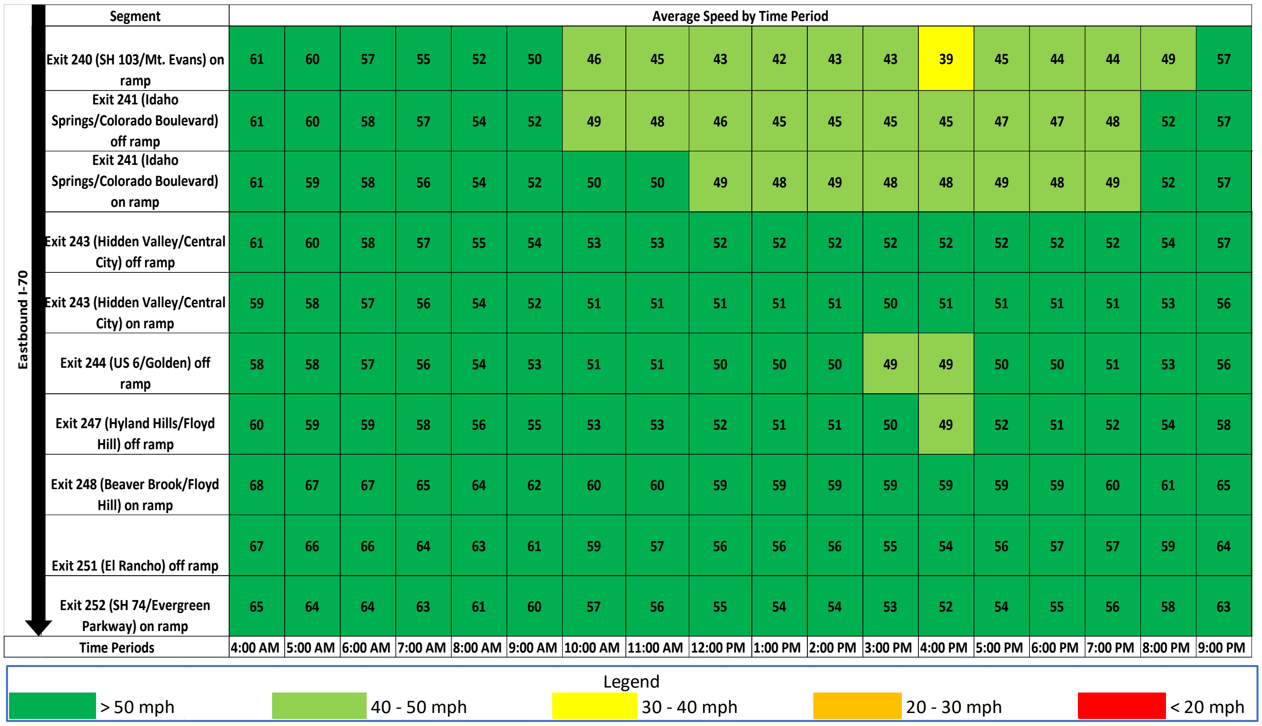
Segment	Average Speed by Time Period																	
Exit 252 (SH 74/Evergreen Parkway) off ramp	60	61	61	59	57	58	57	56	56	57	57	56	58	58	58	59	60	60
Exit 251 (El Rancho) on ramp	68	67	66	65	64	63	62	61	61	62	62	62	64	64	64	65	66	66
Exit 248 (Beaver Brook/Floyd Hill) off ramp	68	67	65	64	62	61	58	57	57	58	59	58	61	62	62	64	65	66
Exit 247 (Hyland Hills/Floyd Hill) on ramp	65	64	63	61	60	59	58	57	57	58	59	58	60	60	61	62	62	63
Exit 244 (US 6/Golden) off ramp	56	54	52	50	48	46	43	41	42	43	44	44	45	48	48	50	51	52
Exit 244 (US 6/Golden) on ramp	54	52	50	47	45	42	36	29	31	34	37	37	34	45	45	47	49	51
Exit 243 (Hidden Valley/Central City) off ramp	56	54	53	51	50	49	47	43	44	45	46	47	44	50	51	52	53	53
Exit 243 (Hidden Valley/Central City) on ramp	59	57	54	52	51	50	48	47	47	48	50	50	50	51	52	53	54	55
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	60	58	55	53	52	51	48	46	47	48	50	51	46	52	53	54	55	57
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	62	60	57	54	53	52	47	44	44	46	49	50	29	50	54	55	56	57
Exit 240 (SH 103/Mt. Evans) off ramp	60	59	55	53	52	51	46	44	45	44	48	44	22	48	52	54	56	57
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 204. No Action-No PPSL Summer Eastbound Congestion Diagram



Eastbound I-70

Segment	Average Speed by Time Period																	
Exit 240 (SH 103/Mt. Evans) on ramp	61	60	57	55	52	50	46	45	43	42	43	43	39	45	44	44	49	57
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	61	60	58	57	54	52	49	48	46	45	45	45	45	47	47	48	52	57
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	61	59	58	56	54	52	50	50	49	48	49	48	48	49	48	49	52	57
Exit 243 (Hidden Valley/Central City) off ramp	61	60	58	57	55	54	53	53	52	52	52	52	52	52	52	52	54	57
Exit 243 (Hidden Valley/Central City) on ramp	59	58	57	56	54	52	51	51	51	51	51	50	51	51	51	51	53	56
Exit 244 (US 6/Golden) off ramp	58	58	57	56	54	53	51	51	50	50	50	49	49	50	50	51	53	56
Exit 247 (Hyland Hills/Floyd Hill) off ramp	60	59	59	58	56	55	53	53	52	51	51	50	49	52	51	52	54	58
Exit 248 (Beaver Brook/Floyd Hill) on ramp	68	67	67	65	64	62	60	60	59	59	59	59	59	59	59	60	61	65
Exit 251 (El Rancho) off ramp	67	66	66	64	63	61	59	57	56	56	56	55	54	56	57	57	59	64
Exit 252 (SH 74/Evergreen Parkway) on ramp	65	64	64	63	61	60	57	56	55	54	54	53	52	54	55	56	58	63
Time Periods	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

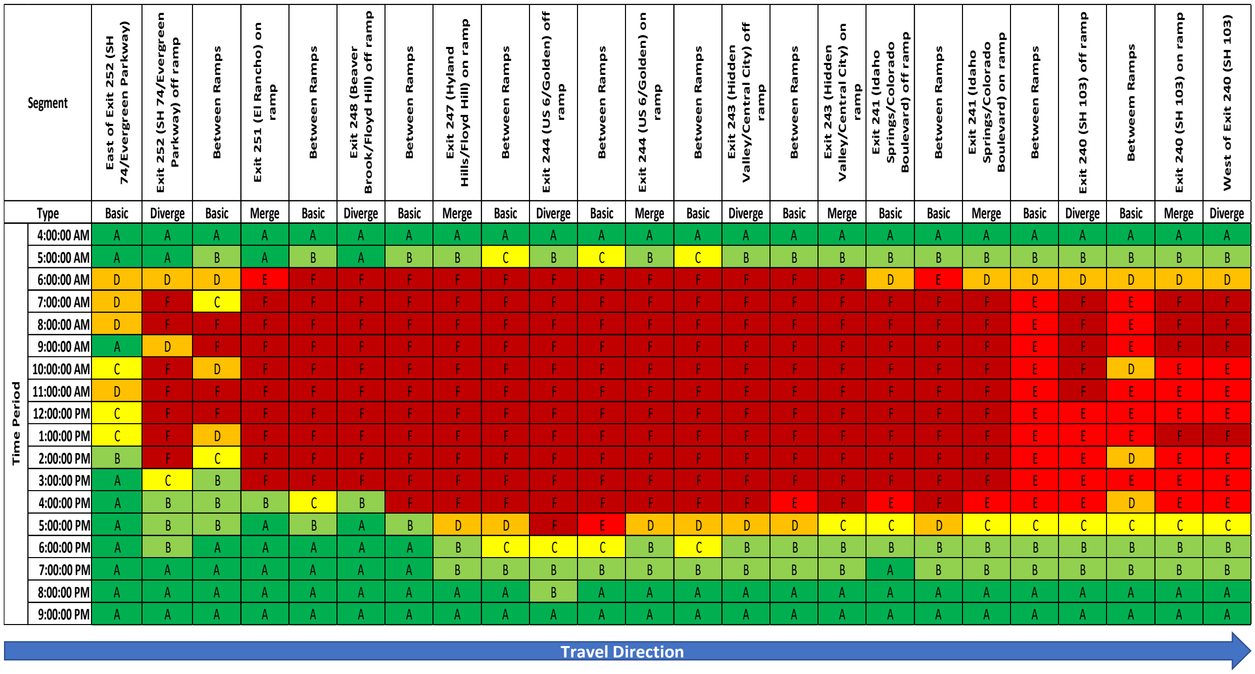
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

7.1.4.4 Freeway Segment LOS

Freeway LOS results for the No Action with no PPSL analyses are shown in Exhibit 205 through Exhibit 208. Congestion levels in the peak direction are worse with more intensity and longer duration of LOS E and F when the PPSL, both eastbound and westbound, are removed compared to when the PPSL remain open to help process more vehicles on I-70. Even the off peak eastbound direction experiences some increase in congestion without the PPSL.

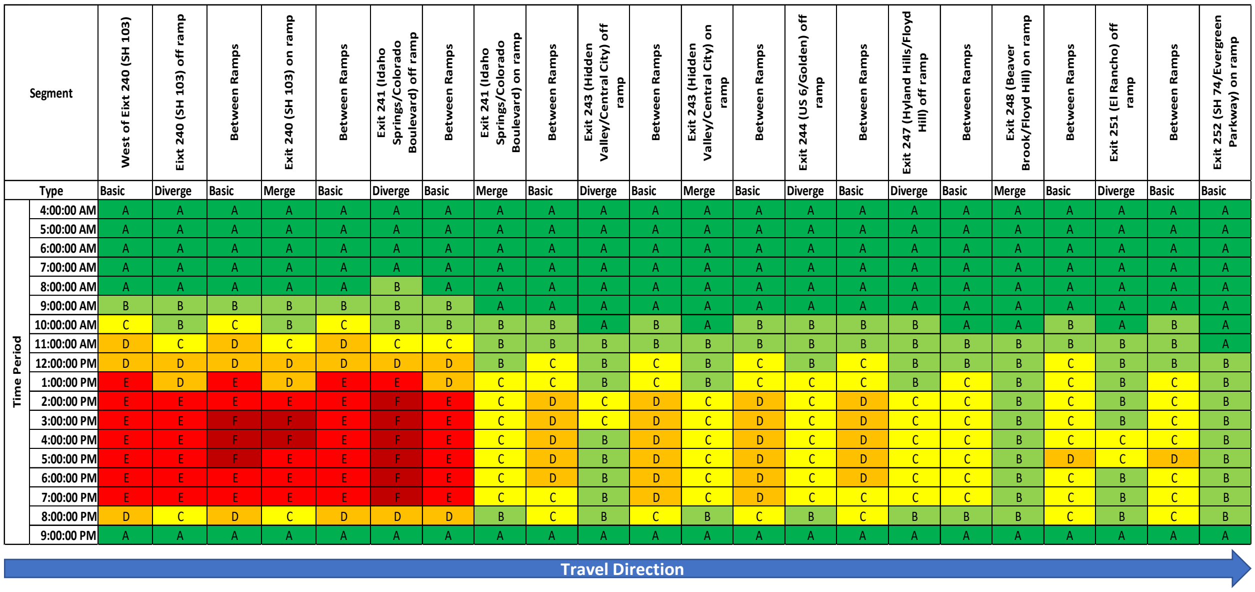
Exhibit 205. No Action-No PPSL Winter Westbound I-70 LOS



	Segment	East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
	Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	B	C	B	C	B	C	B	B	B	B	B	B	B	B	B	B	B
	6:00:00 AM	D	D	D	E	F	F	F	F	F	F	F	F	F	F	F	F	D	E	D	D	D	D	D	D
	7:00:00 AM	D	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	E	F	F
	8:00:00 AM	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	E	F	F
	9:00:00 AM	A	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	E	F	F
	10:00:00 AM	C	F	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	D	E	E
	11:00:00 AM	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	F	E	E	E
	12:00:00 PM	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	E	E	E
	1:00:00 PM	C	F	D	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	E	F	F
	2:00:00 PM	B	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	D	E	E
	3:00:00 PM	A	C	B	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	E	E	E	E	E
	4:00:00 PM	A	B	B	B	C	B	F	F	F	F	F	F	F	F	E	F	E	F	E	E	E	D	E	E
	5:00:00 PM	A	B	B	A	B	A	B	D	D	F	E	D	D	D	D	C	C	D	C	C	C	C	C	C
	6:00:00 PM	A	B	A	A	A	A	A	B	C	C	C	B	C	B	B	B	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Source: TransModeler microsimulation analysis.

Exhibit 206. No Action-No PPSL Winter Eastbound I-70 LOS



	Segment	West of Eixt 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
	Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	C	B	B	B	B	A	B	A	B	B	B	B	A	A	B	A	B	A
	11:00:00 AM	D	C	D	C	D	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A
	12:00:00 PM	D	D	D	D	D	D	D	B	C	B	C	B	C	B	C	B	B	B	C	B	B	B
	1:00:00 PM	E	D	E	D	E	E	D	C	C	B	C	B	C	C	C	B	C	B	C	B	C	B
	2:00:00 PM	E	E	E	E	E	F	E	C	D	C	D	C	D	C	D	C	C	B	C	B	C	B
	3:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	C	D	C	D	C	C	B	C	B	C	B
	4:00:00 PM	E	E	F	F	E	F	E	C	D	B	D	C	D	C	D	C	C	B	C	C	C	B
	5:00:00 PM	E	E	F	E	E	F	E	C	D	B	D	C	D	C	D	C	C	B	D	C	D	B
	6:00:00 PM	E	E	E	E	E	F	E	C	D	B	D	C	D	C	D	C	C	B	C	B	C	B
	7:00:00 PM	E	E	E	E	E	F	E	C	C	B	D	C	D	C	C	C	C	B	C	B	C	B
	8:00:00 PM	D	C	D	C	D	D	D	B	C	B	C	B	C	B	C	B	B	B	C	B	C	B
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Source: TransModeler microsimulation analysis.

Exhibit 207. No Action-No PPSL Summer Westbound I-70 LOS

Segment	East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period																								
4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
7:00:00 AM	A	A	A	A	A	A	A	B	B	B	C	B	C	B	C	B	B	B	B	B	B	B	B	B
8:00:00 AM	A	B	A	A	B	A	B	B	C	C	C	C	C	C	C	C	B	C	B	C	B	B	B	B
9:00:00 AM	A	B	B	B	B	B	B	C	D	D	D	C	D	C	C	C	C	C	C	C	C	C	B	B
10:00:00 AM	A	B	C	B	C	B	C	D	E	E	F	E	E	D	E	E	D	D	D	D	D	D	C	C
11:00:00 AM	B	B	C	B	C	B	C	E	E	F	F	F	F	F	E	F	D	E	E	E	D	D	D	D
12:00:00 PM	B	B	C	B	C	B	C	E	E	F	F	F	F	E	E	F	D	E	D	E	D	D	D	D
1:00:00 PM	A	B	C	B	C	B	C	D	E	F	F	E	E	E	E	E	D	D	D	D	D	D	D	D
2:00:00 PM	A	B	B	B	C	B	C	D	D	E	E	D	E	D	D	D	C	D	C	D	C	D	C	C
3:00:00 PM	A	B	B	B	B	B	B	C	D	D	E	D	D	D	D	C	C	C	C	D	C	C	C	C
4:00:00 PM	A	B	B	B	B	B	B	C	D	D	E	D	D	D	D	D	D	F	F	F	F	C	C	C
5:00:00 PM	A	B	B	A	B	A	B	B	C	C	C	C	C	C	C	C	B	C	C	C	C	C	B	C
6:00:00 PM	A	B	B	A	B	A	B	B	C	C	C	C	C	C	C	C	B	B	B	C	B	B	B	B
7:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
8:00:00 PM	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	A	A	A	B	A	A	A	B
9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 208. No Action-No PPSL Summer Eastbound I-70 LOS

Segment	West of Exit 240 (SH 103)	Eixt 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period																						
4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
8:00:00 AM	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
9:00:00 AM	C	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B	B	A	B	A	B	A
10:00:00 AM	D	D	E	D	E	E	D	C	C	B	C	B	C	C	C	B	B	B	C	B	C	B
11:00:00 AM	E	E	E	E	E	F	E	C	D	B	D	C	D	C	D	C	C	B	C	B	C	B
12:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	C	D	C	D	C	C	B	D	C	C	B
1:00:00 PM	E	E	F	F	F	F	E	C	D	B	D	C	D	C	D	C	C	B	D	C	D	B
2:00:00 PM	E	E	F	F	F	F	E	C	D	B	D	C	D	C	D	C	C	B	D	C	D	C
3:00:00 PM	E	E	E	F	E	F	E	C	D	B	D	D	E	D	E	D	C	C	D	C	D	B
4:00:00 PM	F	F	F	F	E	F	E	C	D	B	D	C	D	C	E	D	C	C	D	C	D	C
5:00:00 PM	E	E	E	E	E	F	E	C	D	C	D	C	D	C	D	C	C	B	D	C	D	B
6:00:00 PM	E	E	E	E	E	F	E	C	D	C	D	C	D	C	D	C	C	B	D	C	C	B
7:00:00 PM	E	E	F	E	E	F	E	C	D	B	D	C	D	C	D	C	C	B	C	B	C	B
8:00:00 PM	C	B	C	B	C	C	C	B	B	B	B	B	B	B	B	B	B	A	B	B	B	A
9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

7.2 Action Alternatives with No PPSL Analysis

This section evaluates the action alternatives conditions if the PPSL are removed and compares the results to Existing Conditions and the No Action with PPSL results.

7.2.1 Transportation Network Characteristics

For this analysis, the same transportation networks used in the action alternatives analyses were used, except the existing eastbound PPSL and planned westbound PPSL were removed. Thus, for all analyses, eastbound I-70 is two lanes wide from the western limits of the traffic analysis modeled area to the Exit 241 (Idaho Springs/Colorado Boulevard) interchange. Eastbound I-70 is three lanes wide from the Exit 241 (Idaho Springs/Colorado Boulevard) interchange all the way to the eastern limits of the traffic analysis modeled area.

Westbound I-70 includes three GPLs from the top of Floyd Hill to the Exit 241 (Idaho Springs/Colorado Boulevard) interchange, at which point the right-most lane becomes a trap lane that must exit I-70 onto Colorado Boulevard. I-70 is two lanes wide, both GPL, from Exit 241 (Idaho Springs/Colorado Boulevard) to the western limits of the study area.

7.2.2 Safety Conditions

A safety analysis was not completed for these conditions.

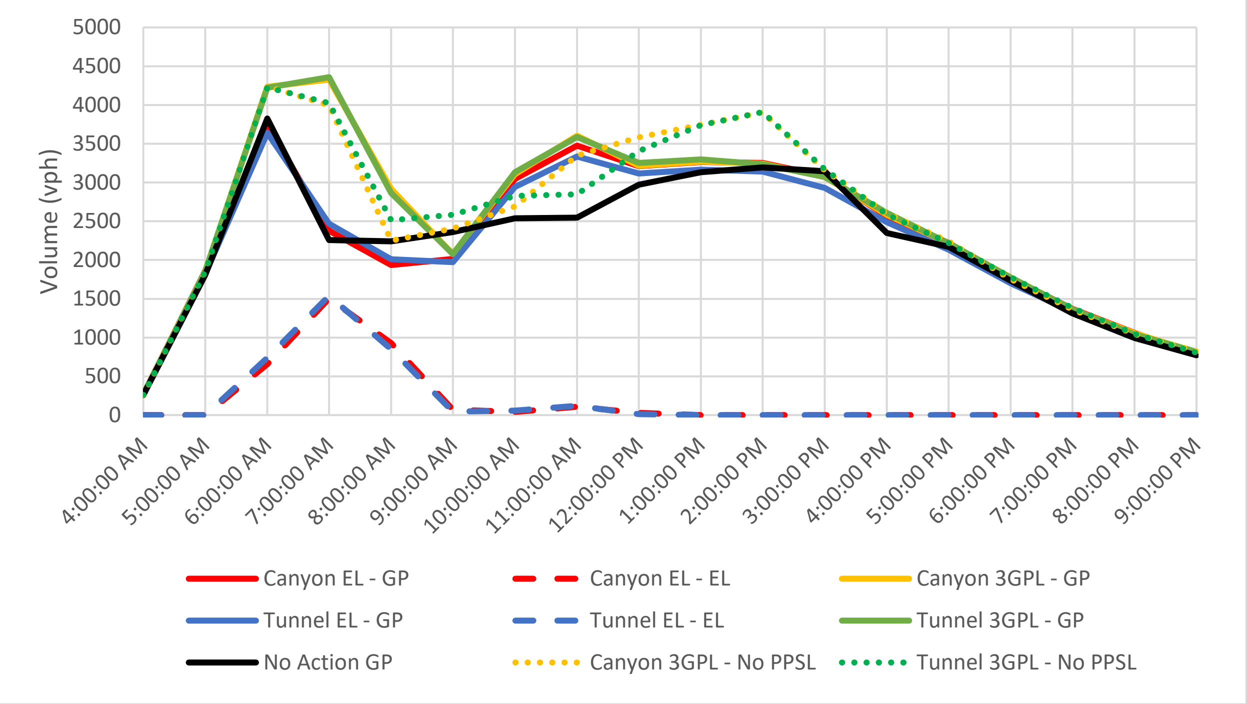
7.2.3 Traffic Volumes and Patterns

The same traffic tables used in the action alternatives analyses were used to complete this additional analysis. The dynamic traffic assignment capabilities within TransModeler were used to allow vehicles to select routes through the study area until user equilibrium was obtained. The expected 2045 Action Alternatives with no PPSL volume patterns for the I-70 mainline and local roads are discussed in the following sections.

7.2.3.1 I-70 Traffic Volumes and Patterns

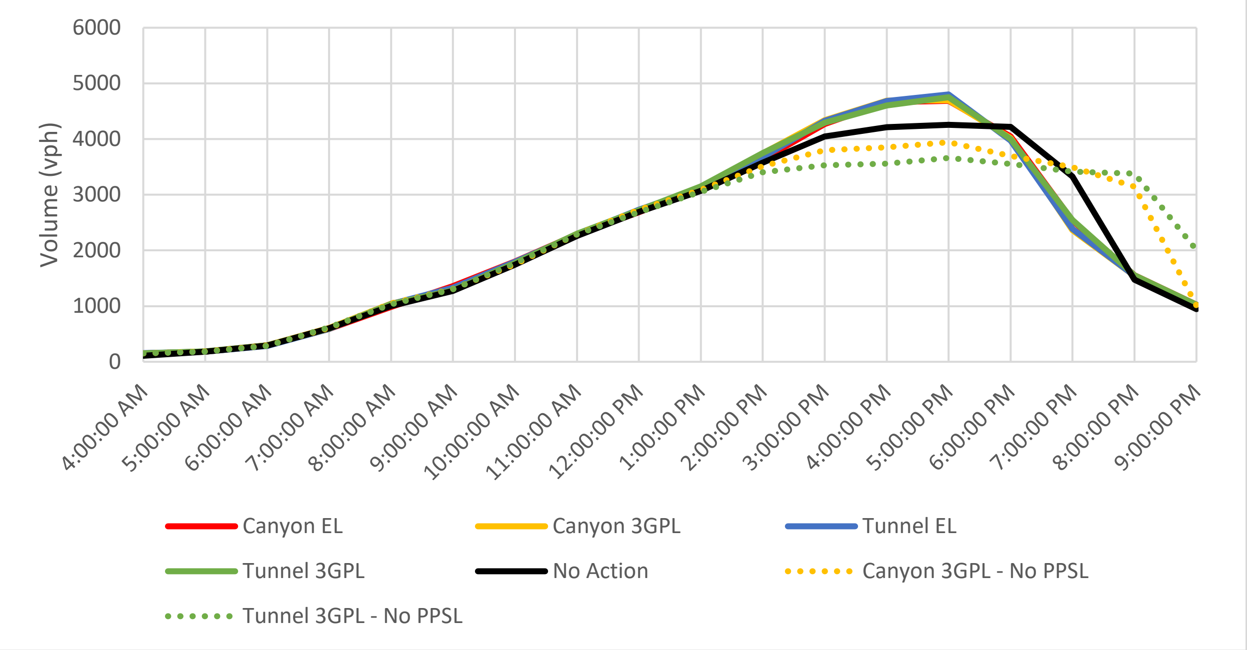
Exhibit 209 through Exhibit 212 show the I-70 volumes just east of Exit 247 and just east of Exit 241 for the action alternatives on a winter peak day. Exhibit 213 through Exhibit 216 show the I-70 volumes just east of Exit 247 and just east of Exit 241 for the action alternatives on a summer peak day. In general, the removal of the PPSL will result in both directions of I-70 being unable to process as many vehicles causing peak periods to stretch out into more hours of the day. This will result in longer periods of congestion and longer delays experienced by drivers.

Exhibit 209. Action Alternatives-No PPSL I-70 Westbound Winter Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



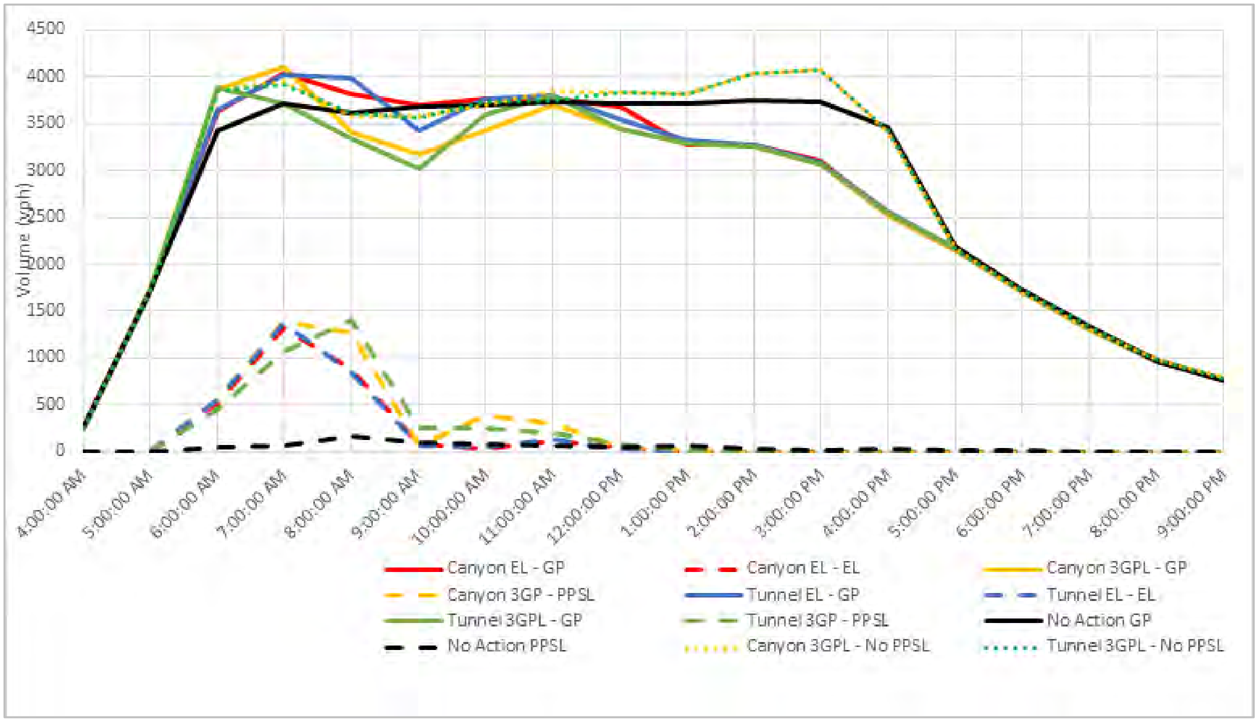
Source: TransModeler microsimulation analysis.

Exhibit 210. Action Alternatives-No PPSL I-70 Winter Eastbound Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



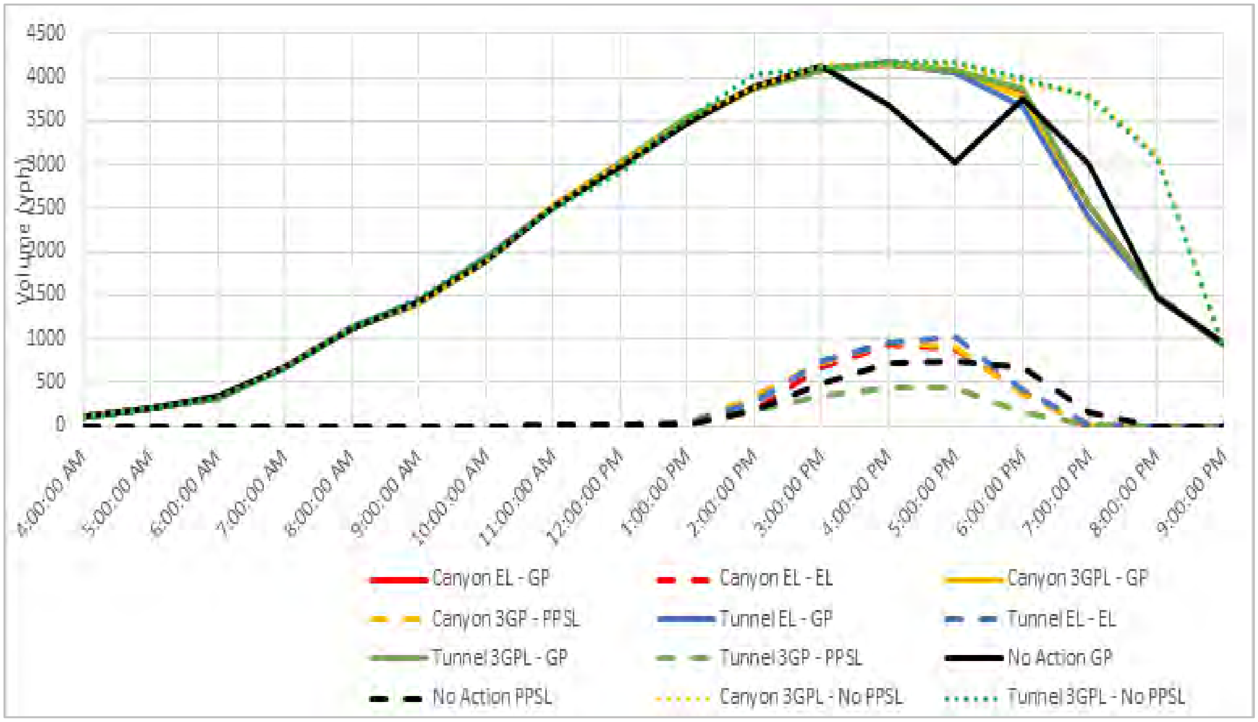
Source: TransModeler microsimulation analysis.

Exhibit 211. Action Alternatives-No PPSL I-70 Winter Westbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



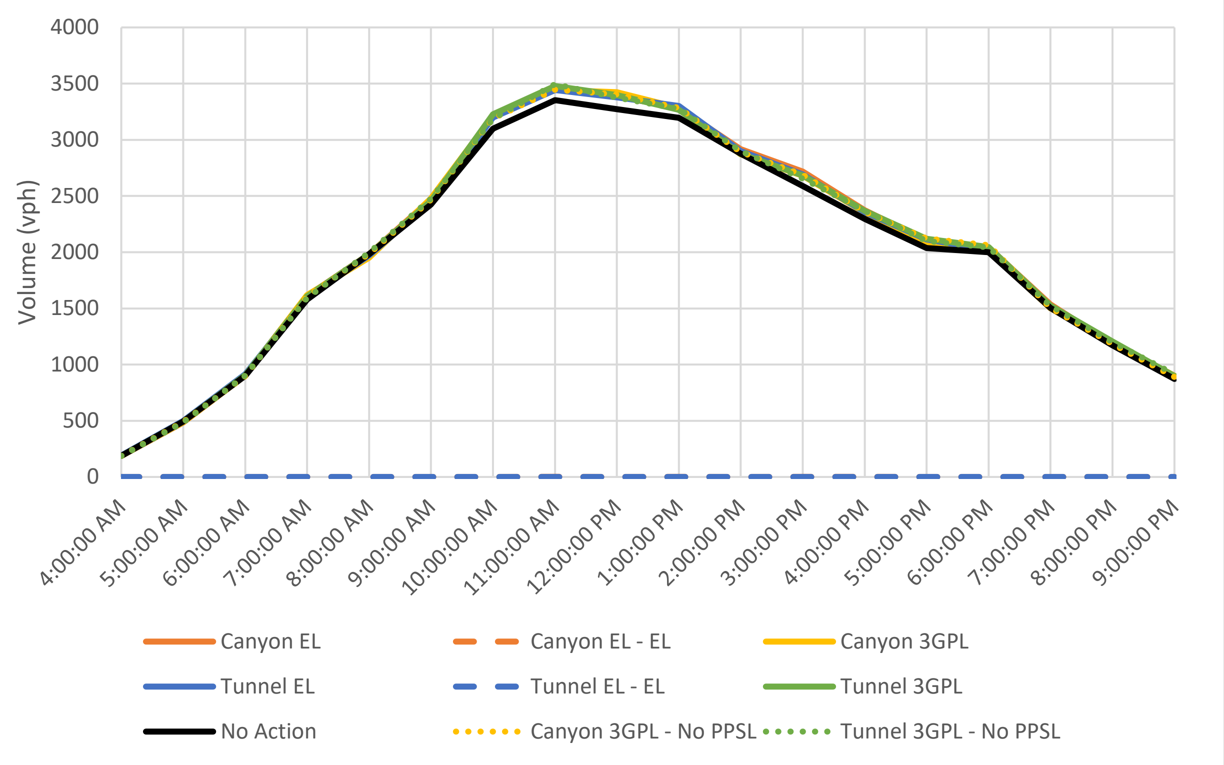
Source: TransModeler microsimulation analysis.

Exhibit 212. Action Alternatives-No PPSL I-70 Winter Eastbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



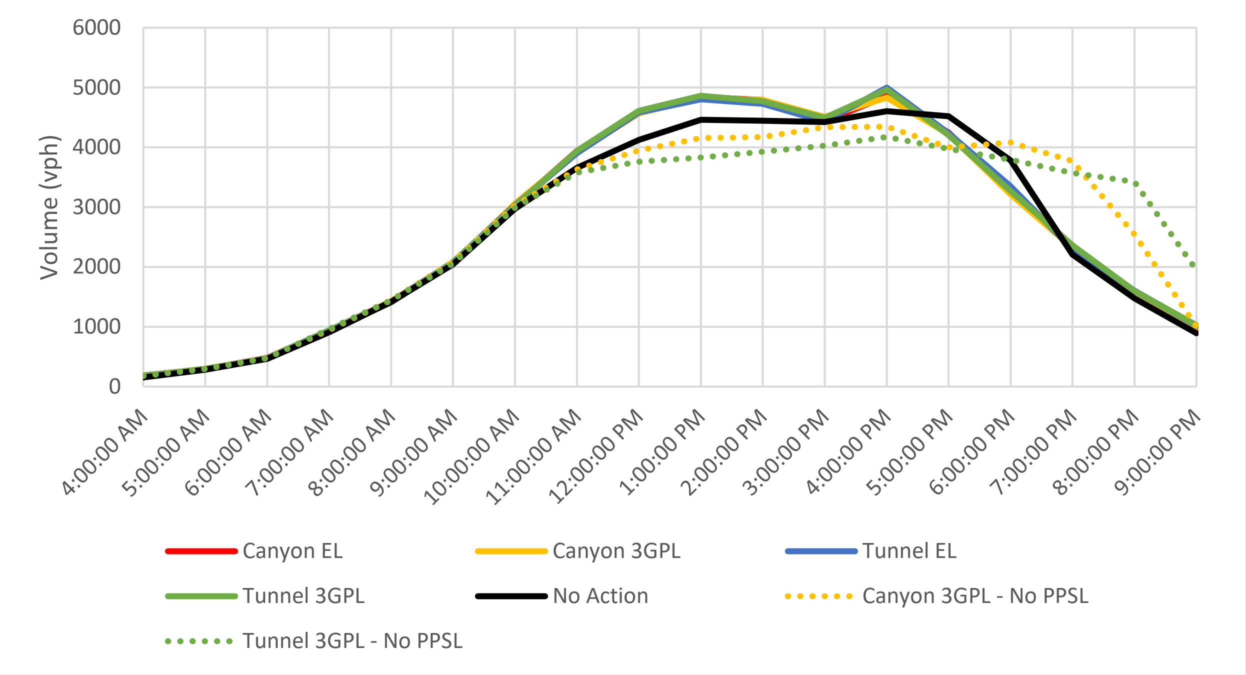
Source: TransModeler microsimulation analysis.

Exhibit 213. Action Alternatives-No PPSL I-70 Summer Westbound Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



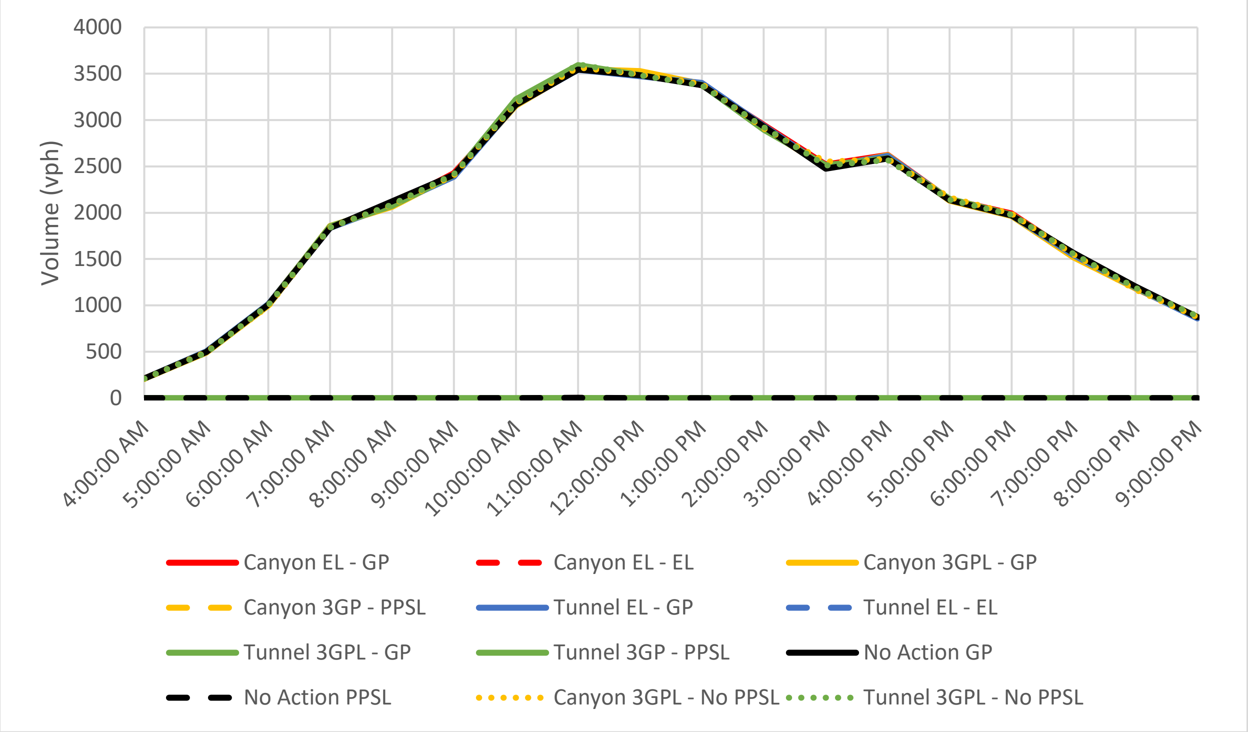
Source: TransModeler microsimulation analysis.

Exhibit 214. Action Alternatives-No PPSL I-70 Summer Eastbound Volumes—East of Exit 247 (Hyland Hills/Floyd Hill)



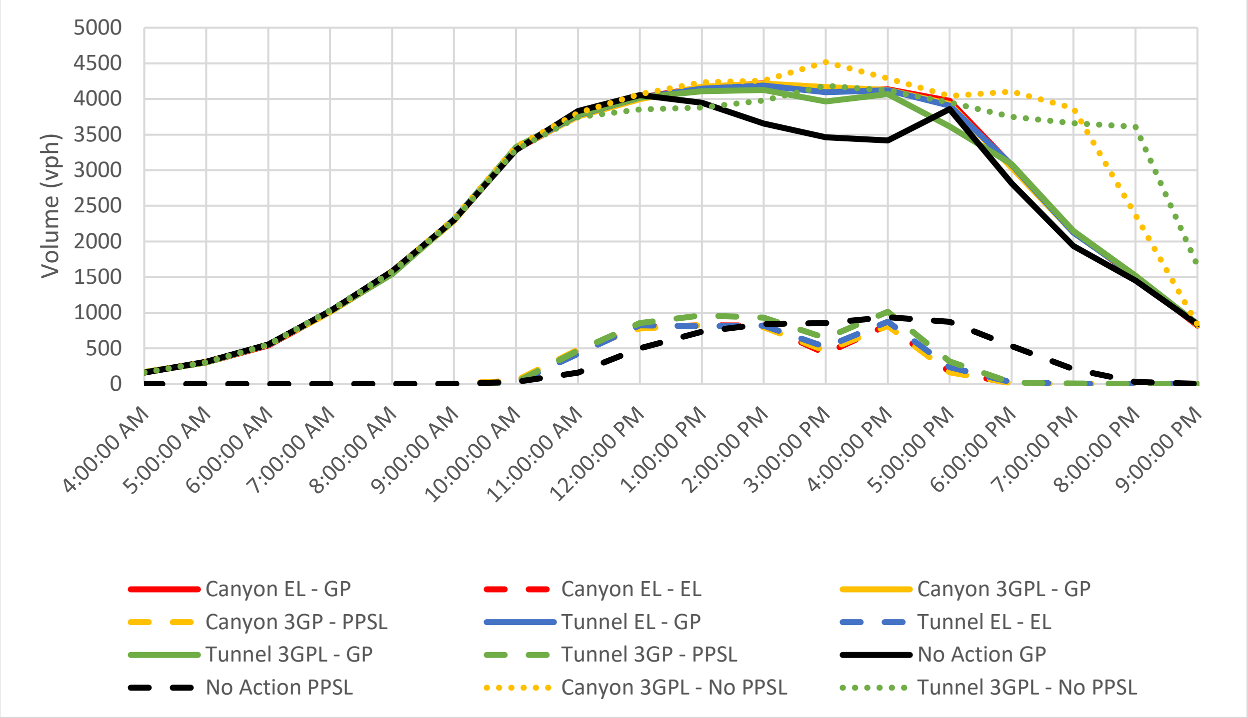
Source: TransModeler microsimulation analysis.

Exhibit 215. Action Alternatives-No PPSL I-70 Summer Westbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

Exhibit 216. Action Alternatives-No PPSL I-70 Summer Eastbound Volumes—East of Exit 241 (Idaho Springs/Colorado Boulevard)



Source: TransModeler microsimulation analysis.

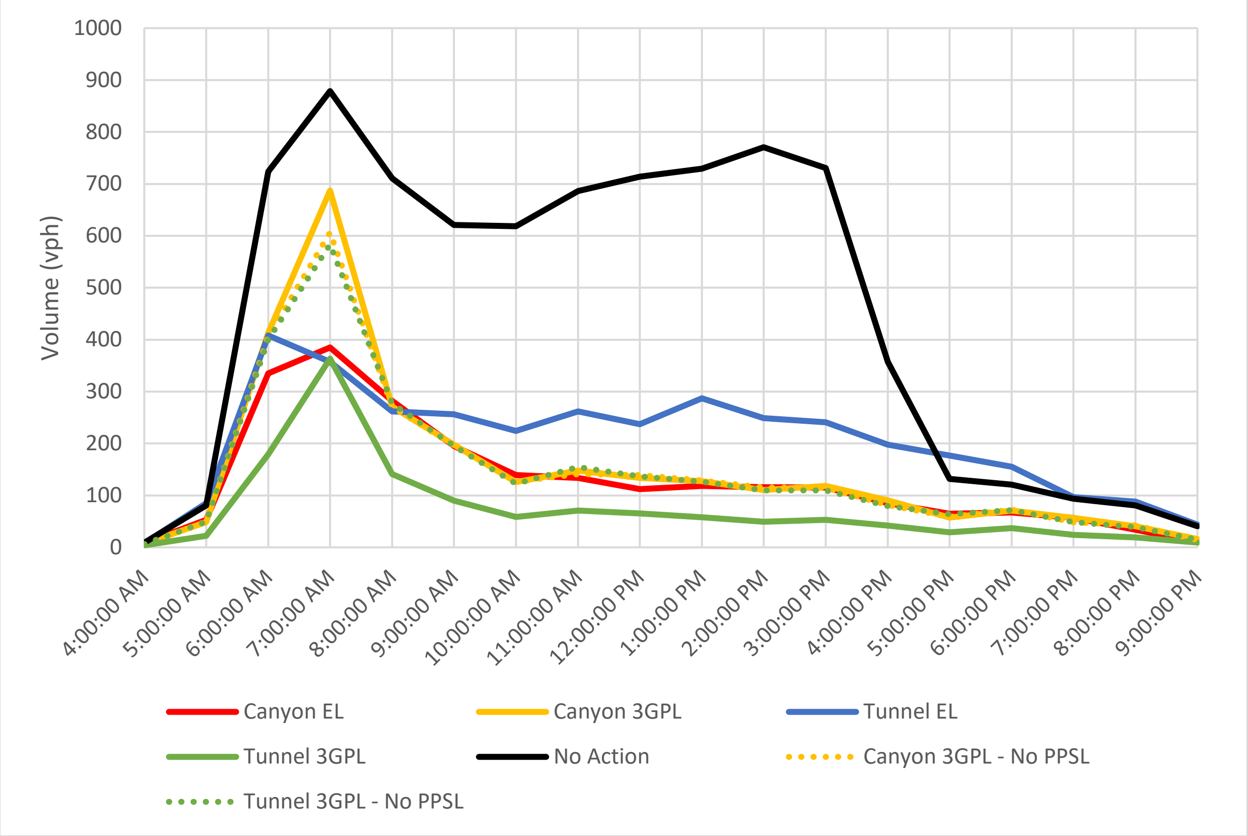
7.2.3.2 Local Roads Traffic Volumes and Patterns

The three local roads of primary interest as those that provide alternate routes to I-70 are US 40, CR 314, and US 6.

7.2.3.2.1 US 40

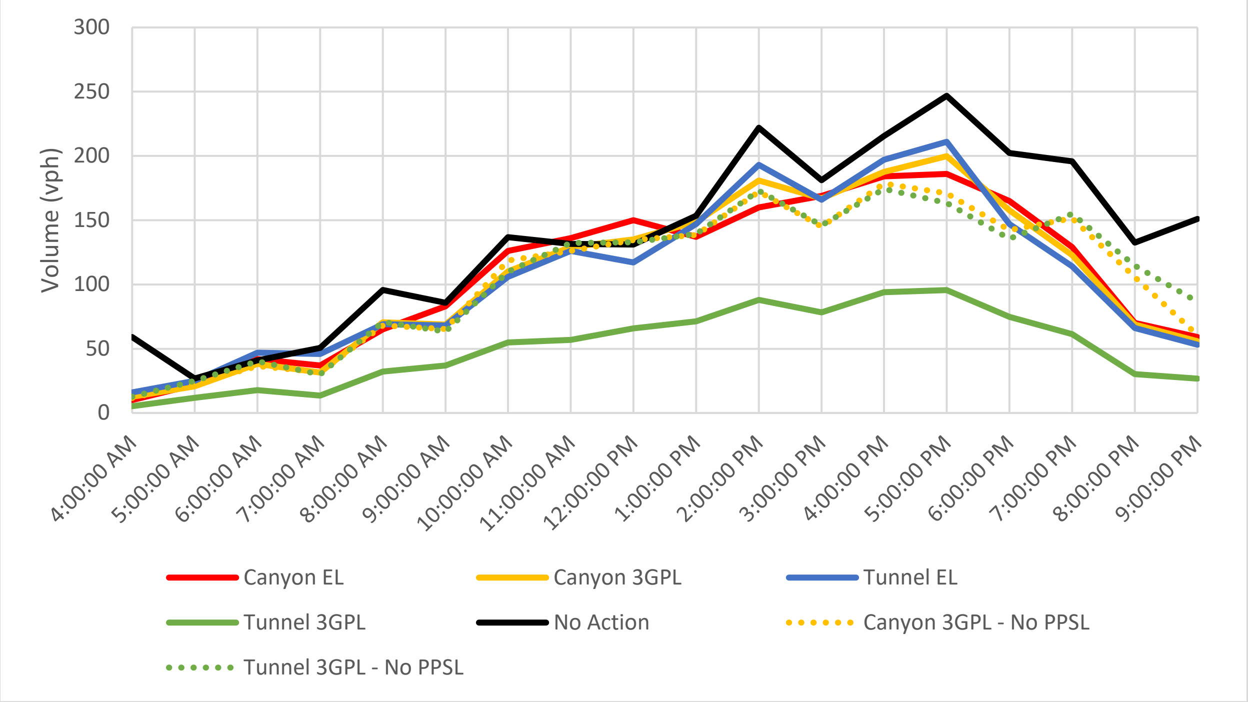
For US 40, the two locations of interest are: (1) between Exit 248 (Beaver Brook/Floyd Hill) and Exit 247 (Hyland Hills/Floyd Hill), and (2) between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden). The action alternative volumes along US 40 are shown in Exhibit 217 to Exhibit 220 for a winter Saturday and Exhibit 221 and Exhibit 224 for a summer Sunday. Compared to the action alternatives, removal of the PPSL will not have significant impact on the volumes on US 40 other than to cause the peaks to stretch out slightly over more hours.

Exhibit 217. Action Alternatives-No PPSL US 40 Winter Westbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)



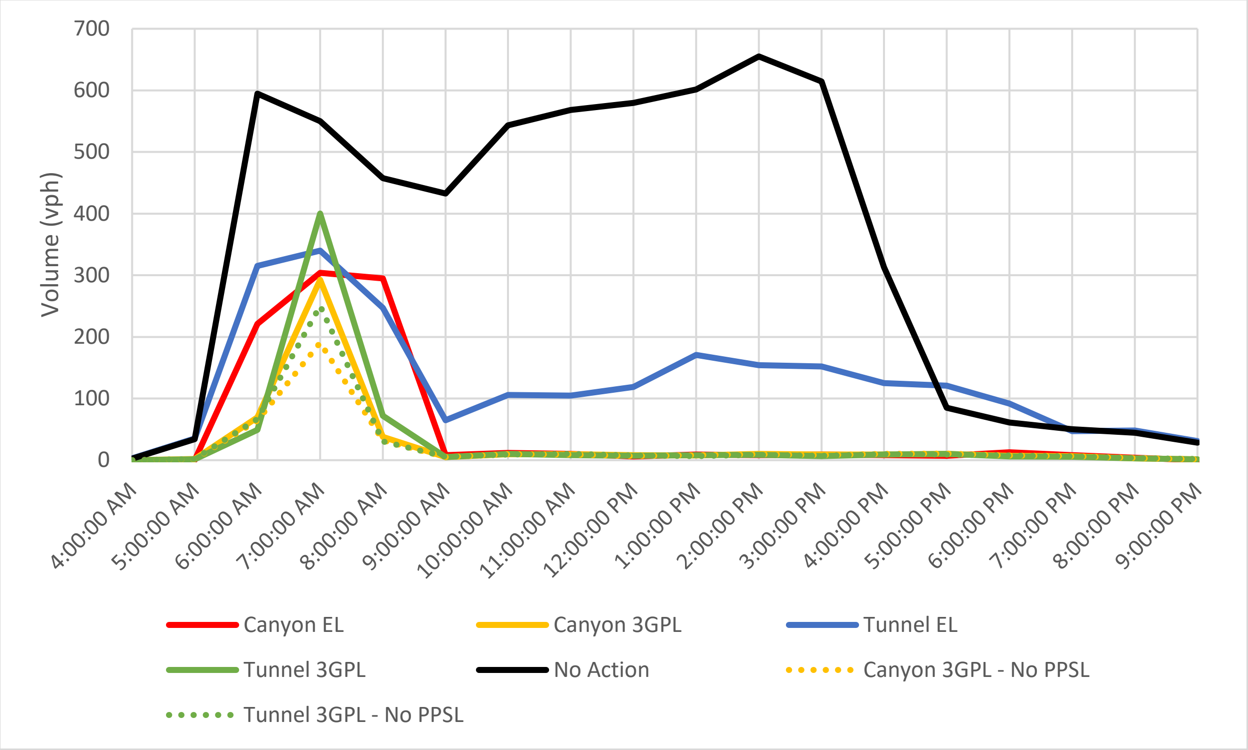
Source: TransModeler microsimulation analysis.

Exhibit 218. Action Alternatives-No PPSL US 40 Winter Eastbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)



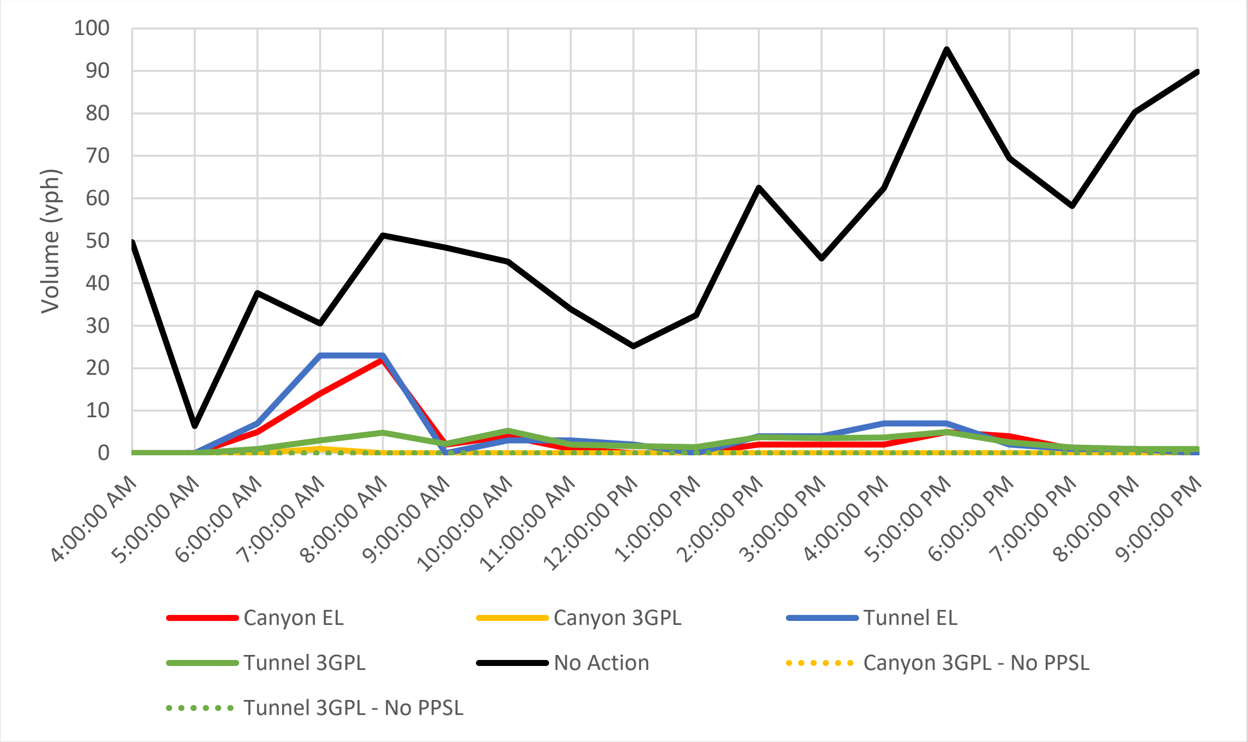
Source: TransModeler microsimulation analysis.

Exhibit 219. Action Alternatives-No PPSL US 40 Winter Westbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)



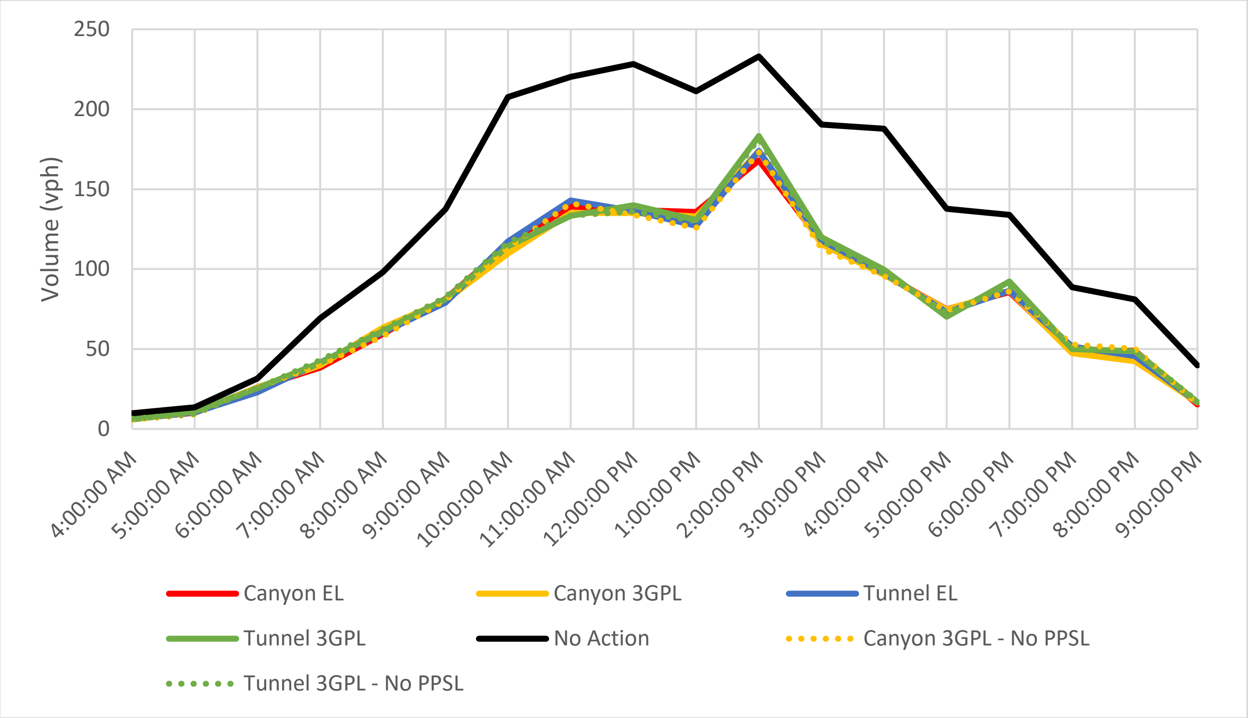
Source: TransModeler microsimulation analysis.

Exhibit 220. **Action Alternatives-No PPSL US 40 Winter Eastbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/ Golden)**



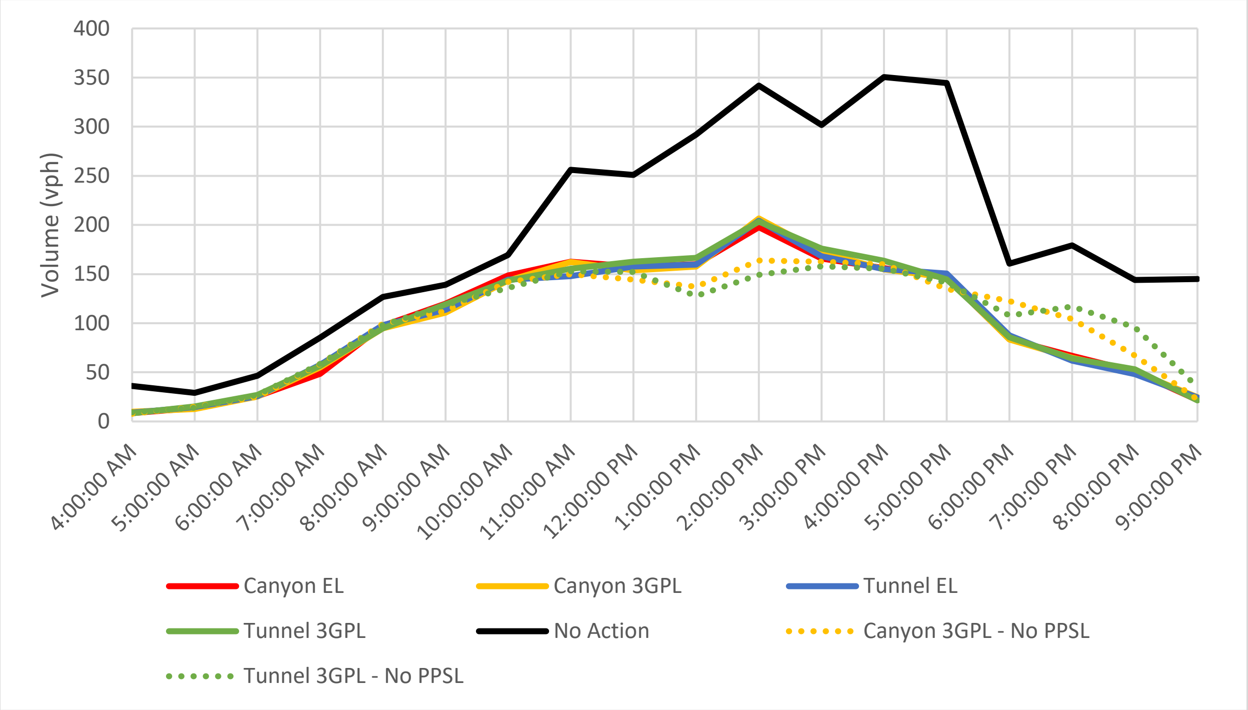
Source: TransModeler microsimulation analysis.

Exhibit 221. **Action Alternatives-No PPSL US 40 Summer Westbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)**



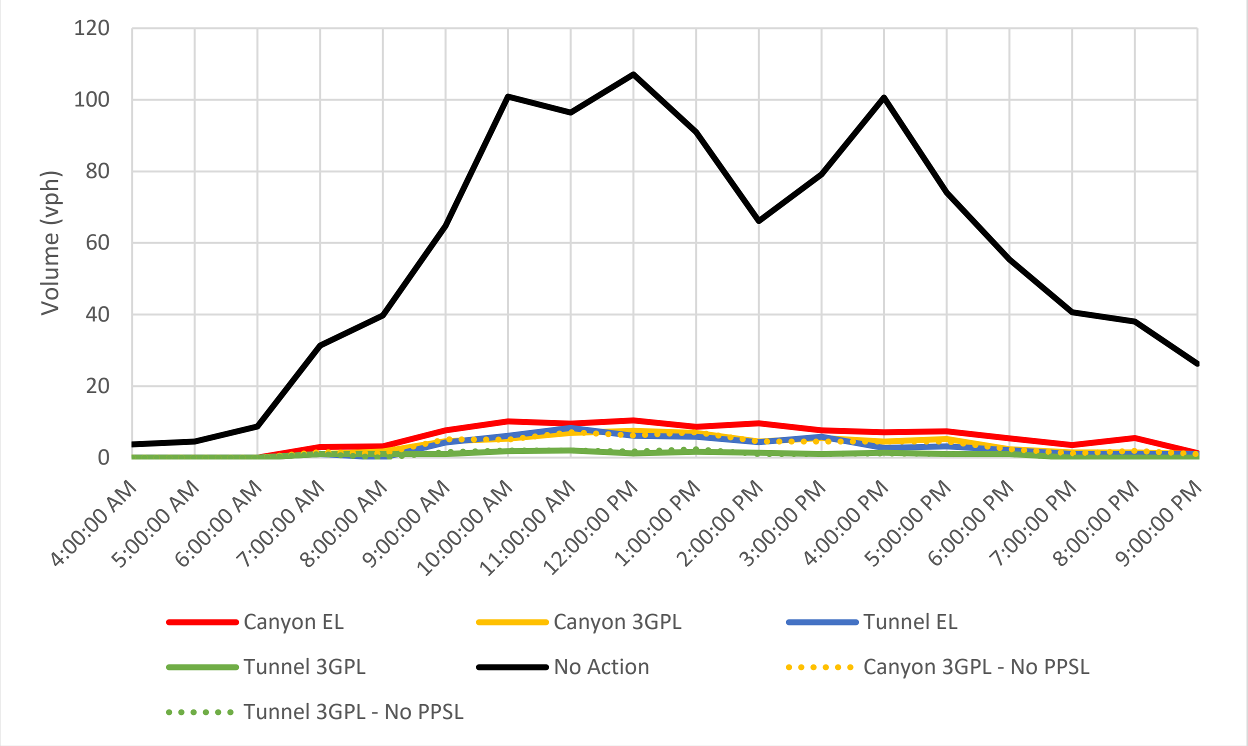
Source: TransModeler microsimulation analysis.

Exhibit 222. **Action Alternatives-No PPSL US 40 Summer Eastbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 248 (Beaver Brook/Floyd Hill)**



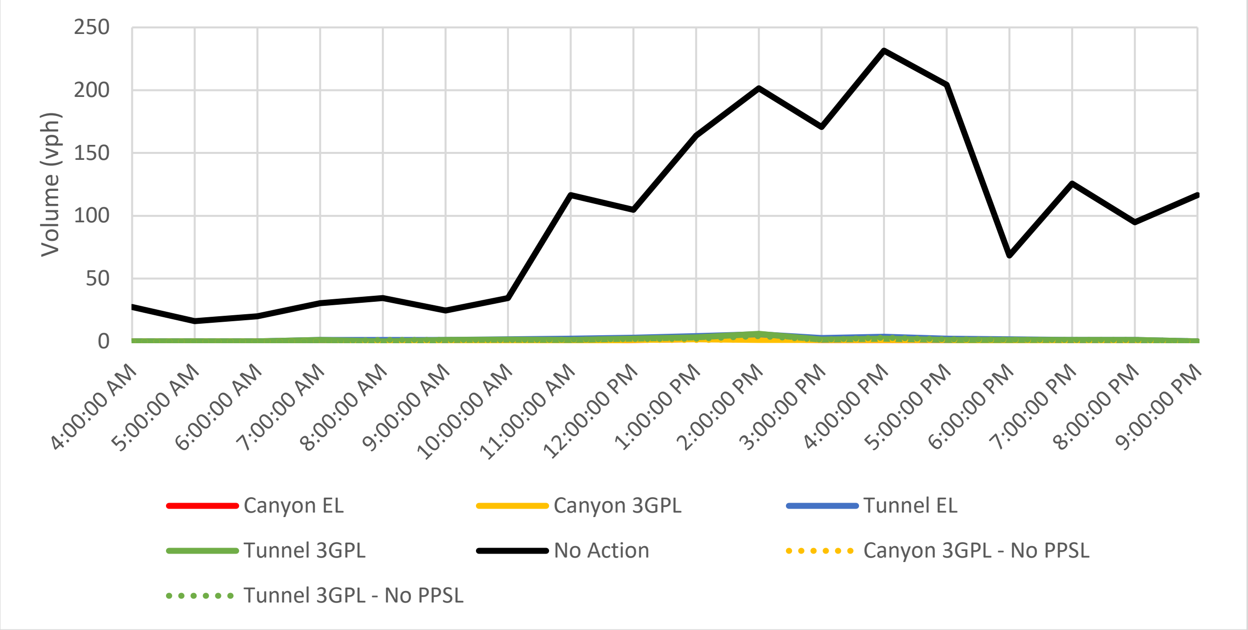
Source: TransModeler microsimulation analysis.

Exhibit 223. **Action Alternatives-No PPSL US 40 Summer Westbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)**



Source: TransModeler microsimulation analysis.

Exhibit 224. Action Alternatives-No PPSL US 40 Summer Eastbound Volumes—Between Exit 247 (Hyland Hills/Floyd Hill) and Exit 244 (US 6/Golden)

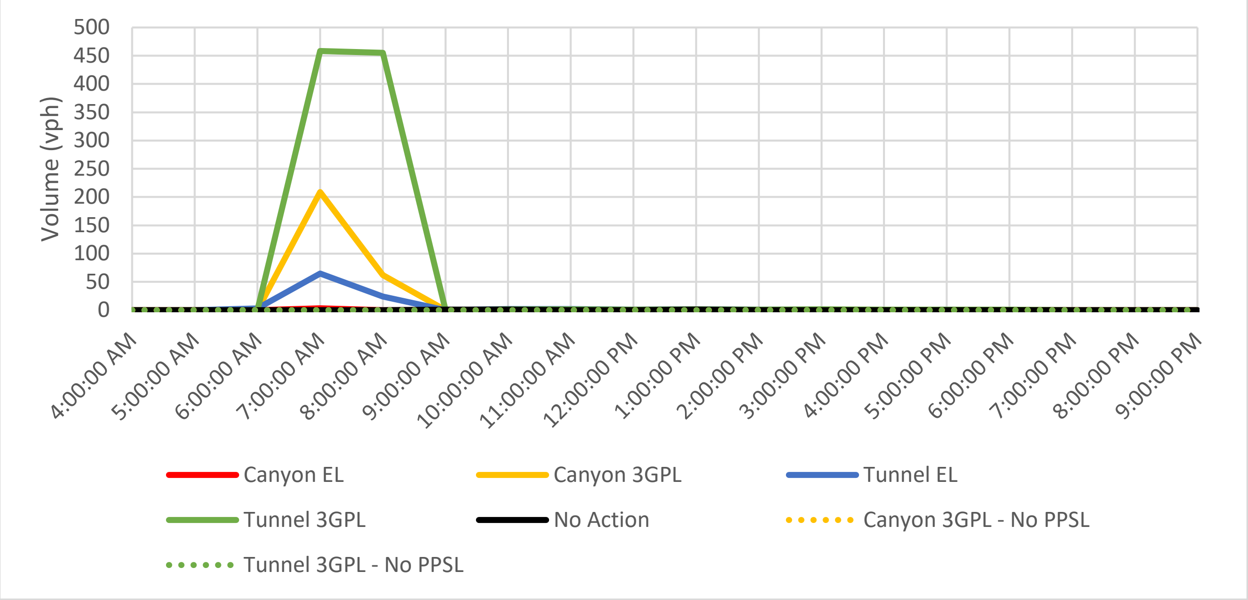


Source: TransModeler microsimulation analysis.

7.2.3.2.2 CR 314

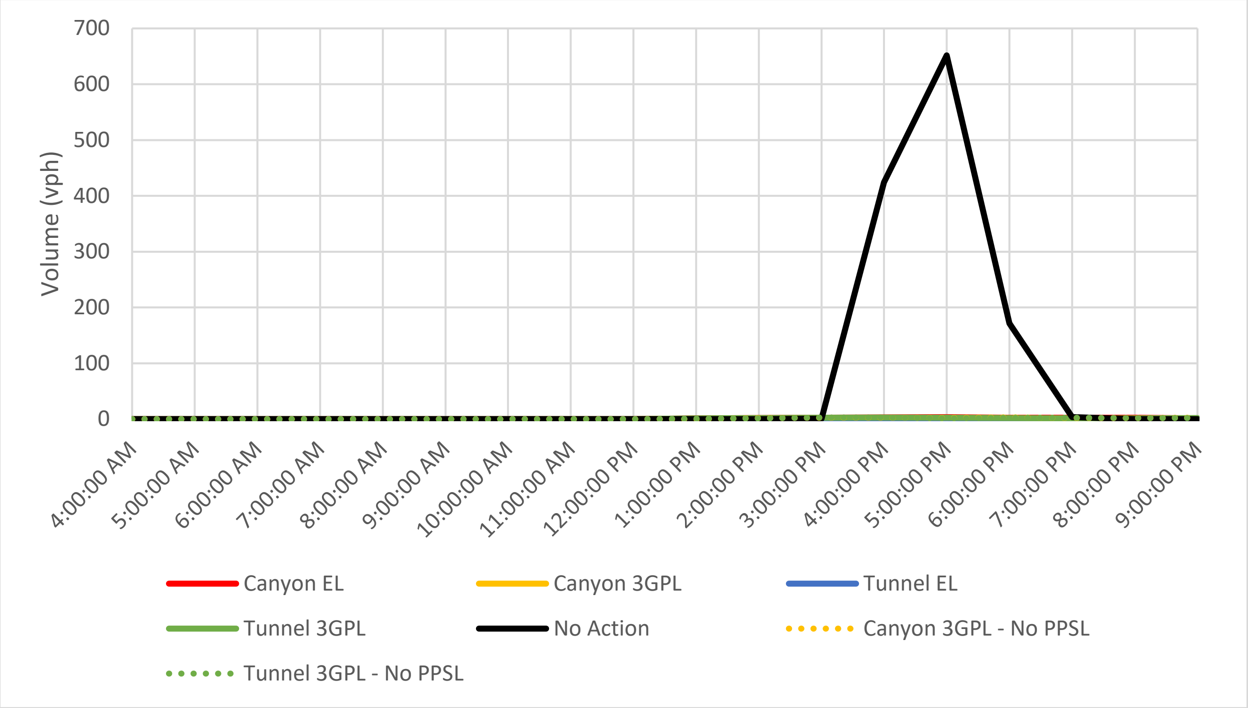
The volumes for the projected action alternatives with no PPSL on CR 314 for a winter Saturday are shown in Exhibit 225 and Exhibit 226 and for a summer Sunday are shown in Exhibit 227 and Exhibit 228. The figures indicate that this roadway is beyond the bottlenecks to the east and west of this location that would be caused by the removal of the PPSL.

Exhibit 225. Action Alternatives-No PPSL CR 314 Winter Westbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)



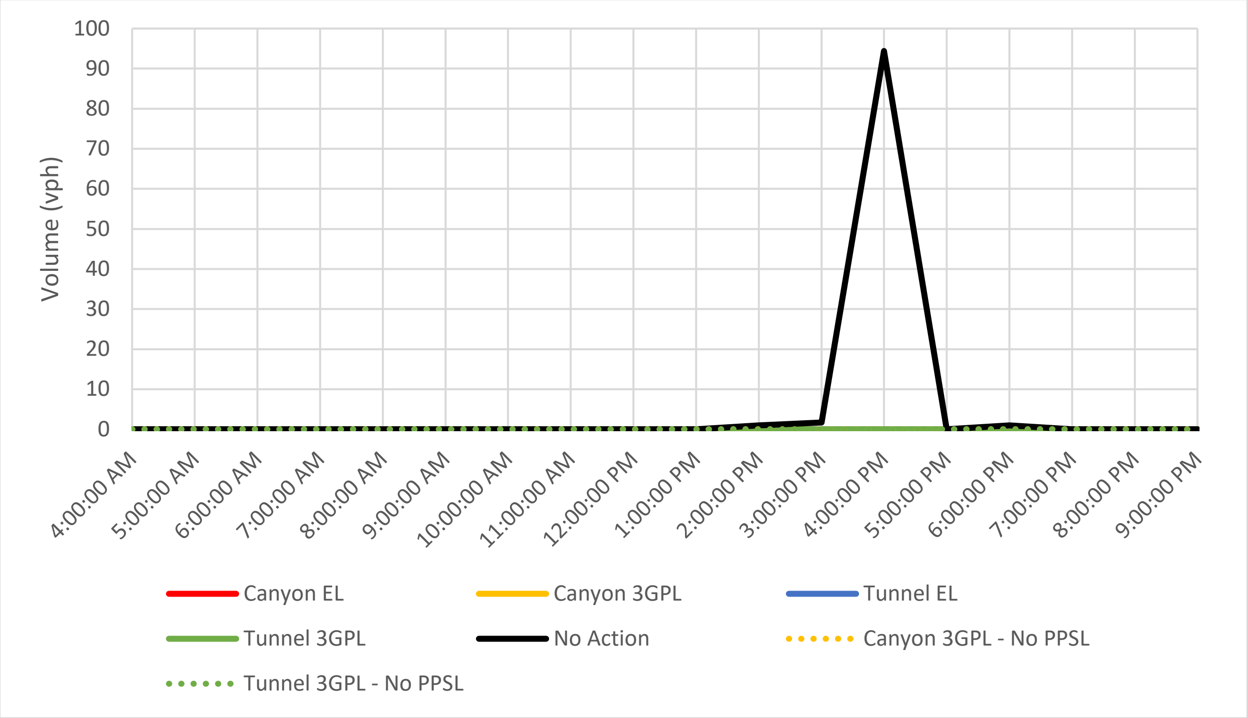
Source: TransModeler microsimulation analysis.

Exhibit 226. **Action Alternatives-No PPSL CR 314 Winter Eastbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)**



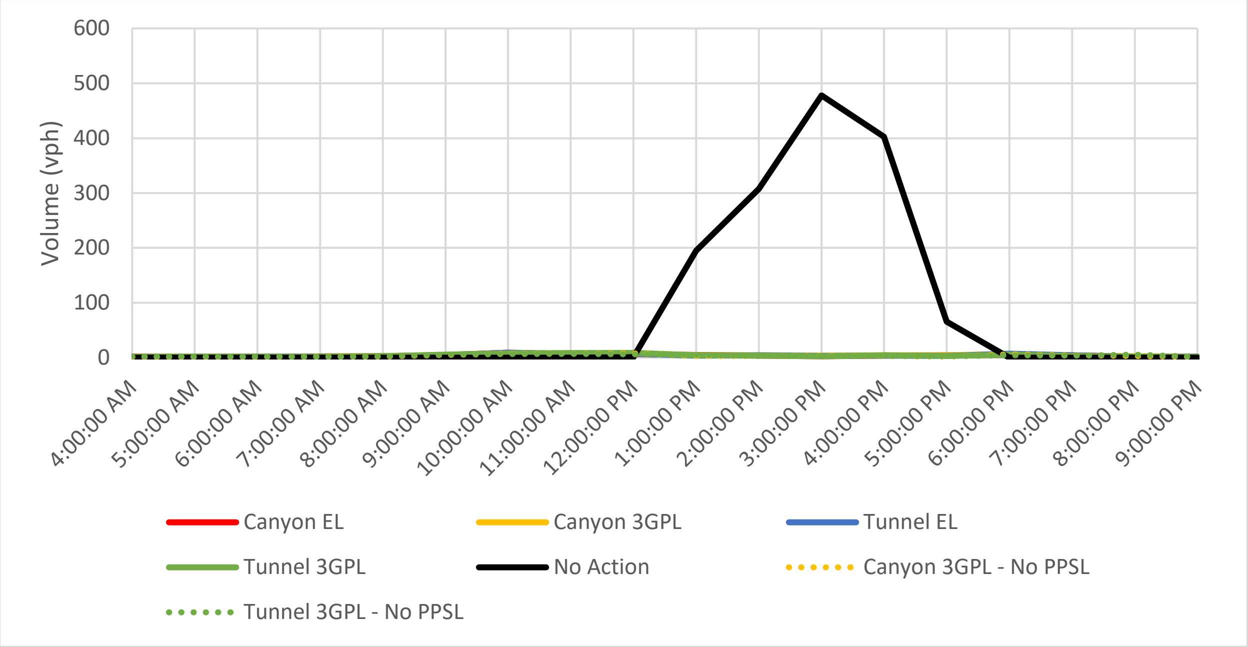
Source: TransModeler microsimulation analysis.

Exhibit 227. **Action Alternatives-No PPSL CR 314 Summer Westbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)**



Source: TransModeler microsimulation analysis.

Exhibit 228. Action Alternatives-No PPSL CR 314 Summer Eastbound Volumes—Between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)

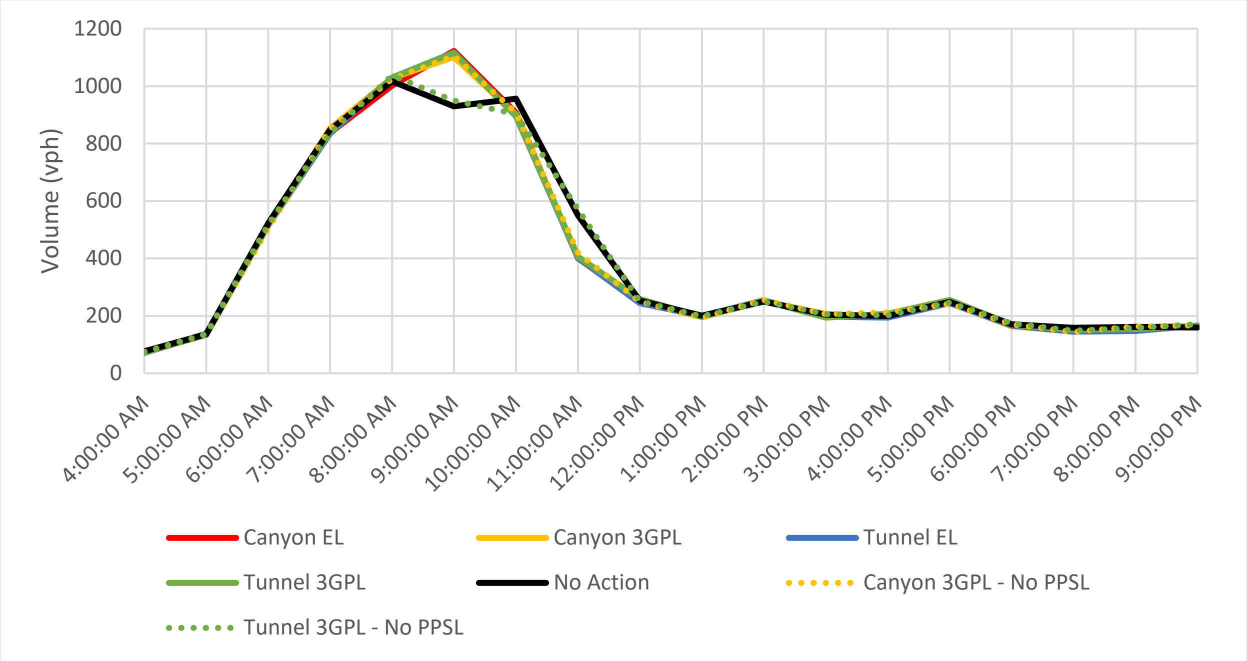


Source: TransModeler microsimulation analysis.

7.2.3.2.3 US 6

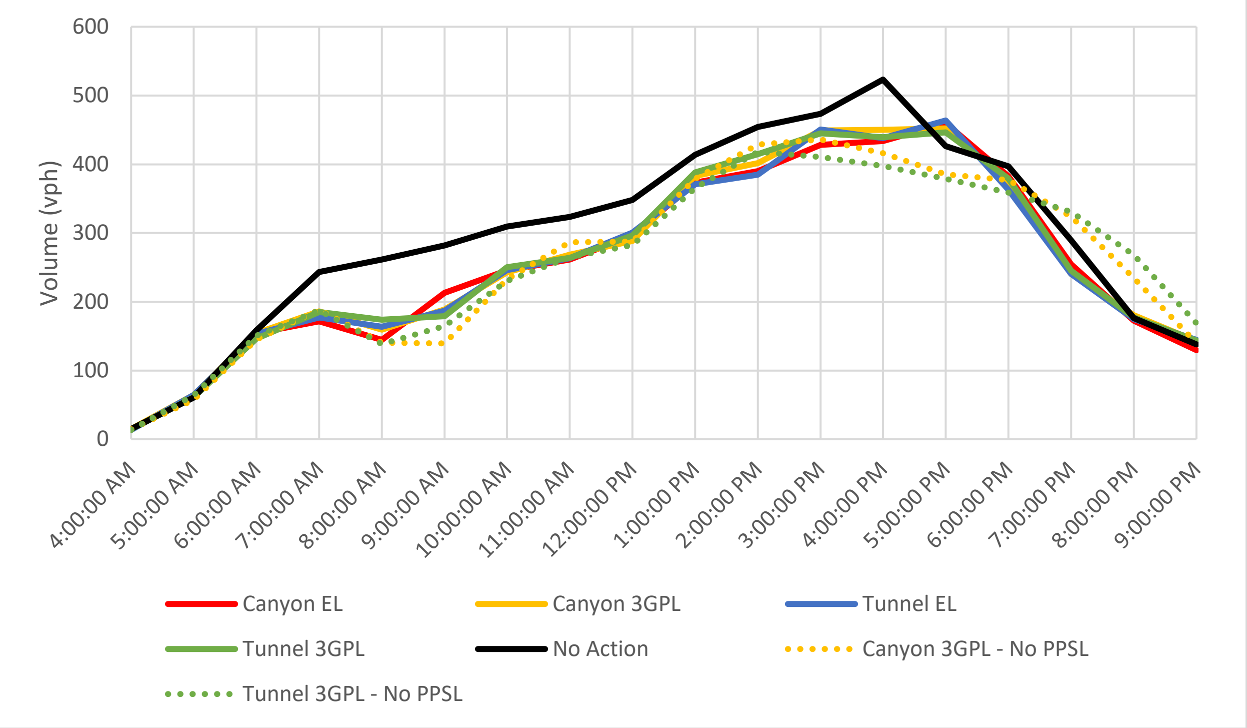
As can be seen from Exhibit 229 through Exhibit 232, volumes on US 6 if the PPSL are removed typically will be lower compared to the action alternatives, with longer peak periods.

Exhibit 229. Action Alternatives-No PPSL US 6 Winter Westbound Volumes—East of the US 40 Intersection



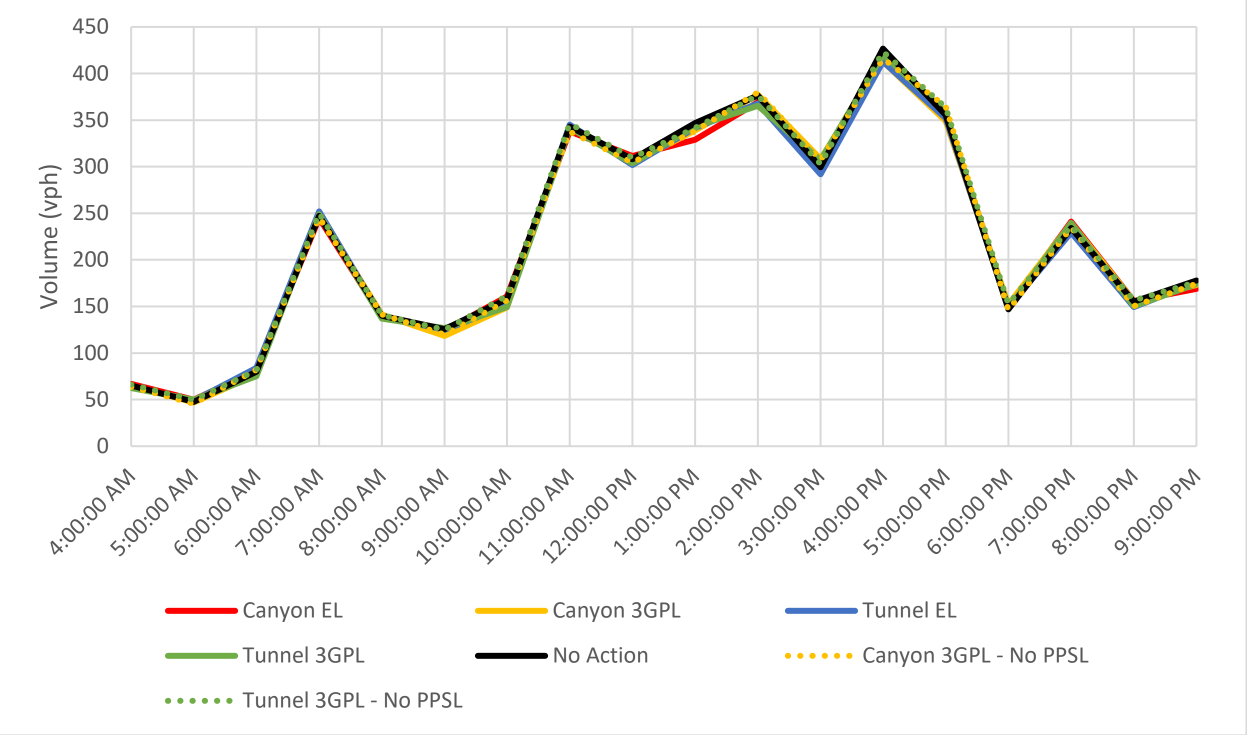
Source: TransModeler microsimulation analysis.

Exhibit 230. Action Alternatives-No PPSL US 6 Winter Eastbound Volumes—East of the US 40 Intersection



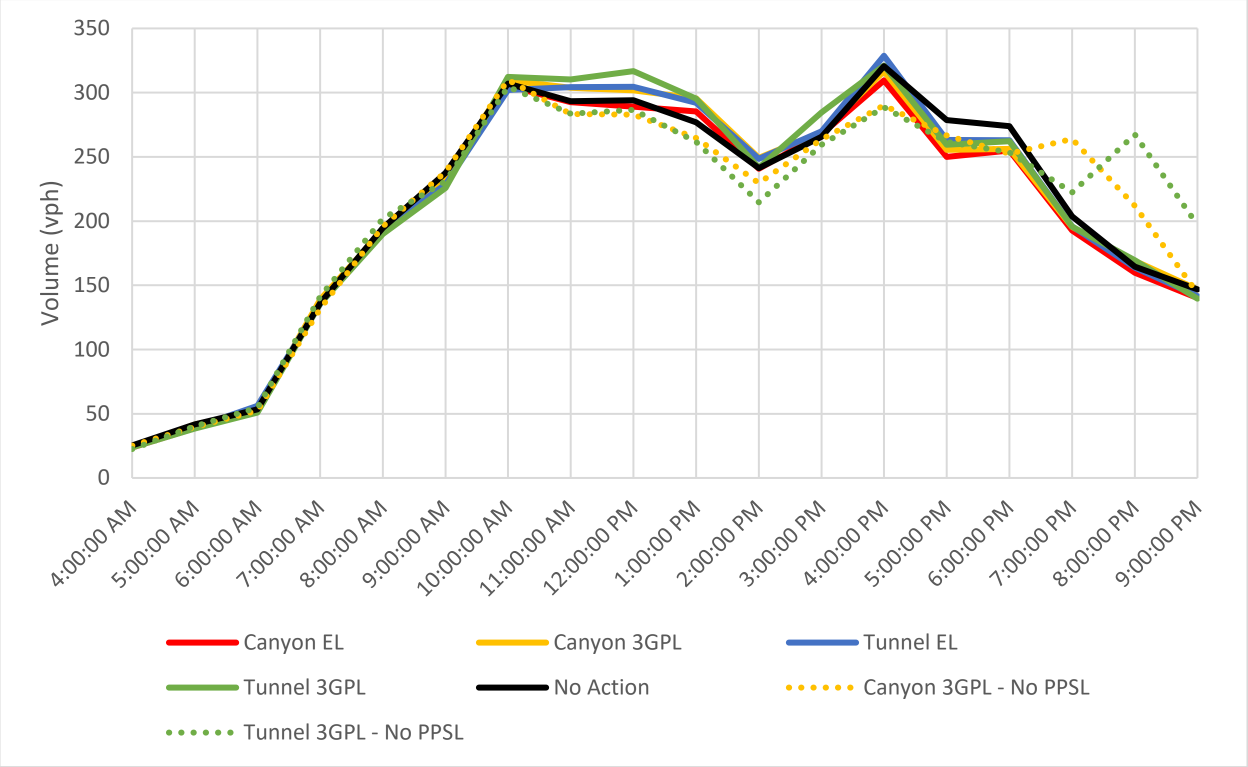
Source: TransModeler microsimulation analysis.

Exhibit 231. Action Alternatives-No PPSL US 6 Summer Westbound Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

Exhibit 232. Action Alternatives-No PPSL US 6 Summer Eastbound Volumes—East of the US 40 Intersection



Source: TransModeler microsimulation analysis.

7.2.4 Action Alternatives with No PPSL Operational Conditions

The action alternatives with no PPSL operational characteristics are compared to the action alternatives and No Action (with PPSL) in the following sections.

7.2.4.1 VMT and VHT

A comparison of VMT and VHT for the action alternatives with PPSL and with no PPSL are shown in Exhibit 233 (Tunnel Alternative) and Exhibit 234 (Canyon Viaduct Alternative). In general, the removal of the PPSL will result in increased traffic on I-70 and decreased traffic on the other local roads. This means an increase in VMT and VHT on I-70. US 6 sees an increase in the Tunnel Alternative as vehicles stay on the frontage roads longer before accessing I-70.

Exhibit 233. Tunnel Alternatives No PPSL VMT and VHT

Facility	Tunnel Alternative with PPSL				Tunnel Alternative with No PPSL[1]			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	VMT	VHT	VMT	VHT	VMT	VHT	VMT	VHT
I-70	917,161	19,967	922,216	18,662	994,155 (8%)	47,347 (137%)	972,059 (5%)	19,688 (5%)
US 6	8,819	295	6,042	156	9,862 (12%)	646 (119%)	6,584 (9%)	175 (12%)
US 40	16,141	592	5,418	173	6,005 (-63%)	170 (-71%)	3,307 (-39%)	175 (1%)
CR 314	172	10	110	6	28 (-84%)	2 (-80%)	99 (-10%)	5 (-17%)

Source: TransModeler microsimulation analysis.

1. Percent difference compared to Tunnel Alternative with PPSL.

Exhibit 234. Canyon Viaduct Alternative No PPSL VMT and VHT

Facility	Canyon Viaduct Alternative with PPSL[1]				Canyon Viaduct Alternative with No PPSL[1]			
	Winter Saturday		Summer Sunday		Winter Saturday		Summer Sunday	
	VMT	VHT	VMT	VHT	VMT	VHT	VMT	VHT
I-70	921,780	20,190	925,562	18,267	995,905 (8%)	47,034 (133%)	973,696 (5%)	19,577 (7%)
US 6	9,701	422	6,188	160	9,725 (0%)	295 (-30%)	6,518 (5%)	172 (8%)
US 40	13,393	801	5,298	168	5,923 (-56%)	168 (-79%)	3,403 (-36%)	91 (-46%)
CR 314	37	2	109	6	30 (-19%)	2 (0%)	109 (0%)	6 (0%)

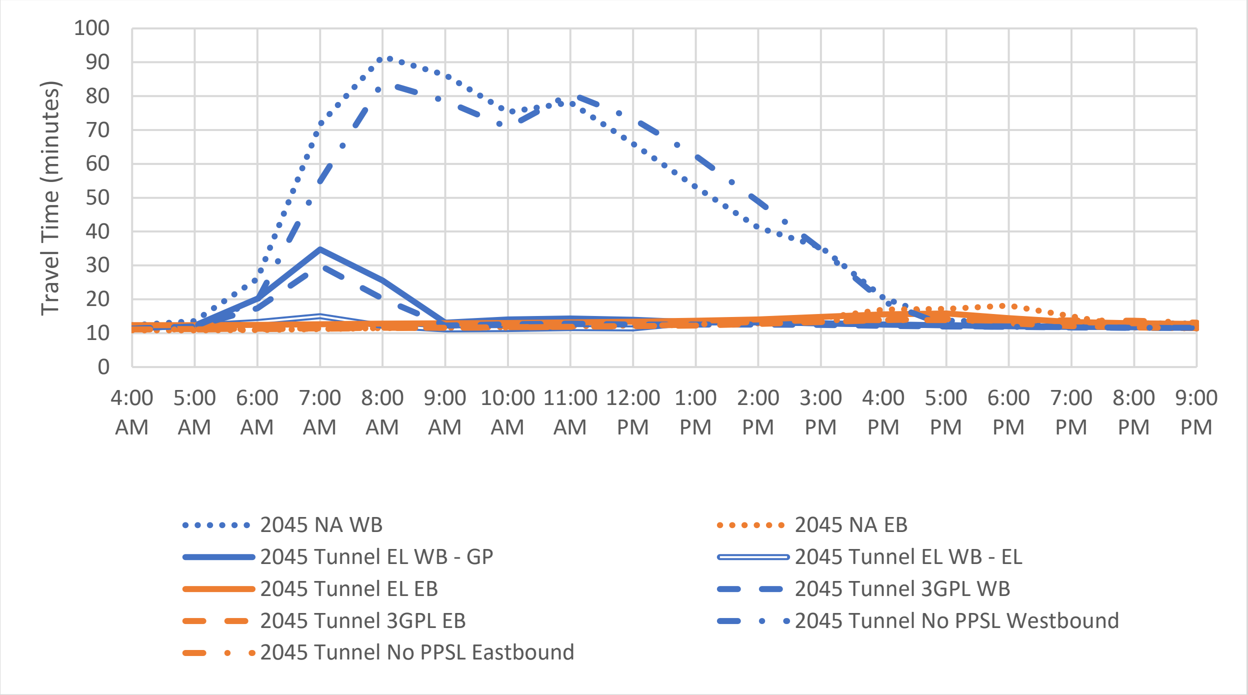
Source: TransModeler microsimulation analysis.

1. Percent difference compared to Canyon Viaduct Alternative with PPSL.

7.2.4.2 Travel Times

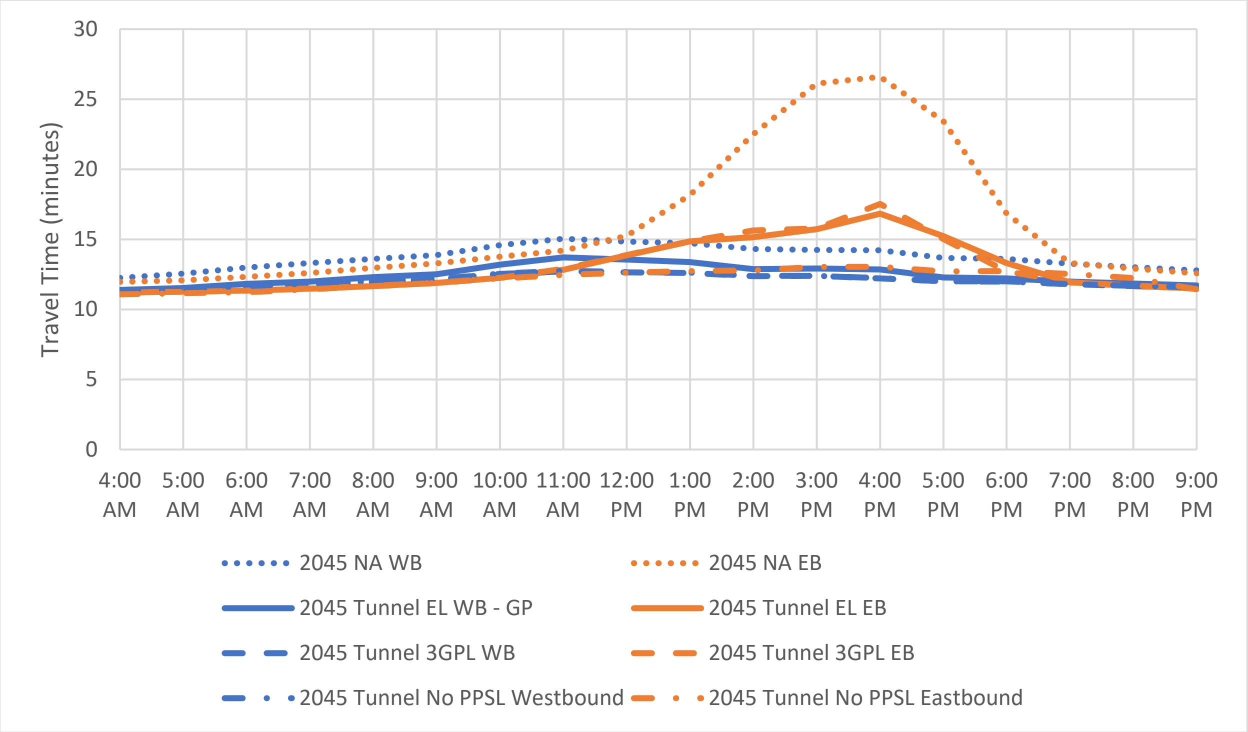
Travel times on I-70 for the action alternatives with no PPSL are shown in Exhibit 235 and Exhibit 236 for the Tunnel Alternative and in Exhibit 237 and Exhibit 238 for the Canyon Viaduct Alternative. Removal of the PPSL will result in travel times that are similar to the No Action (with PPSL) conditions. Eastbound times are slightly better compared to the full action alternatives and the No Action conditions because the bottleneck that meters traffic is farther to the west. For westbound traffic, the removal of the PPSL results in 3GPL approaching Exit 241 (Idaho Springs/Colorado Boulevard), but only two lanes continuing west of Exit 241 (Idaho Springs/Colorado Boulevard). This results in a bottleneck at this location that is similar to the bottleneck that exists at the top of Floyd Hill under Existing Conditions. Basically, the westbound bottleneck just moves west to Exit 241.

Exhibit 235. Tunnel Alternative No PPSL Winter I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



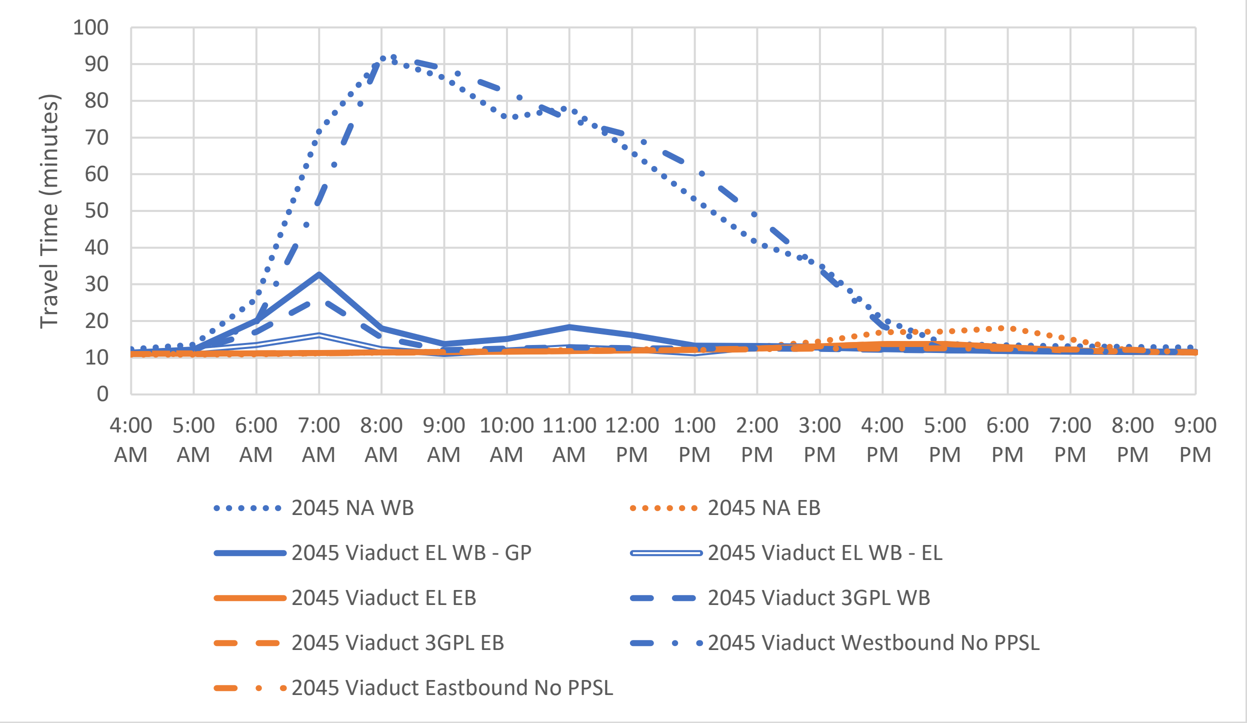
Source: TransModeler microsimulation analysis.

Exhibit 236. Tunnel Alternative No PPSL Summer I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



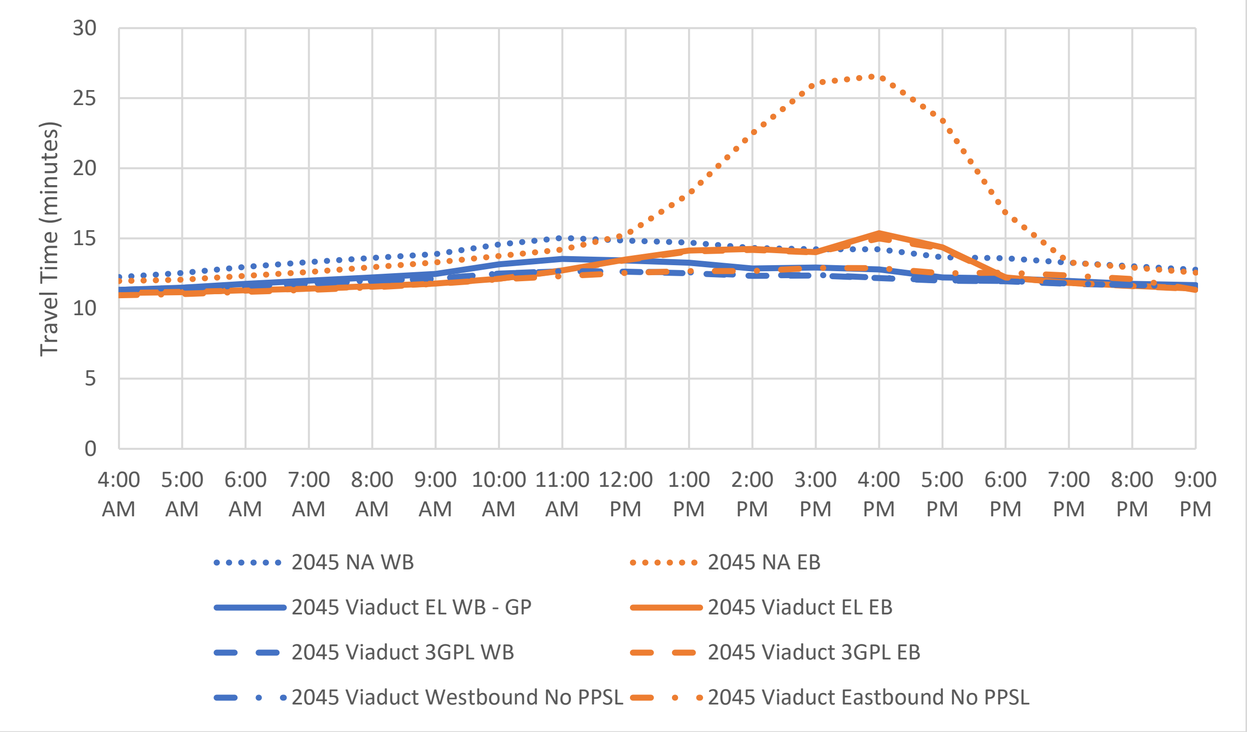
Source: TransModeler microsimulation analysis.

Exhibit 237. Canyon Viaduct Alternative No PPSL Winter I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)



Source: TransModeler microsimulation analysis.

Exhibit 238. Canyon Viaduct Alternative No PPSL Summer I-70 Travel Time—Between Exit 252 (SH 74/Evergreen Parkway) and Exit 240 (SH 103/Mt Evans)

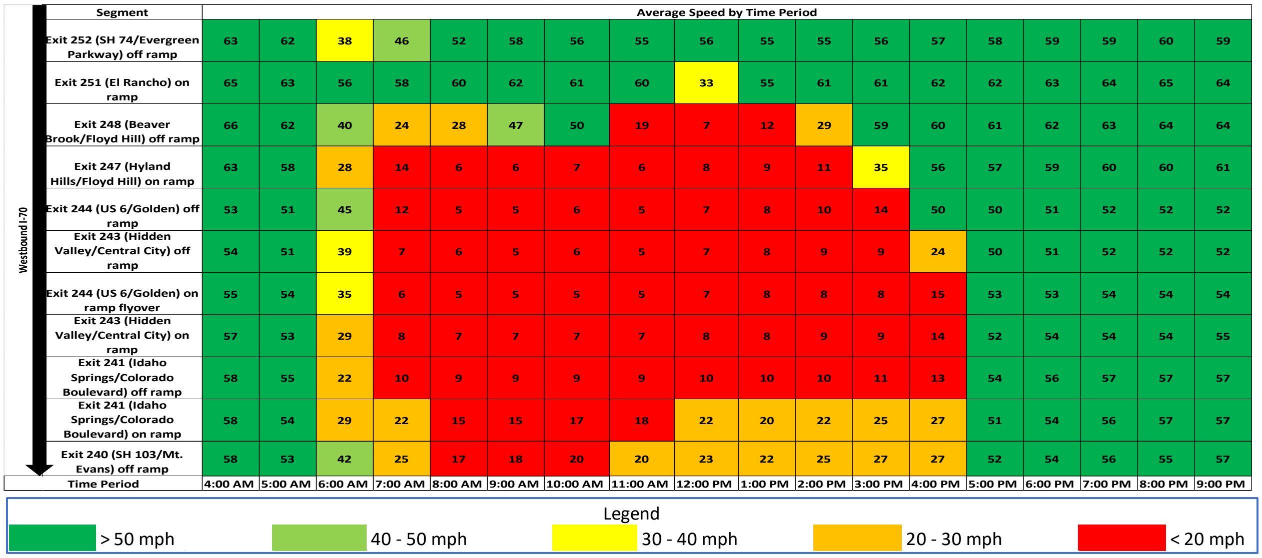


Source: TransModeler microsimulation analysis.

7.2.4.3 I-70 Travel Speeds and Congestion

Speeds on the I-70 mainline for the Tunnel Alternative with no PPSL are shown in Exhibit 239 to Exhibit 242 and for the Canyon Viaduct Alternative with no PPSL are shown in Exhibit 243 to Exhibit 246. Compared to the action alternatives with PPSL, removing the PPSL will reduce eastbound congestion. This happens because the eastbound PPSL starts west of the study area at US 40. Removing the PPSL results in only two lanes for eastbound I-70 and a bottleneck is created at the US 40 interchange, which meters the flow of traffic into the study area. For westbound traffic in the winter, the action alternatives will add the third lane from the top of Floyd Hill to Exit 241 (Idaho Springs/Colorado Boulevard), where the PPSL will continue farther west to US 40. Removing the PPSL will result in a bottleneck at Exit 241 (Idaho Springs/Colorado Boulevard) when I-70 goes from three lanes to two.

Exhibit 239. Tunnel Alternative No PPSL Winter Westbound Congestion Diagram



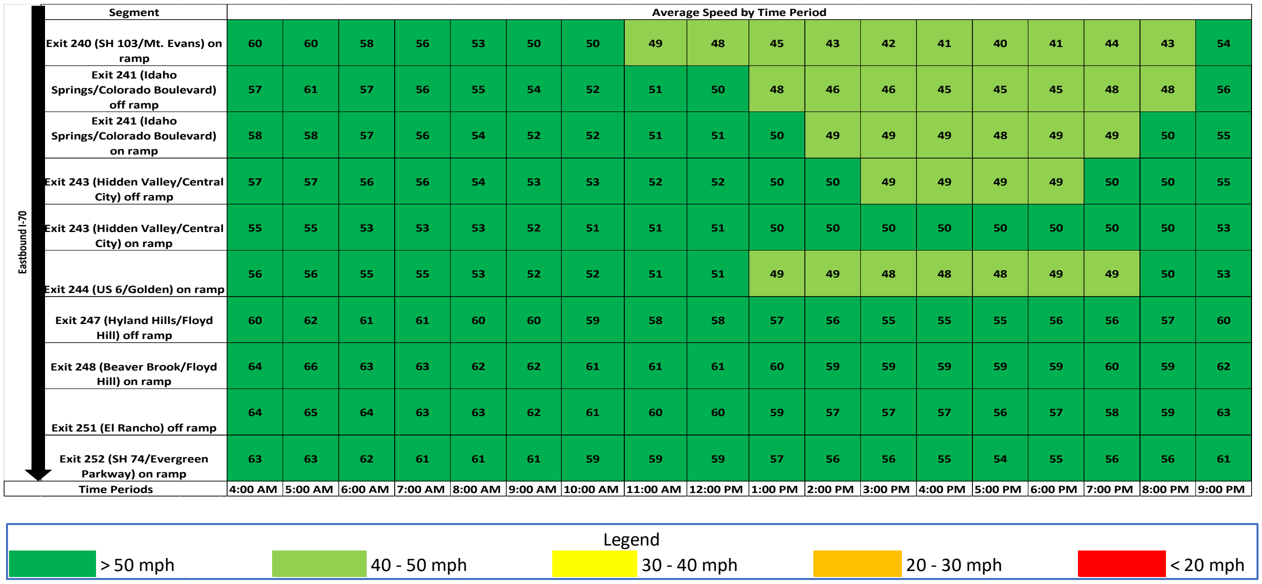
Westbound I-70

Segment	Average Speed by Time Period																	
Exit 252 (SH 74/Evergreen Parkway) off ramp	63	62	38	46	52	58	56	55	56	55	55	56	57	58	59	59	60	59
Exit 251 (El Rancho) on ramp	65	63	56	58	60	62	61	60	33	55	61	61	62	62	63	64	65	64
Exit 248 (Beaver Brook/Floyd Hill) off ramp	66	62	40	24	28	47	50	19	7	12	29	59	60	61	62	63	64	64
Exit 247 (Hyland Hills/Floyd Hill) on ramp	63	58	28	14	6	6	7	6	8	9	11	35	56	57	59	60	60	61
Exit 244 (US 6/Golden) off ramp	53	51	45	12	5	5	6	5	7	8	10	14	50	50	51	52	52	52
Exit 243 (Hidden Valley/Central City) off ramp	54	51	39	7	6	5	6	5	7	8	9	9	24	50	51	52	52	52
Exit 244 (US 6/Golden) on ramp flyover	55	54	35	6	5	5	5	5	7	8	8	8	15	53	53	54	54	54
Exit 243 (Hidden Valley/Central City) on ramp	57	53	29	8	7	7	7	7	8	8	9	9	14	52	54	54	54	55
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	55	22	10	9	9	9	9	10	10	10	11	13	54	56	57	57	57
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	54	29	22	15	15	17	18	22	20	22	25	27	51	54	56	57	57
Exit 240 (SH 103/Mt. Evans) off ramp	58	53	42	25	17	18	20	20	23	22	25	27	27	52	54	56	55	57
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 240. Tunnel Alternative No PPSL Winter Eastbound Congestion Diagram



Eastbound I-70

Segment	Average Speed by Time Period																	
Exit 240 (SH 103/Mt. Evans) on ramp	60	60	58	56	53	50	50	49	48	45	43	42	41	40	41	44	43	54
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	57	61	57	56	55	54	52	51	50	48	46	46	45	45	45	48	48	56
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	58	57	56	54	52	52	51	51	50	49	49	49	48	49	49	50	55
Exit 243 (Hidden Valley/Central City) off ramp	57	57	56	56	54	53	53	52	52	50	50	49	49	49	49	50	50	55
Exit 243 (Hidden Valley/Central City) on ramp	55	55	53	53	53	52	51	51	51	50	50	50	50	50	50	50	50	53
Exit 244 (US 6/Golden) on ramp	56	56	55	55	53	52	52	51	51	49	49	48	48	48	49	49	50	53
Exit 247 (Hyland Hills/Floyd Hill) off ramp	60	62	61	61	60	60	59	58	58	57	56	55	55	55	56	56	57	60
Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	66	63	63	62	62	61	61	61	60	59	59	59	59	59	60	59	62
Exit 251 (El Rancho) off ramp	64	65	64	63	63	62	61	60	60	59	57	57	57	56	57	58	59	63
Exit 252 (SH 74/Evergreen Parkway) on ramp	63	63	62	61	61	61	59	59	59	57	56	56	55	54	55	56	56	61
Time Periods	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 241. Tunnel Alternative No PPSL Summer Westbound Congestion Diagram

	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	63	59	63	60	57	58	56	55	55	56	56	56	57	58	59	60	61	62
	Exit 251 (El Rancho) on ramp	65	65	63	63	63	62	61	61	60	61	61	61	62	62	63	63	63	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	66	65	64	63	62	61	58	58	58	59	59	59	61	62	61	63	64	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	62	61	59	58	57	55	53	54	54	55	55	57	57	58	59	61	61
	Exit 244 (US 6/Golden) off ramp	54	53	51	51	51	50	49	48	49	49	49	49	50	51	51	51	52	52
	Exit 243 (Hidden Valley/Central City) off ramp	53	53	52	51	49	49	47	46	47	46	48	48	48	50	50	51	52	53
	Exit 244 (US 6/Golden) on ramp flyover	54	54	54	53	54	53	52	53	53	52	53	53	53	53	53	53	53	54
	Exit 243 (Hidden Valley/Central City) on ramp	58	57	55	53	53	52	51	50	51	51	52	52	52	52	53	53	54	55
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	59	58	56	55	55	54	53	51	52	52	53	53	53	54	56	56	56	57
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	56	55	55	54	51	48	43	46	46	47	49	48	53	53	56	56	57
	Exit 240 (SH 103/Mt. Evans) off ramp	59	57	56	54	53	52	49	46	48	48	49	50	49	53	53	55	55	57
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 242. Tunnel Alternative No PPSL Summer Eastbound Congestion Diagram

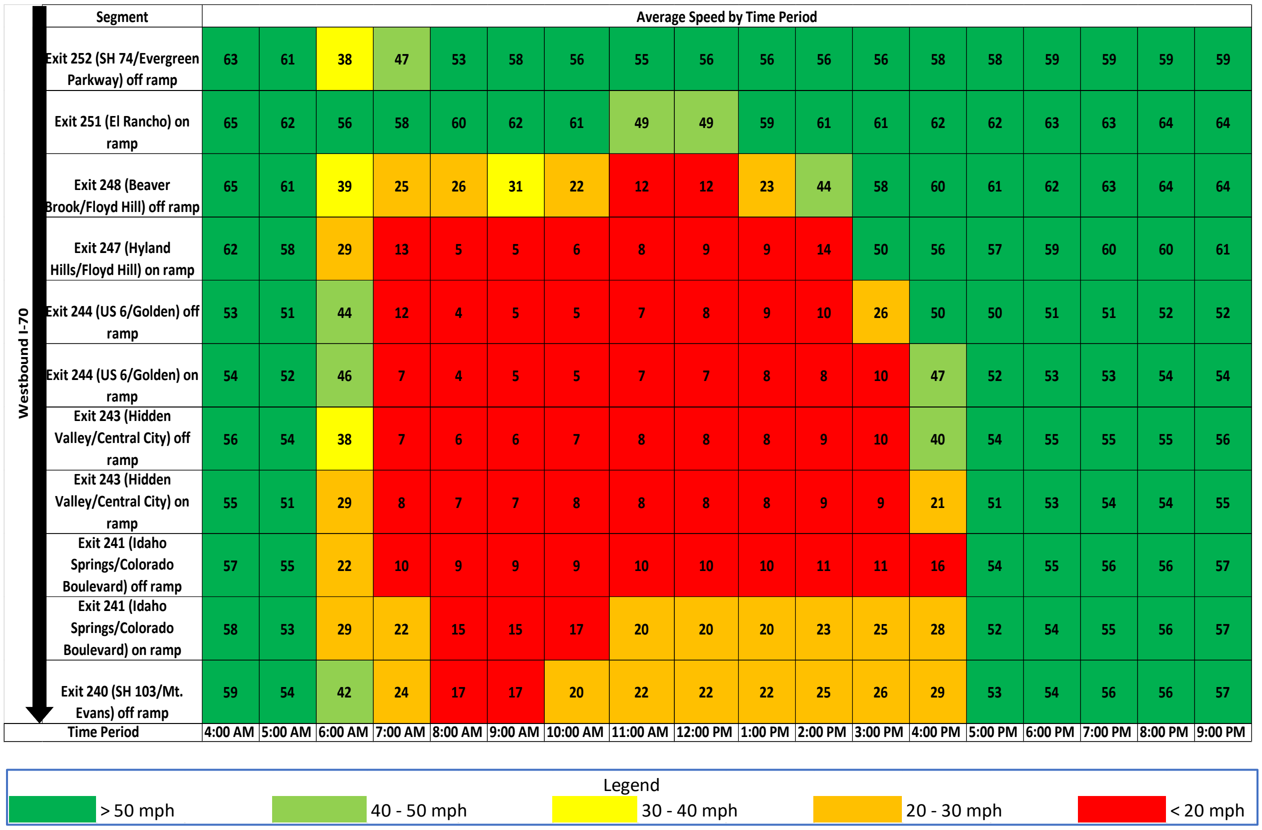
	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	58	56	56	54	52	49	45	44	43	41	41	41	43	42	40	43	45	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	57	57	56	53	51	48	48	47	45	45	45	46	45	45	46	49	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	56	56	55	53	51	50	49	49	49	49	48	49	49	49	49	50	54
	Exit 243 (Hidden Valley/Central City) off ramp	57	57	55	54	53	52	51	50	49	49	49	48	49	49	49	50	51	54
	Exit 243 (Hidden Valley/Central City) on ramp	55	55	55	52	52	51	50	50	50	50	50	49	49	50	49	50	50	54
	Exit 244 (US 6/Golden) on ramp	55	56	54	54	52	51	50	49	48	48	48	46	46	48	47	49	50	54
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	62	61	61	60	59	58	57	56	55	55	54	53	53	55	54	55	57	60
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	65	64	63	63	62	61	60	59	59	59	59	58	58	59	58	59	59	62
	Exit 251 (El Rancho) off ramp	65	64	64	63	62	61	58	57	57	55	55	54	54	56	56	57	59	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	63	62	62	62	60	59	57	56	54	53	54	53	53	54	55	55	57	61
	Time Periods	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 243. Canyon Viaduct Alternative No PPSL Winter Westbound Congestion Diagram



Westbound I-70

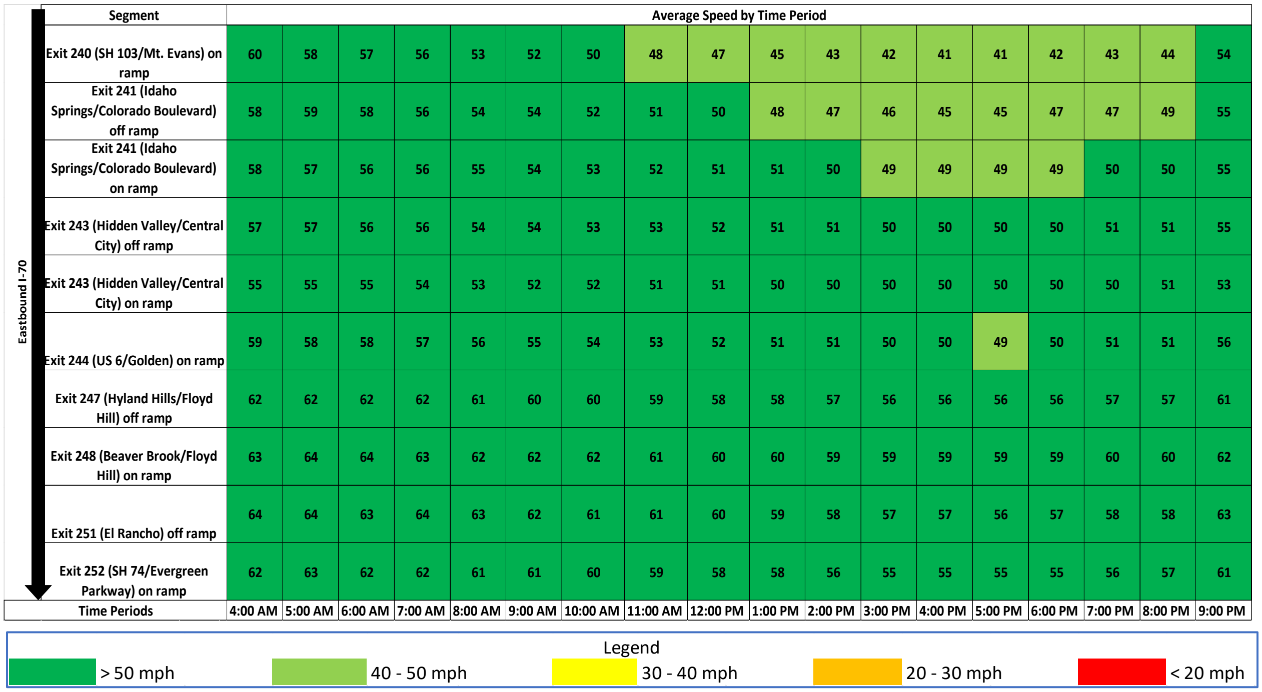
Segment	Average Speed by Time Period																	
Exit 252 (SH 74/Evergreen Parkway) off ramp	63	61	38	47	53	58	56	55	56	56	56	56	58	58	59	59	59	59
Exit 251 (El Rancho) on ramp	65	62	56	58	60	62	61	49	49	59	61	61	62	62	63	63	64	64
Exit 248 (Beaver Brook/Floyd Hill) off ramp	65	61	39	25	26	31	22	12	12	23	44	58	60	61	62	63	64	64
Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	58	29	13	5	5	6	8	9	9	14	50	56	57	59	60	60	61
Exit 244 (US 6/Golden) off ramp	53	51	44	12	4	5	5	7	8	9	10	26	50	50	51	51	52	52
Exit 244 (US 6/Golden) on ramp	54	52	46	7	4	5	5	7	7	8	8	10	47	52	53	53	54	54
Exit 243 (Hidden Valley/Central City) off ramp	56	54	38	7	6	6	7	8	8	8	9	10	40	54	55	55	55	56
Exit 243 (Hidden Valley/Central City) on ramp	55	51	29	8	7	7	8	8	8	8	9	9	21	51	53	54	54	55
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	57	55	22	10	9	9	9	10	10	10	11	11	16	54	55	56	56	57
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	53	29	22	15	15	17	20	20	20	23	25	28	52	54	55	56	57
Exit 240 (SH 103/Mt. Evans) off ramp	59	54	42	24	17	17	20	22	22	22	25	26	29	53	54	56	56	57
Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 244. Canyon Viaduct Alternative No PPSL Winter Eastbound Congestion Diagram



Eastbound I-70

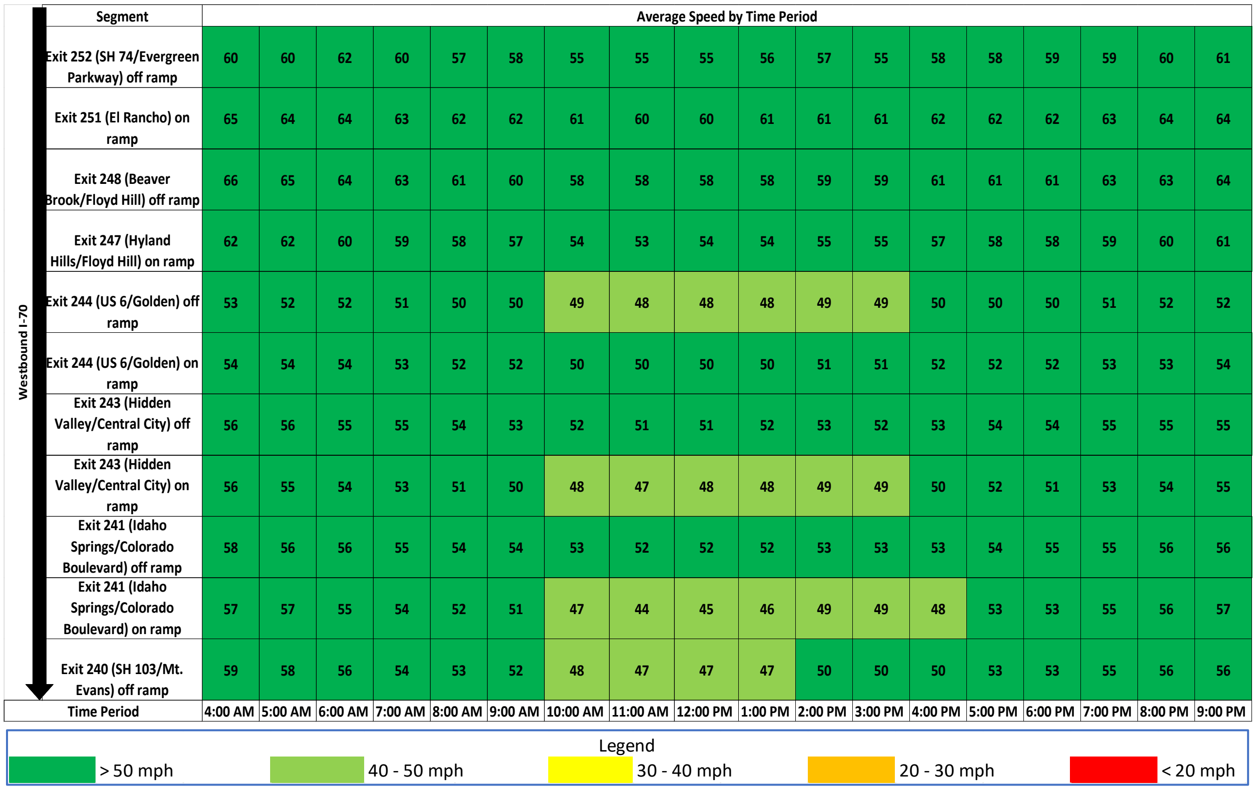
Segment	Average Speed by Time Period																	
Exit 240 (SH 103/Mt. Evans) on ramp	60	58	57	56	53	52	50	48	47	45	43	42	41	41	42	43	44	54
Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	59	58	56	54	54	52	51	50	48	47	46	45	45	47	47	49	55
Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	57	56	56	55	54	53	52	51	51	50	49	49	49	49	50	50	55
Exit 243 (Hidden Valley/Central City) off ramp	57	57	56	56	54	54	53	53	52	51	51	50	50	50	50	51	51	55
Exit 243 (Hidden Valley/Central City) on ramp	55	55	55	54	53	52	52	51	51	50	50	50	50	50	50	50	51	53
Exit 244 (US 6/Golden) on ramp	59	58	58	57	56	55	54	53	52	51	51	50	50	49	50	51	51	56
Exit 247 (Hyland Hills/Floyd Hill) off ramp	62	62	62	62	61	60	60	59	58	58	57	56	56	56	56	57	57	61
Exit 248 (Beaver Brook/Floyd Hill) on ramp	63	64	64	63	62	62	62	61	60	60	59	59	59	59	59	60	60	62
Exit 251 (El Rancho) off ramp	64	64	63	64	63	62	61	61	60	59	58	57	57	56	57	58	58	63
Exit 252 (SH 74/Evergreen Parkway) on ramp	62	63	62	62	61	61	60	59	58	58	56	55	55	55	55	56	57	61
Time Periods	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend

🟩 > 50 mph
🟩 40 - 50 mph
🟨 30 - 40 mph
🟧 20 - 30 mph
🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 245. Canyon Viaduct Alternative No PPSL Summer Westbound Congestion Diagram

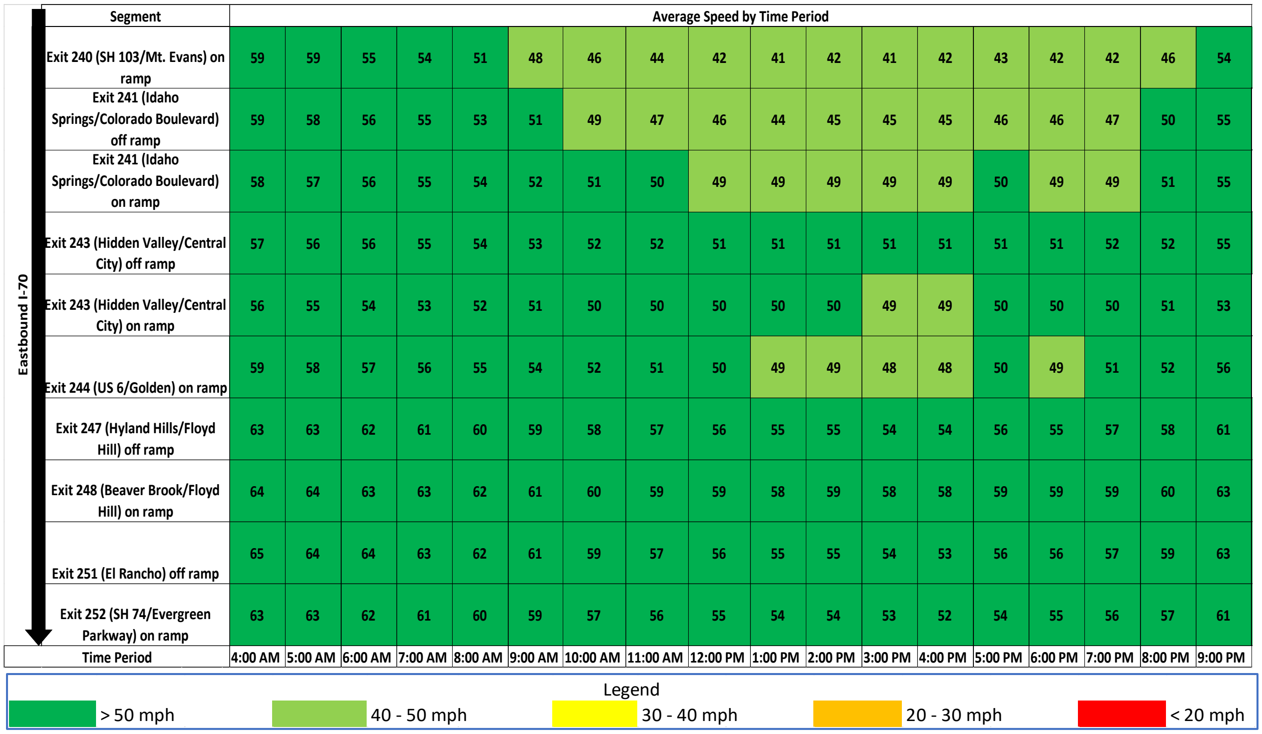


	Segment	Average Speed by Time Period																	
Westbound I-70	Exit 252 (SH 74/Evergreen Parkway) off ramp	60	60	62	60	57	58	55	55	55	56	57	55	58	58	59	59	60	61
	Exit 251 (El Rancho) on ramp	65	64	64	63	62	62	61	60	60	61	61	61	62	62	62	63	64	64
	Exit 248 (Beaver Brook/Floyd Hill) off ramp	66	65	64	63	61	60	58	58	58	58	59	59	61	61	61	63	63	64
	Exit 247 (Hyland Hills/Floyd Hill) on ramp	62	62	60	59	58	57	54	53	54	54	55	55	57	58	58	59	60	61
	Exit 244 (US 6/Golden) off ramp	53	52	52	51	50	50	49	48	48	48	49	49	50	50	50	51	52	52
	Exit 244 (US 6/Golden) on ramp	54	54	54	53	52	52	50	50	50	50	51	51	52	52	52	53	53	54
	Exit 243 (Hidden Valley/Central City) off ramp	56	56	55	55	54	53	52	51	51	52	53	52	53	54	54	55	55	55
	Exit 243 (Hidden Valley/Central City) on ramp	56	55	54	53	51	50	48	47	48	48	49	49	50	52	51	53	54	55
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	58	56	56	55	54	54	53	52	52	52	53	53	53	54	55	55	56	56
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	57	57	55	54	52	51	47	44	45	46	49	49	48	53	53	55	56	57
	Exit 240 (SH 103/Mt. Evans) off ramp	59	58	56	54	53	52	48	47	47	47	50	50	50	53	53	55	56	56
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

Exhibit 246. Canyon Viaduct Alternative No PPSL Summer Eastbound Congestion Diagram



	Segment	Average Speed by Time Period																	
Eastbound I-70	Exit 240 (SH 103/Mt. Evans) on ramp	59	59	55	54	51	48	46	44	42	41	42	41	42	43	42	42	46	54
	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	59	58	56	55	53	51	49	47	46	44	45	45	45	46	46	47	50	55
	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	58	57	56	55	54	52	51	50	49	49	49	49	49	50	49	49	51	55
	Exit 243 (Hidden Valley/Central City) off ramp	57	56	56	55	54	53	52	52	51	51	51	51	51	51	51	52	52	55
	Exit 243 (Hidden Valley/Central City) on ramp	56	55	54	53	52	51	50	50	50	50	50	49	49	50	50	50	51	53
	Exit 244 (US 6/Golden) on ramp	59	58	57	56	55	54	52	51	50	49	49	48	48	50	49	51	52	56
	Exit 247 (Hyland Hills/Floyd Hill) off ramp	63	63	62	61	60	59	58	57	56	55	55	54	54	56	55	57	58	61
	Exit 248 (Beaver Brook/Floyd Hill) on ramp	64	64	63	63	62	61	60	59	59	58	59	58	58	59	59	59	60	63
	Exit 251 (El Rancho) off ramp	65	64	64	63	62	61	59	57	56	55	55	54	53	56	56	57	59	63
	Exit 252 (SH 74/Evergreen Parkway) on ramp	63	63	62	61	60	59	57	56	55	54	54	53	52	54	55	56	57	61
	Time Period	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM

Legend
🟩 > 50 mph 🟩 40 - 50 mph 🟨 30 - 40 mph 🟧 20 - 30 mph 🟥 < 20 mph

Source: TransModeler microsimulation analysis.

7.2.4.4 Freeway Segment LOS

Freeway LOS results for the analysis of the Tunnel Alternative with no PPSL are shown in Exhibit 247 through Exhibit 250 and for the analysis of the Canyon Viaduct Alternative with no PPSL are shown in Exhibit 251 through Exhibit 254. The LOS results show similar patterns as the congestion files and are consistent with the shifting of bottlenecks due to the closing of the PPSL.

Exhibit 247. Tunnel Alternative No PPSL Winter Westbound I-70 LOS

	Segment	East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
	Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	B	B	B	B	B	B	B
	6:00:00 AM	F	E	D	E	F	F	F	C	D	C	E	D	E	F	F	F	F	F	F	E	E	E	F	F
	7:00:00 AM	E	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	8:00:00 AM	C	C	B	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	9:00:00 AM	B	B	B	B	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	10:00:00 AM	C	B	C	B	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	11:00:00 AM	C	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	12:00:00 PM	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	1:00:00 PM	C	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	2:00:00 PM	C	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	3:00:00 PM	C	B	B	B	C	B	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	4:00:00 PM	B	B	B	B	B	A	B	B	C	B	E	F	F	F	F	F	F	F	F	F	F	F	F	F
	5:00:00 PM	B	B	B	A	B	A	B	B	B	B	B	A	B	A	B	A	B	C	B	C	B	C	C	C
	6:00:00 PM	A	B	A	A	A	A	A	A	B	A	B	A	A	A	A	A	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 248. Tunnel Alternative No PPSL Winter Eastbound I-70 LOS

	Segment	West of Exit 240 (SH 103)	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
	Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	B	A	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	C	B	B	A	B	A	B	A	B	A	A	B	A	A	B	A	B	A
	11:00:00 AM	D	C	C	C	D	C	C	B	B	B	B	A	B	B	B	B	B	A	B	A	B	B
	12:00:00 PM	D	C	D	C	D	D	C	B	C	B	C	B	C	B	B	B	B	A	B	B	B	B
	1:00:00 PM	E	D	E	D	E	E	D	B	C	B	C	B	C	B	B	B	C	B	C	B	C	B
	2:00:00 PM	E	E	F	E	E	F	E	C	D	B	D	B	D	B	C	C	C	B	C	B	C	B
	3:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	B	D	C	C	C	C	B	C	B	C	B
	4:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	B	D	C	C	C	C	B	C	B	C	B
	5:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	B	D	C	C	C	C	B	D	B	D	B
	6:00:00 PM	E	E	F	F	E	F	E	C	D	B	D	B	D	C	C	C	C	B	C	B	C	B
	7:00:00 PM	E	E	E	E	E	F	E	C	C	B	C	B	D	B	C	C	C	B	C	B	C	B
	8:00:00 PM	D	D	E	D	D	D	D	B	C	B	C	B	C	B	B	B	C	B	C	B	C	B
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 249. Tunnel Alternative No PPSL Summer Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	B	A	B	A	B	A	B	A	B	B	B	C	B	B	B	B
	8:00:00 AM	B	B	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	C	B	C	C	C	B	B
	9:00:00 AM	B	B	B	B	B	A	B	B	C	B	C	A	B	A	B	A	B	C	C	C	C	C	C	B
	10:00:00 AM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	C	C
	11:00:00 AM	C	C	C	B	C	B	C	B	D	B	D	B	C	B	D	B	D	E	D	E	E	E	D	D
	12:00:00 PM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	E	E	D	D	D
	1:00:00 PM	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	D	D
	2:00:00 PM	B	B	B	B	C	B	C	B	C	B	C	B	C	A	C	B	C	D	C	D	D	D	C	C
	3:00:00 PM	B	B	B	B	B	B	C	B	C	B	C	B	B	A	B	B	B	C	C	D	C	C	C	C
	4:00:00 PM	B	B	B	A	B	A	B	B	C	B	C	B	B	A	C	B	B	D	C	D	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	C	B	C	B	C	B	B
	6:00:00 PM	A	B	B	A	B	A	B	A	B	B	B	A	B	A	B	A	B	C	B	C	B	C	B	B
	7:00:00 PM	A	B	A	A	A	A	A	A	B	A	B	A	A	A	B	A	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 250. Tunnel Alternative No PPSL Summer Eastbound I-70 LOS

Segment		West of Exit 240 (SH 103)	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	C	C	C	C	C	C	C	B	B	B	B	A	B	B	A	B	B	A	B	A	B	A
	10:00:00 AM	E	D	D	D	E	E	D	B	C	B	C	B	C	B	B	B	C	B	C	B	C	B
	11:00:00 AM	E	E	E	E	E	E	E	B	C	B	C	B	D	B	C	C	C	B	C	B	C	B
	12:00:00 PM	E	E	F	E	E	F	E	C	D	C	D	B	D	C	C	C	C	B	C	B	C	B
	1:00:00 PM	E	E	F	F	F	F	E	C	D	C	D	B	D	C	C	C	C	B	D	C	D	C
	2:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	C	D	C	C	C	C	B	D	C	D	B
	3:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	C	E	C	C	C	D	B	D	C	D	C
	4:00:00 PM	E	E	E	F	E	F	E	C	D	C	D	C	D	C	C	C	D	C	D	C	D	C
	5:00:00 PM	E	E	E	F	E	F	E	C	D	B	D	B	D	C	C	C	C	B	D	C	D	B
	6:00:00 PM	E	E	F	F	E	F	E	C	D	B	D	C	D	C	C	C	C	B	D	C	D	B
	7:00:00 PM	E	E	F	E	E	F	E	C	C	B	C	B	D	C	C	C	C	B	C	B	C	B
	8:00:00 PM	C	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B	B	A	B	B	B	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 251. Canyon Viaduct Alternative No PPSL Winter Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	B	B	B	B	B	B	B
	6:00:00 AM	F	E	D	E	F	F	F	C	D	C	D	C	F	E	F	F	F	F	E	E	E	E	F	F
	7:00:00 AM	E	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	8:00:00 AM	C	C	B	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	9:00:00 AM	B	B	B	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	10:00:00 AM	C	B	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	11:00:00 AM	C	C	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	12:00:00 PM	C	B	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	1:00:00 PM	C	C	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	2:00:00 PM	C	C	C	C	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	3:00:00 PM	C	B	B	B	C	B	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	4:00:00 PM	B	B	B	B	B	A	B	B	C	B	C	B	D	D	F	F	F	F	F	F	F	F	F	F
	5:00:00 PM	B	B	B	A	B	A	B	B	B	B	B	A	B	B	B	A	B	C	B	C	B	C	C	C
	6:00:00 PM	A	B	A	A	A	A	B	A	B	A	B	A	B	A	B	A	B	B	B	B	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction →

Source: TransModeler microsimulation analysis.

Exhibit 252. Canyon Viaduct Alternative No PPSL Winter Eastbound I-70 LOS

Segment		West of Exit 240 (SH 103)	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	A	A	A	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	10:00:00 AM	C	B	C	B	C	B	B	B	B	A	B	A	B	A	A	B	A	A	B	A	A	A
	11:00:00 AM	D	C	D	C	D	C	C	B	B	B	B	A	B	B	B	B	B	A	B	A	B	B
	12:00:00 PM	D	D	D	D	D	D	D	B	C	B	C	B	C	B	B	B	B	B	B	B	B	B
	1:00:00 PM	E	D	E	D	E	E	D	C	C	B	C	B	C	B	B	B	C	B	C	B	C	B
	2:00:00 PM	E	E	E	E	E	F	E	C	D	B	C	B	C	B	C	C	C	B	C	B	C	B
	3:00:00 PM	E	E	F	F	E	F	E	C	D	B	D	B	D	C	C	C	C	B	C	B	C	B
	4:00:00 PM	E	E	F	F	E	F	E	C	D	B	D	B	D	C	C	C	C	B	C	B	C	B
	5:00:00 PM	E	E	F	F	E	F	E	C	D	B	D	B	D	C	C	C	C	B	D	C	D	B
	6:00:00 PM	E	E	F	E	E	F	E	C	D	B	D	B	D	B	C	C	C	B	C	B	C	B
	7:00:00 PM	E	E	F	E	E	F	E	C	D	B	C	B	C	B	C	C	C	B	C	B	C	B
	8:00:00 PM	D	D	E	D	D	D	D	C	C	B	C	B	C	B	B	B	C	B	C	B	C	B
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction →

Source: TransModeler microsimulation analysis.

Exhibit 253. Canyon Viaduct Alternative No PPSL Summer Westbound I-70 LOS

Segment		East of Exit 252 (SH 74/Evergreen Parkway)	Exit 252 (SH 74/Evergreen Parkway) off ramp	Between Ramps	Exit 251 (El Rancho) on ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) off ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) on ramp	Between Ramps	Exit 244 (US 6/Golden) off ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 240 (SH 103) off ramp	Betweem Ramps	Exit 240 (SH 103) on ramp	West of Exit 240 (SH 103)
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Basic	Merge	Basic	Diverge	Basic	Merge	Diverge
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	B	A	B	A	B	A	B	A	B	B	B	B	B	B	B	B
	8:00:00 AM	B	B	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	C	B	C	B	B	B	B
	9:00:00 AM	B	B	B	B	B	A	B	B	C	B	B	A	B	B	B	A	B	C	C	C	C	C	B	C
	10:00:00 AM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	D	D	D	D	D	D
	11:00:00 AM	C	C	C	B	C	B	C	B	D	B	C	B	D	B	D	B	D	E	D	E	D	D	D	D
	12:00:00 PM	C	C	C	B	C	B	C	B	D	B	C	B	C	B	C	B	C	E	D	E	D	D	D	D
	1:00:00 PM	C	C	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C	E	D	E	D	D	D	D
	2:00:00 PM	B	B	B	B	C	B	C	B	C	B	C	B	C	B	C	B	C	D	C	D	C	C	C	C
	3:00:00 PM	C	B	B	B	B	B	C	B	C	B	C	A	C	B	C	B	C	C	C	D	C	C	C	C
	4:00:00 PM	B	B	B	A	B	A	B	B	C	B	B	A	B	B	C	B	C	D	C	D	C	C	C	C
	5:00:00 PM	B	B	B	A	B	A	B	B	B	B	B	A	B	A	B	A	B	C	B	C	B	C	B	B
	6:00:00 PM	B	B	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	C	B	C	B	B	B	B
	7:00:00 PM	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B
	8:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	B
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

Exhibit 254. Canyon Viaduct Alternative No PPSL Summer Eastbound I-70 LOS

Segment		West of Exit 240 (SH 103)	Exit 240 (SH 103) off ramp	Between Ramps	Exit 240 (SH 103) on ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) off ramp	Between Ramps	Exit 241 (Idaho Springs/Colorado Boulevard) on ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) off ramp	Between Ramps	Exit 243 (Hidden Valley/Central City) on ramp	Between Ramps	Exit 244 (US 6/Golden) on ramp	Between Ramps	Exit 247 (Hyland Hills/Floyd Hill) off ramp	Between Ramps	Exit 248 (Beaver Brook/Floyd Hill) on ramp	Between Ramps	Exit 251 (El Rancho) off ramp	Between Ramps	Exit 252 (SH 74/Evergreen Parkway) on ramp
Type		Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Basic
Time Period	4:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	6:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7:00:00 AM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	8:00:00 AM	B	B	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	9:00:00 AM	C	C	C	C	C	C	C	B	B	B	B	A	B	B	A	B	B	A	B	A	B	A
	10:00:00 AM	D	D	E	D	D	D	D	C	C	B	C	B	C	B	B	B	C	B	C	B	C	B
	11:00:00 AM	E	E	E	E	E	F	E	C	D	B	C	B	D	B	C	C	C	B	C	B	C	B
	12:00:00 PM	E	E	F	F	E	F	E	C	D	B	D	B	D	C	C	C	C	B	D	C	C	B
	1:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	B	D	C	C	C	C	B	D	C	D	C
	2:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	B	D	C	C	C	C	B	D	C	D	C
	3:00:00 PM	E	E	F	F	E	F	E	D	D	C	D	C	D	C	C	C	D	B	D	C	D	C
	4:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	B	D	C	C	C	D	C	D	C	D	C
	5:00:00 PM	E	E	E	F	E	F	E	C	D	C	D	B	D	C	C	C	C	B	D	C	D	B
	6:00:00 PM	E	E	F	F	E	F	E	C	D	C	D	B	D	C	C	C	C	B	D	C	D	B
	7:00:00 PM	E	E	F	E	E	F	E	C	D	B	C	B	D	B	C	C	C	B	C	B	C	B
	8:00:00 PM	C	C	C	C	C	C	C	B	B	B	B	A	B	B	B	B	B	B	B	B	B	A
	9:00:00 PM	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Travel Direction

Source: TransModeler microsimulation analysis.

7.3 Additional Analysis Summary

Removal of the PPSL (both the existing eastbound and planned westbound) will result in the following:

- In the westbound direction, removing the planned PPSL will result in shifting the existing bottleneck from the top of Floyd Hill to Exit 241 (Idaho Springs/Colorado Boulevard), where the highway will go from three lanes to two lanes.
- The westbound bottleneck will be more intense than existing conditions and will result in poor operations on I-70 that will extend across most hours of the day in the winter.
- In the eastbound direction, removing the existing PPSL will result in a bottleneck forming at US 40, west of the study area, where the highway will go from three lanes to two lanes.
- The eastbound bottleneck will meter traffic that enters the study area, resulting is some improvements to operations and travel times west of Exit 241 (Idaho Springs/Colorado Boulevard), where the highway goes back to three lanes.
- These bottlenecks will result in more vehicles looking to use frontage roads and Colorado Boulevard between US 40 and Exit 241 (Idaho Springs/Colorado Boulevard).

Appendix A

Traffic Analysis Methodology Technical Memorandum

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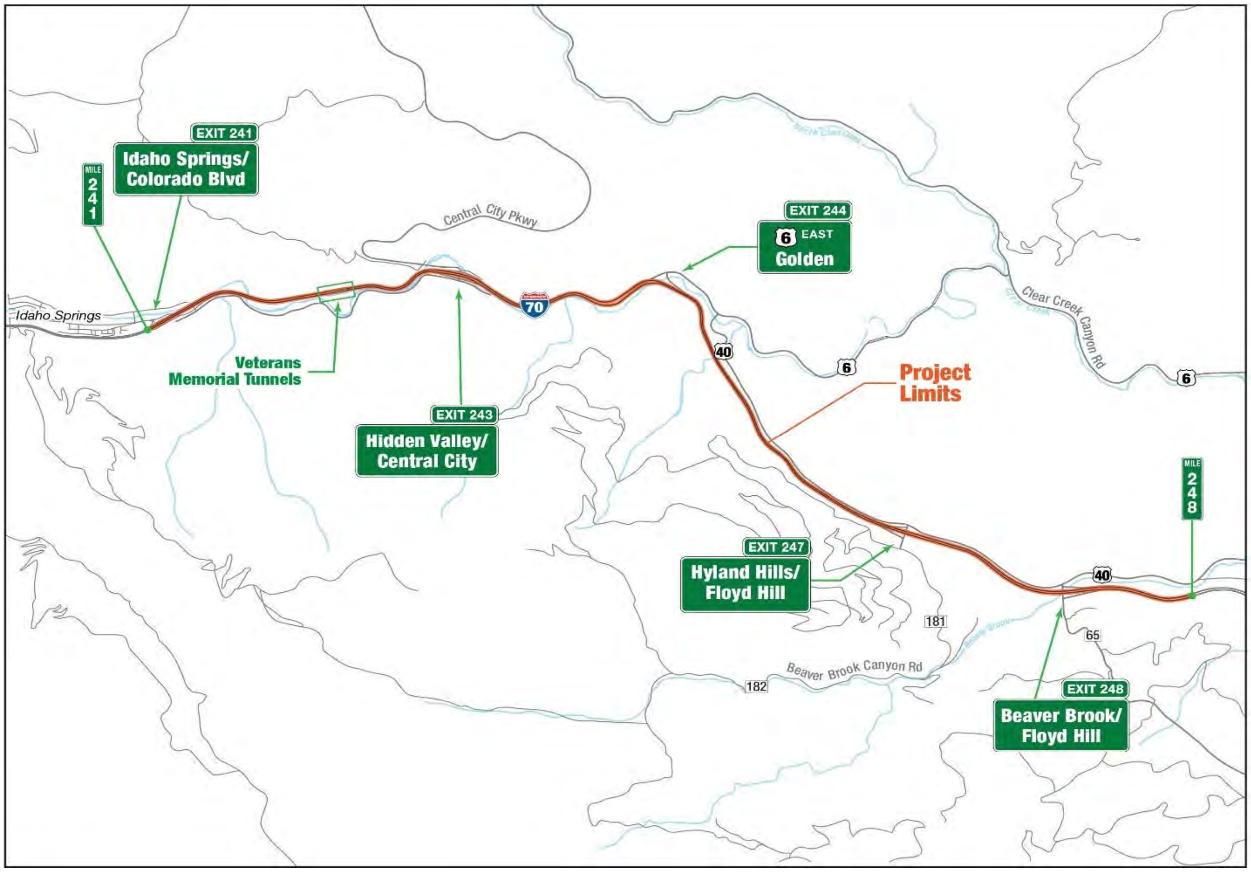
Technical Memorandum

To:	Neil Ogden, Vanessa Henderson, Christiana Lacombe, and Ben Kiene, CDOT; Kelly Larson and Nnaemeka Ezekwemba, FHWA; Anthony Pisano, Atkins
From:	David Sprague, PE, Atkins
Subject:	Traffic Analysis Methodology
Date:	September 2018

Introduction

The Federal Highway Administration (FHWA) and the Colorado Department of Transportation (CDOT) are studying Interstate 70 (I-70) between Exit 248 (Beaver Brook/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard). The study currently is anticipated to be an Environmental Assessment (EA) based on the National Environmental Policy Act (NEPA). The purpose of the project is to provide improvements aimed at reducing congestion and improving safety on westbound I-70 between Milepost (MP) 248, or just east of Exit 248 (Beaver Brook/Floyd Hill), and Exit 241 (Idaho Springs/Colorado Boulevard), or approximately MP 241, as shown in Exhibit 1.

Exhibit 1 Project Limits



Project Background

The EA is evaluating the impacts/benefits of adding a third lane to westbound I-70 to help mitigate recurring peak period congestion, improve safety, and address operational concerns. The additional lane, which may be an Express Lane (EL), would be located somewhere between Exit 248 (Beaver Brook/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard). Other improvements to I-70 that will be evaluated in the EA include:

- Different alignments for both westbound and eastbound I-70 between the Veterans Memorial Tunnels and Exit 244 (U.S. Highway 6 [US 6]/Golden).
- Potential modifications to interchanges to provide optimal access to and from I-70. This may include the addition of new ramps, elimination of existing ramps, and moving ramps to new locations based on the topography of the area and the proposed alignments of the I-70 lanes.
- Potential addition of an eastbound I-70 climbing/auxiliary lane between Exit 244 (US 6/Golden) and Exit 247 (Hyland Hills/Floyd Hill).
- Potential changes to intersection design/control type at key locations (all ramp junctions, intersections near the ramps, and intersections along U.S. Highway 40 [US 40]). This may include the addition of traffic signals to locations that currently are unsignalized, addition of turning lanes, or converting existing intersections to roundabouts.
- Addition of a frontage road between Exit 243 (Hidden Valley/Central City) and Exit 244 (US 6/Golden).

Traffic Analysis Purpose

There are several traffic operations analyses that will be completed for the I-70 Floyd Hill to Veterans Memorial Tunnels EA. The main purpose of completing traffic analyses is to use the results to assist with understanding the existing and future traffic needs for I-70 in the project area. The goal of the traffic operations analyses is to assist with the development and identification of a proposed action.

The purpose of this memorandum is to describe the tools, methodologies, and assumptions that will be used to complete the microscopic traffic operations analysis in support of the I-70 Floyd Hill to Veterans Memorial Tunnels EA. This memorandum does not include any discussion regarding the results of any operational analysis or the model calibration efforts. These topics will be provided and discussed in separate memoranda. The following is an outline of the topics that will be discussed in this methodology memorandum.

- Modeling tools
- Modeling periods
- Modeling area
- Analysis conditions
- Traffic data and volumes
- Model calibration
- Measures of effectiveness

Modeling Tools

This section discusses the need to use a microscopic simulation tool that provides flexibility to evaluate many different transportation elements, including:

- Lane types
    - General-purpose lanes (GPLs)
    - ELs
    - Peak period shoulder lanes (PPSLs)
- Facility types
    - Interstates
    - Arterials, collectors, and local roads
- Ability to model route choice using dynamic traffic assignment (DTA)
- Ability to compute measures of effectiveness that can be compared to level of service thresholds from the *Highway Capacity Manual, 6th Edition*
    - Freeway segments (basic, merge, diverge, weave, and PPSL/EL ingress/egress points)
    - Intersections with different control types (stop sign, traffic signal, and roundabout)
- Geometric characteristics of a mountain corridor
    - Grades
    - Curves
    - Lane restrictions for trucks

In addition, this section discusses the limitations of using a travel demand model as part of the EA analysis methodology.

Microscopic Simulation Tool

TransModeler (developed and supported by the Caliper Corporation) is a traffic operation tool that can perform microscopic analysis of roadway networks consisting of many facility types, including interstates, highways, and surface streets. In addition, the tool has the flexibility to analyze freeway elements (basic segments and ramp merge/diverge areas, and weaving areas), various interchange types, all types of intersection control (stop controlled, signalized, and roundabouts), and lane types (GPL, PPSL, and EL). Another aspect of the software is the ability to evaluate changes in network elements through the application of DTA to vehicle trip paths to achieve equilibrium for the roadway users.

TransModeler evaluates the operations of the different transportation network elements and computes densities, speeds, and control delay that will be compared directly with the level of service (LOS) criteria as provided in the *Highway Capacity Manual*, *6th Edition*. All results reported for this study will be obtained from TransModeler.

Travel Demand Modeling

The existing regional travel demand model (TDM), which is developed and maintained by the Denver Regional Council of Governments (DRCOG), does include I-70 through the project limits. However, based on discussions with DRCOG staff, the model was developed to reflect typical weekday travel patterns in the region to simulate commuter activities. This is done primarily because the model does a better job of reflecting origin-destination trips/pairs that are focused in urbanized areas, but the model becomes much less reliable in rural areas. The I-70 congestion issues that occur within the project limits typically occur on the weekends (Friday afternoon through Sunday afternoon) and are not associated with commuter traffic patterns, but instead are the result of people traveling to recreational areas and activities located in the various mountain communities west of Denver. These patterns of travel are the result of origin-destination pairs that are completely unique and different from the typical weekday information contained in the TDM.

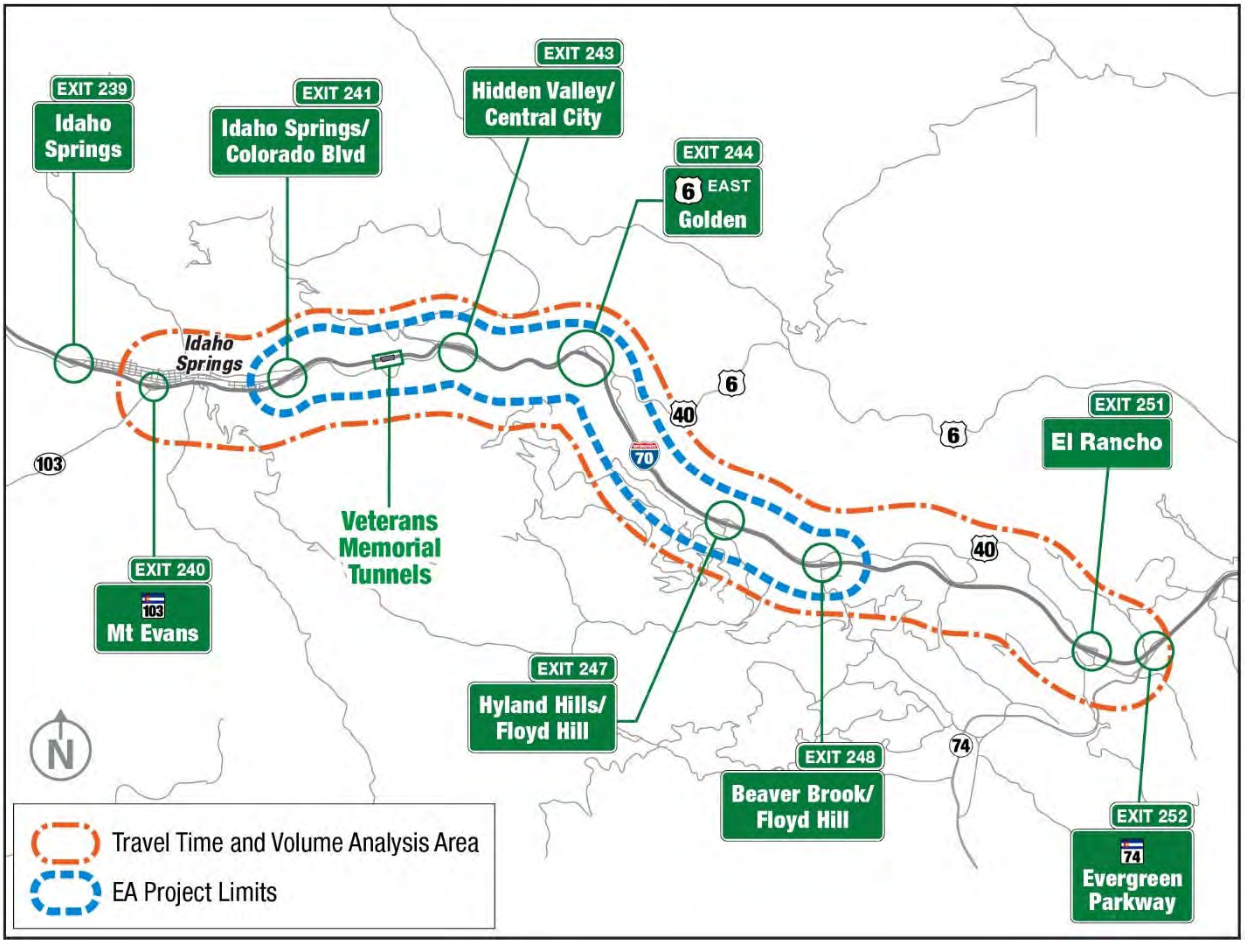
Typically, to project future traffic volumes on I-70 and the other roadways in the project limits using the regional travel demand model, a new set of origin-destination data that best represents weekend/recreational travel patterns would need to be created and calibrated. However, the project team decided not to use the DRCOG TDM for future traffic projections, and instead developed a set of origin-destination tables based on existing weekend traffic data (collected in January 2018 and June 2018). The project then used historic growth factors for the I-70 Mountain Corridor to project future origin-destination tables. The DTA capabilities of TransModeler then were used to project future traffic volumes for I-70 and the other transportation network elements.

Modeling Periods

The I-70 Mountain Corridor experiences unique peaking characteristics because of the high demand for access to the many different recreational areas and resort communities located west of the Front Range. While there is some daily commuting that occurs between the mountain communities and the Front Range, the highest traffic volumes and travel times typically occur on weekends (Friday, Saturday, and Sunday).

To best select the appropriate analysis period(s), a full year (July 31, 2016, to July 30, 2017) of travel time data (from the INRIX global traffic data warehouse) and traffic volumes (from CDOT traffic data sources) were collected for the portion of I-70 between MP 240 and MP 252, which fully encompasses the EA project limits (refer to Exhibit 2). The goal was to define or diagnose the nature of recurring congestion for both directions of I-70 based on demand volumes, free-flow travel times, and experienced travel times.

Exhibit 2 Travel Time and Volume Analysis Area (MP 240 to MP 252)

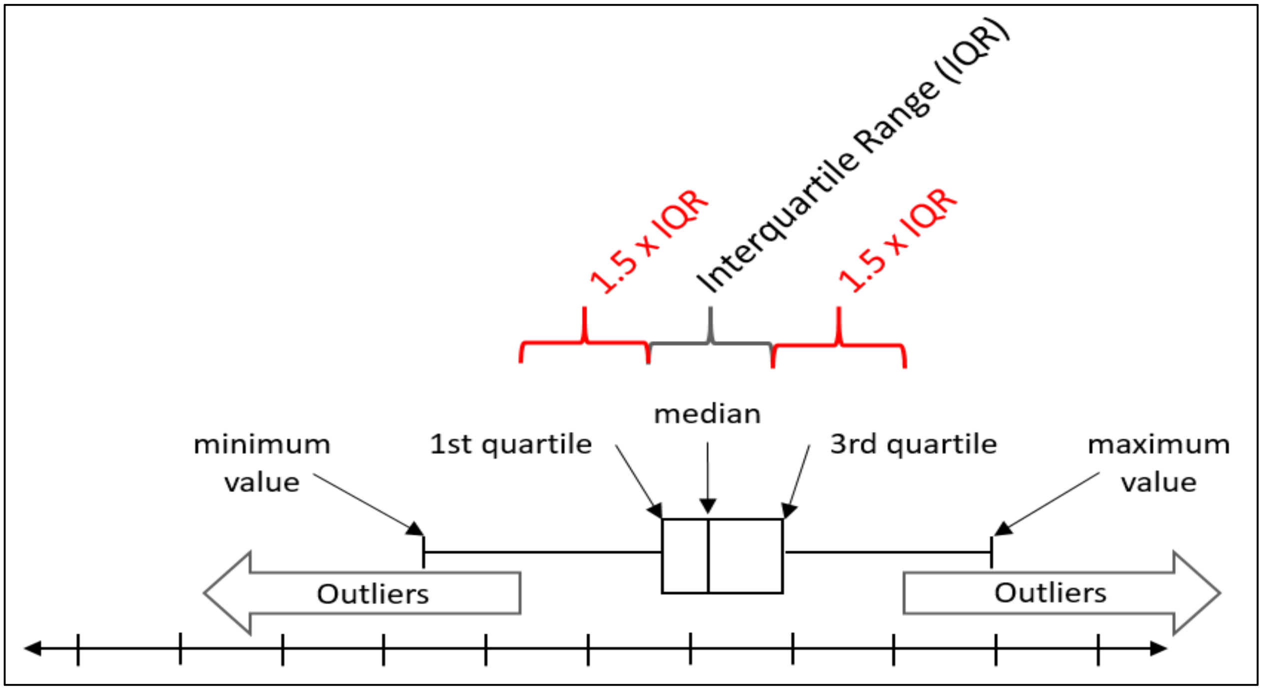


Travel Time Analysis

A statistical methodology was used to identify the period(s) with recurring congestion based on travel time data. This methodology began by examining one year's worth of INRIX travel time data and eliminating outliers from the data set. These outliers represent data that are far enough away from the average to be considered non-typical. Examples of outliers include time periods in which INRIX was not able to provide data—in which case, the obtained data sets show zero travel time—or time periods which were impacted by large events—such as major weather events or incidents that had a significant impact on traffic.

These outliers were identified using the interquartile range (IQR) methodology. This methodology calculates the difference between the third and first quartiles—also known as the IQR—and assumes that data points beyond the upper fence (one and a half times the IQR plus the third quartile) and the lower fence (one and a half times the IQR minus the first quartile) are outliers. Exhibit 3 outlines the IQR outlier methodology.

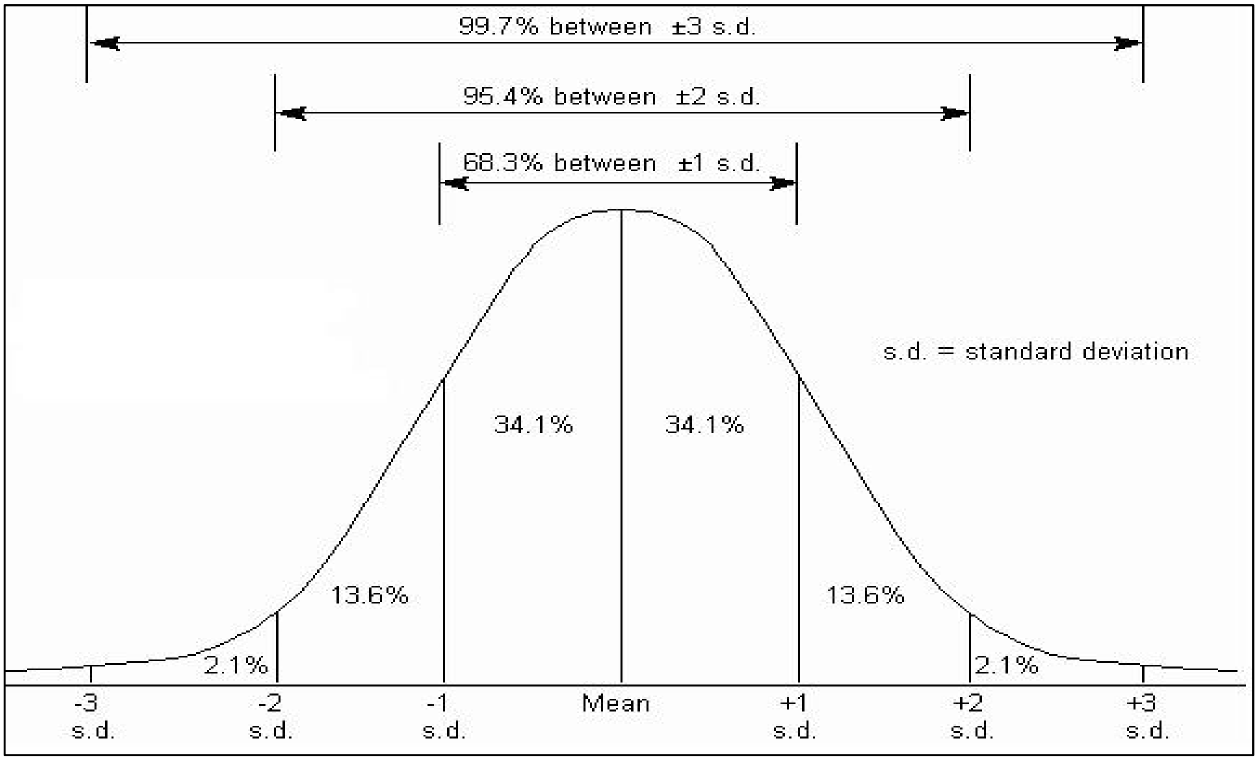
Exhibit 3. Interquartile Range Methodology



After eliminating outliers from the data set, the standard deviation was used to determine the typical daily travel times. The standard deviation provides a measurement of how well data are clustered around the average. The more clustered around the average the data are, the lower the standard deviation is. The more dispersed the data are from the average, the higher the standard deviation is. It was assumed that any data within one standard deviation of the average data—which captures approximately 68 percent of all data points—is representative of typical conditions. This methodology was used to capture daily variation on the corridor while excluding both the high and low extremes.

Exhibit 4 shows an example of how standard deviation captures the typical conditions of a distributed data set.

Exhibit 4. Standard Deviation Methodology



Source: Bumgardner, J. Standard Deviation Curve. Retrieved from: https://www.tes.com/lessons/kXKfES8cuBjqZA/standard-deviation-you-need-to-take-good-notes

Data from INRIX were used to evaluate travel times for the stretch of I-70 between MP 240 and MP 252, which fully encompasses the EA study limits. The travel time data for peak seasonal Fridays, Saturdays, and Sundays were used to help identify the day and time when recurring congestion occurs on I-70. Exhibit 5 shows the number of outlier data points and the amount of remaining data points within one standard deviation of the average for Fridays, Saturdays, and Sundays during each peak seasonal period. It should be noted that the typical 68 percent of data captured within one standard deviation of the average is based on a normal (bell curve) distribution of data. Because travel time data is not normally distributed, the percent of data being captured within one standard deviation is lower than the typical 68 percent.

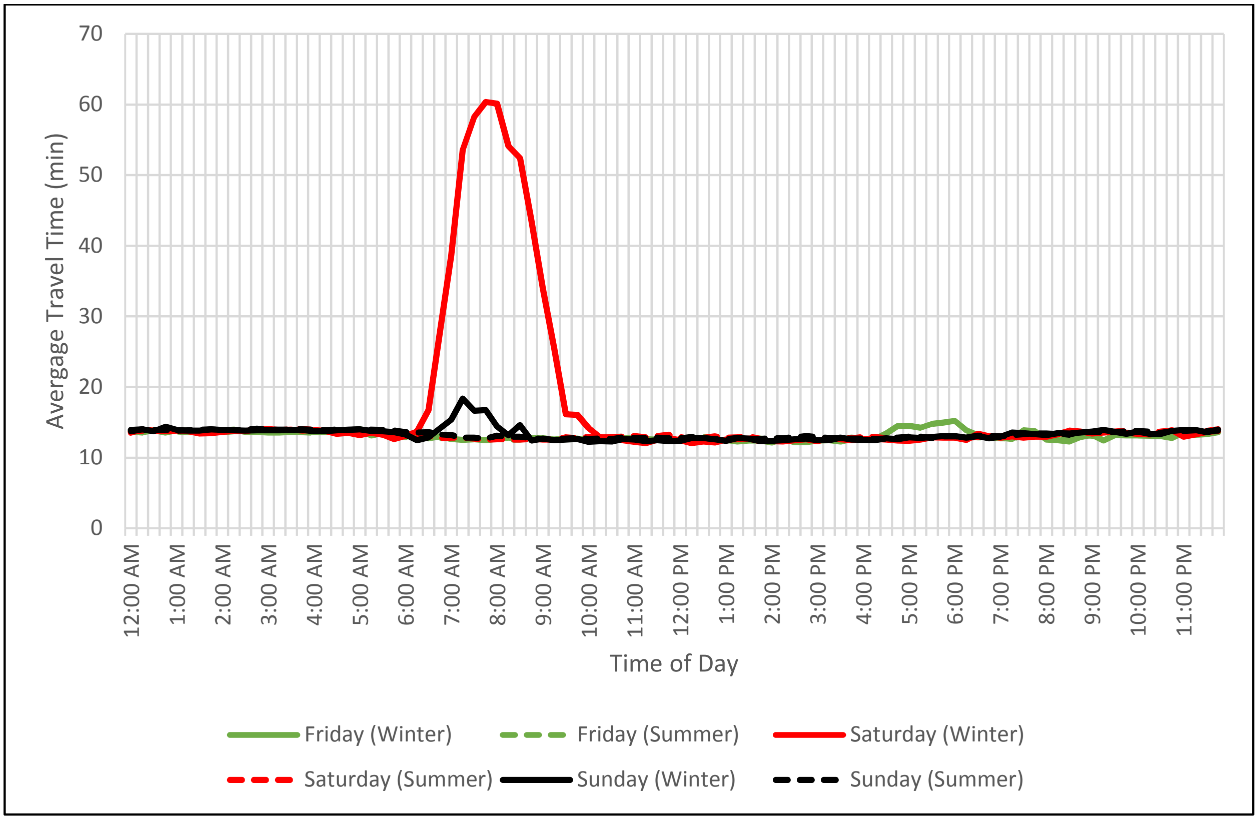
Exhibit 5: INRIX Data Processing Results

Season	Day	Percent of Data Removed as Outliers	Percent of Data Captured in One Standard Deviation of the Average (after the removal of outliers)
Winter, Westbound I-70	Fridays	9.8%	52.7%
	Saturdays	5.7%	57.2%
	Sundays	7.9%	55.2%
Winter, Eastbound I-70	Fridays	8.3%	54.7%
	Saturdays	4.9%	58.7%
	Sundays	7.5%	55.4%
Summer, Westbound I-70	Fridays	18.7%	38.4%
	Saturdays	17.4%	41.5%
	Sundays	15.9%	40.7%
Summer, Eastbound I-70	Fridays	13.3%	45.0%
	Saturdays	14.4%	43.3%
	Sundays	13.4%	44.9%

Using the refined data set, Exhibit 6 shows the westbound travel times for peak travel days in the winter months (January through March) and summer months (June through September) between July 31, 2016, and July 30, 2017. These months have similar daily and hourly volumes, as well as similar overall travel times. The months of April to May and October to December showed much lower traffic volumes and travel times.

The average westbound free-flow travel time (as estimated from Exhibit 6) is 13 to 14 minutes. The seasonal average travel time data indicate worse conditions on Saturdays compared to Fridays and Sundays. Saturday travel times reach a peak of approximately 60 minutes in the winter, which is about 5 times the typical 12 minute free-flow travel time. The average winter Saturday travel times remain above free-flow times between 6:00 a.m. and about 10:00 a.m. (four hours) and are more than double the 12-minute free-flow travel time for about three hours (6:30 a.m. to 9:30 a.m.). Overall, the other travel time peaks are lower compared to the winter Saturday travel times and the Saturday winter travel times represent the worst conditions for westbound I-70 traffic.

Exhibit 6. I-70 Westbound Average Travel Time for Peak Seasonal Days (MP 240 to MP 252)

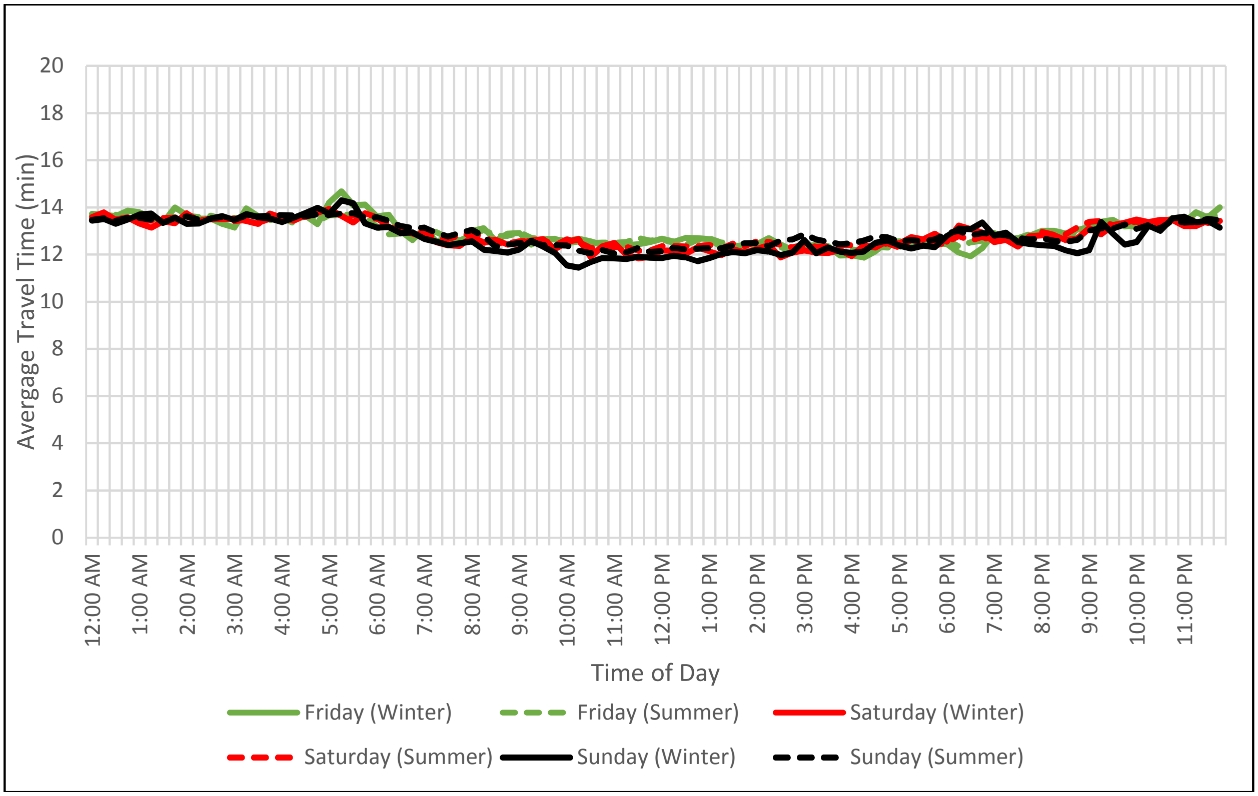


Note: Data are average of seasonal Fridays and Saturdays from July 31, 2016, to July 30, 2017. Winter is January through March and Summer is June through September. (Data Source: INRIX)

Exhibit 7 shows the travel times for eastbound I-70 on peak days (Friday through Sunday) for the stretch of I-70 between MP 240 and MP 252. Note that eastbound I-70 has a PPSL that operates on high-traffic days. It begins at Exit 232 (US 40/Empire/Granby) and terminates at Exit 241 (Idaho Springs/Colorado Boulevard). The PPSL transitions directly into a full time (24 hours/7 days a week) EL that continues east through the Veterans Memorial Tunnels and terminates at MP 243.5. The EL transitions directly into a GPL (free to all roadway users) at this location and the three GPLs continue east all the way to Denver. Eastbound I-70 does not have any locations where the number of lanes decrease, creating pinch points where congestion typically occurs.

As shown in Exhibit 7, the free-flow eastbound travel time from MP 240 to MP 252 is about 12 to 13 minutes. Generally, travel times for the peak days (both winter and summer) do not deviate much from the free-flow conditions. Based on travel times, there are not clear days or periods that represent the worst conditions for eastbound I-70. An analysis of the traffic volumes on I-70, which is discussed in the next section, was also completed to determine the worst conditions for eastbound I-70.

Exhibit 7. I-70 Eastbound Average Travel Time for Peak Seasonal Days (MP 240 to MP 252)



Note: Data are average of seasonal Fridays, Saturdays, and Sundays from July 31, 2016, to July 30, 2017. Winter is January through March and Summer is June through September. (Data Source: INRIX)

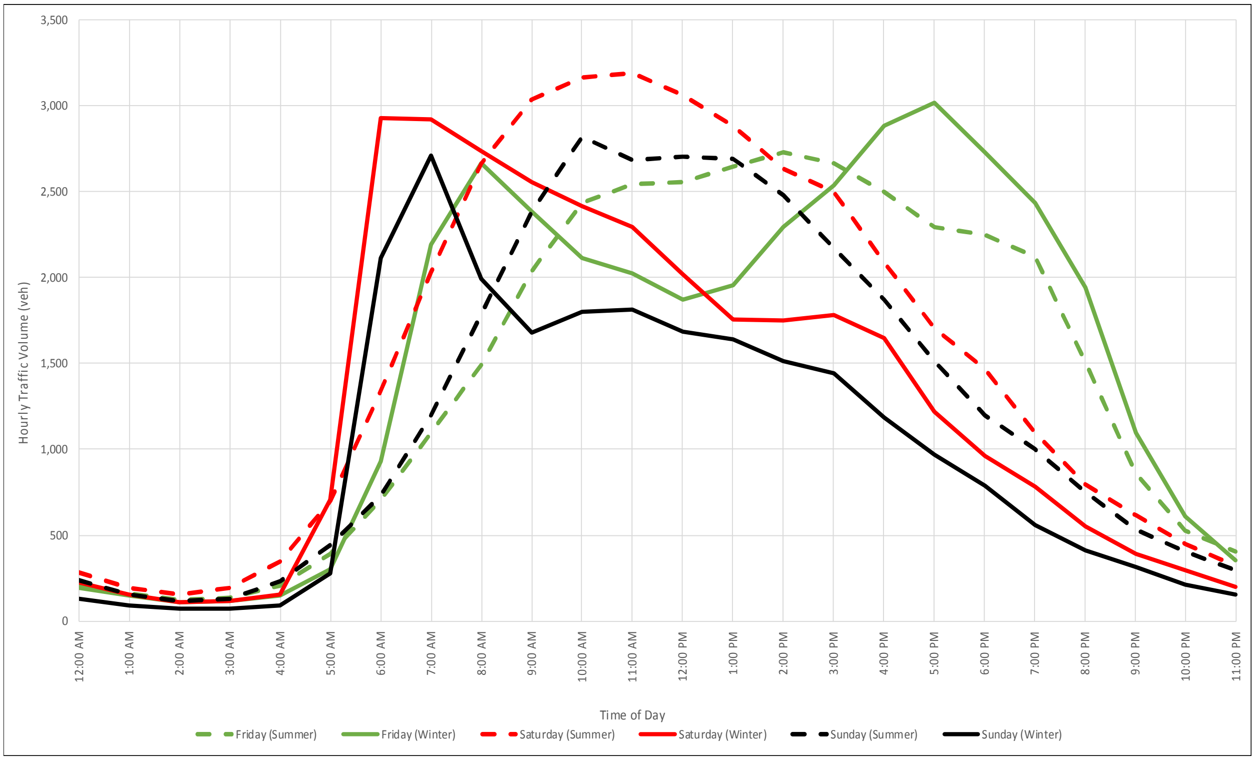
Volume Analysis

Exhibit 8 and Exhibit 9 show the hourly westbound traffic volumes at the CDOT count locations within the traffic analysis study area. Exhibit 8 shows traffic volume data from a counter located near Exit 243 (Hidden Valley/Central City) for peak seasonal Fridays, Saturdays, and Sundays. At this location, there are two lanes on westbound I-70. The winter volumes peak in the morning on Saturday and in the evening on Friday at about 2,900 vehicles per hour (vph) in all lanes, while the Sunday counts are lower during both seasons. The summer counts reach about 3,200 vph on Saturdays, while the other days have lower peaks.

Exhibit 9 is from a counter located near Exit 254 (Genesee), which is just east of the project limits. At this location, there are three lanes on westbound I-70. The volume patterns are very similar to the Hidden Valley location, but with volumes peaking near 3,700 vph or about 800 vph more than the Hidden Valley location. The Genesee location, which has three lanes, can process more vehicles than the Hidden Valley location, which has only two lanes. This difference, combined with the very sharp increase in volume during the early morning hours on a winter Saturday, results in the congestion that was observed in the travel time data. The other days have lower volume peaks or experience a more gradual increase in volumes that the roadway can process better without experiencing congestion. Therefore, winter Saturdays were selected as the peak westbound period for modeling and analysis.

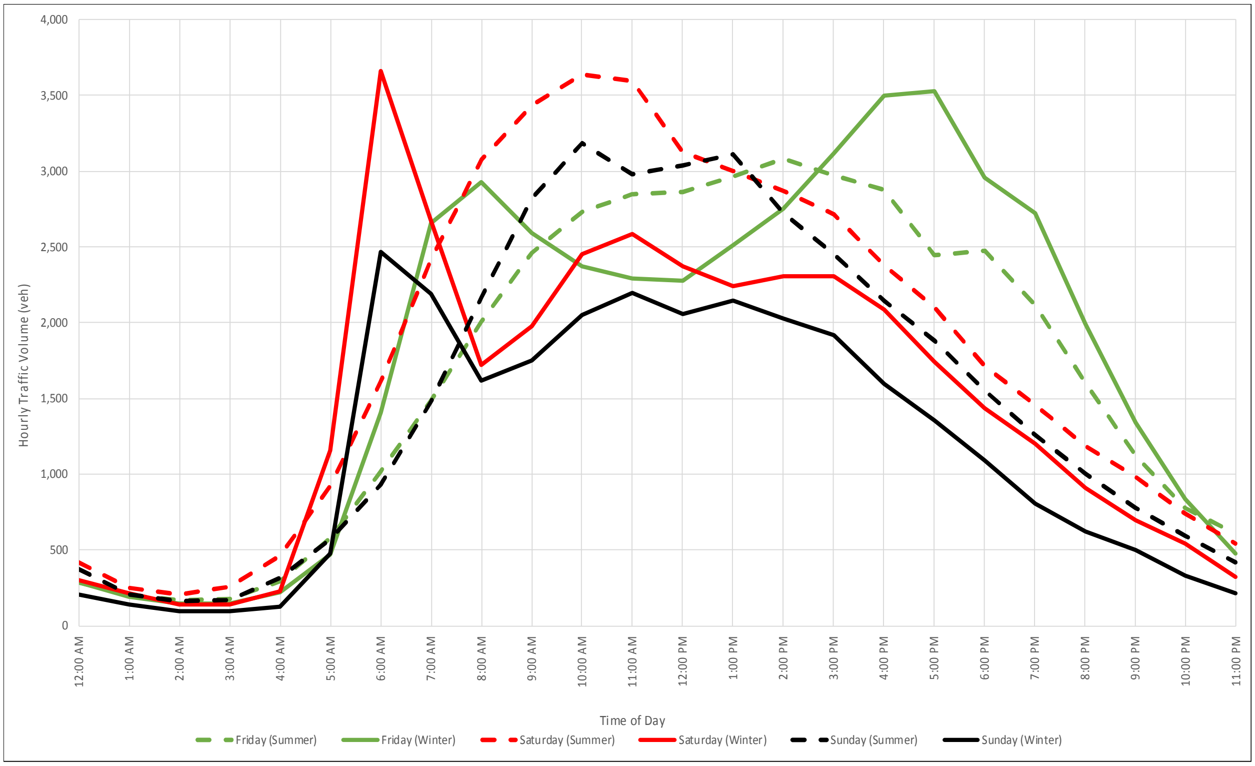
Note that the volumes on winter Saturdays (Exhibit 8) appear to flat line near 3,000 vph during the morning hours. This is consistent with the counts representing service flows at this location and not true demand volume, most likely due to an upstream bottleneck. Since the project developed hourly origin-destination trip tables based on traffic counts collected in 2018, the trip tables used in the micro-simulation were adjusted to represent demand volumes versus service flows during the peak time. This will be discussed in more details later in this memorandum in the *Traffic Data and Volumes* section. The same condition does not to occur in the other volume exhibits.

Exhibit 8. I-70 Westbound Average Traffic Volumes—Near Exit 243 (Hidden Valley/Central City)



Note: Data are average of seasonal Fridays, Saturdays, and Sundays from July 31, 2016, to July 30, 2017. Winter is January through March and Summer is June through September. (Data Source: CDOT traffic data)

Exhibit 9. I-70 Westbound Average Traffic Volumes—Near MP 254 (Genesee)

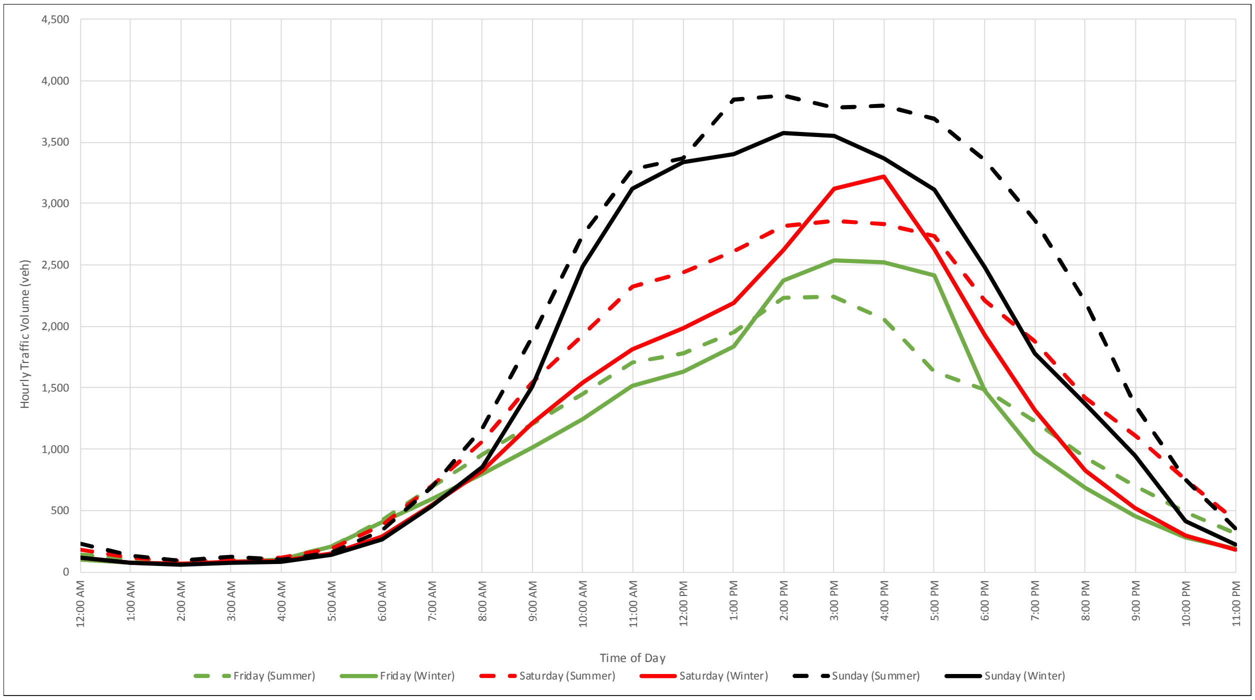


Note: Data are average of seasonal Fridays, Saturdays, and Sundays from July 31, 2016, to July 30, 2017. Winter is January through March and Summer is June through September. (Data Source: CDOT traffic data)

Exhibit 10 and Exhibit 11 show the hourly eastbound traffic volumes from two CDOT count locations within the traffic analysis study area. Exhibit 10 shows traffic volume data from a counter located near Exit 243 (Hidden Valley/Central City) for peak seasonal Fridays, Saturdays, and Sundays. Exhibit 11 data are from a counter located near Exit 254 (Genesee), which is just east of the project limits. Both locations show very similar patterns, with Sunday volumes being highest and Friday volumes the lowest. Saturday volumes typically are in between the other days. Since I-70 has three eastbound lanes at both locations, the peaking volumes are similar at both locations: Sunday volumes peak near 4,000 vph, Saturday volumes peak near 3,300 vph, and Friday volumes peak below these values. Therefore, summer Sundays were selected as the peak eastbound period for modeling and analysis.

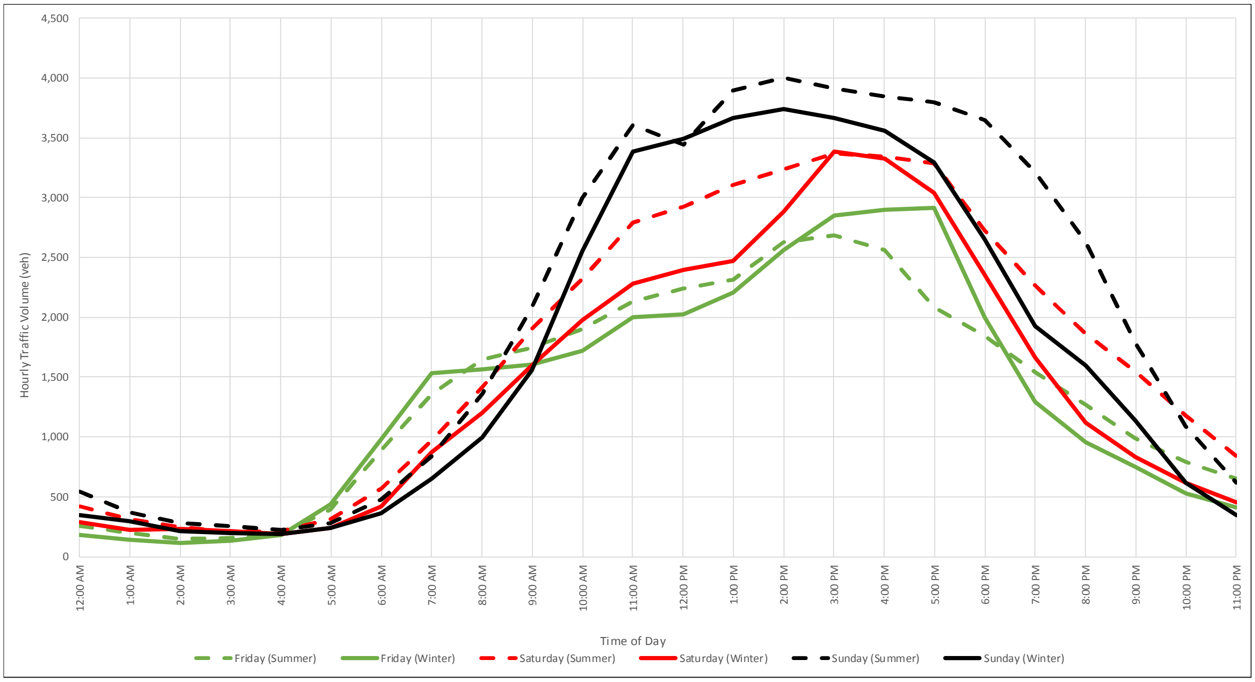
Note that the volumes at the Genesee location typically are higher than the Hidden Valley location because it is located downstream of Exit 252 (State Highway [SH] 74/Evergreen Parkway) which is a major access point to I-70. Also note that the travel time data did not show any indication of congestion on eastbound I-70, meaning the existing facility can reasonably process the current peak volumes through the project limits.

Exhibit 10. I-70 Eastbound Average Traffic Volumes—Near Exit 243 (Hidden Valley/Central City)



Note: Data are average of seasonal Fridays, Saturdays, and Sundays from July 31, 2016, to July 30, 2017. Winter is January through March and Summer is June through September. (Data Source: CDOT traffic data)

Exhibit 11. I-70 Eastbound Average Traffic Volumes—Near MP 254 (Genesee)



Note: Data are average of seasonal Fridays, Saturdays, and Sundays from July 31, 2016, to July 30, 2017. Winter is January through March and Summer is June through September. (Data Source: CDOT traffic data)

Summary

The volume and travel time data together indicate westbound I-70 does experience the highest degree of recurring congestion on winter Saturdays. The other peak weekend days may have higher volumes, but they do not experience the same level of recurring congestion as shown in the travel time data. In reviewing the volume graphs, winter Saturday mornings experience a rapid increase in westbound I-70 traffic, while the other days experience more gradual growth in traffic over longer time periods. The travel time data for eastbound I-70 does not show significant differences in the level of congestion for the peak days. However, eastbound traffic volumes are highest on summer Sundays. To best evaluate the operations of I-70 and the benefits/impacts of the improvements that will be proposed in the EA, separate models based on winter Saturdays and summer Sundays were developed for evaluating the peak congestion periods for westbound and eastbound I-70.

Modeling Area

The traffic analysis models were developed to include sufficient area to allow for the complete analysis of I-70 through the EA project limits. The modeling area also includes enough of the local roadway system (non-interstate) to effectively evaluate the routes that provide drivers with the opportunity to divert around possible bottlenecks on I-70. This section discusses the transportation network elements that make up the traffic analysis modeling area.

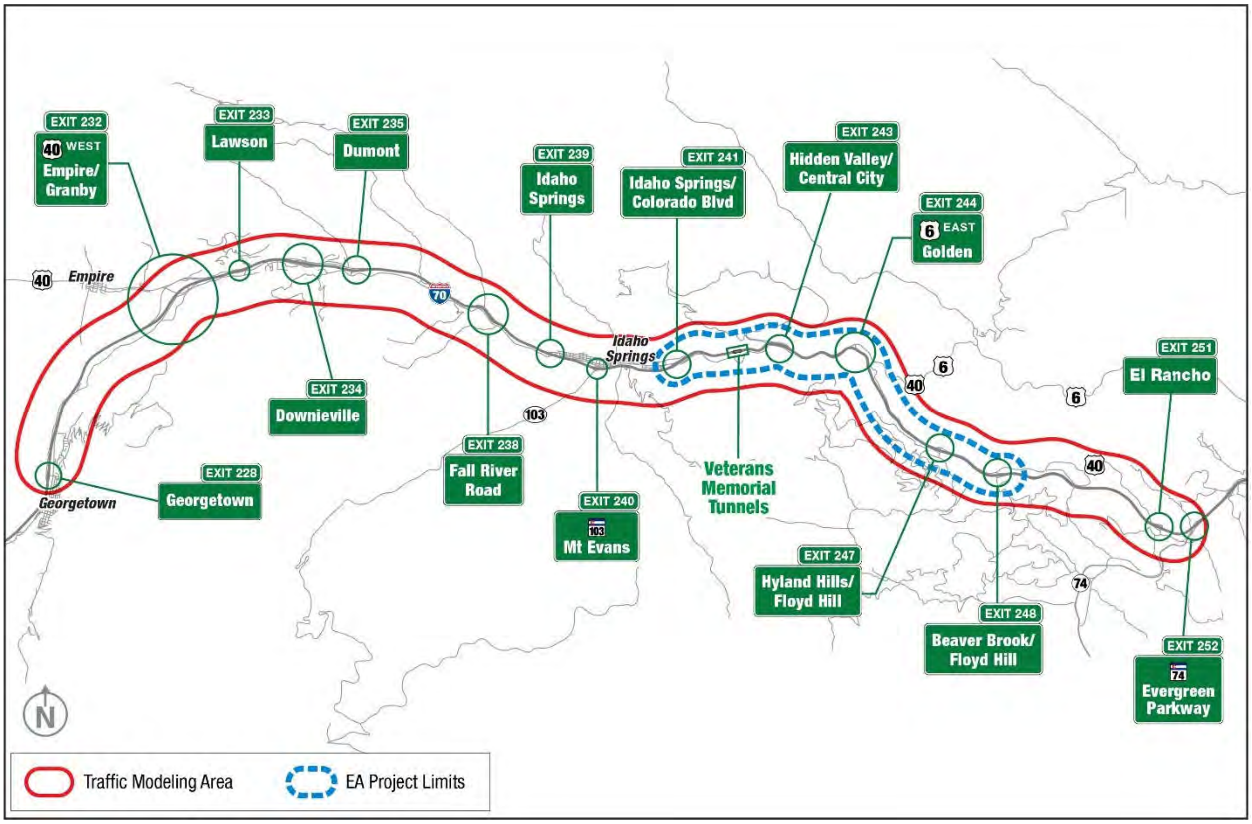
Modeling Limits

The EA is evaluating improvements to I-70 between Exit 241 (Idaho Springs/Colorado Boulevard) and Exit 248 (Beaver Brook/Floyd Hill). As a starting point, the modeling area encompassed these limits. However, the overall size of the modeling area also considered the following recommendations/guidelines:

- The modeling area was made up of enough of the transportation network elements to satisfy the requirements of completing the necessary analysis for an anticipated Interstate Access Request (IAR). Thus, the modeling area includes at least one interchange in each direction beyond the area of the anticipated EA improvement or between Exit 241 (Idaho Springs/Colorado Boulevard) and Exit 248 (Beaver Brook/Floyd Hill). To satisfy this requirement, the models were expanded one interchange in each direction to include Exit 240 (SH 103/Mt Evans) and Exit 251 (El Rancho). However, since El Rancho is only half of a split diamond interchange, the model was expanded to include the other half of the split diamond or Exit 252 (SH 74/Evergreen Parkway).
- An IAR analysis typically includes adequate amount of the surface street network to effectively evaluate and identify possible impacts to the local roadway systems. In urbanized areas, this typically means inclusion of the ramp junctions and one signalized intersection in each direction of travel on all major intersecting roadways. The modeling area for this EA was expanded to include all ramp junctions and intersections that are within 500 feet of the ramps.
- The local roadway network does provide opportunities for diversion around congestion on I-70 through a system of frontage roads that travel parallel to I-70 between Exit 228 (Georgetown) and Exit 252 (SH74/Evergreen Parkway). These frontage roads are continuous between Exit 228 (Georgetown) and Exit 243 (Hidden Valley/Central City), and then again between Exit 244 (US 6/Golden) and Exit 252 (SH 74/Evergreen Parkway). There is only the small section between Exit 243 (Hidden Valley/Central City) and Exit 244 (US 6/Golden) that does not currently have a frontage road connection, but the EA is evaluating the addition of a frontage road to fill in this gap. Therefore, the modeling area was expanded to include the full frontage road system between Exit 228 (Georgetown) and Exit 252 (SH 74/Evergreen Parkway).

Based on the EA project limits, the recommendations for completing an IAR, and the location of the frontage roads (due to their ability to act as diversionary routes to I-70), the modeling area encompasses both directions of I-70 and local transportation network elements (frontage road and intersections) between Exit 228 (Georgetown) and Exit 252 (SH 74/Evergreen Parkway). The traffic modeling area is shown in Exhibit 12.

Exhibit 12. Traffic Modeling Area



Existing (2018) Transportation Network Elements within the Modeling Area

In anticipation of completing an IAR, to evaluate the impacts to the local roadway network, and to capture the possible diversion routes, the modeling area was developed with the following existing elements (as shown in Exhibit 13 and Exhibit 14):

- Eastbound/westbound I-70 from just west of Exit 228 (Georgetown) to just east of Exit 252 (SH 74/Evergreen Parkway)
- The following major connecting roadways:
    - Evergreen Parkway/SH 74
    - County Road (CR) 65
    - US 6
    - SH 103
    - US 40
    - Central City Parkway

- The following interchanges:
    - Exit 228—Georgetown
    - Exit 232—US 40/Empire/Granby
    - Exit 233—Lawson
    - Exit 234—Downieville
    - Exit 235—Dumont
    - Exit 238—Fall River Road
    - Exit 239—Idaho Springs
    - Exit 240—SH 103/Mt Evans
    - Exit 241—Idaho Springs/Colorado Boulevard
    - Exit 243—Hidden Valley/Central City
    - Exit 244—US 6/Golden
    - Exit 247—Hyland Hills/Floyd Hill
    - Exit 248—Beaver Brook/Floyd Hill
    - Exit 251—El Rancho
    - Exit 252—SH 74/Evergreen Parkway
- All ramp junction intersections at the interchanges and additional major intersections along the frontage roads and surface streets
- The complete frontage road/parallel roadway system from Evergreen Parkway to Georgetown, including:
    - US 40 between Exit 252 (SH 74/Evergreen Parkway) and Exit 244 (US 6/Golden)
    - East Idaho Springs Road (CR 314) between Exit 243 (Hidden Valley/Central City) and Exit 241 (Idaho Springs/Colorado Boulevard)
    - Colorado Boulevard between Exit 239 (Idaho Springs) and Exit 241 (Idaho Springs/Colorado Boulevard)
    - Stanley Road between Exit 235 (Dumont) and Exit 239 (Idaho Springs)
    - CR 308 between Exit 232 (US 40/Empire/Granby) and Exit 235 (Dumont)
    - CR 306 (Alvarado Road/Argentine Street) between Exit 228 (Georgetown) and Exit 233 (Lawson)
- The eastbound PPSL located between Exit 232 (US 40/Empire/Granby) and Exit 241 (Idaho Springs/Colorado Boulevard), including:
    - Ingress at Exit 232 (US 40/Empire/Granby)
    - Egress located west of Exit 239 (Idaho Springs)
    - Egress at Exit 241 (Idaho Springs/Colorado Boulevard)
- The eastbound EL between Exit 241 (Idaho Springs/Colorado Boulevard) and MP 243.5 (just east of Exit 243 [Hidden Valley/Central City]), including:
    - Ingress at Exit 241 (Idaho Springs/Colorado Boulevard)
    - End of lane at MP 243.5

Exhibit 13. Existing (2018) Transportation Network Elements in Modeling Area (1 of 2)

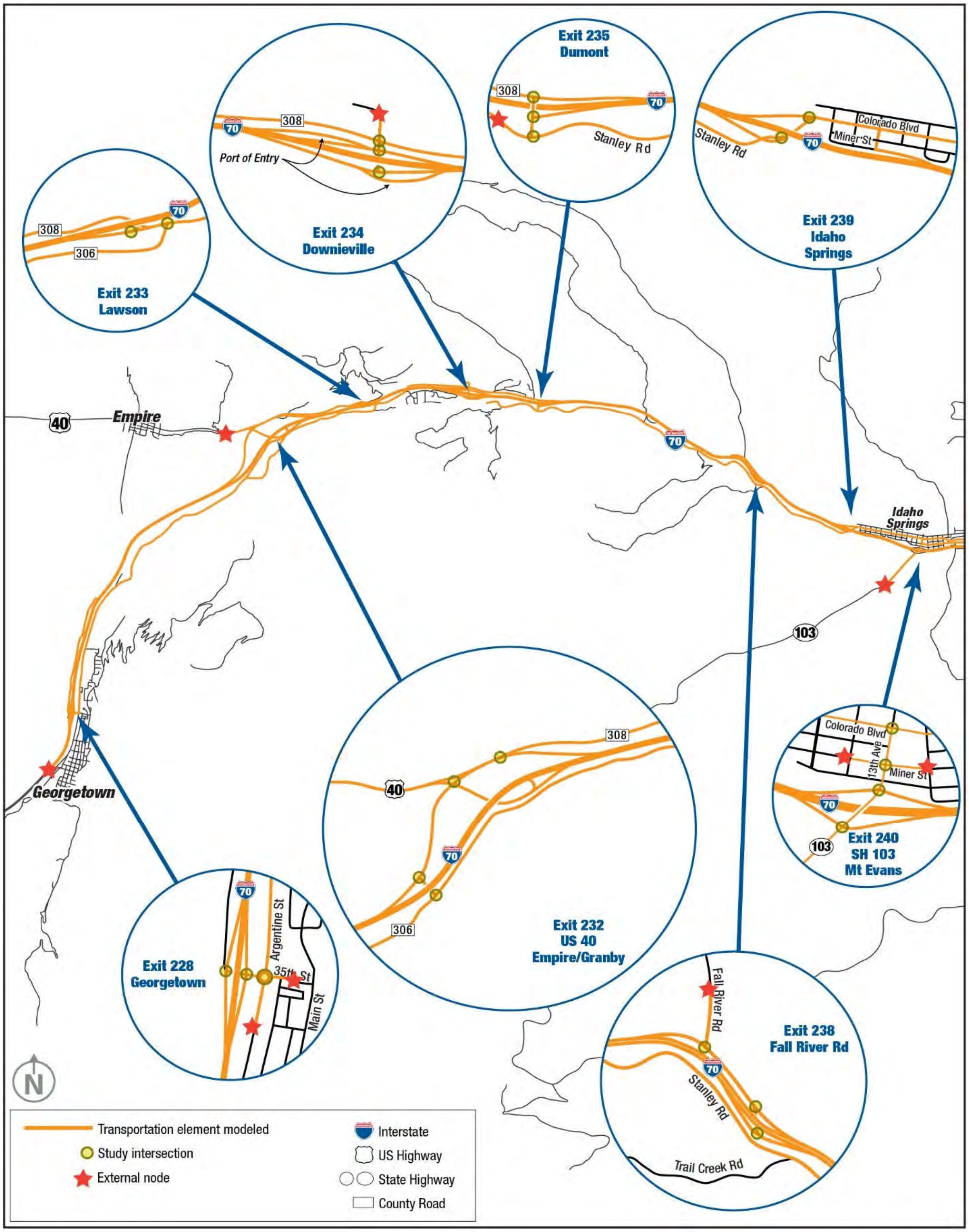
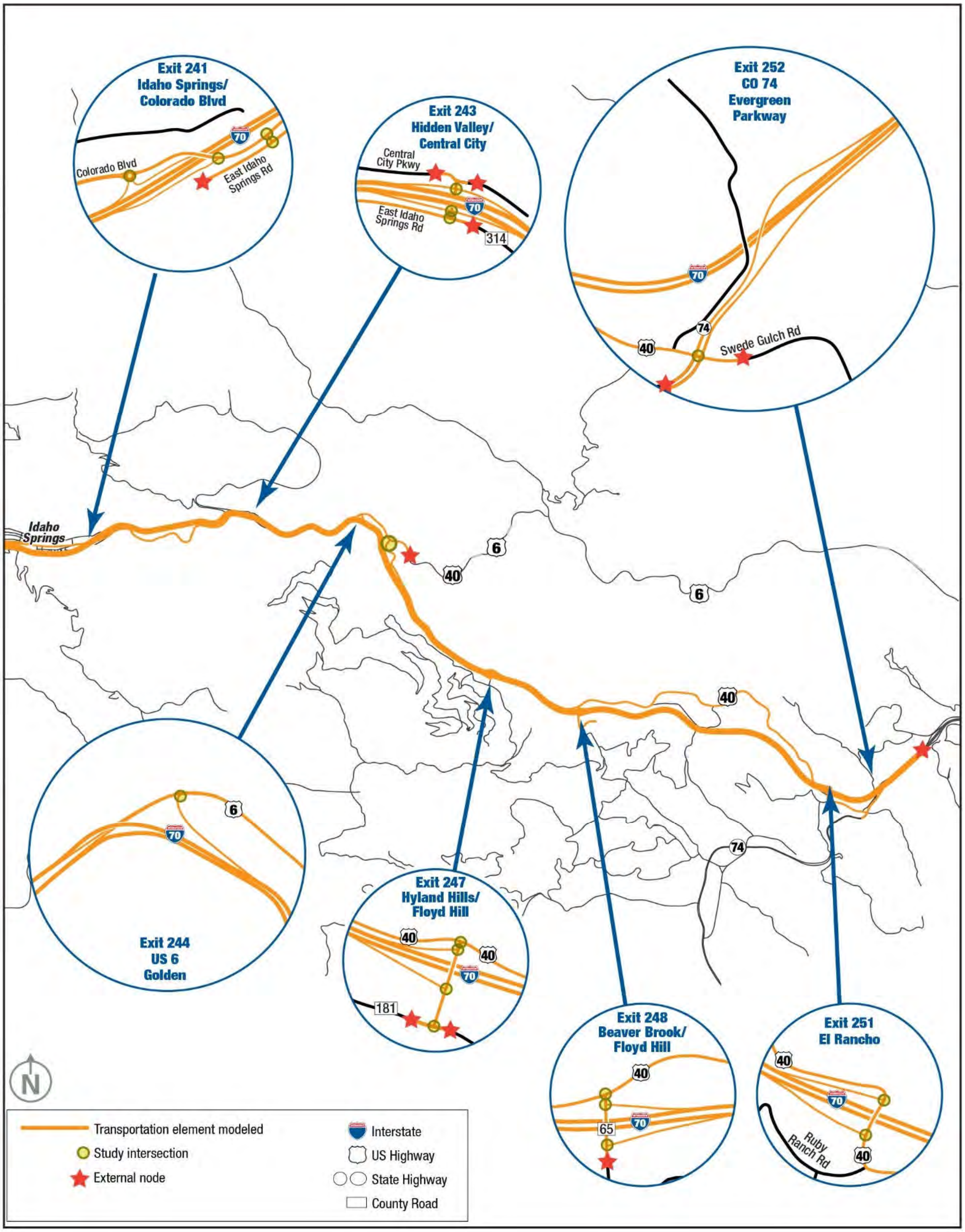


Exhibit 14. Existing (2018) Transportation Network Elements in Modeling Area (2 of 2)



Analysis Conditions

In addition to Existing Conditions (2018), the study will include analysis of the expected Horizon Year (2040) conditions and the planned Opening Year (2025) conditions. The following is list of the conditions that will be analyzed:

- 2018 Existing Conditions
- 2040 Horizon Year No-Action Alternative
- 2040 Horizon Year Proposed Action
- 2025 Opening Year No-Action Alternative
- 2025 Opening Year Proposed Action

The first step in analyzing the future conditions is to modify the existing transportation network to reflect projects that are planned for construction. CDOT is currently in the process of programming an extension of Fall River Road (Exit 238) crossing Clear Creek and connecting to the frontage road south of I-70 (also known as CR 312 or Stanley Road). According to CDOT, this project will be constructed in 2019; thus, this roadway network modification will be considered in all future conditions analyses (2025 and 2040).

Another project will add a left-side westbound PPSL on I-70 between the Veterans Memorial Tunnels and Exit 232 (US 40/Empire/Granby). According to CDOT, this project is already programmed and will be operational before 2025, but the long-term operations beyond 2035 are uncertain. With the addition of the westbound PPSL, drivers would have an option to pay a fee to access the lane during the peak traffic times. The westbound PPSL project plans to have the lane start at the east portal of the Veterans Memorial Tunnels and continue to just west of Exit 232 (US 40/Empire/Granby). In addition to the initial ingress at the east portal of the Veterans Memorial Tunnels, there would be an ingress just west of Exit 239 (Idaho Springs), an egress just east of Exit 232 (US 40/Empire/Granby), and a final egress just west of the US 40 interchange area where the westbound PPSL will end. The westbound PPSL would only be open on peak travel days and would be managed through tolls that would be flexible to change based on prevailing traffic conditions, as with the current operations of the eastbound PPSL. The existence or lack of a westbound PPSL may have a significant impact on the operations of and congestion levels on I-70, which in turn may impact the level of traffic that would choose to divert on the local street network to avoid the congestion on I-70. The 2040 Horizon Year Proposed Action analyses will consider a transportation network where both PPSLs (eastbound and westbound) are operational and one where both PPSLs are not operational.

Each of the analysis models that will be evaluated are discussed in more detail in the following sections.

2018 Existing Conditions

The traffic data collected during the winter (January) and summer (June) of 2018 will be used to create Existing Conditions for the EA.

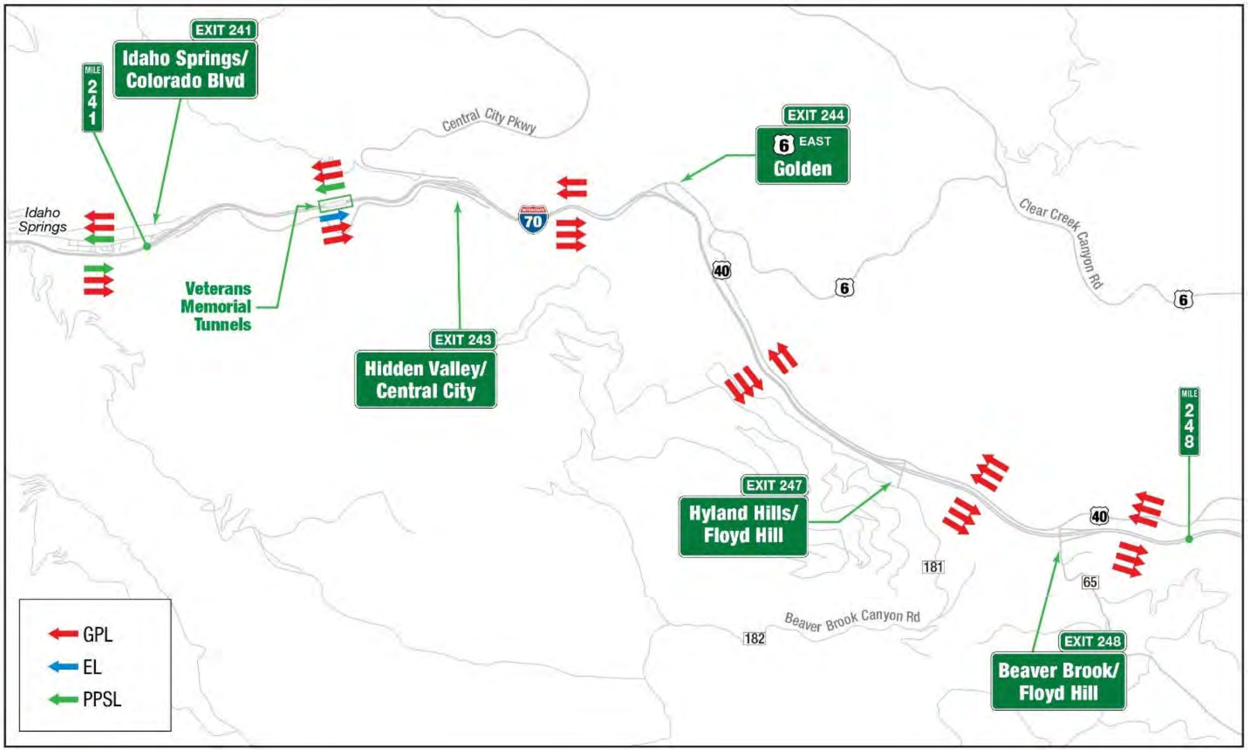
2040 Horizon Year No-Action Alternative

Based on an existing memorandum of understanding for the I-70 corridor, it is yet to be determined if either the eastbound PPSL or the westbound PPSL will continue operations beyond 2035. Thus, the traffic analysis models for the 2040 Horizon Year No-Action Alternative conditions will consider a transportation network where both PPSLs are operational and another transportation network where neither of the PPSLs are operational.

PPSLs in Operation

With the PPSLs in operation, the 2040 Horizon Year No-Action Alternative conditions analysis model will include two GPLs plus a PPSL on westbound I-70 between the Veterans Memorial Tunnels and Exit 232 (US 40/Empire/Granby). East of the Veterans Memorial Tunnels, the westbound I-70 configuration will remain the same as the Existing Conditions. Eastbound I-70 remains the same as the Existing Conditions, including the location of the existing eastbound PPSL and the eastbound EL. The number and type of lanes that will be analyzed in the 2040 No-Action Alternative conditions when both PPSLs are operational are shown in Exhibit 15.

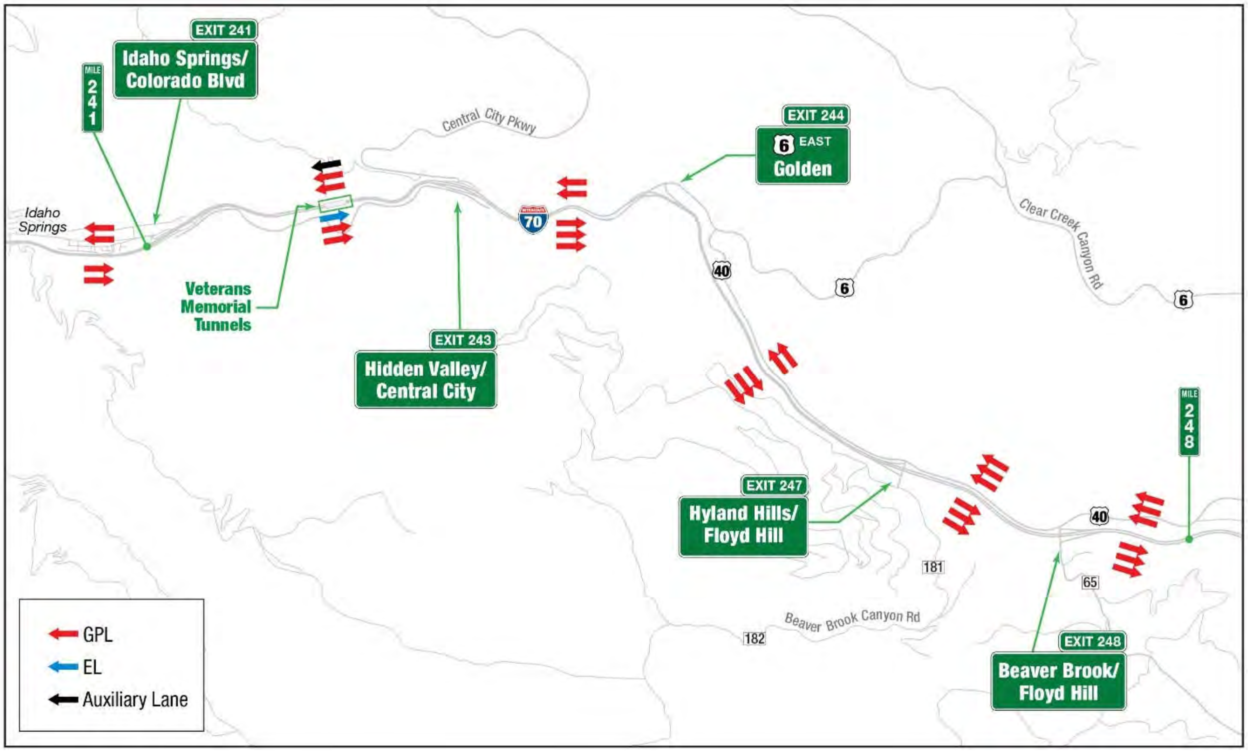
Exhibit 15. 2040 Horizon Year No-Action Alternative with PPSLs



PPSLs not in Operation

The analysis of the 2040 Horizon Year No-Action Alternative conditions when both PPSLs are not operational considers eastbound I-70 with only two GPLs between Exit 232 (US 40/Empire/Granby) and Exit 241 (Idaho Springs/Colorado Boulevard). East of Exit 241 (Idaho Springs/Colorado Boulevard), eastbound I-70 would be the same as the Existing Conditions. Westbound I-70 will remain the same as the Existing Conditions across the entire analysis area except for the section of highway between the Veterans Memorial Tunnels and Exit 241 (Idaho Springs/Colorado Boulevard). There will be sufficient pavement on westbound I-70 to have three total lanes through the Veterans Memorial Tunnels and west to Exit 241 (Idaho Springs/Colorado Boulevard). The assumption is that the roadway will have two westbound GPLs plus an auxiliary (exit) lane starting at the east portal of the Veterans Memorial Tunnels and continuing west to Exit 241 (Idaho Springs/Colorado Boulevard). At Exit 241 (Idaho Springs/Colorado Boulevard), the right lane (auxiliary lane) would become an exit-only lane (or trap lane) where traffic would exit onto Colorado Boulevard. This would result in two GPLs continuing west of Exit 241 (Idaho Springs/Colorado Boulevard). The number and type of lanes that will be analyzed in the 2040 Horizon Year No-Action Alternative conditions when both PPSLs are not operational are shown in Exhibit 16.

Exhibit 16. 2040 Horizon Year No-Action Alternative without PPSLs



2040 Horizon Year Proposed Action Conditions

The 2040 Horizon Year Proposed Action conditions will update the roadway system from the 2040 Horizon Year No-Action Alternative conditions to reflect the proposed improvements from the EA, which may include:

- Addition of a westbound I-70 lane (type of lane to be determined as part of 2040 Horizon Year Proposed Action analysis) between Exit 248 (Beaver Brook/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard)
- New interchange access (including removal or combining of existing access) to and from both westbound and eastbound I-70, potentially including the Exit 243 (Hidden Valley/Central City), Exit 244 (US 6/Golden), and Exit 248 (Beaver Brook/Floyd Hill) interchanges
- Realignment of one or both directions of I-70 to flatten out curves and reduce grades where possible
- Addition of an eastbound climbing/auxiliary lane between Exit 244 (US 6/Golden) and Exit 247 (Hyland Hills/Floyd Hill)
- New intersection configurations and/or types of control at intersections along US 40, at Exit 243 (Hidden Valley/Central City), at Exit 244 (US 6/Golden), at Exit 247 (Hyland Hills/Floyd Hill), and at Exit 248 (Beaver Brook/Floyd Hill)
- New frontage roads or parallel roadways between Exit 243 (Hidden Valley/Central City) and Exit 244 (US 6/Golden)

The analysis models for the 2040 Horizon Year Proposed Action conditions will consider a transportation network where both PPSLs are operational and another transportation network where neither of the PPSLs are operational, as described in the following sections.

PPSLs in Operation

The first analysis model assumes the eastbound PPSL and the westbound PPSL are operational in 2040. The analysis will include two GPLs plus a PPSL in the westbound direction of I-70 between Exit 241 (Idaho Springs/Colorado Boulevard) and Exit 232 (US 40/Empire/Granby). The model also will include a total of three westbound lanes from the eastern limits of the modeling area up to Exit 241 (Idaho Springs/Colorado Boulevard). The westbound lanes will be three GPLs between the eastern limits of the model and Exit 247 (Hyland Hills/Floyd Hill). There will be two GPLs plus one additional lane from Exit 247 (Hyland Hills/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard). The analysis will determine if this additional lane is a GPL or EL and how the lanes interact/connect with each other near Exit 247 (Hyland Hills/Floyd Hill) and Exit 241 (Idaho Springs/Colorado Boulevard). In general, eastbound I-70 remains the same as the Existing Conditions, including the location of the existing eastbound PPSL and the eastbound EL. The number and type of lanes that will be analyzed in the 2040 Horizon Year Proposed Action conditions when both PPSLs are operational are shown in Exhibit 17.

PPSLs not in Operation

The second 2040 Horizon Year Proposed Action conditions analysis model assumes that neither of the PPSLs are operational. In this analysis model, the number of westbound lanes to be analyzed is identical to 2040 Horizon Year Proposed Action with Lane Option 1 except the eastbound PPSL and westbound PPSL are removed west of Exit 241 (Idaho Springs/Colorado Boulevard). The number and type of lanes that will be analyzed in the 2040 Horizon Year Proposed Action conditions when both PPSL are not operational are shown in Exhibit 18.

Exhibit 17. 2040 Horizon Year Proposed Action with PPSLs

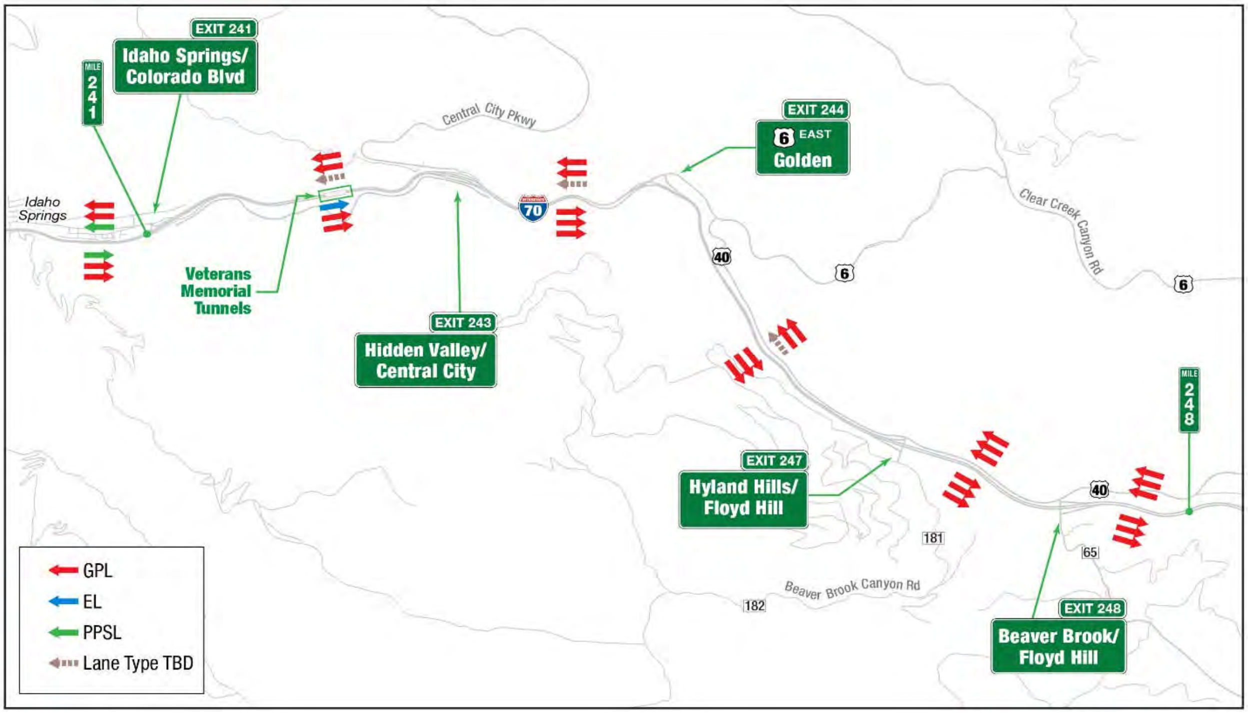
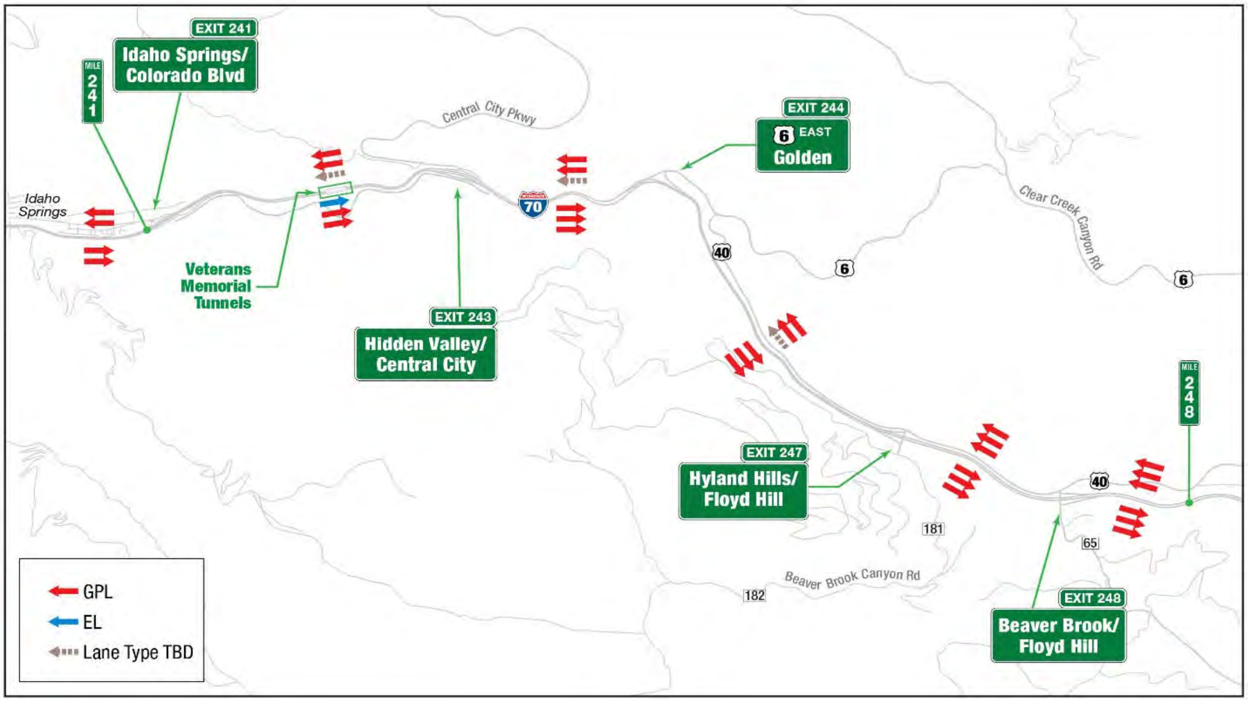


Exhibit 18. 2040 Horizon Year Proposed Action without PPSLs



2025 Opening Year No-Action Alternative

The 2025 Opening Year No-Action Alternative conditions will include both PPSLs. The number and type of lanes that will be analyzed for the 2025 Opening Year No-Action Alternative conditions will be the same as the 2040 Horizon Year No-Action Alternative and are shown Exhibit 15.

2025 Opening Year Proposed Action

The 2025 Opening Year Proposed Action conditions will include both PPSLs and all roadway improvements as identified as part of the Proposed Action. The number and type of lanes for this analysis will be the same as the 2040 Horizon Year Proposed Action with PPSL as shown in Exhibit 17.

Sensitivity Analyses

There may be a need to evaluate other traffic growth scenarios, including latent/induced demand, that may result in changes to traffic volumes using the I-70 Mountain Corridor. In addition, there may be a need to complete a sensitivity analysis that evaluates different diversion patterns within the study area. The following examples provide a brief discussion of the anticipated sensitivity analyses that may be completed as part of this study.

- The first sensitivity analysis could evaluate the potential latent/induced traffic demand for I-70 that may occur with the reduction of the bottleneck that is currently occurring near Floyd Hill. This sensitivity analysis assumes that a third lane is added to westbound I-70 between the top of Floyd Hill to US 40 in some combination of GPL, EL, and/or PPSL. The study may consider a scenario where traffic using I-70 could reach the capacity of the highway (creating LOS E/F conditions) in the future years. Based on the projected traffic volumes, the project will identify the reserve capacity of I-70, if any, and assume that additional traffic demand will use up this available roadway capacity. An analysis of the potential impacts to the roadway network will be evaluated under these conditions.
- US 6 provides an alternative route to I-70 for the northwest front range and destinations west of Denver. Future roadway improvements, such as the Northwest Parkway, may result in additional development and increased demand for the US 6 route. The study may evaluate a future growth scenario specific to the US 6 route by examining a high-growth scenario for the traffic demand on this route. The study could consider a scenario where traffic using the US 6 highway will reach the capacity of the highway (creating LOS E/F conditions) in the future years. Based on the projected traffic volumes, the project will identify the reserve capacity of US 6, if any, and assume that additional traffic demand will use up this available capacity. An analysis of the potential impacts to the roadway network will be evaluated under these conditions.

Summary

In summary, Exhibit 19 shows the operational analyses that are anticipated to be completed to satisfy the current study and possibly an IAR in the future.

Exhibit 19. Operational Analyses to be Completed

Analysis Year	Analysis Models	Peak	PPSL Conditions	New Westbound Lane Type
2018	Existing Conditions	Westbound	Eastbound PPSL, but no westbound PPSL	N/A
		Eastbound		
2040 (Horizon Year)	No-Action Alternative	Westbound	Eastbound PPSL and westbound PPSL	N/A
			No eastbound PPSL or westbound PPSL	
		Eastbound	Eastbound PPSL and westbound PPSL	
			No eastbound PPSL or westbound PPSL	
2040 (Horizon Year)	Proposed Action	Westbound	Eastbound PPSL and westbound PPSL	GPL
				EL
			No eastbound PPSL or westbound PPSL	GPL
				EL
		Eastbound	Eastbound PPSL and westbound PPSL	GPL
				EL
			No eastbound PPSL or westbound PPSL	GPL
				EL
2025 (Opening Year)	No-Action Alternative	Westbound	Eastbound PPSL and westbound PPSL	N/A
		Eastbound		
2025 (Opening Year)	Proposed Action	Westbound	Eastbound PPSL and westbound PPSL	Note 1
		Eastbound		

1. Analysis will only evaluate final lane types as determined during the 2040 Horizon Year Proposed Action analysis.

Traffic Data and Volumes

The different traffic analysis models require traffic volumes to evaluate the operational conditions of I-70 and the other transportation network elements. This section describes the methodology that was used to develop existing and future traffic volumes.

Existing Data and Volumes

Traffic data were collected (see Exhibit 20 and Exhibit 21) within the traffic analysis area in 2018 on what was anticipated to be a typical winter Saturday in January 2018 and a typical summer Sunday in June 2018. The data collected included:

- Travel times for the I-70 corridor from INRIX
- 24-hour traffic counts for mainline I-70 at each end of the analysis area (including classification data)—a total of two locations
- 24-hour volume counts on all ramps (including classification data)—a total of 45 locations
- AM and PM peak hour turning movement counts at most ramp junctions and other study intersections within the study area—a total of 38 locations
- 24-hour volume counts on the major connecting roadways and at several locations along the frontage roads (including classification data)—a total of 19 locations

In addition, travel pattern data were collected using Bluetooth reading technology at some of the study area intersections, as shown in Exhibit 20 and Exhibit 21, to help identify overall travel patterns in the study area.

Origin-Destination Volume Development

Since the DRCOG regional travel demand model does not adequately represent the entire study area for weekend (non-commuter) trips, existing origin-destination volume trip tables were developed based on the collected traffic count data. Based on the count data, separate hourly origin-destination matrices were developed from 4:00 a.m. to 10:00 p.m. to represent the full extent of a typical winter Saturday and a typical summer Sunday. Mainline and ramp volumes on I-70 were balanced for each hour to create a baseline model. The increase in travel times during the peak hours prevents some trips from reaching their destinations within the same hourly period in which they are generated. This means the traffic counts during this time represent service flow and not demand volume. To correct for this, the ramp and mainline volumes downstream of the bottlenecks were increased to more accurate represent hourly demand volumes that are higher than the hourly count volumes. All ramp and mainline volumes that were increased during the hours experiencing the highest congestion were adjusted downward during the succeeding hours so that total daily volumes equal the collected ramp and mainline data. This process was repeated until the location and duration of congestion on I-70 was relatively replicated compared to INRIX travel times for the actual days of the data collection. The calibration process and targets for the comparison are discussed in more detail in the *Model Calibration* section of this memorandum.

Exhibit 20. Data Collection Locations and Types (1 of 2)

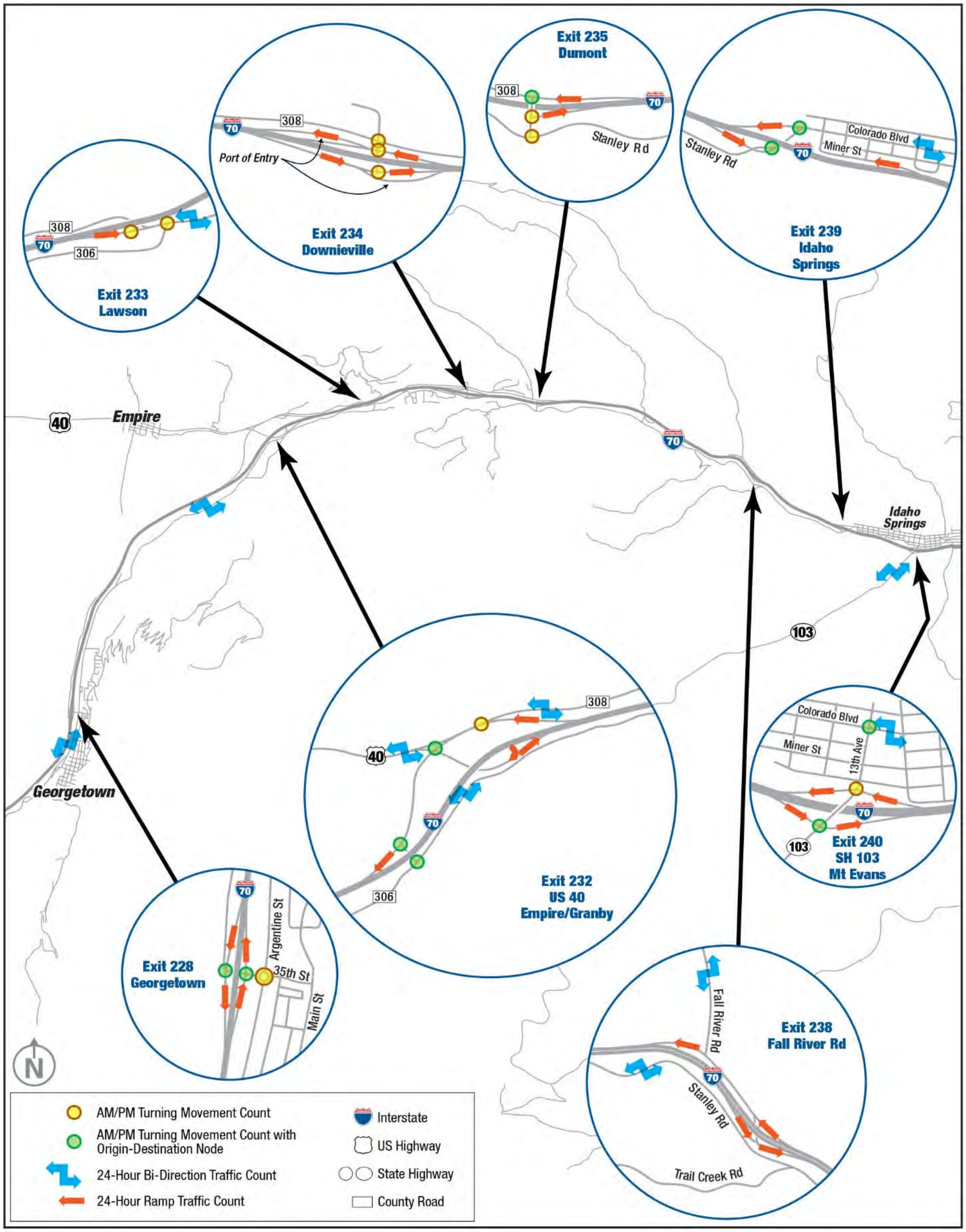
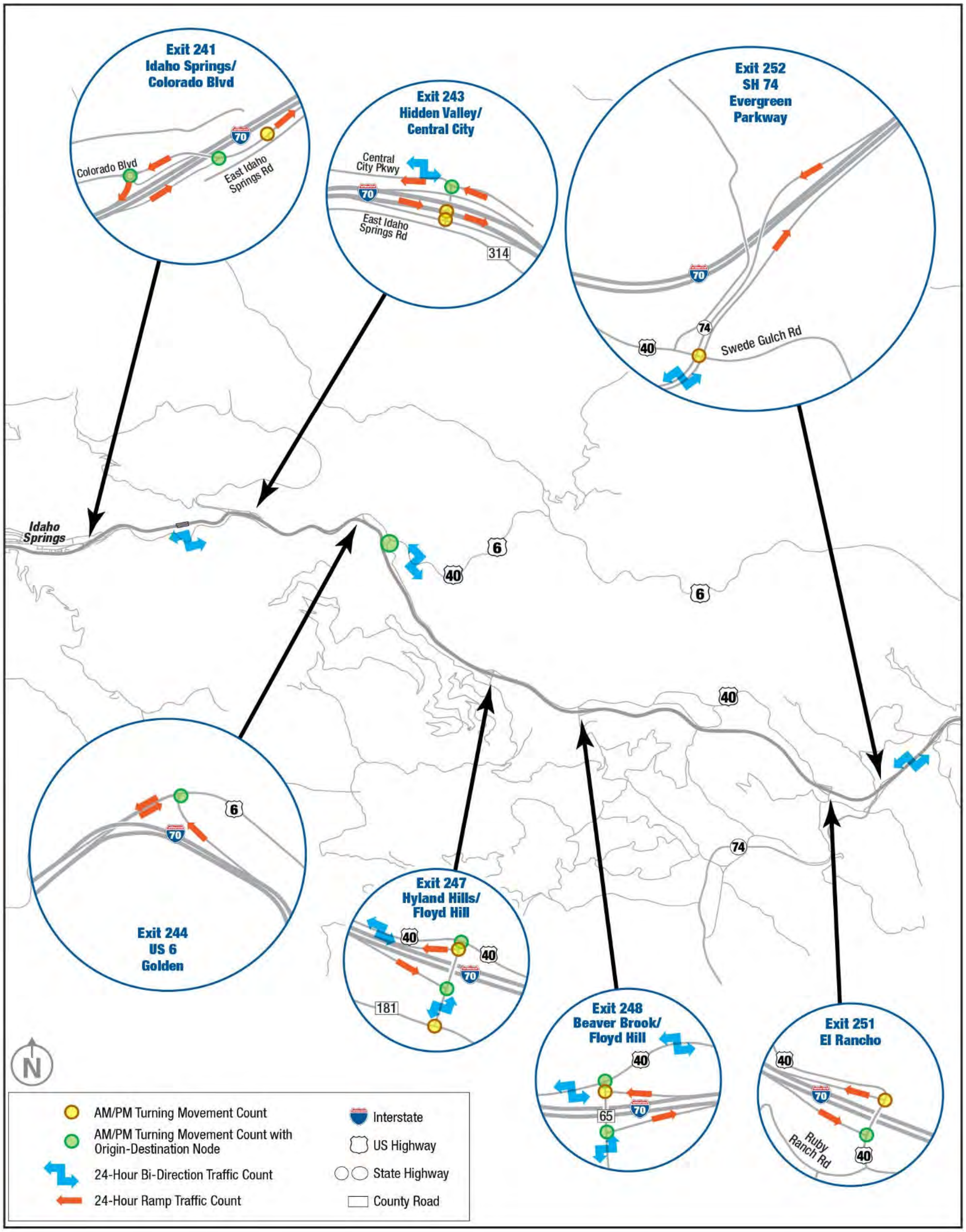


Exhibit 21. Data Collection Locations and Types (2 of 2)



Hourly volumes throughout the modeled area—including the balanced mainline and ramp volumes, frontage road volumes, and intersection turning movement ratios—were used to balance the network and develop hourly entering and exiting volumes for each external node, shown in Exhibit 13 and Exhibit 14. The final origin-destination matrices for input into TransModeler were created from the balanced external node volumes assuming that most trips within the modeled area either originate or terminate on I-70, US 40 to Empire, or US 6 to Golden. The model includes all volumes entering from and exiting at all local nodes, but the assumption is that most trips originating from local, low-volume external nodes do not terminate at another local, low-volume external node in the model. To reduce complexity, trips were modeled between local external nodes for trips ending or beginning at CR 65, Central City Parkway, SH 103, and Evergreen Parkway (SH 74), because these nodes have relatively high volumes compared to other local external nodes.

Traffic Projections

As previously discussed, there is not a TDM that can be used to develop projected future volumes for the study area. Thus, future volumes for both the Opening Year and Horizon Year analyses were developed based on applying a growth rate to the 2018 traffic volumes. Some previous studies and models that include growth rate information for the I-70 Mountain Corridor include:

- I-70 Programmatic Environmental Impact Statement (PEIS, 2011)
- Twin Tunnels EA (2012)
- I-70 Eastbound PPSL (2013)
- Traffic and Revenue Study (2014)
- Westbound PPSL (Ongoing)
- DRCOG 2040 TDM

These studies identified annual growth rates between 0.80 percent and 1.40 percent. A review of the CDOT traffic count location data shows there are two counters in or near the traffic analysis study area for this study. One is located at the Veterans Memorial Tunnels and the second is located near Genesee. Exhibit 22 summarizes the growth rate information from these count locations.

Exhibit 22. CDOT Growth Rate Data

Location	20-Year Factor	Annual Rate	2025 Growth Factor	2040 Growth Factor
Veterans Memorial Tunnels	1.24	1.08%	1.08	1.27
Genesee[1]	1.29	1.28%	1.09	1.32

Data Source: CDOT traffic data

1. Location is shown for reference only as only other continuous count station near the project limits.

The difference in growth factors is most likely due to the difference in number of lanes and capacity at each location, since the Veterans Memorial Tunnels location has fewer lanes (five total lanes—three eastbound and two westbound) than the Genesee location (six total lanes—three in each direction). The Genesee location also is located east of SH 74/Evergreen Parkway. Because this count location could be subject to the potential growth along this highway and population center, this location was used as a reference point only and was not considered in the development of a growth rate for projected future volumes on I-70.

To develop future volumes for this study, an annual growth rate of 1.08 percent will be used to project the Existing (2018) traffic volumes to the Opening Year (2025) and Horizon Year (2040) conditions. Using this value, the 2025 (Opening Year) growth factor is 1.08 and the 2040 (Horizon Year) growth factor is 1.27. These growth factors will be applied to the origin-destination tables created from the 2018 data collection efforts to develop future traffic projections for use in the modeling of future conditions within the traffic analysis area.

For the future years, the DTA capability of TransModeler will be used to best estimate how drivers make route choices through the transportation network. This will identify traffic volumes on the diversion routes and assist in the analysis of possible impacts to frontage roads and intersections within the project limits.

Model Calibration

The following is a discussion of the methodology that was used to calibrate the Existing Conditions models. The results of the calibration efforts are summarized in a separate memorandum, *Model Calibration Results*. The models were calibrated against the calibration targets presented in FHWA's *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software* (2004) using traffic volumes, travel times, and magnitude of congestion from specific peak seasonal days.

Note that since the onset of this project, when modeling calibration targets were established, CDOT has published their own set of calibration guidelines and targets. In general, CDOTs new guidelines match the FHWA guidelines being used for the calibration of the traffic analysis models for this project. Because CDOT's guidelines were not available at the onset of this project and because the new guidelines are like those already being followed, the project continued to use the FHWA guidelines and calibration targets. For reference, the new CDOT guidelines can be found in *CDOT's Traffic Analysis and Forecasting Guidelines* (July 2018).

It also is important to note that the models were not validated because the project did not collect an independent data set that is necessary to complete a such an effort.

Volumes

The Existing Conditions model was calibrated by comparing modeled volumes to collected/observed traffic volumes. The calibration was done for non-managed links (those that are free of charge) and for the PPSL/EL that currently exists on I-70.

Link Volumes

There are two methods for calibrating the model against collected traffic count data for non-managed lanes/links. The first approach evaluated how well the modeled traffic flows compare to the collected 2018 counts (balanced when appropriate/necessary). This was accomplished by using the percent root mean square error (%RMSE) method. The goal is to show low %RMSE values, which indicate the modeled volumes closely correspond to the counted volumes. The targets for the %RMSE approach are shown in Exhibit 23.

Next, the modeled traffic volumes were evaluated against FHWA's microsimulation calibration targets as presented in the *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*. This test compares the variation in modeled link volumes to the counted volumes based on a set of criteria and measures, as shown in Exhibit 23. When the volume comparisons from the %RMSE and/or the FHWA's calibration targets analysis were outside of the desired levels, then adjustments to the trip table volume inputs were made and the comparative analyses were repeated. The two calibration methods were applied to link volumes where counts were completed on I-70, entrance and exit ramps, US 6, US 40, Central City Parkway, CR 314, SH 103, Colorado Boulevard, and all frontage roads—including Stanley Road, CR 308, and Alvarado Road (CR 306). The volumes were evaluated during the AM peak period (winter Saturday) or PM peak period (summer Sunday) and across the entire modeled period (4:00 a.m. to 10:00 p.m.) for each day.

Exhibit 23. FHWA Calibration Targets for Link Flows

Roadway Classification	FHWA Target %RMSE
Freeway	±18%
Major Arterial	±37%
Collector	±77%
Ramp	±75%
All Roadways	±37%
Link Hourly Volume	**FHWA Criteria Target**
Counts < 700 vph	85% within 100 vehicles
700 vph < Counts 2,700 vph	85% within 15%
Counts > 2,700 vph	85% within 400 vehicles

PPSL/Express Lane Volumes

Eastbound I-70 currently has a PPSL/EL from US 40 to just west of US 6. Data from CDOT traffic data sources were gathered for the same day that field counts were collected in January 2018 and June 2018 to identify hourly and daily volumes using the PPSL/EL.

There are two primary variables that have an impact on the decision for vehicles to use the PPSL/EL in the model: price of the tolls and value of time. The eastbound PPSL was modeled in TransModeler using traffic-responsive toll pricing based on occupancy rates in the eastbound PPSL. The base toll rate as well as the incremental increases used were developed with input from CDOT's High-Performance Transportation Enterprise. These tolling rates are shown in Exhibit 24.

Exhibit 24: PPSL Toll Rates

PPSL Percent Occupancy	Toll Rate
Base	$5.00
11.7%	$7.00
15.6%	$9.00
19.5%	$11.00

Next, the value of time for all vehicles was stratified between three categories describing different potential users of the PPSL: residents with express toll accounts (67 percent of users), residents without express toll accounts (23 percent of users), and visitors (10 percent of users). Other studies along the corridor have not come to a consensus on the appropriate value of time to be used for the I-70 Mountain Corridor. Values as low as $10.00 and as high as $84.00 have been discussed and used. In addition, the studies also have varied on how many different classifications of roadway users should be examined along the corridor: weekday users, weekend users, residents, visitors, commercial vehicles,

vehicles with/without toll transponders, etc. The Eastbound PPSL Feasibility Study used a value of time of about $18.00 per person, with an average vehicle occupancy of 2.5 passengers, for a total of about $45.00 per vehicle. Other studies, such as the Westbound PPSL Project that is on-going at the time of this memorandum, do not use value of time at all, but rather use a straight percent capture for the volume of vehicles that would enter the PPSL/EL. For this project, the weighted average value of time for all vehicles across the three user categories was set to a starting value of approximately $80.00.

The modeled PPSL/EL volumes were compared to volumes from CDOT data sources (for the day that traffic counts are collected in January 2018 and June 2018) with a target of having peak hours, those where the volume in the PPSL/EL are greater than 300 vph, within ±20 percent of the observed value. Adjustments to the value of time distribution will be made and evaluated until the PPSL/EL volume target is achieved.

A westbound PPSL is being added to I-70 in the next few years, but there is no data to indicate the capture rate or toll pricing characteristics that this lane may experience. For this study, the intent is to apply the same approach to toll pricing and value of time for modeling and analysis of the westbound PPSL in all future models.

Travel Times

The modeled travel times were compared to the travel times from INRIX to determine how well the model is replicating vehicle movements through the entire modeling area on I-70 from Exit 228 (Georgetown) to Exit 252 (SH 74/Evergreen Parkway). For this comparison, the INRIX data were gathered for the same day that traffic counts were collected in the field. Travel time calibration targets from FHWA's *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software* were used for this comparison. These targets are shown in Exhibit 25.

Exhibit 25: FHWA Travel Time Calibration Targets

Roadway Segment Travel Time	**FHWA Criteria Target**
Less than 7 minutes	±1 minute of observed travel times
Greater than 7 minutes	±15 percent of observed travel times
Hourly Travel Times	**FHWA Criteria Target**
All critical routes	85% within calibration targets

If the comparison did not achieve the target travel times, adjustments to modeling parameters were made and the comparative analysis was repeated. Some of the parameters that were adjusted include:

- Mean stopped gap
- Connectivity bias on lane connectors
- Rate of increase in headway buffer on grades
- Compliance rate—do not block uncontrolled intersections
- Speed distributions

Magnitude of Congestion

Using travel time and speed data, the location and duration of congestion along I-70 were evaluated. The INRIX travel time and speed data for I-70 were broken down into individual segments to identify the location, magnitude, and duration of congestion that is occurring on the study days. The modeled travel times and speeds then were broken down for similar segments of I-70 and compared to the INRIX data.

A comparison between the modeled and observed travel times by segment was completed to determine where congestion was occurring (links where the congestion starts), the magnitude of the congestion (extent of adjacent links showing congestion during the same time periods), and the overall duration of the congestion (number of hours the congestion is present).

For the purposes of this comparison, FHWA calibration targets were obtained from the *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*. This document identifies a speed target of ±10 miles per hour between observed and modeled speeds. Travel time targets are presented in Exhibit 25.

In addition to the segment-by-segment comparison between INRIX data and modeled results, a qualitative analysis of queues was completed. This analysis collected information about typical queues from in-field observations and stakeholder input and compared these observations with those seen within the model to ensure reasonable queues were being captured within the model. This qualitative methodology was used because quantitative queueing data were not available.

A visual review of the model was completed to check the overall operation of all roadways and intersections within the modeling area. This check verified that intersections were operating with queue levels that are consistent with field observations and/or input from stakeholders. Modifications to signal operations or model parameters (such as gap acceptance) were made as needed.

Measures of Effectiveness

The EA analysis will focus primarily on the transportation network elements between Exit 241 (Idaho Springs/Colorado Boulevard) and Exit 248 (Beaver Brook/Floyd Hill). Additional elements outside of these limits will be evaluated on an as-needed basis to respond to questions and to determine diversionary impacts, if necessary.

The traffic operations analyses between Exit 240 (SH 103/Mt Evans)) and Exit 252 (SH 74/Evergreen Parkway) will include:

- All ramp merge and diverge areas, weave sections, and basic freeway segments
- All ramp junction intersections with surface streets
- The intersection of US 40 and US 6
- Major intersections along US 40 at the interchanges
- Ingress/egress and termini of any EL and PPSL

This study will require a comparison between the Proposed Action and No-Action Alternatives, as well as the Existing Conditions and No-Action Alternatives. TransModeler provides a wide range of flexibility to evaluate all the different transportation network elements, including EL and PPSL facilities, and make direct comparison to the level of service thresholds provided in the *Highway Capacity Manual, 6th Edition*. The anticipated measures of effectiveness that will be reported for this study include:

- Travel times on I-70
- Identification of location, magnitude, and duration of congestion on I-70
- Travel speeds for lanes on I-70 (including GPL, EL, and PPSL)
- Intersection LOS
- Queue lengths at intersections
- LOS for freeway elements, including basic, weaves, merges, diverges, and at PPSL/EL entrance/exit segments
- Throughput for GPL, PPSL, and EL
- Trip travel time reliability on I-70 in the GP, PPSL, and EL

Summary

The following is a summary of the modeling methodology and assumptions.

- All analyses in support of this study will be done using TransModeler.
- The analyses will be done for a typical winter Saturday (westbound peak) and a typical summer Sunday (eastbound peak).
- The model will include the hours of 4:00 a.m. to 10:00 p.m. and will include the following features:
  - I-70 (eastbound and westbound) from Exit 228 (Georgetown) to Exit 252 (SH 74/Evergreen Parkway)
  - Parallel routes such as US 40, CR 314 (East Idaho Springs Road), and all frontage roads
  - Intersections at or near the interchanges, along frontage roads, and along US 40
- The project may evaluate two sensitivity analyses:
  - Increase the traffic on I-70 to a value that is at or near capacity (LOS E/F) to evaluate possible induced/latent demand
  - Consider a growth scenario to account for a high-growth option for the US 6 highway traffic volumes by increasing traffic flow on US 6 to a level that is at or near capacity (LOS E/F)
- The growth factor for 2025 traffic projections is 1.08 and the 2040 growth factor will be 1.27.
  - The future trip tables were used as input in TransModeler and actual traffic flows/routes will be determined by using the dynamic traffic assignment capabilities within the software.

The analyses to be completed are shown in Exhibit 26.

Exhibit 26. Operational Analyses to be Completed

Analysis Year	Analysis Models	Peak	PPSL Conditions	New Westbound Lane Type
2018	Existing Conditions	Westbound	Eastbound PPSL, but no westbound PPSL	N/A
		Eastbound		
2040 (Horizon Year)	No-Action Alternative	Westbound	Eastbound PPSL and westbound PPSL	N/A
			No eastbound PPSL or westbound PPSL	
		Eastbound	Eastbound PPSL and westbound PPSL	
			No eastbound PPSL or westbound PPSL	
2040 (Horizon Year)	Proposed Action	Westbound	Eastbound PPSL and westbound PPSL	GPL
				EL
			No eastbound PPSL or westbound PPSL	GPL
				EL
		Eastbound	Eastbound PPSL and westbound PPSL	GPL
				EL
			No eastbound PPSL or westbound PPSL	GPL
				EL
2025 (Opening Year)	No-Action Alternative	Westbound	Eastbound PPSL and westbound PPSL	N/A
		Eastbound		
2025 (Opening Year)	Proposed Action	Westbound	Eastbound PPSL and westbound PPSL	Note 1
		Eastbound		

1. Analysis will only evaluate final lane types as determined during the 2040 Horizon Year Proposed Action analysis.

Appendix B

Model Calibration Results Technical Memorandum

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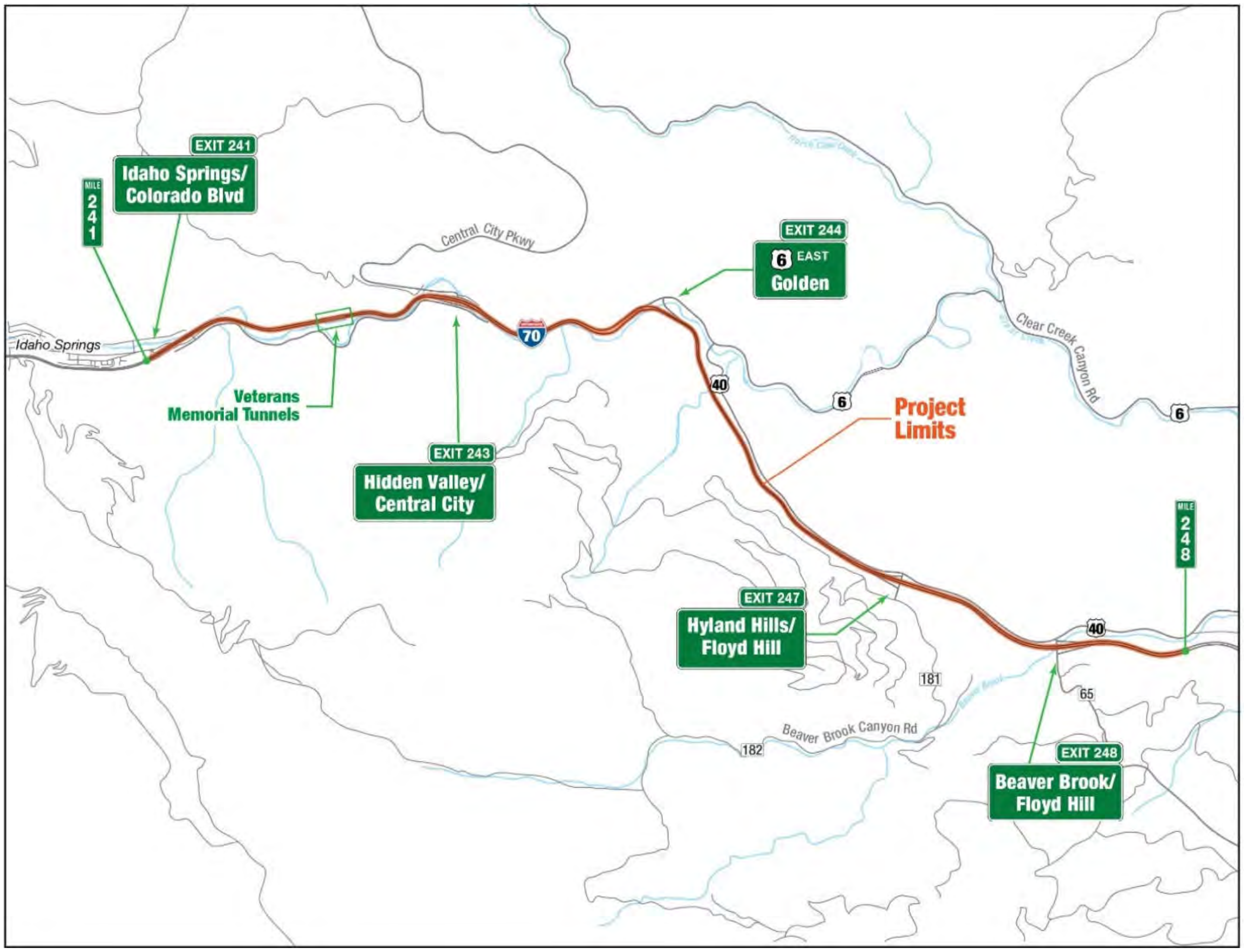
Technical Memorandum

To:	Neil Ogden, Vanessa Henderson, and Ben Kiene, CDOT; Kelly Larson, FHWA; Nnaemeka Ezekwemba, FHWA; Anthony Pisano, PE, Atkins
From:	David Sprague, PE, Atkins; Devin Louie, Atkins; James Parkhill, Atkins; Scott Kilgore, Atkins
Subject:	Model Calibration Results
Date:	September 2018

Introduction

This memorandum describes the results of the calibration of the mesoscopic/microscopic models that will be used to perform the analyses for the Interstate 70 (I-70) Floyd Hill to Veterans Memorial Tunnels Environmental Assessment (EA). The extent of the project study area is shown in Exhibit 1.

Exhibit 1. Project Limits



The calibrated models will be used to complete the necessary operational analyses to assist decision makers in the selection of a proposed action. For more details about the role and use of TransModeler traffic simulation software, refer to the *Traffic Analysis Methodology Memorandum*, which this memorandum is intended to support.

Due to the traffic patterns present on the I-70 corridor, two modeling scenarios were created. This was done because the peak westbound I-70 and peak eastbound I-70 traffic flows occur on different days and in different seasons of the year. Based on a review of historical data, presented in the *Traffic Analysis Methodology Memorandum*, the peak westbound traffic was determined to occur on Saturday in the winter and the peak eastbound traffic was determined to occur on Sundays during the summer. Therefore, models were created for both a winter Saturday and a summer Sunday. Although peak travel periods occur on other days, these days were shown to have the largest peaks for their respective seasons. The calibration process and results for both models is discussed in this memorandum.

Summary of Methodology

As a brief summary of the *Traffic Analysis Methodology Memorandum*, the existing roadway network in TransModeler, shown in Exhibit 2 and Exhibit 3, was developed along I-70 from Exit 252 (SH 74/Evergreen Parkway) to Exit 228 (Georgetown). The network included the eastbound peak-period shoulder lane (PPSL) and Express Lane (EL), all interchanges on I-70, and all frontage roads and parallel routes functioning as alternate routes for I-70, such as U.S. Highway 40 (US 40), East Idaho Springs Road (County Road [CR] 314), Colorado Boulevard, Stanley Road, CR 308, and Alvarado Road (CR 306). Refer to the *Traffic Analysis Methodology Memorandum, Modeling Area* (pages 15 to 19) for more discussion on the selection of the modeling area limits and the transportation network elements.

Since no regional travel demand model currently exists that adequately represents the entire study area for weekend (non-commuter) trips, existing origin-destination (OD) volumes were developed based on traffic count data collected throughout the study area, shown in Exhibit 4 and Exhibit 5. Traffic counts were collected on a winter Saturday (January 13, 2018) and a summer Sunday (June 3, 2018) to obtain the following existing conditions data:

- I-70 ramp volume and vehicle classification data for each interchange in the modeled area (24 hours at 45 locations)
- I-70 mainline volume and classification data (24 hours at two locations)
- Bi-directional volume and classification data for frontage roads and parallel routes (24 hours at 19 locations)
- AM and PM peak hour turning movement count data for all major intersections and ramp terminals (one hour during the AM peak and one hour during the PM Peak at 38 locations)

Exhibit 2. Traffic Model Details (1 of 2)

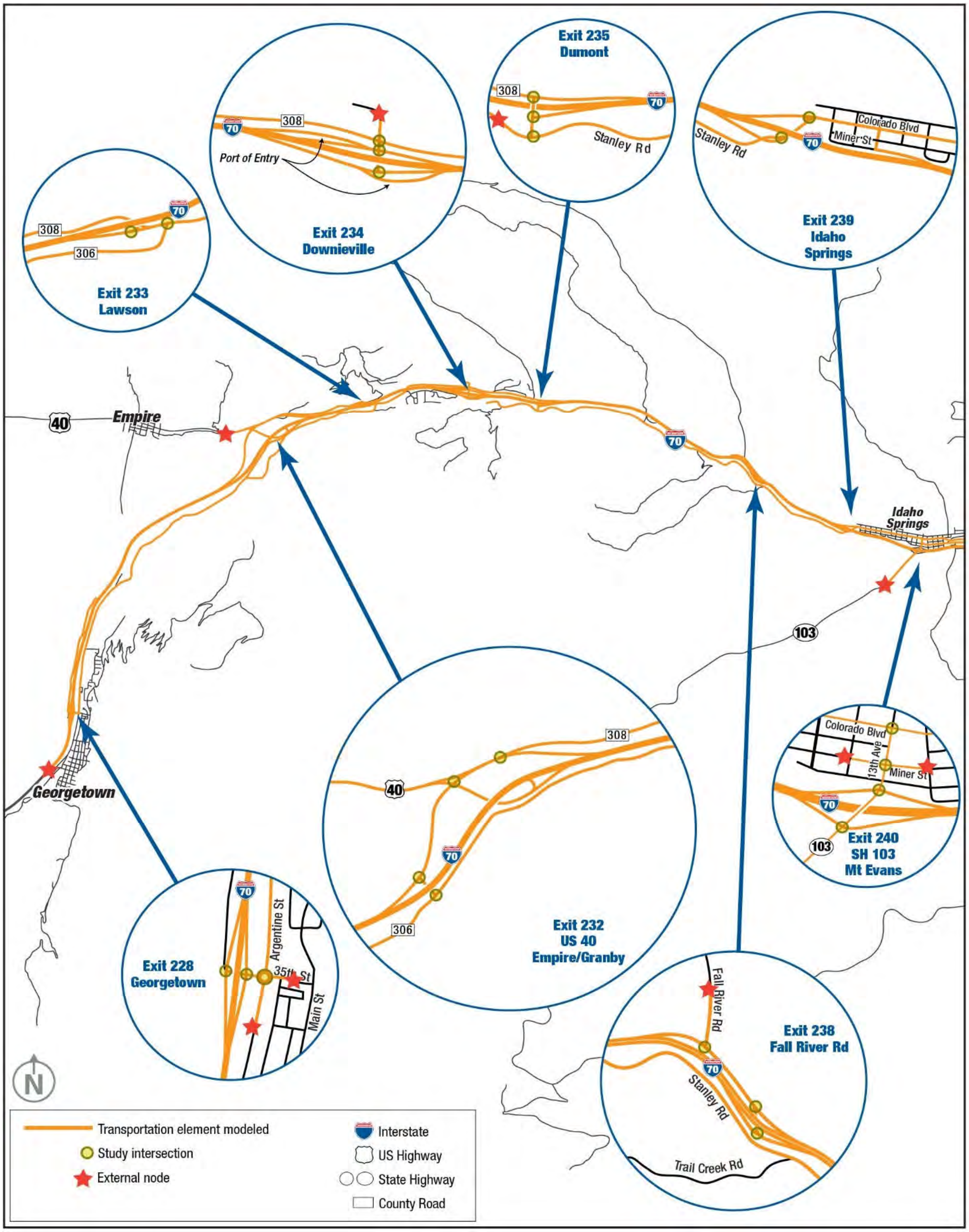


Exhibit 3. Traffic Model Details (2 of 2)

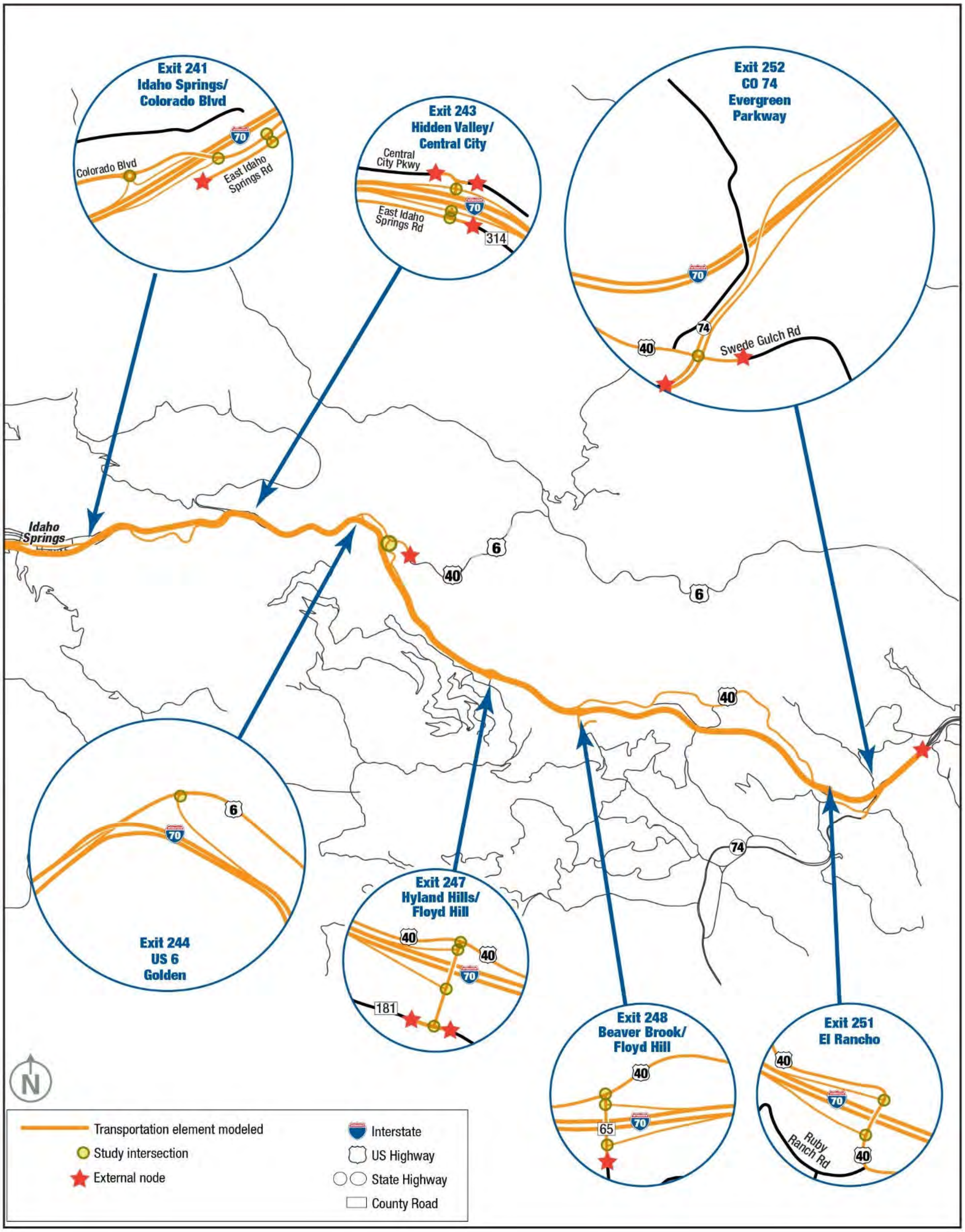


Exhibit 4. Data Collection Locations and Types (1 of 2)

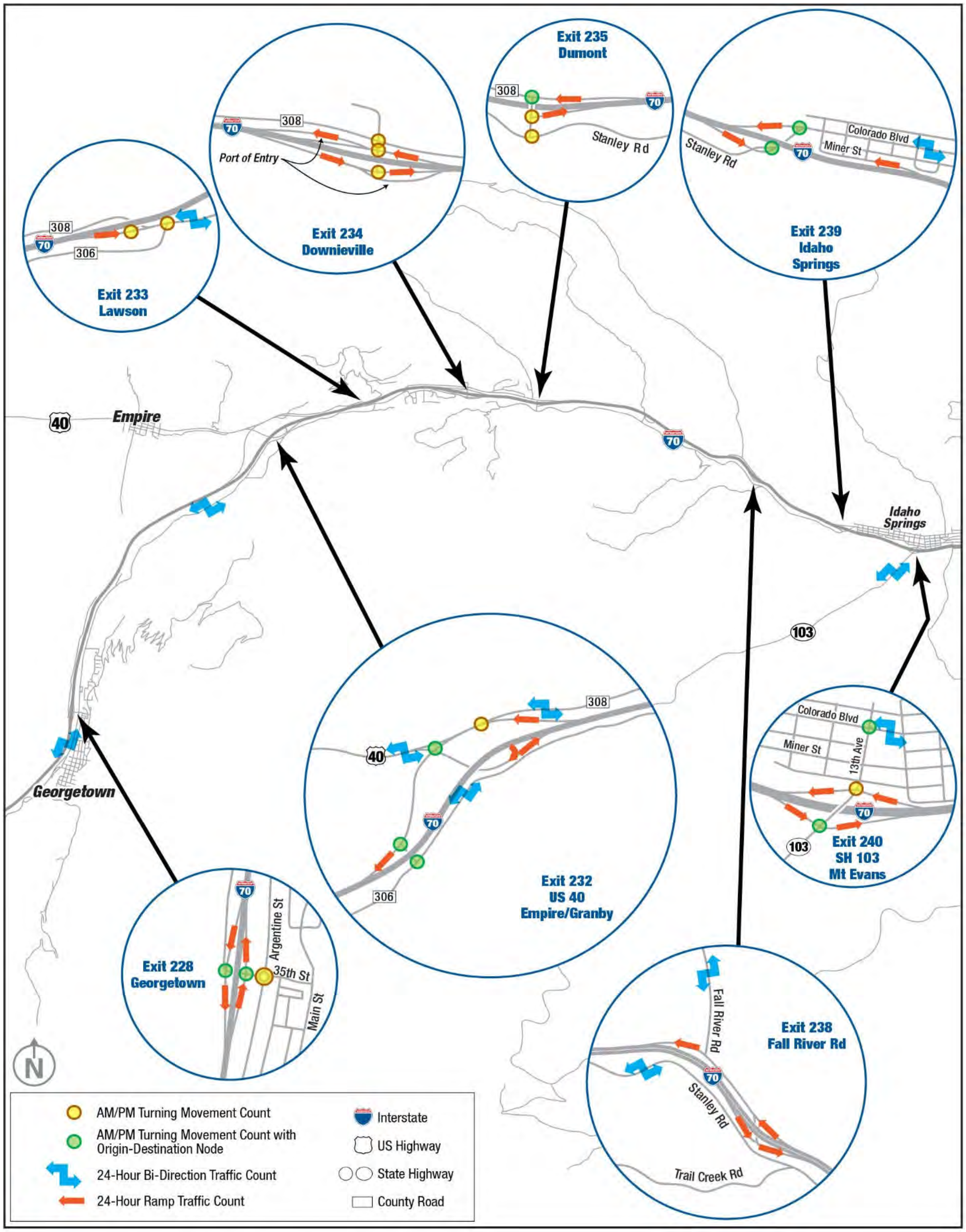
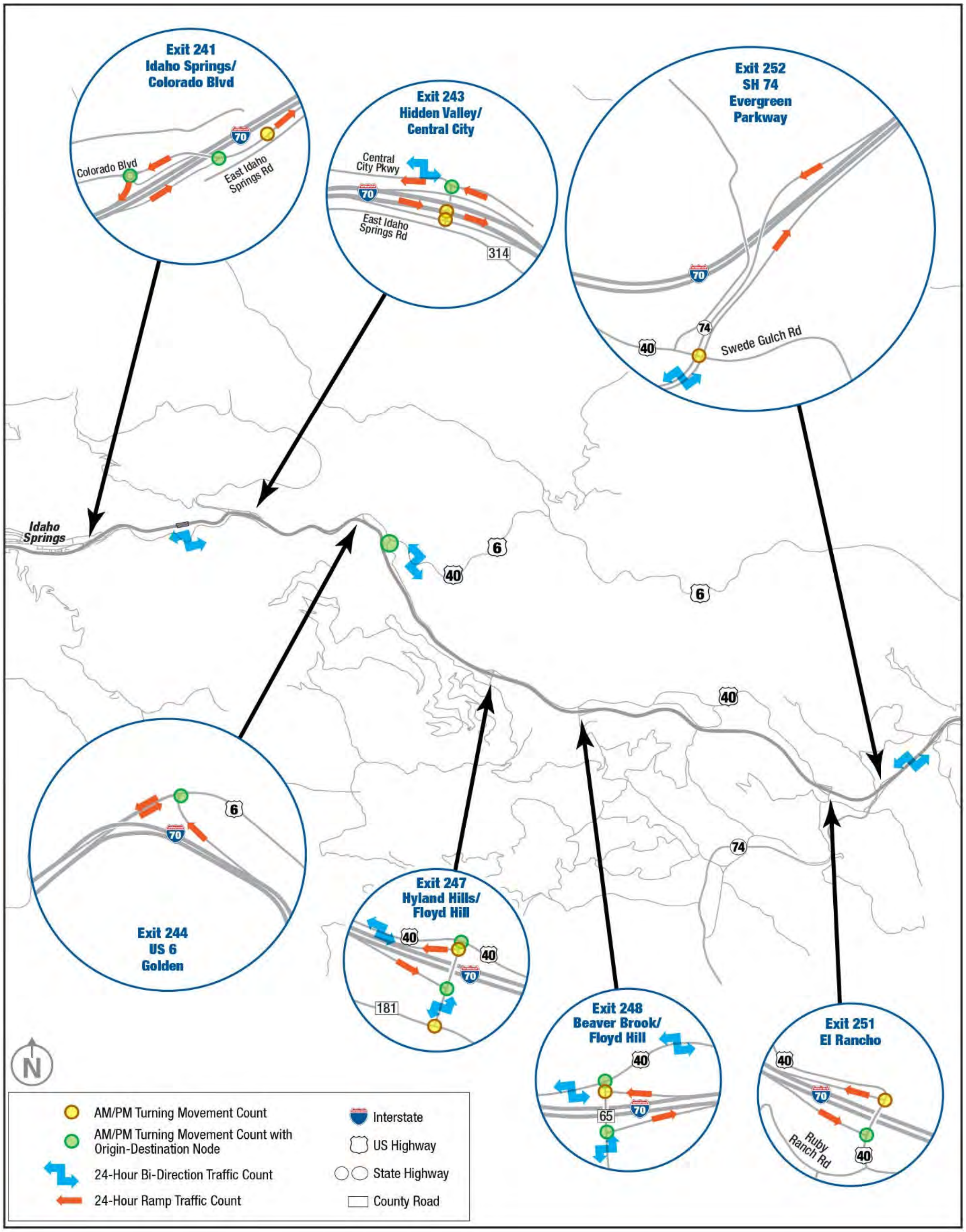


Exhibit 5. Data Collection Locations and Types (2 of 2)



Calibration Targets

For more details on calibration targets, refer to the *Traffic Analysis Methodology Memorandum, Model Calibration* (pages 33 to 36). Three pieces of data were used for the calibration of this model: link volumes, travel times, and magnitude of congestion.

Link Volumes

FHWA percent root mean square error (%RMSE) targets were used based on roadway classifications. These targets were obtained from FHWA's *Model Validation and Reasonableness Checking Manual* (1997). The %RMSE targets represent the acceptable difference between the traffic volumes simulated in the model and the traffic volumes observed in the field. These targets are presented in Exhibit 6. In addition, FHWA microsimulation targets based on hourly count volumes also were used for calibration. These calibration targets are presented in the *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software* (2004). The hourly volume targets represent the ratio of hourly modeled link volumes that should be within a specified range of the hourly observed count volumes.

It should be noted that, since the onset of this project when modeling calibration targets were established, CDOT has published its own set of calibration guidelines and targets. In general, CDOT's new guidelines match the FHWA guidelines being used within this memorandum. Because CDOT's guidelines were not available at the onset of this project and because the new guidelines are like those already being followed, it was determined that the project should continue to use the FHWA guidelines and calibration targets. For reference, the new CDOT guidelines can be found in CDOT's *Traffic Analysis and Forecasting Guidelines* (July 2018).

Exhibit 6. Link Volume FHWA Calibration Targets

Roadway Classification	FHWA Target %RMSE
Freeway	±18%
Major Arterial	±37%
Collector	±77%
Ramp	±75%
All Roadways	±37%
Link Hourly Volume	**FHWA Criteria Target**
Counts < 700 vph	85% within 100 vehicles
700 vph < Counts 2,700 vph	85% within 15%
Counts > 2,700 vph	85% within 400 vehicles

Currently, there is little guidance on appropriate calibration targets for EL facilities. For the EL lane on this project, the target was to have all peak hours—those hours where the volume in the EL lane is greater than 300 vehicles per hour (vph)—within ±20 percent of the observed volumes. This calibration target was created by the project team and was considered to reflect FHWA targets for general freeway facilities.

Travel Times

The modeled travel times were compared to the travel times from INRIX data to determine how well the model is replicating vehicle movements through the modeling area. Calibration targets from FHWA's *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software* were used for this comparison. These targets are shown in Exhibit 7.

Exhibit 7: FHWA Travel Time Calibration Targets

Roadway Segment Travel Time	FHWA Criteria Target
Less than 7 minutes	±1 minute of observed travel times
Greater than 7 minutes	±15 percent of observed travel times
Hourly Travel Times	**FHWA Criteria Target**
All critical routes	85% within calibration targets

Magnitude of Congestion

The magnitude of congestion was assessed based on the duration of congestion and the length of queues. For this, the INRIX travel time and speed data for I-70 were broken down into individual segments to identify the location, magnitude, and duration of congestion that occurred on the days that traffic counts were collected in the field. The modeled travel times and speeds also were broken down into similar segments on I-70 and compared to the INRIX segment data. A comparison between the modeled and observed travel times by segment was completed to determine where congestion was occurring (links where the congestion starts), the magnitude of the congestion (extent of adjacent links showing congestion during the same time periods), and the overall duration of the congestion (number of hours the congestion is present).For the purposes of this comparison, FHWA calibration targets obtained from the *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software* were used. This document identifies a speed target of ±10 miles per hour (mph) between observed and modeled speeds. Travel time targets are presented in Exhibit 7.

In addition to the segment-by-segment comparison between INRIX data and modeled results, a qualitative analysis of queues was completed. This analysis collected information about typical queues from in-the-field observations and stakeholder input and compared these observations with those seen within the model to ensure reasonable queues were being captured within the model. This qualitative methodology was used because quantitative queueing data was not available.

Model Validation

The models were calibrated against the calibration targets presented in FHWA's *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software* using traffic volumes, travel times, and magnitude of congestion from specific peak seasonal days. It is important to note that the models were not validated because the project did not collect an independent data set that is necessary to complete a validation effort.

Model Calibration Process

This section summarizes the process used and parameters adjusted during the calibration process.

Data Processing

As discussed previously, data for use in the winter Saturday model were collected on January 13, 2018, and data for use in the summer Sunday model were collected on June 3, 2018. Before using these data, they were analyzed to ensure the data accurately reflected the typical peak winter and peak summer travel patterns.

Winter Saturday Data (January 13, 2018)

To review the data collected on January 13, additional data were collected from COGNOS for the same date to check the validity of the data. These data showed that there was one incident during the data collection period. Details of this incident are shown in Exhibit 8. Because this incident occurred during the overnight hours, it was determined not to have an impact of the data collection efforts.

Exhibit 8: Event Information from COGNOS for January 13, 2018

Date and Time	Location	Direction	Event	Severity[1]	Roadway Closure	Duration
January 13, 2018, at 1:23 a.m.	MP[2] 239.5	Eastbound	Mechanical	Moderate	Partial Closure	14 minutes

[1] Severity is based on the user input to COGNOS. Severity can be classified as: Minimal, Moderate, Severe
[2] MP = Milepost
Source: COGNOS

In addition to identifying incidents along the corridor during the data collection period, COGNOS volume data from other Saturdays in January also were obtained and compared to ensure that January 13 represented a typical peak winter day. This comparison, shown in Exhibit 9, shows that January 6, 2018, was representative of typical volumes as compared to other days in January 2018.

Exhibit 9: Winter Saturday Volume Comparisons

Location	Source	Date of Count	I-70 Daily Volume		Percent Difference from January 13	
			Eastbound	Westbound	Eastbound	Westbound
I-70 West of Exit 228 (Georgetown)	COGNOS	January 6, 2018	25,187	26,012	-1%	-15%
	COGNOS	January 13, 2018	25,331	30,768	N/A	N/A
	COGNOS	January 20, 2018	24,193	28,103	-4%	-9%
	COGNOS	January 27, 2018	26,883	29,737	+6%	-3%

Summer Sunday Data (June 3, 2018)

To review the data collected on June 3, additional data were collected from COGNOS. These data showed that there were two crashes that occurred on I-70 during the data collection period. Details of these crashes are shown in Exhibit 10. Due to these incidents, the eastbound PPSL was closed for a significant duration of the data collection period. Discussion about how this was addressed during the calibration process is provided below.

Exhibit 10: Event Information from COGNOS for June 3, 2018

Date and Time	Location	Direction	Event	Severity[1]	Roadway Closure	Duration
June 3, 2018, at 3:37 p.m.	MP[2] 242	Eastbound	Multi-Vehicle Crash	Severe	Partial Closure	45 minutes
June 3, 2018, at 3:55 p.m.	MP 234	Eastbound	Multi-Vehicle Crash	Severe	Partial Closure	26 minutes

[1] Severity is based on the user input to COGNOS. Severity can be classified as: Minimal, Moderate, Severe
[2] MP = Milepost
Source: COGNOS

In addition to identifying incidents along the corridor during the data collection period, COGNOS volume data from other Saturdays in June also were obtained and compared to ensure that June 3 represented a typical peak summer day. This comparison is shown in Exhibit 11. These data show that, in general, eastbound I-70 volumes were lower on June 3 than other Sundays in June 2018.

Exhibit 11: Winter Saturday Volume Comparisons

Location	Source	Date of Count	I-70 Daily Volume		Percent Difference from June 3	
			Eastbound	Westbound	Eastbound	Westbound
I-70 West of Exit 228 (Georgetown)	COGNOS	June 3, 2018	24,759	19,560	N/A	N/A
	COGNOS	June 10, 2018	32,232	21,195	+30%	+8%
	COGNOS	June 17, 2018	32,140	22,249	+30%	+14%
	COGNOS	June 24, 2018	31,974	21,016	+29%	+7%

The review of the COGNOS data showed that there were two issues that needed to be addressed during the calibration process. This includes the closure of the eastbound PPSL during the afternoon period, which historical data shows is typically the peak period for eastbound PPSL usage, and the overall lower volumes observed on eastbound I-70 as compared to other Sundays in June 2018.

Methodology for Addressing Summer Sunday Data Considerations

To assess and address the potential impacts from the crashes and overall low volumes, the issues were first reviewed to see if they were related. Based on this review, the project team determined that these issues did not affect each other (i.e., the closure of the eastbound PPSL was not the cause of the daily volumes on eastbound I-70 being lower). This determination was based on the consideration that there are few alternative routes to I-70. Although the closure of the eastbound PPSL may have increased congestion, it likely did not result in people taking a different route all together. Therefore, diversion from I-70 due to the closure of the eastbound PPSL likely was not the cause of the lower daily volumes.

Since it was determined that the lower overall eastbound volume concern was unrelated to the closure of the eastbound PPSL, these two issues were addressed using two methodologies. Because the summer Sunday model is intended to represent the peak eastbound travel, and the volumes from the collected data were nearly 30 percent lower than other Sundays in June, volumes were addressed first by adjusting the count data collected in the field. This adjustment consisted of increasing the trips on I-70—those that originated west of Exit 228 (Georgetown) and traveled all the way through the model to I-70 east of Exit 248 (State Highway 74 [SH 74]/Evergreen Parkway)—by 10 percent. A 10-percent increase was chosen by the project team because it brings the June 3 volumes closer to counts observed on other Sundays within June 2018 without overinflating the through movement on I-70. Furthermore, only the single OD pair—through traffic on I-70 that originates west of Exit 228 (Georgetown) and goes to I-70 east of Exit 248 (SH 74/Evergreen Parkway)—was increased because additional data on ramps and frontage roads were not available. Given the lack of other data to compare against, it was not known if other facilities experienced the same abnormally low volumes observed on eastbound I-70.

After the eastbound I-70 volumes were adjusted, the project team examined COGNOS traffic count data to find a day close to June 3, 2018, that had similar volumes as the adjusted I-70 volumes. This was done because the closure of the eastbound PPSL on June 3 resulted in no usable hourly volumes for calibration of the eastbound PPSL. Additionally, the closure of the eastbound PPSL likely resulted in abnormal travel times throughout the corridor.

This review of COGNOS data found that the daily volumes on May 28, 2018, (Memorial Day) were similar to those of the adjusted June 3, 2018, volumes (see Exhibit 12); therefore, eastbound PPSL volume and INRIX travel time data from May 28, 2018, were obtained and used for the calibration of the summer Sunday model.

Exhibit 12: June 3, 2018, and May 28, 2018, COGNOS Volume Comparison

Location	Source	Date of Count	I-70 Daily Volume		Percent Difference from In-the-Field Count Day	
			Eastbound	Westbound	Eastbound	Westbound
I-70 West of Exit 228 (Georgetown)	COGNOS	May 28, 2018	28,467	16,046	+15%	-18%
	COGNOS	June 3, 2018	24,759	19,560	N/A	N/A

For clarity, Exhibit 13 summarizes the dates, sources, and uses of the data in the calibration process. Additional details about the uses of data and specific adjustment made during the calibration process are discussed in subsequent sections of this memorandum.

Exhibit 13: Summary of Data Sources and Uses for Calibration

Date of Data Collection	In-the-Field Volume Counts	COGNOS Volumes	INRIX Travel Times
January 6, 2018	Used for winter Saturday I-70 mainline and eastbound PPSL volume calibration	Used to determine if January 13 volumes represented typical conditions	Used for winter Saturday travel time and speed calibration
January 13, 2018	—	Used to determine if January 13 volumes represented typical conditions	—
January 20, 2018	—	Used to determine if January 13 volumes represented typical conditions	—
January 27, 2018	—	Used to determine if January 13 volumes represented typical conditions	—
May 28, 2018		Used to determine if May 28 volumes matched adjusted June 3 volumes. Also used for summer Sunday eastbound PPSL volume calibration.	Used for summer Sunday travel time and speed calibration
June 3, 2018	Used for summer Sunday I-70 mainline volume calibration	Used to determine if June 3 volumes represented typical conditions	—
June 10, 2018	—	Used to determine if June 3 volumes represented typical conditions	—
June 17, 2018	—	Used to determine if June 3 volumes represented typical conditions	—
June 24, 2018	—	Used to determine if June 3 volumes represented typical conditions	—

Model Run Setup

TransModeler's dynamic traffic assignment (DTA), using the stochastic shortest path methodology with a minimum of 30 iterations, was used to route trips within the study area between the OD pairs. After the DTA was run, 10 runs of the model outputs were obtained and averaged together for analysis. Because initial outputs from the model did not meet calibration targets, adjustments to the model, discussed in the following sections, were made and the DTA and 10 model run process was repeated. This process was repeated until the model was considered calibrated.

Origin-Destination Tables

As outlined in the *Traffic Analysis Methodology Memorandum,* OD tables were created manually using volumes collected in the field. During the development of the OD tables for the two distinct scenarios—winter Saturday and summer Sunday—it was noticed that there were some discrepancies within the data collected that needed to be addressed/accounted for to better represent typical peak conditions. These discrepancies and modifications made to accommodate them are discussed for each scenario below.

Winter Saturday OD Table Modifications

Within the winter Saturday morning peak period, it was observed that severe congestion was occurring near the eastern end of the model, around Exit 248 (Beaver Brook/Floyd Hill) and Exit 243 (Hidden Valley/Central City). This congestion during the peak hours prevents some trips from reaching their destinations within the same hourly period in which they entered the modeling area, so ramp and mainline volumes downstream of the bottlenecks were increased to account for hourly demand volumes higher than hourly count volumes. All ramp and mainline volumes that were increased during the hours experiencing the highest congestion also were adjusted downward during the succeeding hours so that total volumes remained the same across the day for all ramps and mainline locations. The resulting adjusted hourly volumes and adjusted OD trip tables can be found in Appendix A and Appendix B. For more discussion on the methodology for developing the trip tables and adjustments to model demand volumes, not service flows, refer to the *Traffic Analysis Methodology Memorandum, Traffic Data and Volumes* (pages 27 to 31).

Adjustments made to the in-the-field volumes as well as the final OD tables used in the models are shown in Appendix A and Appendix B, respectively.

Summer Sunday OD Table Modifications

As discussed previously in this memorandum, data collected during June 3, 2018, was lower than other Sundays in June 2018. To account for this, trips on I-70 that originated west of Exit 228 (Georgetown) and traveled all the way through the model on I-70 to east of Exit 248 (SH 74/Evergreen Parkway) were increased by 10 percent. The adjusted summer Sunday OD tables used in the models are shown in Appendix C.

Parameter Adjustments

To have the model reflect in-the-field travel time, speed, and congestion conditions, multiple adjustments to model parameters were made. Exhibit 14 summarizes these changes and shows both the default value in TransModeler, the revised value implemented by the project team, and the percent difference between the two. A description of each modified parameter and a brief justification for its modification is provided in the following sections.

Exhibit 14. TransModeler Parameter Changes

Parameter	Units	Default Value	Calibrated Value	Percent Change
Mean stopped gap with non-heavy vehicle in front	Feet	8.000	5.800	-27.5%
Mean stopped gap with heavy vehicle in front	Feet	12.000	8.000	-33.3%
Connectivity bias at specific lane connectors	n/a	1.000	0.100	-90.0%
Rate of increase in headway buffer on downgrade	Seconds per percent grade	0.000	0.305	n/a
Rate of increase in headway buffer on upgrade	Seconds per percent grade	0.000	0.305	n/a
Toll cost route choice parameter for all user groups	n/a	-0.550	0.000	-100%
Compliance rate—do not block uncontrolled intersection	n/a	0.900	1.000	11.1%
Truck speed distribution	n/a	Inactive	Active	n/a
Freeway speed distribution	n/a	See Exhibit 15	See Exhibit 15	n/a

Exhibit 15: TransModeler Speed Curves (see Exhibit 14)

Deviation from Speed Limit (mph)	Default Percentage of Drivers	Modified Trucks (global)
-10	1%	50%
-5	7%	25%
0	55%	20%
+5	21%	5%
+10	8%	0%
+15	5%	0%
+20	2%	0%
+25	1%	0%

Mean Stopped Gap

The mean stopped gap is the average distance between two vehicles when they come to a stop. This distance is influenced by multiple factors, one of which is the type of vehicle the driver is following. Drivers tend to leave more space between themselves and a larger vehicle, such as a large truck or bus, when stopped than they do between themselves and another passenger car. This parameter accounts for this behavior by setting the average distance drivers will stop behind both heavy and non-heavy vehicles. The average is used because other factors, such as how aggressive the driver is, will influence the exact distance the driver chooses to leave.

For this project's traffic models, this parameter was adjusted for both the stopped gap behind heavy vehicles and the stopped gap behind regular vehicles. In both cases, the value was reduced from the default value (see Exhibit 14). This change was made based on the project team's judgement that drivers along this corridor tend to be more aggressive than those on other facilities. Many drivers on the I-70 corridor live in urban areas, such as the Colorado Front Range. Because these urban areas tend to experience consistent traffic congestion, drivers in these areas have more aggressive driver behaviors. These drivers likely maintain these behaviors when they travel through the I-70 corridor.

Connectivity Bias on Lane Connectors

A lane connector in TransModeler is how two lanes are joined together when one lane ends (merge area) or when one lane splits into two lanes (diverge area). The lane connectors determine which upstream lane can go to which downstream lane, basically identifying which vehicle must perform a lane change maneuver. The lane connectivity bias is a value between zero and one assigned to each individual lane connector. This value can be thought of as a reflection of a driver's preference for using a merging/diverging lane. A value of one will mean 100 percent of drivers are willing to perform a late merge/diverge and a value of zero means no drivers are willing to do a late merge/diverge.

One way to think about this is to consider the example of a lane drop, where two upstream lanes merge into a single downstream lane. In scenario one, both lane connectors have a lane connectivity bias of one. In this scenario, drivers in both lanes will drive all the way to the merge point. At the merge point, they will take turns merging into the single downstream lane in a zipper like fashion. In scenario two, one lane connector has a bias of one and the other lane connector has a bias of zero. In this scenario, drivers in the lane with a factor of one will approach the merge point just the same as in scenario one. However, the drivers in the lane with a factor of zero will attempt to change lanes prior to reaching the merge area. This is because, in their view, their lane does not connect to their desired downstream lane.

For select lane connectors within the traffic models, including those at the end of acceleration lanes or at lane drop locations, the connectivity bias was adjusted from one, the default value, to 0.1. This modification was made based on in-the-field observations in which drivers were observed to use an on-ramp to I-70 and then quickly merge into the mainline freeway before reaching the end of the acceleration lane.

Rate of Increase in Headway Buffer on Grades

The headway distance between vehicles is measured between the rear bumper of one vehicle and the front bumper of the next consecutive vehicle behind it while the vehicles are in motion. This distance is determined by a variety of factors, including driver comfort, speed, and grade. This parameter deals with how a grade affects the headway distance.

For this project's models, the rate of increase in headway buffer on grades was increased from a default value of zero seconds per percent grade to 0.305 seconds per percent grade. This number was derived from an iterative process in which the value was increased from its default until a reasonable behavior, as determined by the project team, was observed in the model. This change was based on in-the-field observations that drivers tend to leave more space between them and the vehicle in front of them when they are driving up or down a steep grade.

Compliance Rate—Do Not Block Uncontrolled Intersection

The compliance rate for blocking uncontrolled intersections parameter is a value between zero and one that represents a driver's likelihood to block an intersection when a queue is present. A value of zero means all drivers will block uncontrolled intersections and a value of one means no drivers will block an uncontrolled intersection.

For this project, this parameter was changed from its default value, 0.9, to 1. This change was based on in-the-field observations as well as the project team's local knowledge that most drivers in the study area do not block intersections.

Speed Distribution

Speed distribution is a parameter that accounts for the fact that drivers have varying rates of compliance with speed limits. Some drivers will tend to drive slower than the posted speed limit, while others may driver faster than the limit. This parameter represents this natural variation in speeds by assigning a certain percentage of drivers to want to drive a specific speed faster or slower than the posted speed limit.

For this project, the default TransModeler speed distribution was applied to all non-heavy vehicles. For Heavy vehicles, a new speed curve was created to reflect the tendency for large vehicles on the I-70 corridor to travel notably slower than the posted speed limits. This is a result of the steep grades and sharp curves that make it more difficult for large vehicles to navigate this corridor. The revised speed distribution for trucks, shown in Exhibit 15, was applied to all heavy vehicles within the model, regardless of facility type.

Model Calibration Results

This section provides a summary of the results for the calibration of the traffic analysis model and how well the model achieves the predetermined targets.

Link Volumes

Calibration of the model was based on link volumes on I-70, all entrance and exit ramps, U.S. Highway 6 (US 6), US 40, Central City Parkway, CR 314, State Highway 103 (State Highway 103 [SH 103]), Colorado Boulevard, and frontage roads—including Stanley Road, CR 308, and Alvarado Road (CR 306). As discussed previously, two days of traffic count data were collected. The first was collected in January 2018, during the winter peak period on the I-70 corridor, and the second was collected in June 2018, during the summer peak period on the corridor. The existing conditions model was calibrated to both sets of volumes for the hours between 4:00 a.m. and 10:00 p.m. For the purposes of this report, the calibration results for both the single largest peak period of each day and the full modeling period are reported. Due to the nature of traffic on the I-70 corridor, the AM peak period represents the primary peak within the winter Saturday model and the PM peak represents the primary peak period within the summer Sunday model. Results of the calibration effort are shown in Exhibit 16 and Exhibit 17.

Results for the eastbound PPSL and EL are presented and discussed in a subsequent section of this report.

Exhibit 16. Link Volume Results for the Winter Saturday Model

Roadway Classification	FHWA Target %RMSE	Modeled %RMSE	
		AM Peak	Entire Period
Freeway	±18%	15.6%	9.4%
Major Arterial	±37%	34.3%	28.2%
Collector	±77%	69.3%	72.7%
Ramp	±75%	77.7%	48.4%
All Roadways	±37%	45.8%	30.2%
Link Hourly Volume	**FHWA Criteria Target**	**Modeled Percent within Target**	
Counts < 700 vph	85% within 100 vehicles	91%	
700 vph < Counts 2,700 vph	85% within 15%	84%	
Counts > 2,700 vph	85% within 400 vehicles	100%	

Note: Red text identifies a value that is outside of the desired range.

Exhibit 17. Link Volume Results for the Summer Sunday Model

Roadway Classification	FHWA Target %RMSE	Modeled %RMSE	
		PM Peak	Entire Period
Freeway	±18%	7.89%	8.35%
Major Arterial	±37%	25.33%	24.49%
Collector	±77%	63.69%	73.54%
Ramp	±75%	34.13%	38.31%
All Roadways	±37%	25.04%	26.51%
Link Hourly Volume	**FHWA Criteria Target**	**Modeled Percent within Target**	
Counts < 700 vph	85% within 100 vehicles	95%	
700 vph < Counts 2,700 vph	85% within 15%	94%	
Counts > 2,700 vph	85% within 400 vehicles	92%	

A comparison of the hourly observed winter Saturday volumes to modeled volumes by link classification is presented in Exhibit 18 and the summer Sunday comparison is shown in Exhibit 19. The exhibits show that the modeled volumes reflect the traffic volume patterns and magnitude during all hours of the day and for all roadway classifications.

Exhibit 18. Observed vs. Modeled Volumes by Link Classification for Winter Saturday Conditions

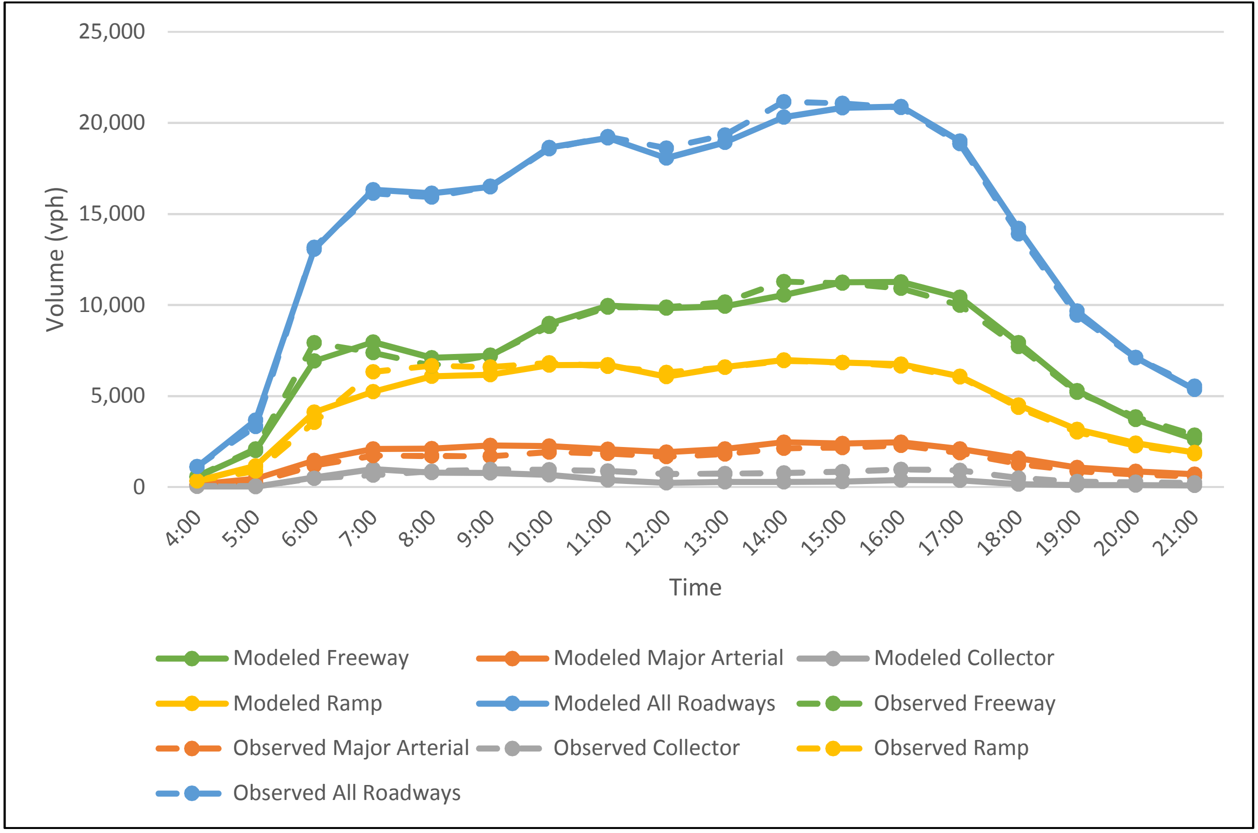
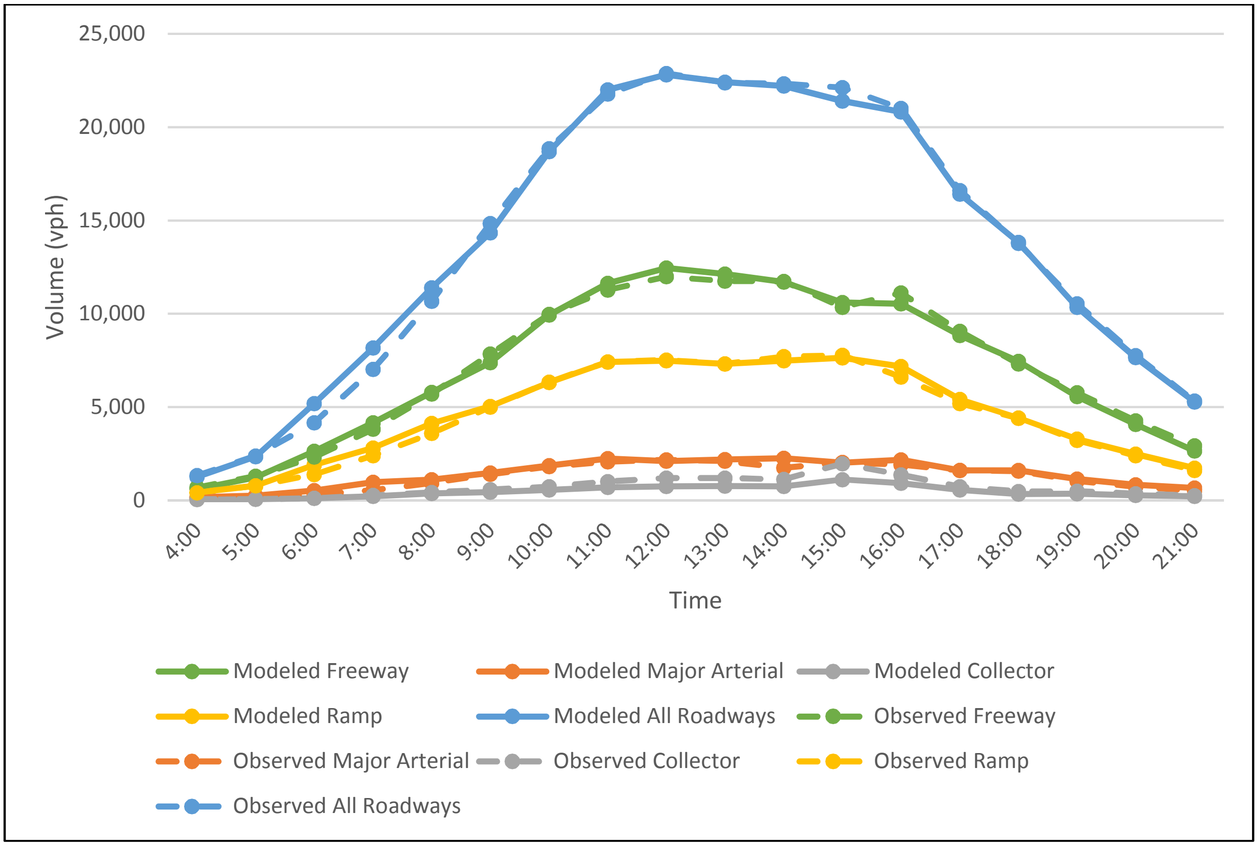


Exhibit 19. Observed vs. Modeled Volumes by Link Classification for Summer Sunday Conditions



Modeled volumes were compared to observed count volumes in a scatter plot for each hour between 4:00 a.m. and 10:00 p.m. for all count locations. The results of this comparison are shown in Exhibit 20 for the winter Saturday model and Exhibit 21 for the summer Sunday model. The scatter plots indicate a very good correlation between the modeled and counted volumes. More detailed information for modeled and count volumes for the AM peak, PM peak, and daily time periods can be found in Appendix C and Appendix D.

Exhibit 20. Observed vs. Modeled Hourly Volumes for All Count Locations for Winter Saturday Conditions

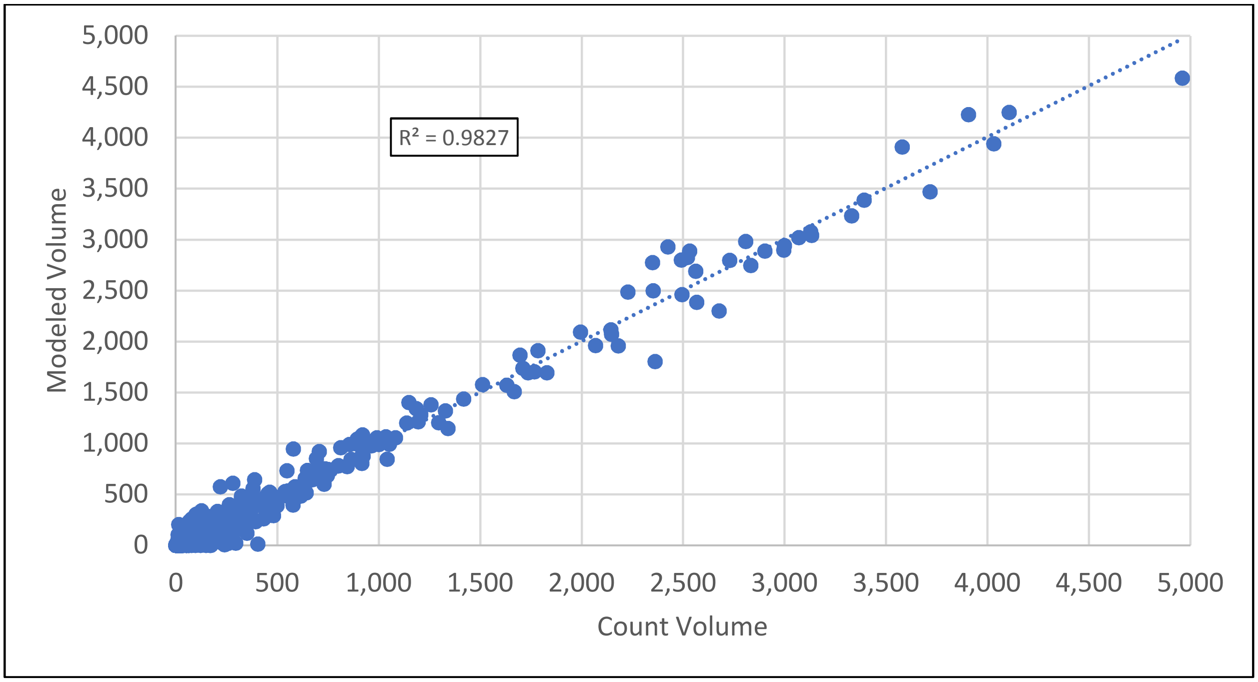
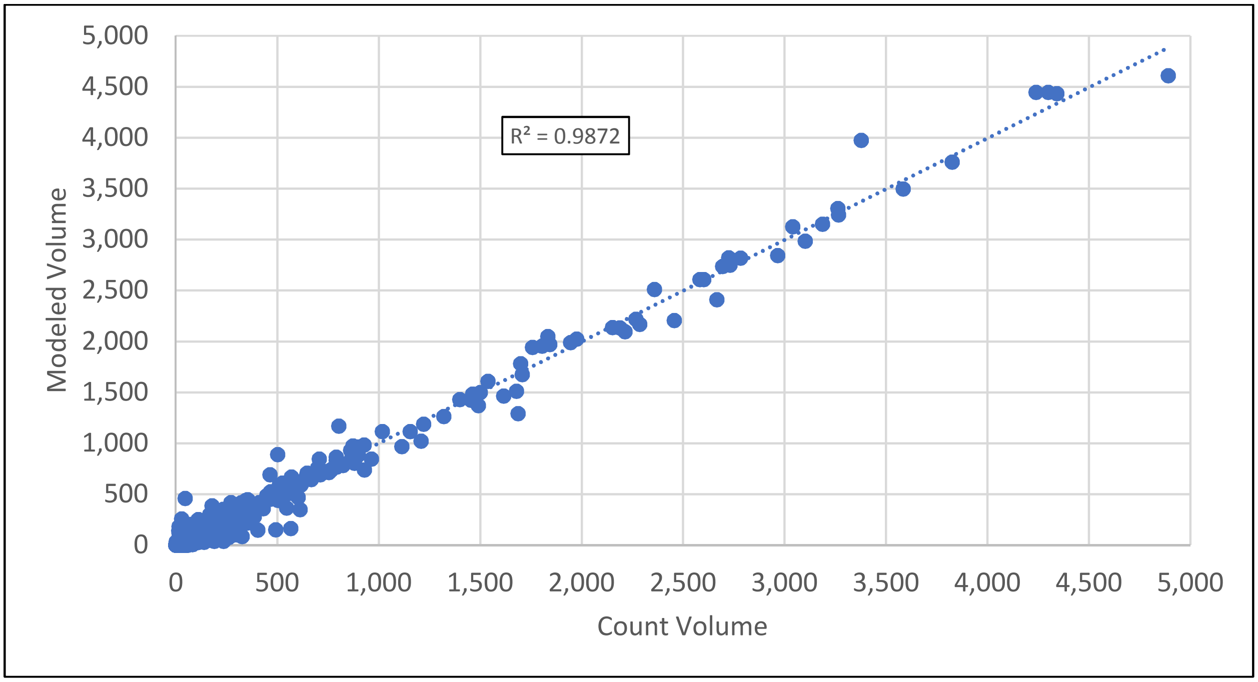


Exhibit 21. Observed vs. Modeled Hourly Volumes for All Count Locations for Summer Sunday Conditions



Discussion of Results

Overall, both the winter Saturday and summer Sunday modeled volumes accurately reflect in-the-field collected volumes with all volume targets for the AM peak period and the overall daily volumes being met in the summer Sunday model, and almost all targets for the AM period and all targets for the daily period being met in the winter Saturday model.

In the winter Saturday model, targets for the ramps and all roadways during the AM peak period, as well as the overall target for roadways with less than 700 vph, were not met. The primary source of all three of these missed targets is likely the methodology in which origins and destinations were generated and loaded into the network.

As discussed previously, OD tables were created manually based on in-the-field traffic count data. Centroids were created and placed strategically to best represent major trip generators, such as downtown areas of existing cities along the I-70 corridor or other attractions, such as recreational facilities and amenities. Although a best effort was made to reflect these major trip generators, it was not the purpose of this model to precisely capture the intricacies of the local roadway networks around each major trip generator. Therefore, in areas with multiple on-ramps and/or off-ramps from I-70, such as Downieville and Idaho Springs, modeled ramp volumes tend to deviate more from targets because drivers are preferring to use one access point over another. Volumes are better balanced between ramps at these locations because trip origins and destinations are better distributed throughout the local town; however, in the model, the trip origins and destinations are more concentrated at certain locations because of the placement of centroids and the loading of the network.

Although this results in some targets for the winter Saturday model being outside of targets, the overall effect on the model is limited. This is because drivers are still entering or exiting I-70 from the correct general location along the corridor, it is just one ramp upstream or downstream from what the in-the-field counts show. This will not affect the traffic model’s ability to accurately evaluate design options in the project area and, therefore, does not prohibit the model from being considered calibrated.

PPSL/Express Lane Volumes

The I-70 eastbound PPSL is included in the existing conditions models. This managed facility is located between Exit 232 (US 40/Empire/Granby) and Exit 241 (Idaho Springs/Colorado Boulevard), continuing into an EL located between Exit 241 (Idaho Springs/Colorado Boulevard) and approximately Milepost (MP) 243.5.

PPSL/Express Lane Parameters

This facility used the same parameters that were used for the general-purpose lanes, including the modified parameters discussed in previous sections of this report. However, there are some parameters that are unique to managed lanes for which there is no default value provided in TransModeler. These parameters are discussed below.

Tolling Rates

The eastbound PPSL was modeled in TransModeler using traffic-responsive toll pricing based on occupancy rates in the eastbound PPSL. The base toll rate as well as the incremental increases used were developed with input from CDOT's High-Performance Transportation Enterprise. These tolling rates are shown in Exhibit 22.

Exhibit 22: PPSL Toll Rates

PPSL Percent Occupancy	Toll Rate
Base	$5.00
11.7%	$7.00
15.6%	$9.00
19.5%	$11.00

Value of Time

The value of time parameter is a dollar value per hour assigned to a driver that is used to determine if a driver will choose to pay the toll if the option is available to them. A driver will choose to use a tolled facility if the amount of money that might be saved by using the tolled facility—derived by taking the travel time savings by use of the facility multiplied by the driver's value of time—is greater than the price of the toll.

When calibrating the existing conditions model, the value of time was iteratively modified until modeled usage of the eastbound PPSL reflected in-the-field conditions. To begin the value of time calibration process, two existing sources for the value of time were considered. These sources, as well as the reasoning about why the source was eliminated or used in the model, are discussed below.

TransModeler default value of time: TransModeler provides a default value of time that is based on general information gathered from around the country (see Exhibit 23). However, when this value of time was tested within the project's existing conditions model, the results showed that too few vehicles used the PPSL as compared to in-the-field counts. Therefore, it was determined that this default value of time is likely not well calibrated to the specific conditions of the I-70 project area and, thus, it was not used in the project's models.

Exhibit 23: TransModeler Default Value of Time

User Group	Value of Time
Low Income	$7.50
Medium Income	$15.00
High Income	$25.00

Denver Regional Council of Governments (DRCOG) value of time: After eliminating the use of the default TransModeler value of time, the project team attempted to use the value of time established by DRCOG (see Exhibit 24). DRCOG is the metropolitan planning organization (MPO) for the Denver region and has developed a value of time for use in its regional travel demand model. After comparing the PPSL utilization rates using the DRCOG value of time to the in-the-field counts, the calibration results still showed fewer people using the lanes in the model than were observed in the field.

Exhibit 24: DRCOG Value of Time

User Group	Value of Time
Low Value of Time	$14.45
High Value of Time	$43.36
Commercial Vehicle Value of Time	$86.73

Project team-derived value of time: Because both the TransModeler default and the DRCOG values of time did not replicate the appropriate utilization of the PPSL, the project team, through an iterative process of trial and error, created a value of time specifically calibrated for the I-70 project corridor (see Exhibit 25).

Exhibit 25: Project Team-Derived Value of Time

User Group	Value of Time
Low Value of Time	$50.00
Moderate Value of Time	$87.00
High Value of Time	$95.00

This value of time, which is greater than both the TransModeler default and the DRCOG values of time, was determined by the project team to be reasonable because most trips through the project study area are recreational in nature. Based on discussions among the project team, it was concluded that drivers making recreational trips are likely to have a higher value of time. This assumption is based on the following observations/considerations:

- Unlike commuting trips, which many people make every day, recreational trips occur less frequently and usually do not involve the same route. Therefore, people making a recreational trip will be less expectant of, and therefore less tolerant of, congestion and delays.
- People making recreational trips are more aware of the cost of delays. This can be seen in the "last ski run of the day" scenario. In this hypothetical situation, a person may be more aware of his/her value of time because he/she has paid a direct cost to do an activity; in this case, the person has paid for a lift ticket at a ski resort. They may be more willing to pay a toll on the freeway if it makes it possible to stay longer at the ski resort and get back home at the same time.

- As identified in the *I-70 Mountain Corridor PEIS Travel Demand Technical Report* (2011), vehicles traveling through the I-70 mountain corridor can have average vehicle occupancy that is more than twice the regular commuting occupancy rate within Denver. This is important because the value of time within TransModeler is assigned to a vehicle and does not consider the impacts of higher vehicle occupancies. People may be willing to pay a higher toll if there are more people in the car because the cost per person per minute saved is lower.

PPSL/Express Lane Calibration Results

For the eastbound PPSL and EL, the calibration target was to have all peak hours within ±20 percent of the observed values. Peak hours for the eastbound PPSL and EL were defined as hours where the volume within the lanes exceeded 300 vph.

As discussed previously, on June 3, 2018—the day on which the summer Sunday in-the-field counts were collected—there were two incidents that resulted in the eastbound PPSL being closed during a portion of the peak travel period. Therefore, no direct comparison between modeled volumes and observed volumes could be made.

To account for this lack of data, additional eastbound PPSL volume information from May 28, 2018—during which time the eastbound PPSL was operational—was collected from COGNOS and used for calibration comparisons. Because total eastbound volumes varied between May 28 and June 3, a direct comparison of eastbound PPSL volumes does not provide an equal comparison. This is because different total volumes will result in different levels of congestion and, therefore, different volumes within the eastbound PPSL.

To provide the best comparisons possible for model calibration, two variations of comparisons were made. First, modeled eastbound PPSL volumes were compared to data collected in the field. For the winter Saturday model, a direct comparison was made between modeled data and in-the-field collected data because all data were collected on the same day. For the summer Sunday model, modeled volumes were compared to data collected for May 28, 2018. Second, eastbound PPSL volumes for the summer Sunday model and data collection effort were converted to capture rates calculated as the percentage of vehicles using the eastbound PPSL divided by the total number of eastbound vehicles. This second methodology was not applied to the winter Saturday modeling results because eastbound PPSL data were available for the same day in which in-the-field counts were collected.

Results of the eastbound PPSL calibration effort for the winter Saturday model are shown in Exhibit 26 and Exhibit 27. Results for the summer Sunday model are shown in Exhibit 28 through Exhibit 30.

Exhibit 26. Observed vs. Modeled Volumes in EB PPSL for Winter Saturday Conditions

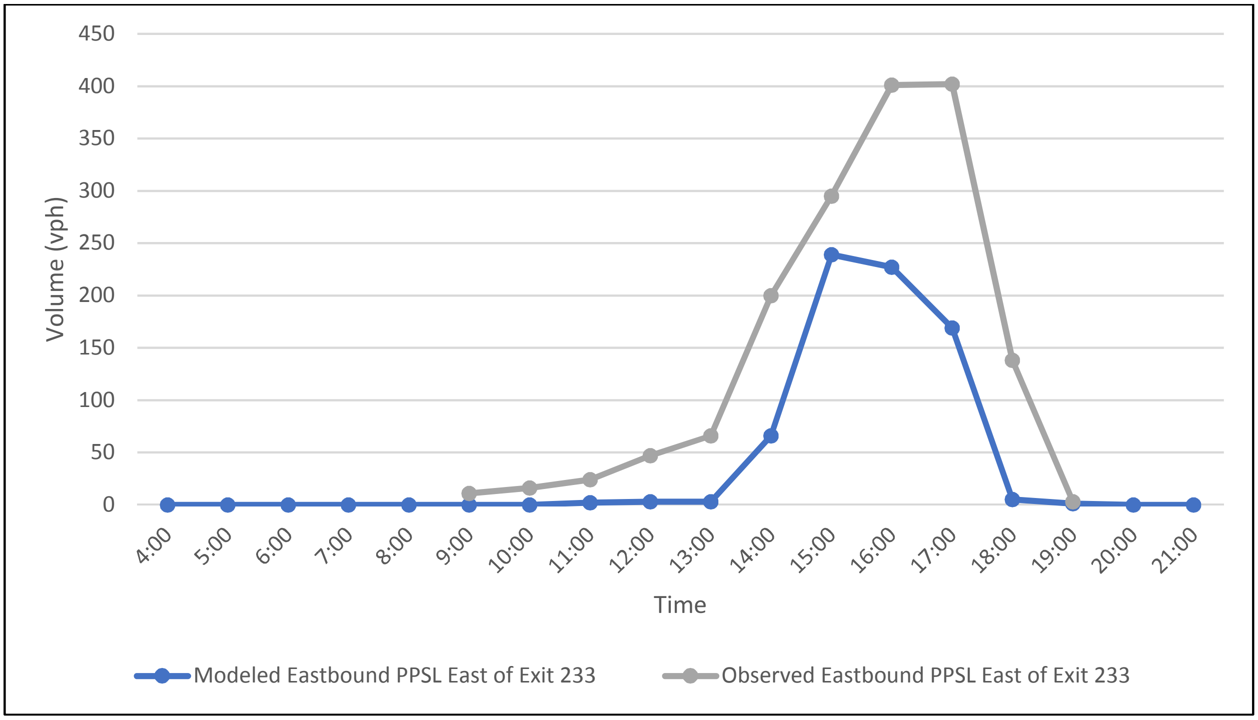


Exhibit 27. Hourly Eastbound PPSL Volume Comparison for Winter Saturday Conditions

Hourly Period	**Observed PPSL Volumes East of Exit 233 (Lawson) on January 13, 2018**	**Modeled EB PPSL Volumes East of Exit 233 (Lawson)**	
		Volume	**% Error**
9:00 a.m.	11	0	Not Peak
10:00 a.m.	16	0	Not Peak
11:00 a.m.	24	2	Not Peak
12:00 p.m.	47	3	Not Peak
1:00 p.m.	66	3	Not Peak
2:00 p.m.	200	66	Not Peak
3:00 p.m.	295	239	-19%
4:00 p.m.	401	227	-43%
5:00 p.m.	402	169	-58%
6:00 p.m.	138	5	Not Peak
7:00 p.m.	3	1	Not Peak

Note: Red text identifies a value that is outside of the desired target of ±20 percent.

Exhibit 28. Observed vs Modeled Volumes in Eastbound PPSL for Summer Sunday Conditions

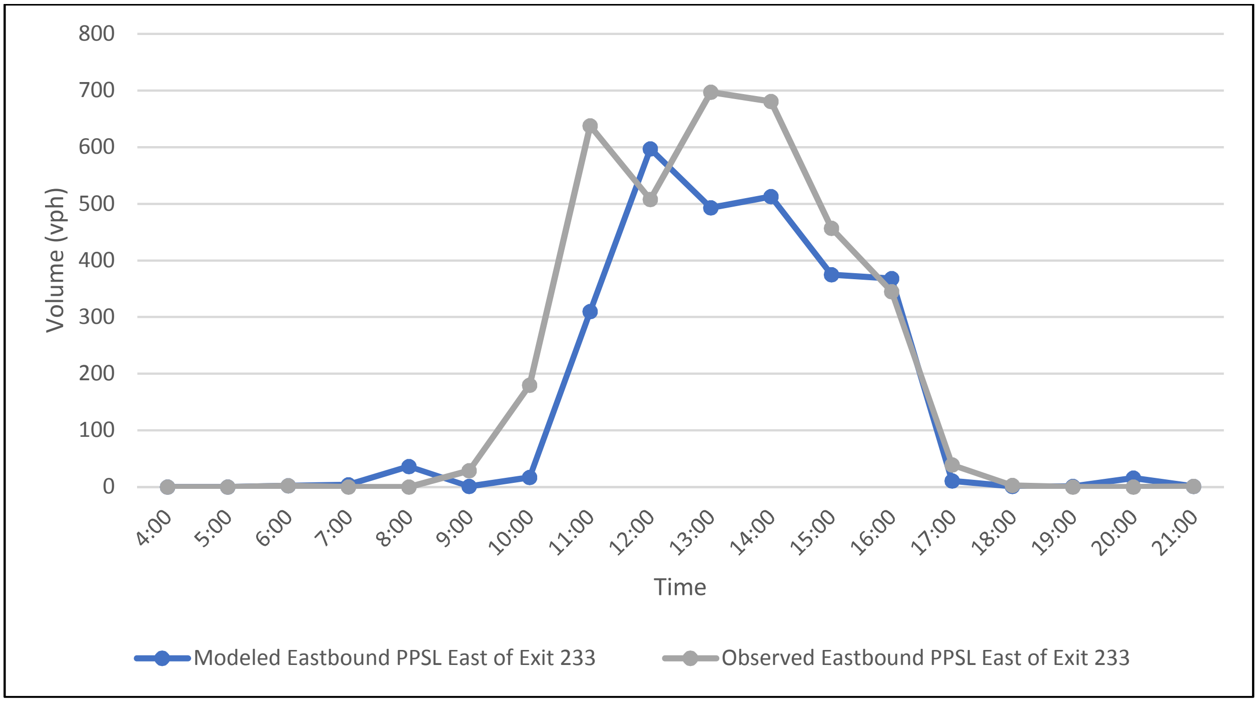
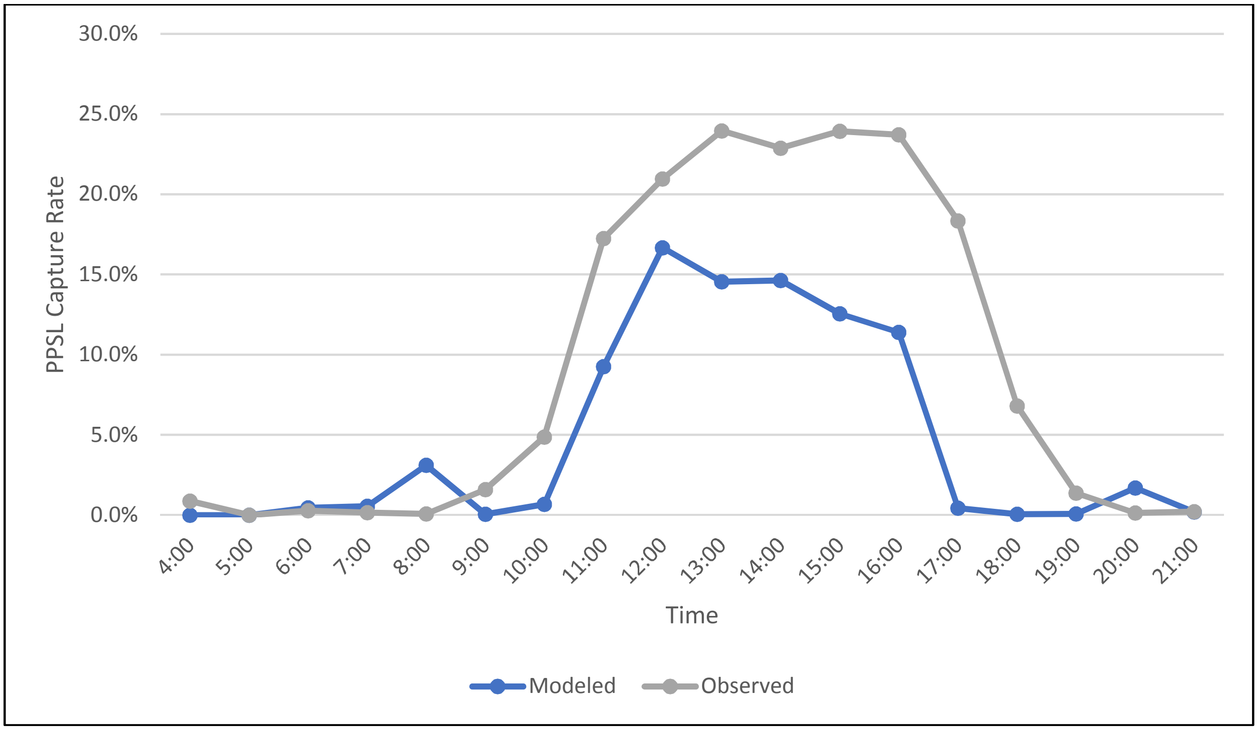


Exhibit 29. Hourly EB PPSL Volume Comparison for Summer Sunday Conditions

Hourly Period	**Observed PPSL Volumes East of Exit 233 (Lawson) on May 28, 2018**	**Modeled EB PPSL Volumes East of Exit 233 (Lawson)**	
		Volume	**% Error**
9:00 a.m.	29	1	Not Peak
10:00 a.m.	180	17	Not Peak
11:00 a.m.	638	310	-51%
12:00 p.m.	508	597	+18%
1:00 p.m.	697	493	-29%
2:00 p.m.	681	513	-25%
3:00 p.m.	457	375	-18%
4:00 p.m.	345	368	+7%
5:00 p.m.	39	11	Not Peak
6:00 p.m.	3	1	Not Peak
7:00 p.m.	0	1	Not Peak

Note: Red text identifies a value that is outside of the desired target of ±20 percent.

Exhibit 30. Capture Rate of Eastbound PPSL for Summer Sunday Conditions



Discussion of Results

The results of the calibration analysis show that the model generally captures the appropriate volumes in the eastbound PPSL during the most congested eastbound I-70 conditions. However, the model does not do as well at capturing eastbound PPSL usage when congestion is less. This is likely a result of the many different decision factors used by drivers when determining whether to use the eastbound PPSL.

Capturing the Peak Usage

Although parameters governing a driver's decision to use the eastbound PPSL, such as the value of time, could have been adjusted further, this was not done because the capture rate during the peak period within the summer Sunday conditions—which represents the highest overall usage of the eastbound PPSL—is very close to in-the-field conditions. Further adjusting values to increase eastbound PPSL usage would likely oversaturate the eastbound PPSL during the peak conditions. This would have a larger overall effect on modeled results as compared to under-representing volumes during lower-volume, off-peak periods.

Unaccounted-For Factors

In general, the model is under-representing volumes in the eastbound PPSL, especially during off-peak periods. This is likely the result of limitations within the traffic model. This is because usage of the eastbound PPSL is governed by numerous factors, many of which are minor and unique to specific driver circumstances and conditions. For example, a driver's willingness to use the eastbound PPSL may change depending on changing weather conditions—if a driver is attempting to get home before a storm occurs—or depending on how long the journey has lasted—if a driver has been traveling all day and is tired, he/she may be more willing to pay to bypass congestion.

Although many different scenarios can be identified, it is likely impossible to perfectly represent each of these conditions within the model. The fact that the model accurately captures volumes during the peak conditions, in which congestion is likely the primary decision-making factor for drivers, reflects that the model is accurately capturing this single scenario. This is important because the purpose of the Floyd Hill project is to identify the best design option(s) to reduce congestion and improve safety throughout the corridor. The calibration results show that this model will be able to capture the appropriate behavior of drivers during congested conditions, which is the primary focus of the evaluation process, even though it may not perfectly capture off-peak conditions when factors other than congestion may play a larger role in a driver's choice to use the eastbound PPSL.

Travel Times

End-to-end travel time data for I-70 were obtained from INRIX for January 13, 2018, and May 28, 2018. INRIX data for these days were used because January 13, 2018, is the same day in which in-the-field winter traffic count information was obtained, and May 28, 2018, is the closest comparable day available to the summer Sunday counts for which there were no incidents or other factors that would skew the travel time data. Travel time data were gathered between Exit 252 (SH 74/Evergreen Parkway) and Exit 228 (Georgetown).

A comparison of end-to-end travel times between modeled and observed conditions for winter Saturday conditions is shown in Exhibit 31 through Exhibit 33 and comparison of the summer Sunday conditions is shown in Exhibit 34 through Exhibit 36.

Exhibit 31. Travel Time and Percent Error by Hour for Winter Saturday Conditions (MP 228 to MP 252)

Hourly Period	**INRIX Travel Times (min, January 13, 2018)**		**Modeled Travel Times (min)**			
	I-70 EB	I-70 WB	I-70 EB		I-70 WB	
			TT	% Error	TT	% Error
4:00 a.m.	26.9	25.6	23.6	-12%	23.2	-9%
5:00 a.m.	26.3	24.7	23.6	-10%	23.9	-3%
6:00 a.m.	26.0	31.6	23.9	-8%	36.6	16%
7:00 a.m.	25.0	77.3	24.2	-3%	76.7	-1%
8:00 a.m.	24.9	70.2	24.4	-2%	82.0	17%
9:00 a.m.	25.3	56.8	24.8	-2%	59.0	4%
10:00 a.m.	25.1	40.5	25.1	0%	36.9	-9%
11:00 a.m.	25.0	31.3	25.6	3%	33.0	5%
12:00 p.m.	24.2	26.8	25.9	7%	26.8	0%
1:00 p.m.	23.8	24.1	26.2	10%	25.4	5%
2:00 p.m.	24.0	22.5	26.8	12%	25.4	13%
3:00 p.m.	26.3	22.4	28.1	7%	25.3	13%
4:00 p.m.	28.7	22.2	30.1	5%	24.9	12%
5:00 p.m.	29.1	22.7	31.2	7%	24.7	9%
6:00 p.m.	24.6	23.6	27.3	11%	24.3	3%
7:00 p.m.	24.8	23.4	25.4	2%	23.9	2%
8:00 p.m.	25.3	24.8	24.9	-2%	23.8	-4%
9:00 p.m.	25.1	24.3	24.4	-3%	23.6	-3%
Route		**FHWA Criteria Target**		**Modeled Percent within Target**		
I-70		85% of results within targets		94%		

Note: Red text identifies a value that is outside of the desired target of ±15 percent.

Exhibit 32. Observed vs. Modeled Travel Times for Winter Saturday Conditions (MP 228 to MP 252)

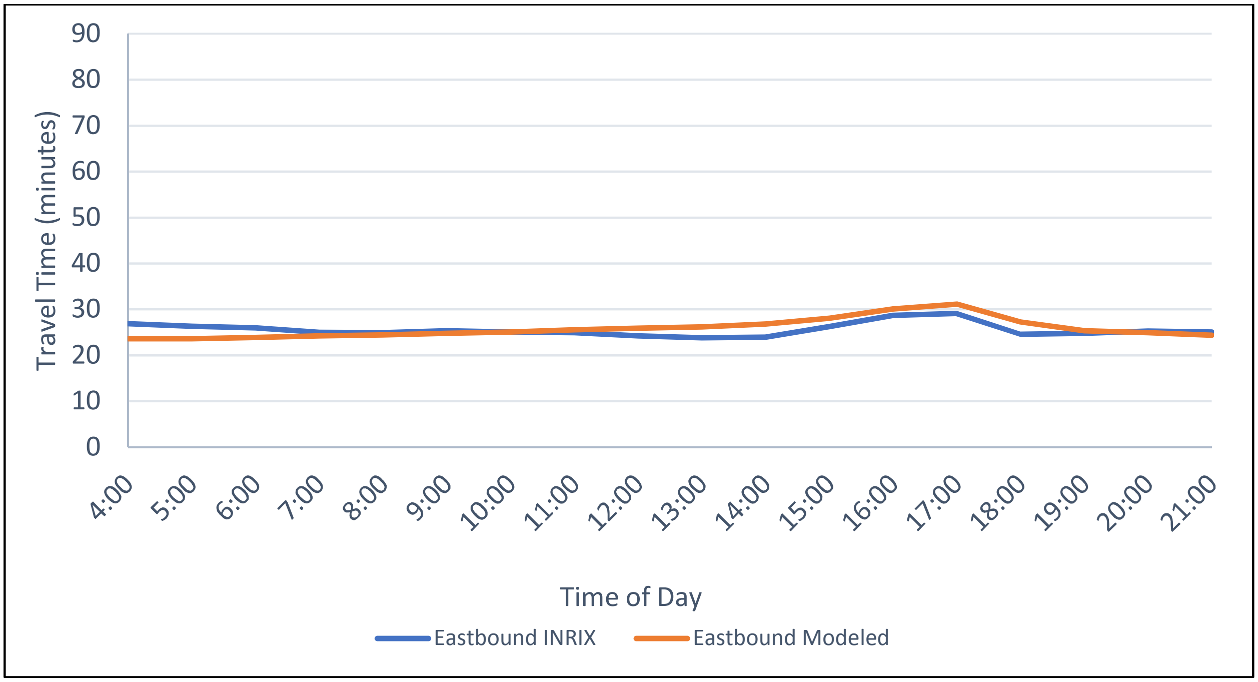


Exhibit 33. Observed vs. Modeled Travel Times for Winter Saturday Conditions (MP 228 to MP 252)

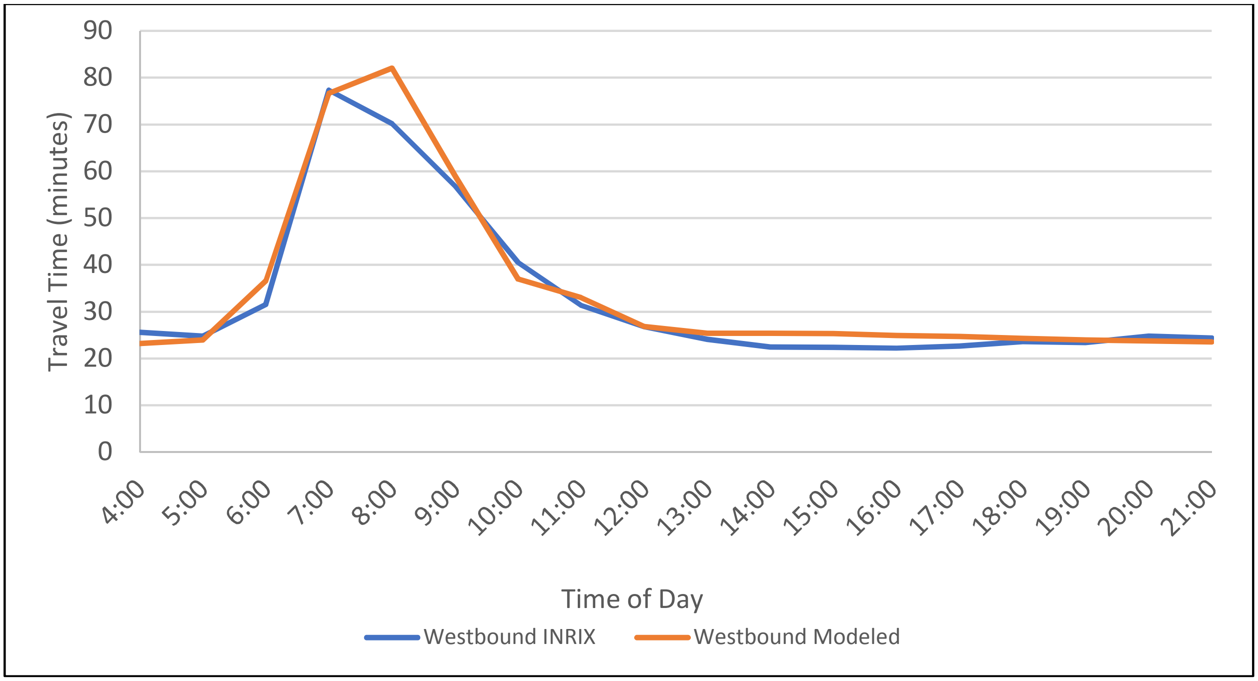


Exhibit 34. Travel Time and Percent Error by Hour for Summer Sunday Conditions (MP 228 to MP 252)

Hourly Period	INRIX Travel Times (min, May 28, 2018)		Modeled Travel Times (min)			
	I-70 EB	I-70 WB	I-70 EB		I-70 WB	
			TT	% Error	TT	% Error
4:00 a.m.	26.1	25.1	23.6	-9%	23.2	-7%
5:00 a.m.	24.4	24.7	23.7	-3%	23.4	-5%
6:00 a.m.	24.7	23.8	24.2	-2%	24.1	1%
7:00 a.m.	25.7	24.4	24.4	-5%	24.5	1%
8:00 a.m.	24.8	26.0	24.8	0%	24.7	-5%
9:00 a.m.	22.6	24.5	25.4	12%	24.9	2%
10:00 a.m.	23.3	22.0	26.1	12%	25.6	16%
11:00 a.m.	26.9	22.8	27.0	0%	26.0	14%
12:00 p.m.	26.8	22.7	28.1	5%	25.9	14%
1:00 p.m.	31.5	23.3	27.5	-13%	25.8	11%
2:00 p.m.	36.4	23.6	27.5	-24%	25.4	8%
3:00 p.m.	39.7	24.5	27.9	-30%	25.4	4%
4:00 p.m.	28.6	25.3	28.0	-2%	25.1	-1%
5:00 p.m.	23.4	23.8	26.3	12%	24.7	4%
6:00 p.m.	24.3	23.4	25.8	6%	24.6	5%
7:00 p.m.	23.7	23.3	25.2	6%	24.3	4%
8:00 p.m.	22.7	23.7	24.7	9%	24.0	1%
9:00 p.m.	24.2	24.8	24.3	0%	23.8	-4%
Route		**FHWA Criteria Target**		**Modeled Percent within Target**		
I-70		85% of results within targets		92%		

Note: Red text identifies a value that is outside of the desired range.

Exhibit 35. Observed vs. Modeled Travel Times for Summer Sunday Conditions (MP 228 to MP 252)

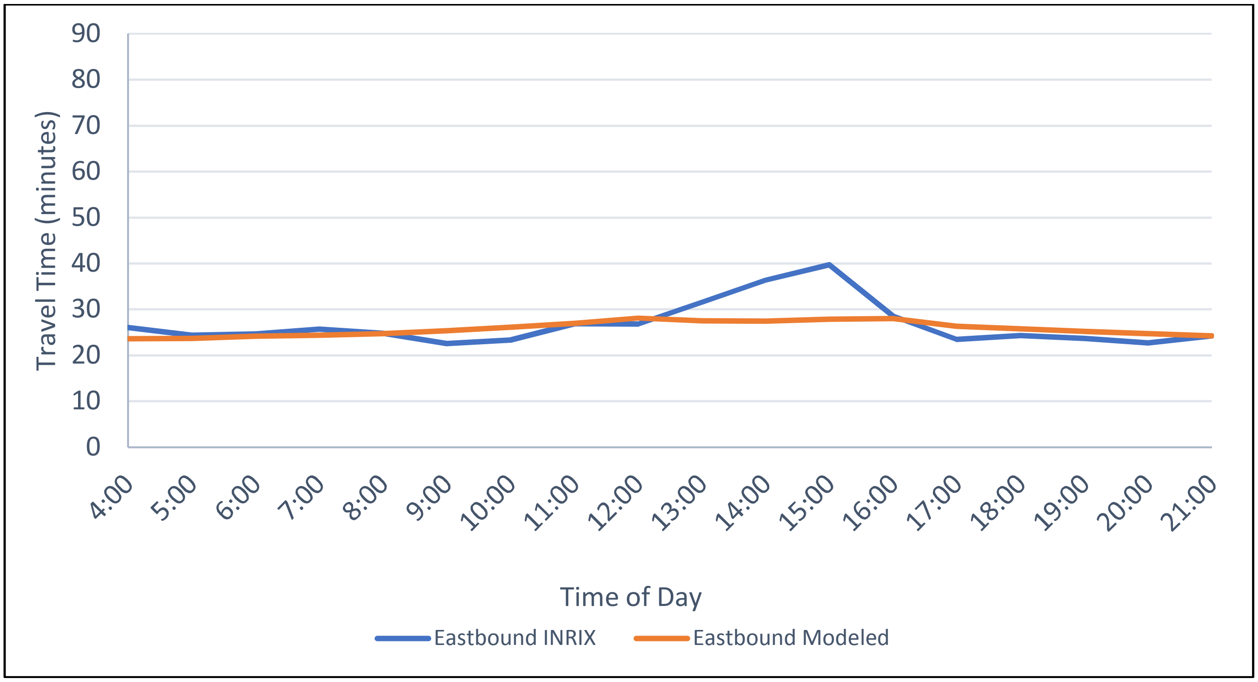
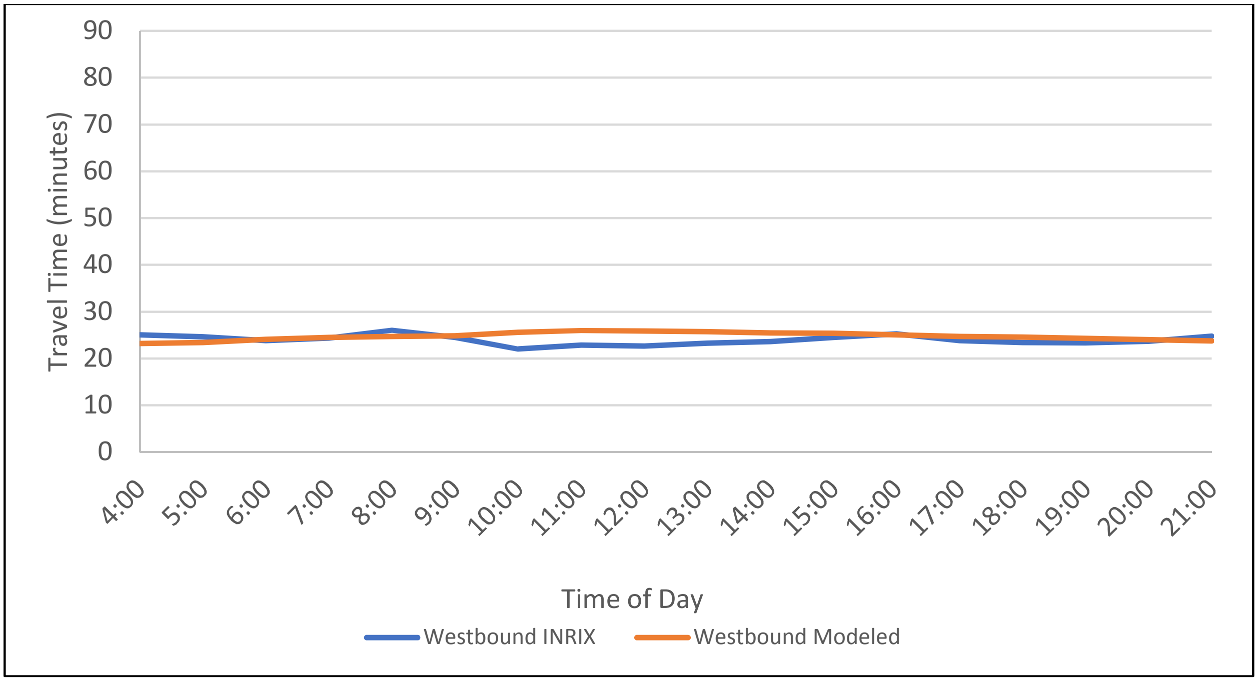


Exhibit 36. Observed vs. Modeled Travel Times for Summer Sunday Conditions (MP 228 to MP 252)



Discussion of Results

The modeled travel times for winter Saturday conditions are very similar to the INRIX travel times on the same days, with almost all the travel times in both directions meeting the calibration target. The only two periods of the winter Saturday model that have modeled travel times outside of the target thresholds are the 6:00 a.m. to 7:00 a.m. and the 8:00 a.m. to 9:00 a.m. time periods. During these two periods, modeled travel times are slightly higher than observed travel times.

The modeled travel times for summer Sunday conditions were like INRIX data in the westbound direction, with all but three periods meeting travel time calibration targets. In the eastbound direction, the model under-represents travel times between 2:00 p.m. and 4:00 p.m. At least part of this error could come from the fact that modeled travel times are based on volumes collected on June 3, 2018, whereas observed travel time data were taken from May 28, 2018. Although the overall volumes between June 3 and May 28 were similar, May 28 was the Monday of Memorial Day weekend. Due to this, the travel patterns may have been slightly different than a typical summer Sunday, resulting in a stronger peak period than typical.

The only other travel time outside of target in the summer Sunday model was the 10:00 a.m. to 11:00 a.m. hour in the westbound direction. During this period, the model over-represents travel times, resulting in slightly longer travel times than what were observed in the field.

Location, Magnitude, and Duration of Congestion

The location, magnitude, and duration of congestion was evaluated in two ways. First, INRIX speed and travel time data were used to compare in-the-field conditions to modeled conditions on a segment-by-segment basis. Second, qualitative queueing data were reviewed to ensure that vehicle queues were being modeled appropriately.

INRIX Segment Comparison

INRIX travel time and speed data for I-70—collected on January 13, 2018, for the winter Saturday model comparison and May 28, 2018, for the summer Sunday model comparison—were broken down into nine individual segments to evaluate the location, magnitude, and duration of congestion that occurred on the days that traffic counts were collected in the field. The modeled travel times and speeds also were broken down into similar segments on I-70 and compared to the INRIX segment data.

It should be noted that the segments in the model and the segments in INRIX do not match exactly due to some ambiguity in the way INRIX creates segments. Although this error is relatively small when looking at the larger corridor, it becomes increasingly more significant as segments become smaller. For this reason, the nine segments were identified to balance the benefits of segment-by-segment comparisons with the level of error. However, even strategically choosing segments cannot completely compensate for this segmentation error. This is apparent by comparing the description of the segments provided by INRIX versus the length of the segments identified by INRIX versus the length of the segments as measured in Google Earth (Exhibit 37 and Exhibit 38). This comparison shows that INRIX segments are consistently longer than the actual length of the described segments.

Exhibit 37: Westbound Segments—Exit 252 (SH 74/Evergreen Parkway) to Exit 228 (Georgetown)

Segment ID	Description/Extents	Length According to INRIX (miles)		Approximate Length as Measured in Google Earth (miles)
		Eastbound	Westbound	
Segment 1	Exit 252 (SH 74/Evergreen Pkwy) to Exit 251 (El Rancho)	4.1	1.5	1.1
Segment 2	Exit 251 (El Rancho) to Exit 248 (Beaver Brook/Floyd Hill)	3.5	3.7	2.8
Segment 3	Exit 248 (Beaver Brood/Floyd Hill) to Exit 247 (Hyland Hills/Floyd Hill)	3.4	4.2	1.4
Segment 4	Exit 247 (Hyland Hills/Floyd Hill) to Exit 243 (Hidden Valley/Central City)	5.3	4.5	3.6
Segment 5	Exit 243 (Hidden Valley/Central City) to Exit 240 (SH 103/Mt Evans)	4.3	4.6	3.3
Segment 6	Exit 240 (SH 103/Mt Evans) to Exit 239 (Idaho Springs)	1.9	2.1	1.0
Segment 7	Exit 239 (Idaho Springs) to Exit 234 (Dumont)	5.8	5.5	4.5
Segment 8	Exit 234 (Dumont) to Exit 233 (Lawson)	2.1	2.2	1.4
Segment 9	Exit 233 (Lawson) to Exit 228 (Georgetown)	7.1	6.3	4.9

Exhibit 38: Eastbound Segments—Exit 228 (Georgetown) to Exit 252 (SH 103/Evergreen Parkway)

Segment ID	Description/Extents	Length According to INRIX (miles)		Approximate Length as Measured in Google Earth (miles)
		Eastbound	Westbound	
Segment 1	Exit 228 (Georgetown) to Exit 233 (Lawson)	7.1	6.3	4.9
Segment 2	Exit 233 (Lawson) to Exit 234 (Dumont)	2.1	2.2	1.4
Segment 3	Exit 234 (Dumont) to Exit 239 (Idaho Springs)	5.8	5.5	4.5
Segment 4	Exit 239 (Idaho Springs) to Exit 240 (SH 103/Mt Evans)	1.9	2.1	1.0
Segment 5	Exit 240 (SH 103/Mt Evans) to Exit 243 (Hidden Valley/Central City)	4.3	4.6	3.3
Segment 6	Exit 243 (Hidden Valley/Central City) to Exit 247 (Hyland Hills/Floyd Hill)	5.3	4.5	3.6
Segment 7	Exit 247 (Hyland Hills/Floyd Hill) to Exit 248 (Beaver Brook/Floyd Hill)	3.4	4.2	1.4
Segment 8	Exit 248 (Beaver Brook/Floyd Hill) to Exit 251 (El Rancho)	3.5	3.7	2.8
Segment 9	Exit 251 (El Rancho) to Exit 252 (SH 74/Evergreen Pkwy)	4.1	1.5	1.1

Even though segments do not match up, it was still considered useful to provide a comparison between the modeled and observed travel times and speeds to determine if the model generally is capturing the overall trends of where congestion was occurring (links where the congestion starts), the magnitude of the congestion (extent of adjacent links showing congestion during the same time periods), and the overall duration of the congestion (number of hours the congestion is present).

Due to the number of data points being compared, multiple exhibits were created to increase the legibility. The contents of all exhibits are summarized below:

- Winter Saturday, Westbound
  - Exhibit 39: Travel Times, Segments 1 through 5
  - Exhibit 40: Speeds, Segments 1 through 5
  - Exhibit 41: Travel Times, Segments 6 through 9
  - Exhibit 42: Speeds, Segments 6 through 9
- Winter Saturday, Eastbound
  - Exhibit 43: Travel Times, Segments 1 through 5
  - Exhibit 44: Speeds, Segments 1 through 5
  - Exhibit 45: Travel Times, Segments 6 through 9
  - Exhibit 46: Speeds, Segments 6 through 9
- Summer Sunday, Westbound
  - Exhibit 47: Travel Times, Segments 1 through 5
  - Exhibit 48: Speeds, Segments 1 through 5
  - Exhibit 49: Travel Times, Segments 6 through 9
  - Exhibit 50: Speeds, Segments 6 through 9
- Summer Sunday, Eastbound
  - Exhibit 51: Travel Times, Segments 1 through 5
  - Exhibit 52: Speeds, Segments 1 through 5
  - Exhibit 53: Travel Times, Segments 6 through 9
  - Exhibit 54: Speeds, Segments 6 through 9

To reduce the repetitiveness of text, data in the legends has been abbreviated using the following nomenclature:

X-YY #

- X = the source of the data, with “I” meaning the data comes from INRIX and “M” meaning the data comes from the mode
- YY = the direction of travel
- # = the segment ID number based on Exhibit 37 and Exhibit 38.

The data is presented in tabular format (Exhibit 55 to Exhibit 58) to show more details regarding the hour-by-hour comparison between the modeled output and the INRIX data.

Exhibit 39. I-70 Westbound Observed vs. Modeled Travel Times for Winter Saturday Conditions (Segments 1 to 5)

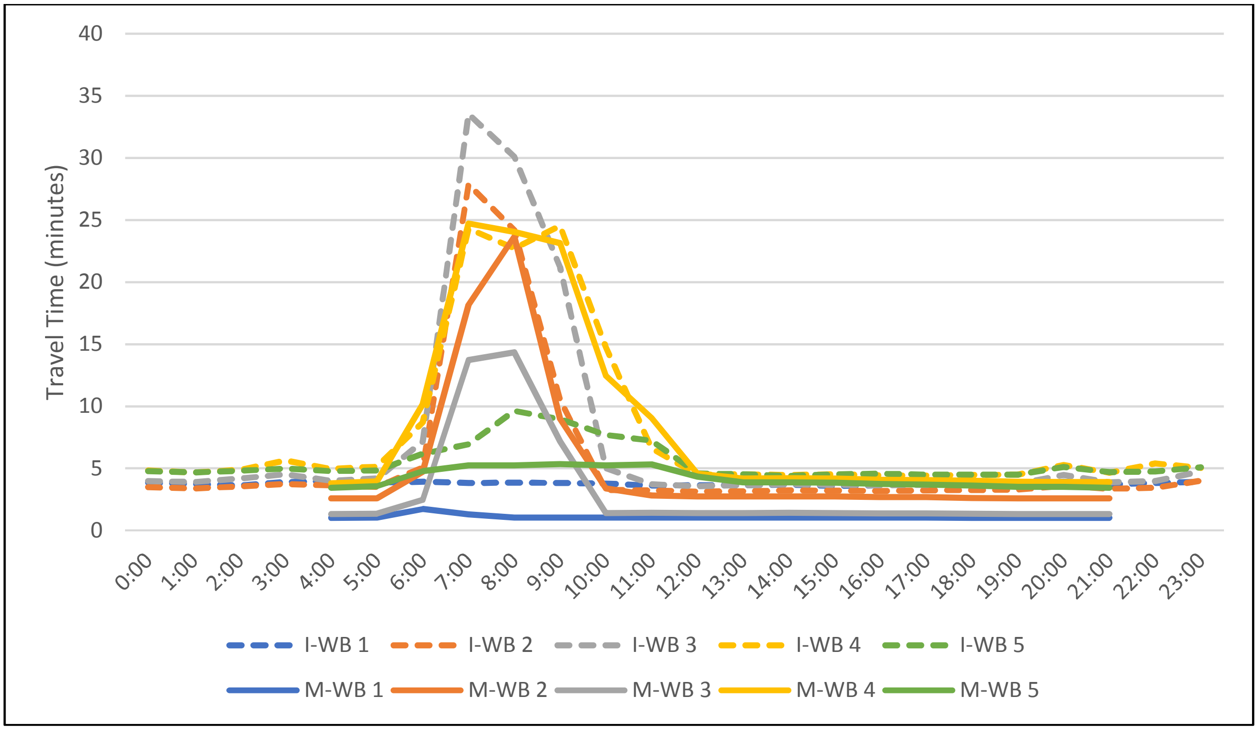


Exhibit 40. I-70 Westbound Observed vs. Modeled Speeds for Winter Saturday Conditions (Segments 1 to 5)

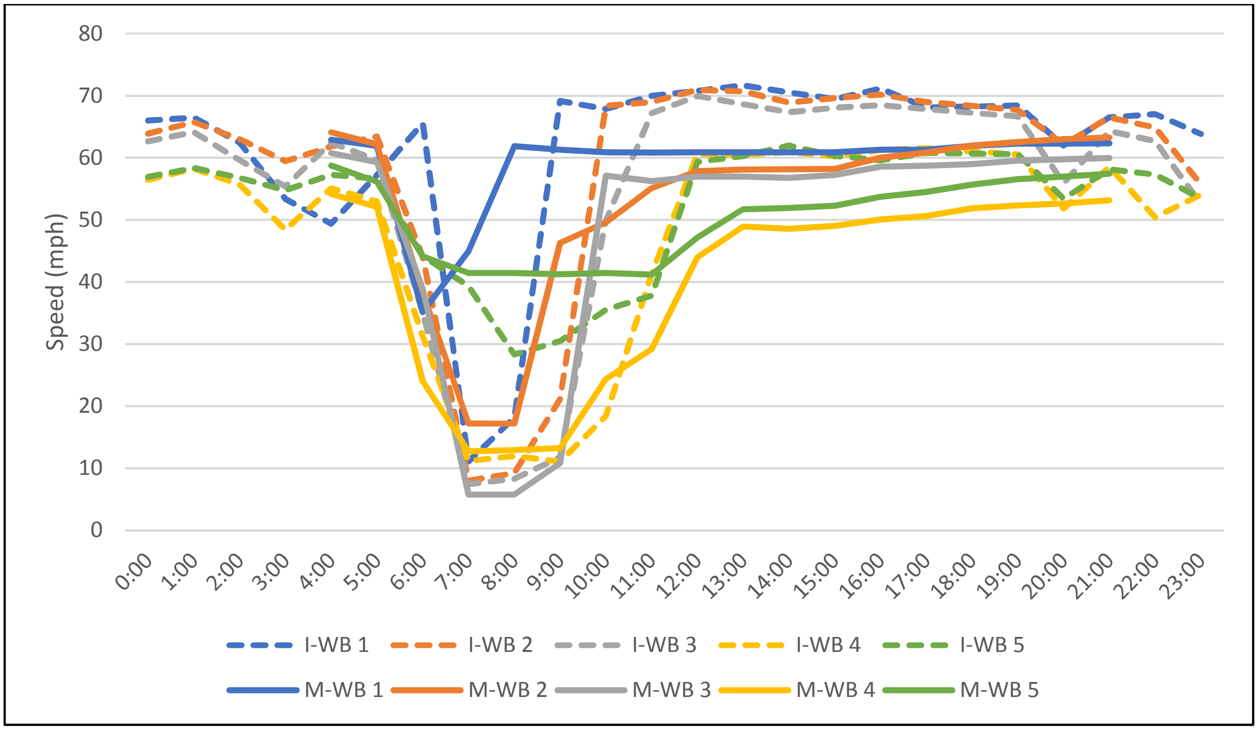


Exhibit 41. I-70 Westbound Observed vs. Modeled Travel Times for Winter Saturday Conditions (Segments 6 to 9)

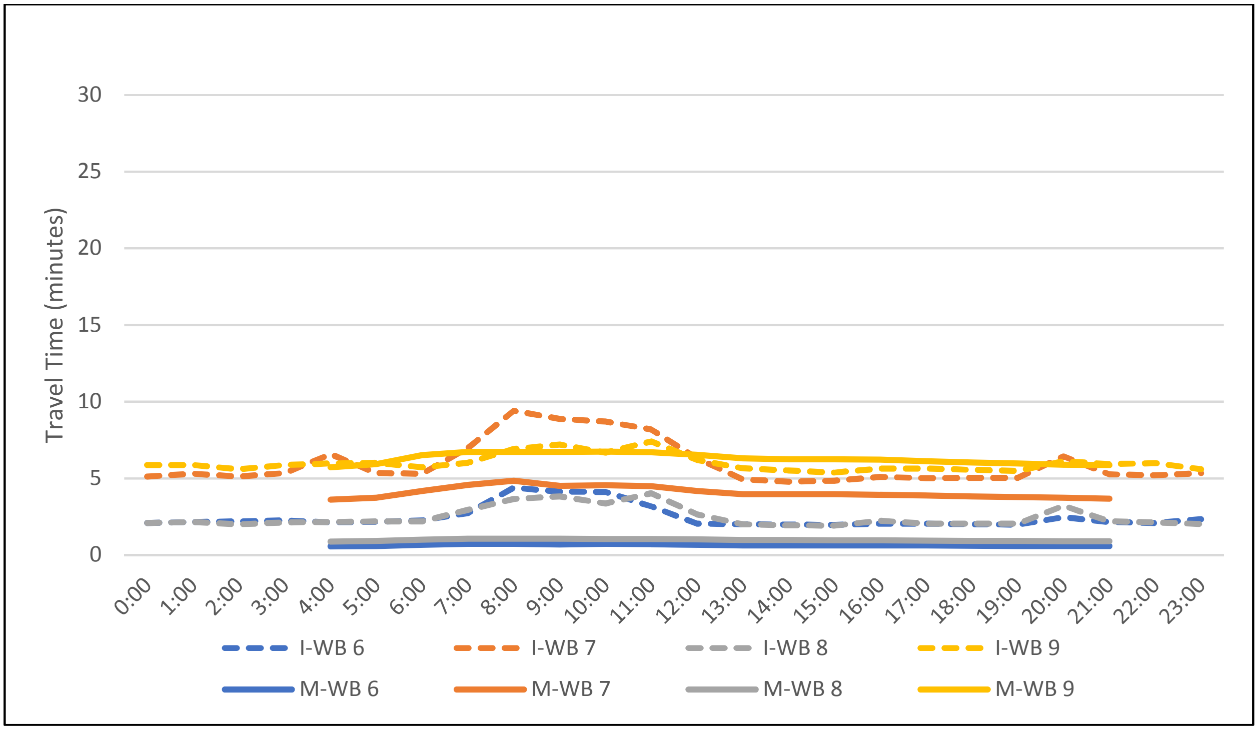


Exhibit 42. I-70 Westbound Observed vs. Modeled Speeds for Winter Saturday Conditions (Segments 6 to 9)

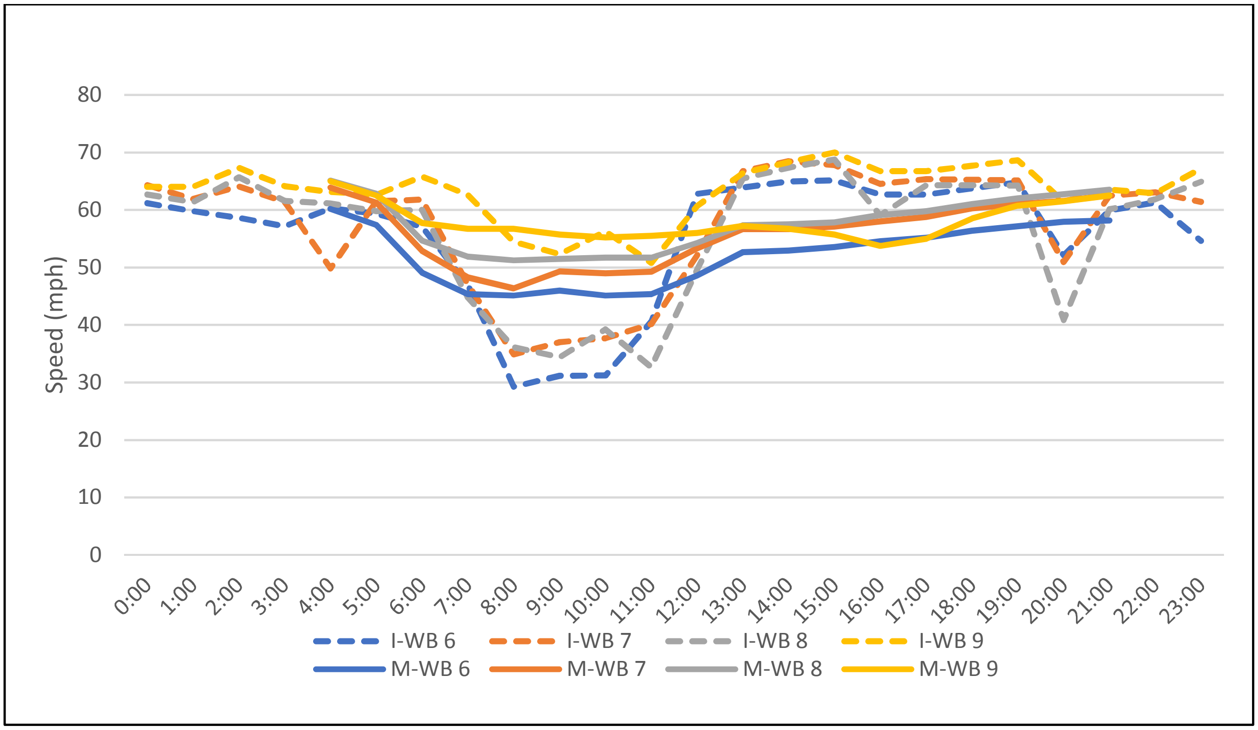


Exhibit 43. I-70 Eastbound Observed vs. Modeled Travel Times for Winter Saturday Conditions (Segments 1 to 5)

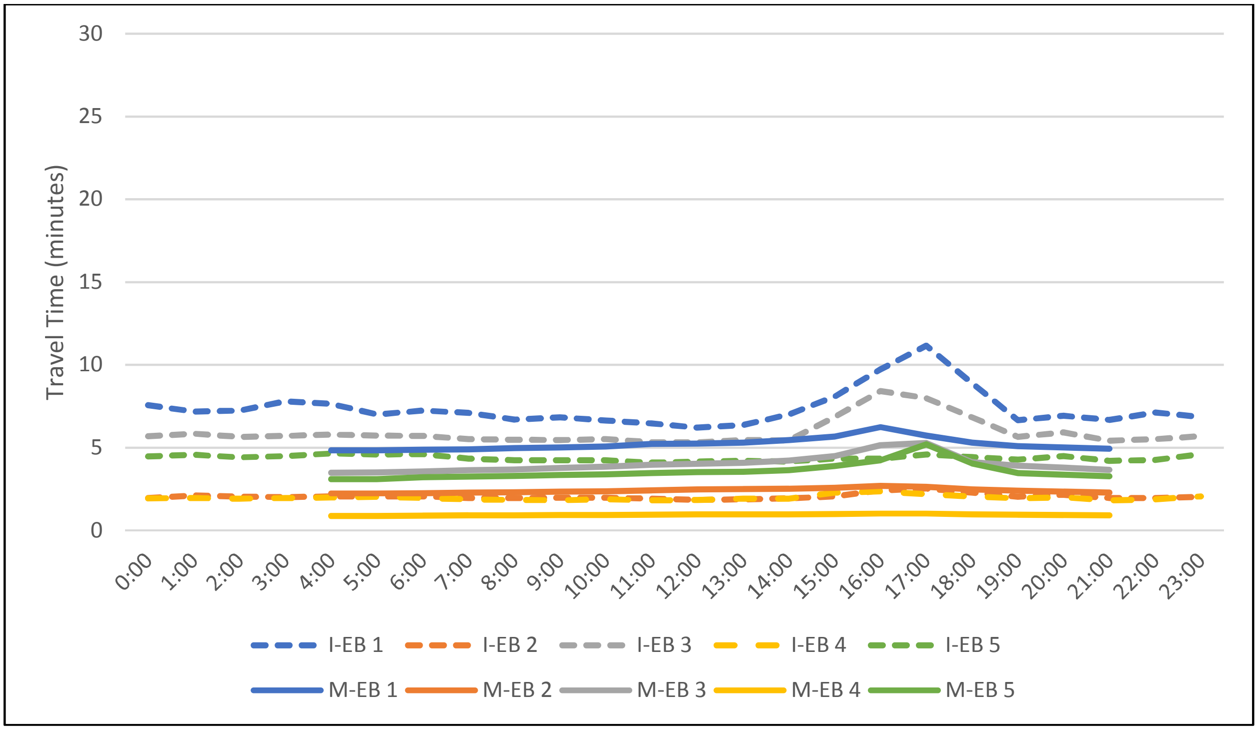


Exhibit 44. I-70 Eastbound Observed vs. Modeled Speeds for Winter Saturday Conditions (Segments 1 to 5)

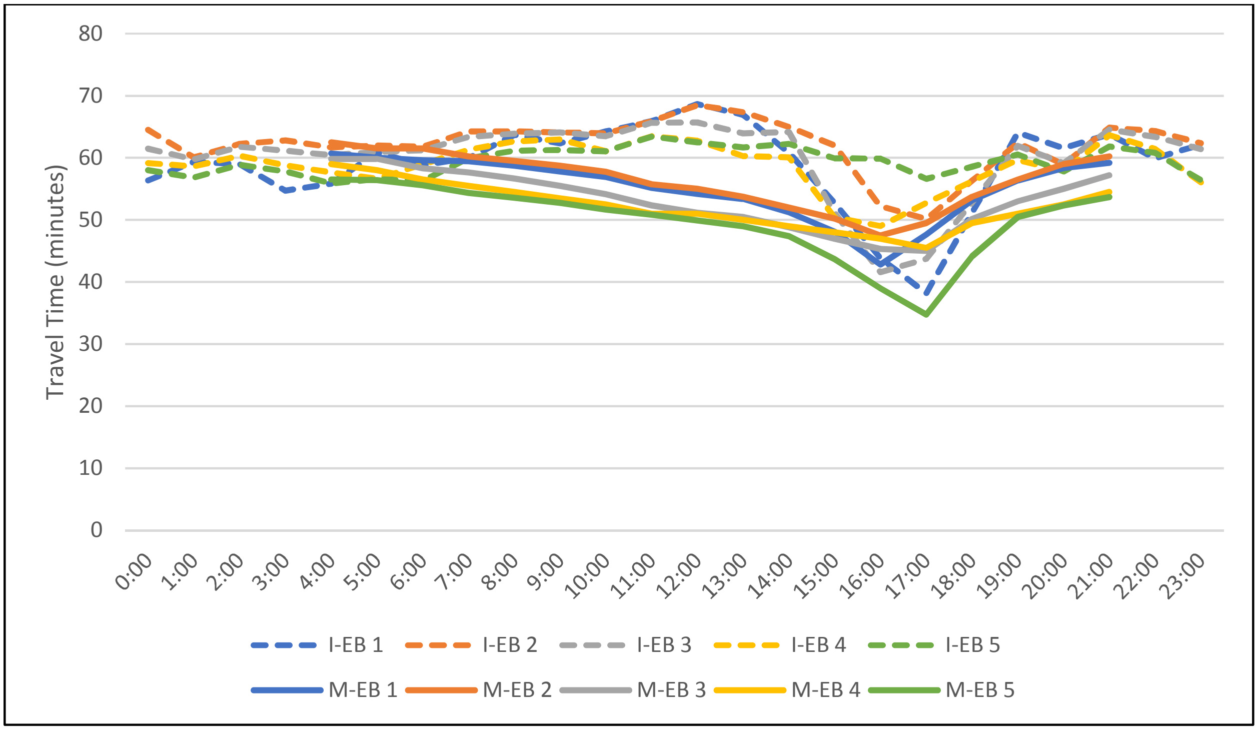


Exhibit 45. I-70 Eastbound Observed vs. Modeled Travel Times for Winter Saturday Conditions (Segments 6 to 9)

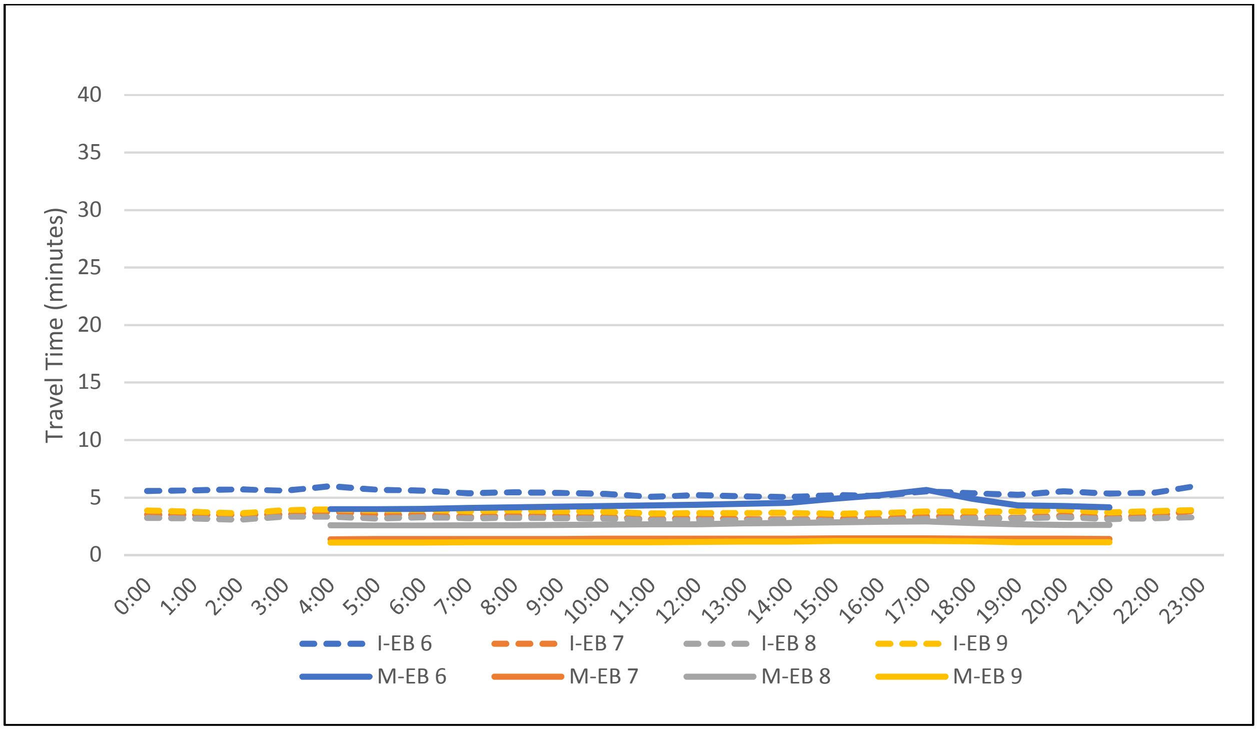


Exhibit 46. I-70 Eastbound Observed vs. Modeled Speeds for Winter Saturday Conditions (Segments 6 to 9)

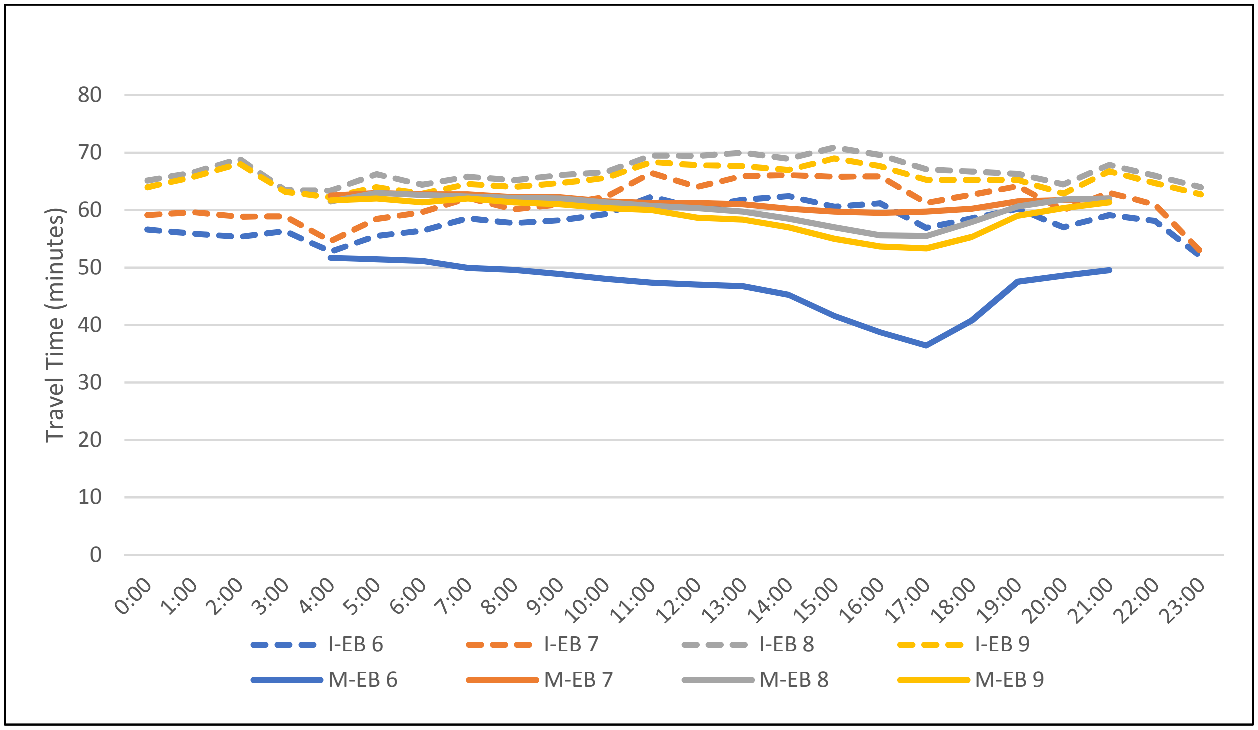


Exhibit 47. I-70 Westbound Observed vs. Modeled Travel Times for Summer Sunday Conditions (Segments 1 to 5)

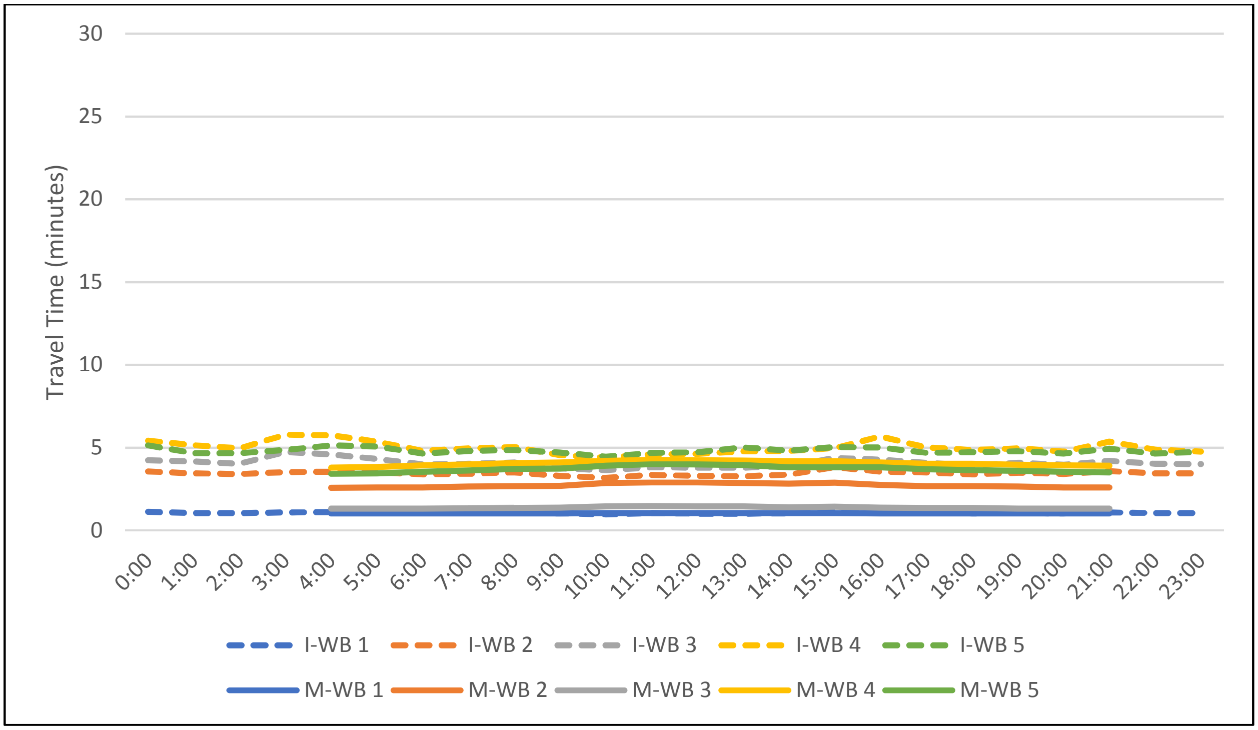


Exhibit 48. I-70 Westbound Observed vs. Modeled Speeds for Summer Sunday Conditions (Segments 1 to 5)

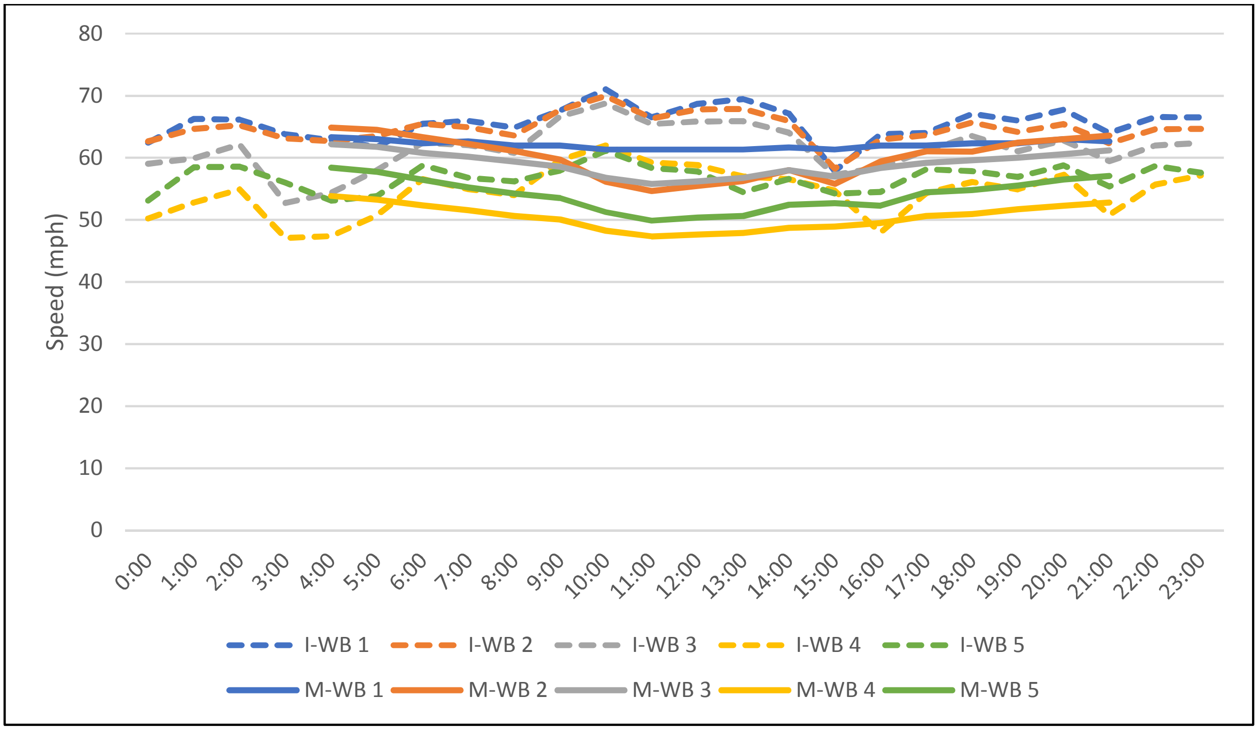


Exhibit 49. I-70 Westbound Observed vs. Modeled Travel Times for Summer Sunday Conditions (Segments 6 to 9)

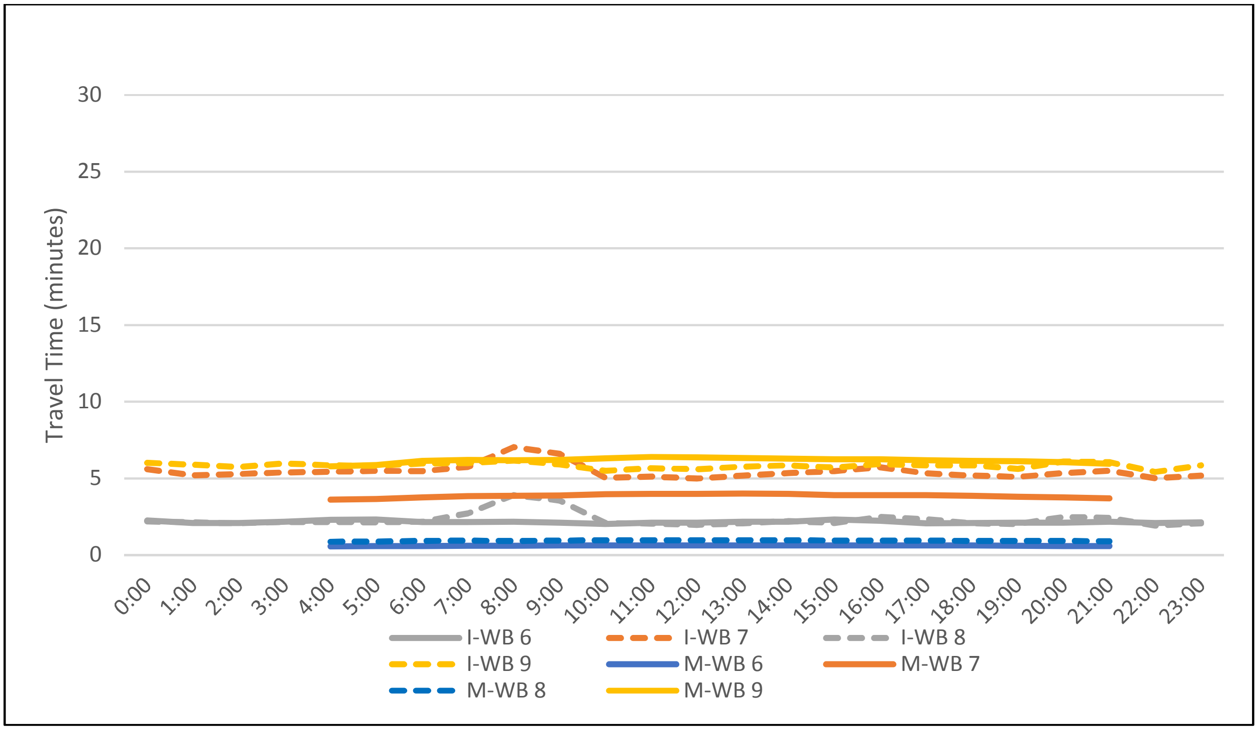


Exhibit 50. I-70 Westbound Observed vs. Modeled Speeds for Summer Sunday Conditions (Segments 6 to 9)

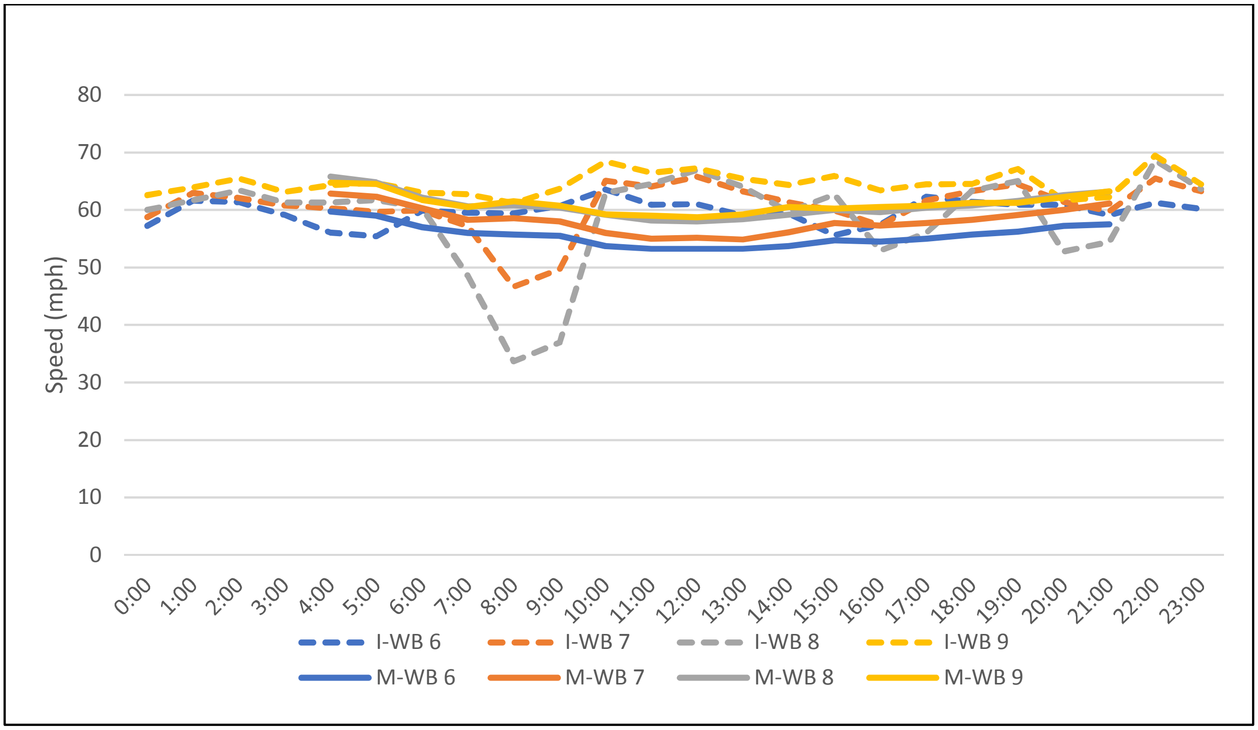


Exhibit 51. I-70 Eastbound Observed vs. Modeled Travel Times for Summer Sunday Conditions (Segments 1 to 5)

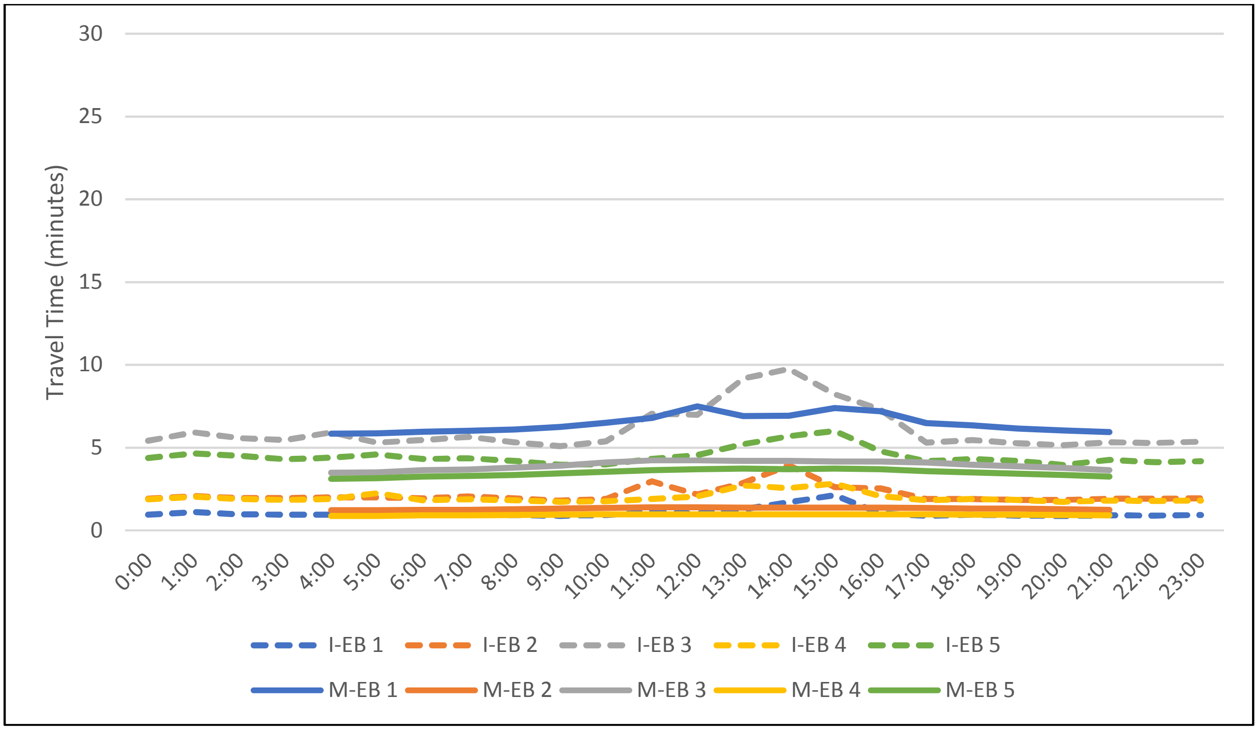


Exhibit 52. I-70 Eastbound Observed vs. Modeled Speeds for Summer Sunday Conditions (Segments 1 to 5)

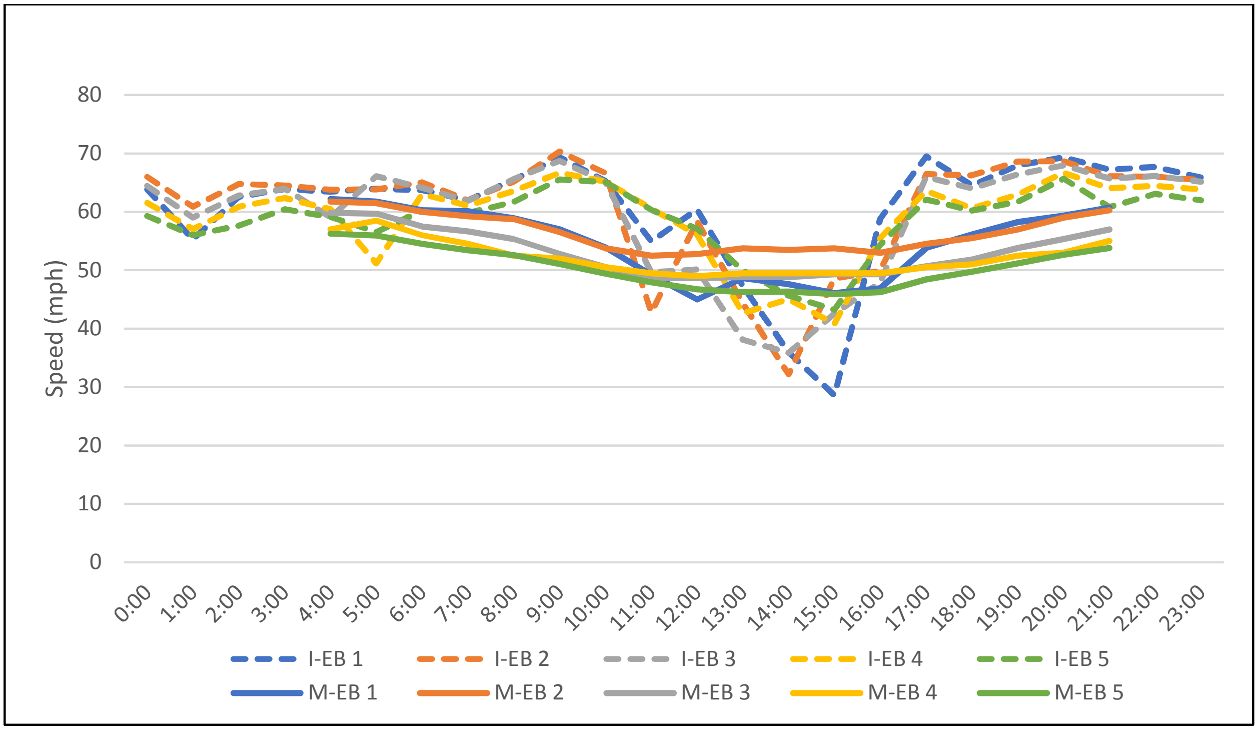


Exhibit 53. I-70 Eastbound Observed vs. Modeled Travel Times for Summer Sunday Conditions (Segments 6 to 9)

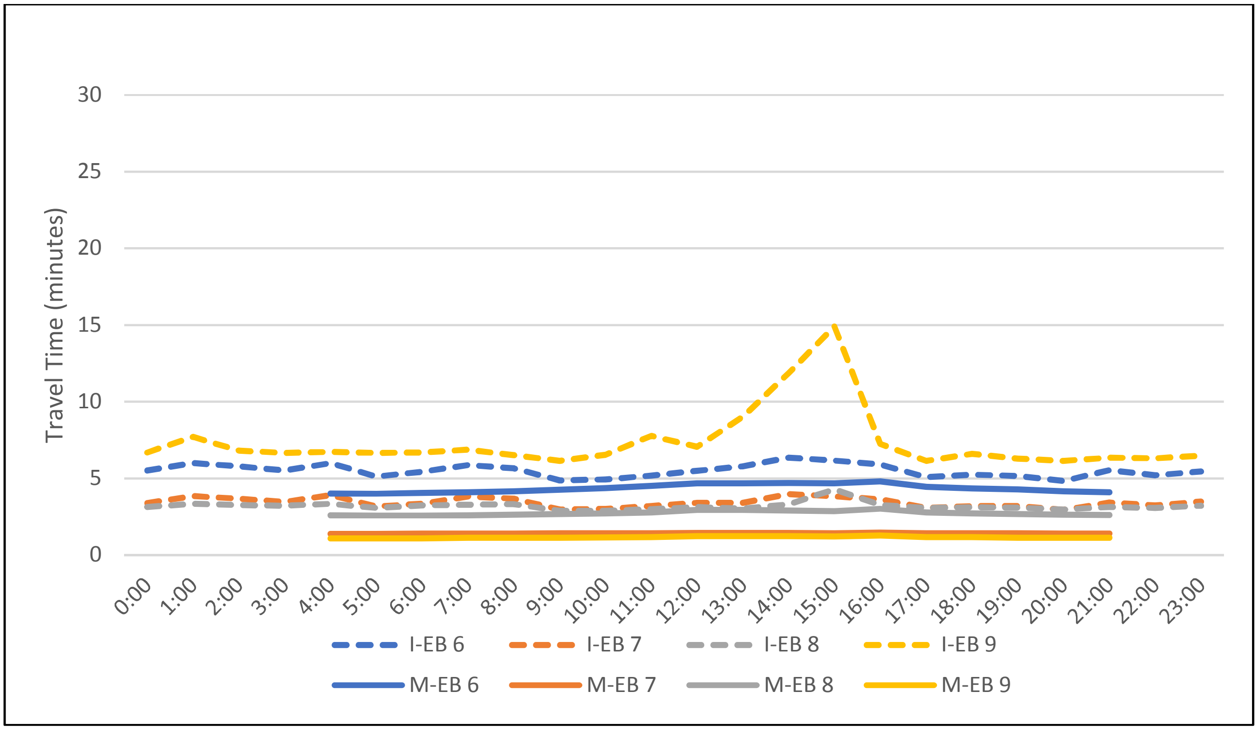


Exhibit 54. I-70 Eastbound Observed vs. Modeled Speeds for Summer Sunday Conditions (Segments 6 to 9)

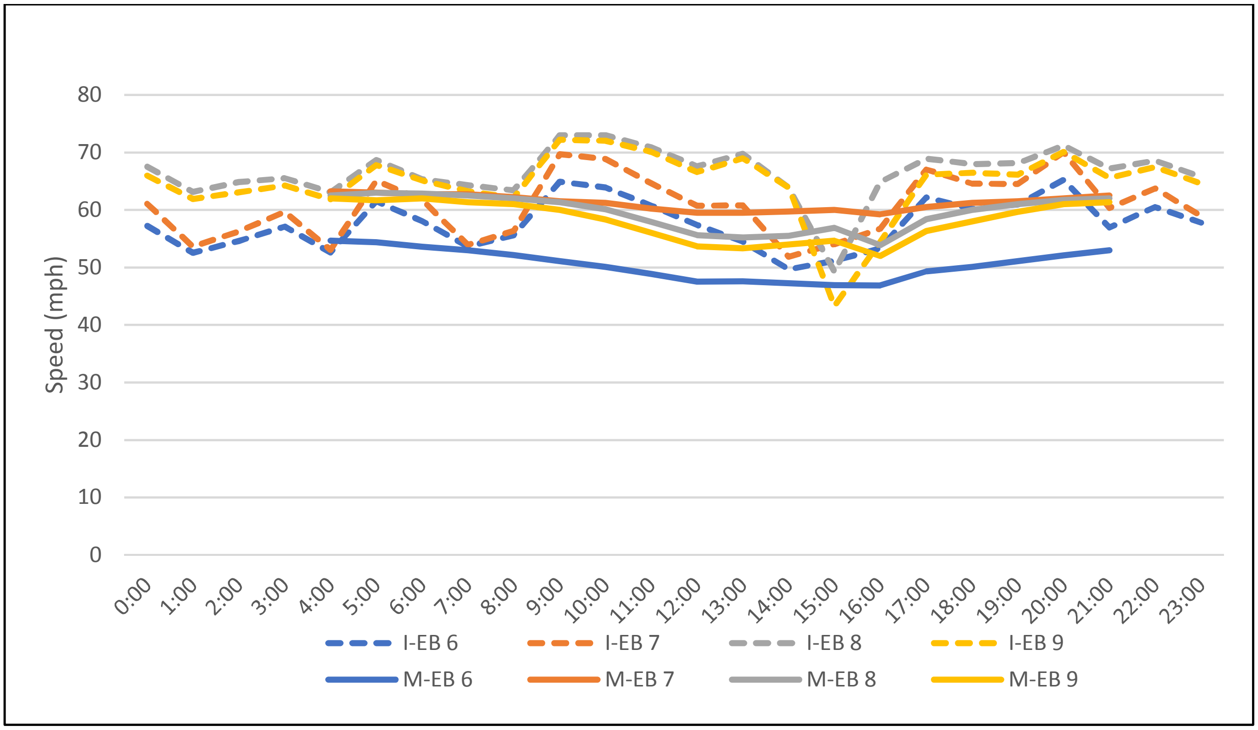


Exhibit 55: Winter, Westbound Segment-by-Segment Comparison—Exit 252 (SH 74/Evergreen Parkway) to Exit 228 (Georgetown)

Winter Saturday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
WB Segment 1	Travel Time (min)	Modeled	1.0	1.0	1.7	1.3	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
		INRIX	1.8	1.6	1.4	8.1	5.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.5	1.4
		%	-44%	-34%	26%	-84%	-79%	-21%	-23%	-19%	-19%	-18%	-20%	-21%	-19%	-22%	-23%	-23%	-30%	-25%
	Speed (mph)	Modeled	62.9	61.9	35.2	44.9	61.9	61.3	60.9	60.9	60.9	60.9	60.9	60.9	61.3	61.3	61.9	62.3	62.3	62.3
		INRIX	49.4	57.3	65.6	11.1	18.1	69.2	67.9	70.0	70.8	71.7	70.5	69.4	71.2	68.1	68.3	68.4	62.0	66.5
		Difference	13.5	4.7	-30.4	33.8	43.8	-7.8	-7.0	-9.1	-9.9	-10.8	-9.6	-8.5	-9.8	-6.8	-6.3	-6.1	0.3	-4.2
WB Segment 2	Travel Time (min)	Modeled	2.6	2.6	4.7	18.2	23.7	9.0	3.4	2.8	2.8	2.8	2.8	2.8	2.7	2.7	2.6	2.6	2.6	2.6
		INRIX	3.6	3.5	5.1	27.9	24.2	10.5	3.3	3.2	3.1	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.6	3.4
		%	-29%	-26%	-7%	-35%	-2%	-15%	4%	-13%	-12%	-13%	-15%	-14%	-16%	-17%	-20%	-21%	-28%	-22%
	Speed (mph)	Modeled	64.1	62.2	38.3	17.2	17.2	46.3	49.6	55.1	57.8	58.1	58.2	58.2	60.0	60.9	62.0	62.5	63.0	63.3
		INRIX	61.8	63.4	44.0	8.0	9.2	21.2	68.4	69.0	71.0	70.7	68.9	69.6	70.2	69.0	68.4	67.7	62.2	66.5
		Difference	2.3	-1.3	-5.7	9.2	8.0	25.1	-18.8	-13.9	-13.1	-12.6	-10.7	-11.4	-10.2	-8.2	-6.4	-5.2	0.8	-3.2
WB Segment 3	Travel Time (min)	Modeled	1.3	1.4	2.5	13.7	14.4	7.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3
		INRIX	4.0	4.2	7.1	33.5	30.1	21.2	5.0	3.7	3.6	3.6	3.7	3.7	3.7	3.7	3.7	3.8	4.5	3.9
		%	-67%	-68%	-65%	-59%	-52%	-66%	-72%	-62%	-61%	-62%	-62%	-62%	-62%	-63%	-64%	-65%	-70%	-66%
	Speed (mph)	Modeled	60.8	59.3	38.9	5.8	5.8	10.8	57.2	56.3	57.0	57.0	56.8	57.2	58.6	58.8	59.0	59.6	59.8	60.0
		INRIX	62.4	59.6	35.0	7.5	8.3	11.8	49.9	67.2	70.0	68.7	67.4	68.1	68.5	67.9	67.3	66.7	55.9	64.3
		Difference	-1.7	-0.3	3.9	-1.7	-2.5	-1.0	7.2	-10.9	-13.0	-11.7	-10.6	-10.8	-9.9	-9.1	-8.3	-7.1	3.9	-4.4
WB Segment 4	Travel Time (min)	Modeled	3.8	4.0	10.2	24.7	24.1	23.2	12.5	9.1	4.6	4.2	4.2	4.2	4.1	4.1	4.0	3.9	3.9	3.9
		INRIX	5.0	5.1	8.7	24.3	22.7	24.5	14.8	6.6	4.5	4.5	4.5	4.5	4.5	4.4	4.5	4.5	5.3	4.7
		%	-23%	-23%	17%	2%	6%	-6%	-16%	37%	2%	-7%	-6%	-7%	-8%	-8%	-10%	-13%	-26%	-16%
	Speed (mph)	Modeled	54.1	52.1	24.0	12.8	12.9	13.3	24.4	29.2	44.0	48.9	48.6	49.1	50.1	50.6	51.9	52.3	52.7	53.2
		INRIX	55.1	53.0	31.3	11.2	12.0	11.1	18.4	41.2	60.6	60.4	61.0	60.2	61.3	61.6	61.1	60.6	51.8	58.6
		Difference	-0.9	-0.9	-7.3	1.5	0.9	2.2	5.9	-12.1	-16.6	-11.5	-12.4	-11.2	-11.2	-10.9	-9.2	-8.2	0.8	-5.4
WB Segment 5	Travel Time (min)	Modeled	3.4	3.6	4.8	5.3	5.3	5.3	5.3	5.3	4.4	3.9	3.9	3.8	3.7	3.7	3.6	3.5	3.5	3.5
		INRIX	4.8	4.8	6.2	6.9	9.6	9.0	7.7	7.2	4.6	4.5	4.4	4.5	4.6	4.5	4.5	4.5	5.1	4.7
		%	-28%	-26%	-22%	-24%	-45%	-40%	-32%	-26%	-5%	-15%	-12%	-15%	-18%	-18%	-19%	-22%	-31%	-26%
	Speed (mph)	Modeled	58.8	56.2	44.1	41.5	41.5	41.2	41.4	41.2	47.2	51.7	51.9	52.3	53.7	54.5	55.7	56.6	57.0	57.4
		INRIX	57.3	56.6	44.2	39.3	28.3	30.5	35.5	37.8	59.3	60.3	62.0	60.4	59.6	60.8	60.7	60.6	53.4	58.2
		Difference	1.5	-0.4	-0.1	2.1	13.1	10.8	5.9	3.4	-12.1	-8.6	-10.1	-8.1	-5.9	-6.3	-5.0	-4.0	3.6	-0.7

Winter Saturday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
WB Segment 6	Travel Time (min)	Modeled	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
		INRIX	2.1	2.2	2.3	2.7	4.4	4.1	4.1	3.2	2.1	2.0	2.0	2.0	2.1	2.1	2.0	2.0	2.5	2.2
		%	-73%	-73%	-70%	-73%	-83%	-83%	-82%	-77%	-67%	-69%	-68%	-68%	-70%	-70%	-70%	-71%	-77%	-73%
	Speed (mph)	Modeled	60.2	57.4	49.1	45.4	45.1	46.0	45.1	45.4	48.6	52.7	53.0	53.6	54.6	55.2	56.4	57.1	58.0	58.2
		INRIX	60.3	59.4	57.1	46.9	29.3	31.2	31.2	40.6	62.8	63.9	65.0	65.1	62.7	62.7	63.8	64.8	52.1	59.9
		Difference	-0.1	-1.9	-8.0	-1.6	15.9	14.8	13.9	4.8	-14.2	-11.2	-12.0	-11.6	-8.1	-7.5	-7.3	-7.7	5.8	-1.8
WB Segment 7	Travel Time (min)	Modeled	3.6	3.8	4.2	4.6	4.9	4.5	4.6	4.5	4.2	4.0	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7
		INRIX	6.6	5.3	5.3	7.0	9.4	8.9	8.7	8.2	6.3	4.9	4.8	4.8	5.1	5.0	5.0	5.0	6.4	5.3
		%	-45%	-30%	-21%	-35%	-48%	-49%	-48%	-45%	-34%	-19%	-17%	-18%	-23%	-23%	-24%	-25%	-42%	-30%
	Speed (mph)	Modeled	63.9	61.3	52.9	48.2	46.4	49.3	49.0	49.3	53.4	56.7	56.7	57.1	58.0	58.8	60.3	61.0	61.6	62.6
		INRIX	49.8	61.5	61.8	47.0	34.9	37.0	37.7	40.1	52.1	66.8	68.5	67.8	64.5	65.3	65.2	65.1	51.0	62.5
		Difference	14.1	-0.2	-8.9	1.2	11.5	12.3	11.3	9.2	1.2	-10.1	-11.8	-10.7	-6.5	-6.6	-4.9	-4.1	10.6	0.1
WB Segment 8	Travel Time (min)	Modeled	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9
		INRIX	2.2	2.2	2.2	2.9	3.7	3.8	3.4	4.0	2.7	2.0	2.0	1.9	2.2	2.1	2.1	2.1	3.2	2.2
		%	-59%	-58%	-55%	-64%	-71%	-72%	-69%	-74%	-62%	-51%	-50%	-49%	-57%	-54%	-55%	-55%	-72%	-59%
	Speed (mph)	Modeled	65.1	62.8	54.6	51.9	51.2	51.5	51.7	51.7	54.3	57.3	57.5	57.9	59.1	59.8	61.0	62.0	62.8	63.5
		INRIX	61.1	59.8	60.0	44.8	36.1	34.4	39.2	32.7	49.6	65.5	67.4	68.8	59.1	64.3	64.3	64.2	40.9	60.1
		Difference	4.0	3.0	-5.3	7.1	15.1	17.1	12.5	19.1	4.7	-8.2	-9.9	-10.9	0.0	-4.5	-3.2	-2.2	21.9	3.4
WB Segment 9	Travel Time (min)	Modeled	5.7	5.9	6.5	6.7	6.7	6.7	6.8	6.7	6.5	6.3	6.3	6.3	6.2	6.1	6.0	6.0	5.9	5.9
		INRIX	6.0	6.0	5.7	6.0	6.9	7.2	6.7	7.4	6.2	5.7	5.5	5.4	5.6	5.6	5.6	5.5	6.1	5.9
		%	-4%	-1%	14%	12%	-3%	-7%	1%	-9%	5%	11%	13%	16%	10%	9%	9%	9%	-4%	-1%
	Speed (mph)	Modeled	65.0	62.5	57.8	56.8	56.8	55.8	55.3	55.5	56.0	57.3	56.8	55.8	53.8	55.0	58.5	60.8	61.5	62.5
		INRIX	63.1	62.6	65.8	62.6	54.5	52.3	56.3	50.8	60.7	66.4	68.3	70.0	66.8	66.8	67.7	68.6	61.5	63.6
		Difference	1.9	-0.1	-8.0	-5.9	2.3	3.4	-1.0	4.7	-4.7	-9.2	-11.6	-14.3	-13.0	-11.8	-9.2	-7.9	0.0	-1.1

Exhibit 56: Winter, Eastbound Segment-by-Segment Comparison—Exit 228 (Georgetown) to Exit 252 (SH 74/Evergreen Parkway)

Winter Saturday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
EB Segment 1	Travel Time (min)	Modeled	4.8	4.8	4.9	4.9	5.0	5.0	5.1	5.2	5.3	5.3	5.5	5.7	6.2	5.7	5.3	5.1	5.0	4.9
		INRIX	7.6	7.0	7.2	7.1	6.7	6.8	6.6	6.5	6.2	6.4	7.0	8.1	9.7	11.2	8.9	6.7	6.9	6.7
		%	-37%	-31%	-33%	-31%	-26%	-27%	-23%	-19%	-15%	-17%	-22%	-30%	-36%	-49%	-41%	-23%	-28%	-26%
	Speed (mph)	Modeled	60.7	60.0	59.6	59.5	58.7	57.8	56.9	55.2	54.2	53.4	51.2	48.1	42.8	47.6	53.2	56.4	58.4	59.2
		INRIX	55.8	60.8	58.9	60.0	63.7	62.4	64.3	65.9	68.7	66.9	60.8	52.7	43.8	38.2	51.1	64.1	61.6	63.8
		Difference	4.9	-0.8	0.8	-0.5	-4.9	-4.6	-7.4	-10.7	-14.5	-13.6	-9.6	-4.6	-1.0	9.4	2.0	-7.7	-3.2	-4.6
EB Segment 2	Travel Time (min)	Modeled	2.2	2.2	2.3	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.5	2.6	2.7	2.6	2.5	2.4	2.4	2.3
		INRIX	2.1	2.1	2.1	2.0	2.0	2.0	2.0	1.9	1.9	1.9	2.0	2.1	2.4	2.5	2.3	2.0	2.2	2.0
		%	9%	9%	10%	16%	17%	19%	19%	27%	35%	33%	30%	26%	11%	4%	9%	18%	9%	16%
	Speed (mph)	Modeled	62.5	61.5	61.5	60.3	59.5	58.8	57.8	55.8	55.0	53.8	52.0	50.3	47.5	49.5	53.8	56.5	59.0	60.3
		INRIX	61.7	62.0	61.8	64.3	64.3	64.1	63.9	65.9	68.5	67.4	65.0	62.0	52.2	50.2	56.3	62.4	59.0	64.9
		Difference	0.8	-0.5	-0.3	-4.0	-4.8	-5.3	-6.2	-10.2	-13.5	-13.6	-13.0	-11.7	-4.7	-0.7	-2.5	-5.9	0.0	-4.6
EB Segment 3	Travel Time (min)	Modeled	3.5	3.5	3.6	3.7	3.7	3.8	3.9	4.0	4.0	4.1	4.2	4.5	5.2	5.3	4.1	3.9	3.8	3.7
		INRIX	5.8	5.7	5.7	5.5	5.5	5.5	5.5	5.3	5.3	5.5	5.5	6.9	8.4	8.0	6.8	5.7	5.9	5.4
		%	-40%	-39%	-38%	-34%	-33%	-31%	-30%	-25%	-24%	-25%	-22%	-34%	-39%	-34%	-40%	-31%	-36%	-32%
	Speed (mph)	Modeled	59.8	59.8	58.3	57.7	56.7	55.5	54.2	52.3	51.2	50.5	48.8	47.0	45.3	45.0	50.2	53.0	55.0	57.2
		INRIX	60.4	61.0	61.2	63.4	63.9	64.1	63.5	65.6	65.7	63.9	64.2	51.1	41.6	43.7	52.8	61.9	59.1	64.6
		Difference	-0.6	-1.1	-2.9	-5.7	-7.2	-8.6	-9.3	-13.3	-14.5	-13.4	-15.3	-4.1	3.8	1.3	-2.7	-8.9	-4.1	-7.4
EB Segment 4	Travel Time (min)	Modeled	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9
		INRIX	2.0	2.0	2.0	1.9	1.8	1.8	1.9	1.8	1.8	1.9	1.9	2.3	2.4	2.2	2.1	1.9	2.0	1.8
		%	-56%	-57%	-54%	-51%	-50%	-49%	-51%	-48%	-47%	-49%	-49%	-56%	-57%	-53%	-53%	-51%	-54%	-49%
	Speed (mph)	Modeled	59.0	58.0	56.5	55.5	54.5	53.5	52.5	51.0	51.0	50.0	49.0	48.0	47.0	45.5	49.5	51.0	52.5	54.5
		INRIX	57.7	56.6	59.0	61.3	62.7	63.0	61.1	63.5	62.8	60.3	60.1	50.4	49.0	52.7	56.2	59.7	57.9	63.7
		Difference	1.3	1.4	-2.5	-5.8	-8.2	-9.5	-8.6	-12.5	-11.8	-10.3	-11.1	-2.4	-2.0	-7.2	-6.7	-8.7	-5.4	-9.2

Winter Saturday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
EB Segment 5	Travel Time (min)	Modeled	3.1	3.1	3.2	3.3	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.9	4.3	5.2	4.1	3.5	3.4	3.3
		INRIX	4.7	4.6	4.6	4.3	4.3	4.2	4.3	4.1	4.2	4.2	4.2	4.3	4.3	4.6	4.4	4.3	4.5	4.2
		%	-33%	-32%	-30%	-25%	-22%	-21%	-20%	-15%	-15%	-16%	-12%	-10%	-2%	13%	-9%	-19%	-25%	-22%
	Speed (mph)	Modeled	56.5	56.4	55.6	54.3	53.6	52.8	51.7	50.8	49.9	49.0	47.4	43.7	39.0	34.8	44.2	50.5	52.3	53.7
		INRIX	55.9	56.6	56.3	59.9	61.2	61.3	61.1	63.4	62.5	61.7	62.3	59.9	59.9	56.6	58.6	60.6	57.8	61.8
		Difference	0.6	-0.1	-0.7	-5.6	-7.6	-8.5	-9.4	-12.6	-12.6	-12.7	-14.8	-16.3	-20.9	-21.9	-14.4	-10.1	-5.5	-8.1
EB Segment 6	Travel Time (min)	Modeled	4.0	4.0	4.0	4.1	4.2	4.2	4.3	4.3	4.4	4.5	4.6	4.9	5.2	5.7	4.9	4.3	4.3	4.2
		INRIX	6.0	5.7	5.6	5.4	5.5	5.4	5.3	5.1	5.2	5.1	5.1	5.2	5.2	5.5	5.4	5.2	5.5	5.3
		%	-33%	-30%	-28%	-24%	-24%	-22%	-20%	-15%	-16%	-13%	-10%	-6%	1%	2%	-9%	-17%	-23%	-22%
	Speed (mph)	Modeled	51.7	51.4	51.2	49.9	49.6	48.9	48.1	47.4	47.1	46.8	45.3	41.6	38.8	36.4	40.8	47.6	48.6	49.6
		INRIX	52.8	55.5	56.4	58.6	57.7	58.2	59.3	62.3	60.4	61.8	62.4	60.6	61.2	56.9	58.6	60.3	57.0	59.1
		Difference	-1.1	-4.1	-5.2	-8.6	-8.1	-9.4	-11.2	-14.9	-13.3	-15.1	-17.2	-19.0	-22.4	-20.4	-17.8	-12.7	-8.4	-9.5
EB Segment 7	Travel Time (min)	Modeled	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.4	1.4	1.4	1.4
		INRIX	3.8	3.5	3.5	3.3	3.4	3.4	3.3	3.1	3.2	3.1	3.1	3.1	3.1	3.4	3.3	3.2	3.4	3.3
		%	-63%	-60%	-60%	-58%	-59%	-59%	-57%	-54%	-56%	-54%	-54%	-54%	-54%	-57%	-57%	-56%	-59%	-57%
	Speed (mph)	Modeled	62.5	63.0	62.8	62.8	62.3	62.3	61.5	61.3	61.3	61.0	60.3	59.8	59.5	59.8	60.3	61.5	61.8	62.0
		INRIX	54.6	58.5	59.7	62.2	60.1	61.0	62.2	66.5	64.0	65.9	66.1	65.8	65.9	61.2	62.7	64.1	60.0	63.0
		Difference	7.9	4.5	3.1	0.6	2.1	1.2	-0.7	-5.2	-2.8	-4.9	-5.8	-6.1	-6.4	-1.5	-2.4	-2.6	1.7	-1.0
EB Segment 8	Travel Time (min)	Modeled	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.9	2.8	2.7	2.6	2.6
		INRIX	3.3	3.2	3.3	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.1	3.0	3.0	3.2	3.2	3.2	3.3	3.1
		%	-22%	-19%	-21%	-19%	-20%	-18%	-16%	-12%	-12%	-9%	-9%	-4%	-5%	-7%	-12%	-16%	-20%	-15%
	Speed (mph)	Modeled	61.5	63.0	62.6	62.4	62.1	62.0	61.4	60.8	60.4	59.8	58.5	57.0	55.6	55.5	57.9	60.6	61.9	62.0
		INRIX	63.4	66.2	64.4	65.8	65.2	66.1	66.6	69.5	69.4	70.0	68.9	70.9	69.6	67.1	66.7	66.3	64.5	67.9
		Difference	-1.9	-3.2	-1.8	-3.4	-3.1	-4.1	-5.2	-8.7	-9.1	-10.3	-10.4	-13.9	-14.0	-11.6	-8.8	-5.7	-2.6	-5.9
EB Segment 9	Travel Time (min)	Modeled	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1
		INRIX	4.0	3.9	3.9	3.8	3.9	3.8	3.8	3.6	3.6	3.7	3.7	3.6	3.7	3.8	3.8	3.8	3.9	3.7
		%	-73%	-72%	-73%	-71%	-71%	-71%	-70%	-69%	-68%	-68%	-68%	-66%	-66%	-67%	-68%	-70%	-71%	-70%
	Speed (mph)	Modeled	61.7	62.0	61.3	62.0	61.3	61.0	60.3	60.0	58.7	58.3	57.0	55.0	53.7	53.3	55.3	59.0	60.3	61.3
		INRIX	62.2	64.0	62.9	64.5	64.0	64.7	65.6	68.4	67.8	67.7	67.0	69.0	67.7	65.2	65.2	65.3	62.9	66.8
		Difference	-0.6	-2.0	-1.5	-2.5	-2.7	-3.7	-5.2	-8.3	-9.2	-9.3	-10.0	-14.0	-14.0	-11.9	-9.9	-6.3	-2.5	-5.4

Exhibit 57: Summer, Westbound Segment-by-Segment Comparison— Exit 252 (SH 74/Evergreen Parkway) to Exit 228 (Georgetown)

Summer Sunday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
WB Segment 1	Travel Time (min)	Modeled	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
		INRIX	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.2	1.1	1.1	1.0	1.1	1.0	1.1
		%	-8%	-10%	-5%	-3%	-5%	0%	7%	0%	3%	4%	1%	-13%	-6%	-6%	-1%	-4%	-1%	-6%
	Speed (mph)	Modeled	63.3	63.0	62.3	62.7	62.0	62.0	61.3	61.3	61.3	61.3	61.7	61.3	62.0	62.0	62.3	62.3	63.0	62.7
		INRIX	62.9	61.8	65.5	66.0	64.9	67.6	71.1	66.5	68.7	69.5	67.1	57.9	63.8	64.0	67.1	66.0	67.8	64.0
		Difference	0.5	1.2	-3.1	-3.3	-2.9	-5.6	-9.7	-5.2	-7.3	-8.1	-5.5	3.4	-1.8	-2.0	-4.8	-3.7	-4.8	-1.3
WB Segment 2	Travel Time (min)	Modeled	2.6	2.6	2.6	2.7	2.7	2.7	2.9	2.9	2.9	2.9	2.8	2.9	2.8	2.7	2.7	2.7	2.6	2.6
		INRIX	3.6	3.5	3.4	3.4	3.5	3.3	3.2	3.4	3.3	3.3	3.4	3.8	3.5	3.5	3.4	3.5	3.4	3.6
		%	-27%	-26%	-24%	-23%	-24%	-18%	-10%	-14%	-12%	-13%	-16%	-25%	-22%	-24%	-21%	-24%	-24%	-27%
	Speed (mph)	Modeled	64.9	64.5	63.3	62.3	61.1	59.7	56.1	54.7	55.5	56.3	58.0	55.8	59.4	61.1	61.0	62.5	63.0	63.6
		INRIX	62.7	63.5	65.5	64.9	63.6	67.7	70.0	66.3	67.8	67.9	66.0	58.3	63.0	63.6	65.7	64.1	65.4	62.3
		Difference	2.1	1.0	-2.2	-2.6	-2.4	-8.0	-13.9	-11.7	-12.4	-11.6	-8.0	-2.5	-3.6	-2.6	-4.7	-1.7	-2.4	1.3
WB Segment 3	Travel Time (min)	Modeled	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3
		INRIX	4.6	4.3	4.0	4.0	4.1	3.8	3.6	3.8	3.8	3.8	3.9	4.4	4.3	4.1	3.9	4.1	4.0	4.2
		%	-71%	-69%	-67%	-67%	-67%	-63%	-60%	-62%	-62%	-62%	-64%	-67%	-68%	-67%	-65%	-67%	-67%	-68%
	Speed (mph)	Modeled	62.2	61.8	60.8	60.2	59.4	58.6	56.8	55.8	56.2	56.8	58.0	57.0	58.4	59.2	59.6	60.0	60.6	61.2
		INRIX	54.3	58.0	62.5	62.1	60.8	66.7	68.8	65.4	65.8	65.9	64.0	57.3	58.5	61.2	63.5	61.1	62.8	59.5
		Difference	7.9	3.8	-1.7	-1.9	-1.4	-8.1	-12.0	-9.6	-9.6	-9.1	-6.0	-0.3	-0.1	-2.0	-3.9	-1.1	-2.2	1.7
WB Segment 4	Travel Time (min)	Modeled	3.8	3.8	3.9	4.0	4.1	4.1	4.2	4.3	4.3	4.2	4.2	4.2	4.1	4.0	4.0	4.0	3.9	3.9
		INRIX	5.8	5.4	4.8	5.0	5.0	4.6	4.4	4.6	4.6	4.8	4.8	5.0	5.7	5.0	4.9	5.0	4.8	5.4
		%	-34%	-28%	-18%	-19%	-19%	-10%	-4%	-7%	-8%	-12%	-13%	-16%	-28%	-20%	-17%	-20%	-17%	-27%
	Speed (mph)	Modeled	53.9	53.3	52.4	51.6	50.6	50.1	48.3	47.4	47.6	47.9	48.7	48.9	49.5	50.6	50.9	51.7	52.3	52.8
		INRIX	47.4	50.7	56.6	55.0	54.0	59.7	62.0	59.3	58.8	57.0	56.6	54.7	47.9	54.4	56.1	54.9	57.3	50.8
		Difference	6.5	2.6	-4.2	-3.4	-3.3	-9.6	-13.7	-11.9	-11.2	-9.0	-7.9	-5.8	1.6	-3.7	-5.2	-3.2	-5.0	2.0
WB Segment 5	Travel Time (min)	Modeled	3.4	3.4	3.5	3.6	3.7	3.7	3.9	4.0	4.0	4.0	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.5
		INRIX	5.1	5.1	4.6	4.8	4.9	4.7	4.5	4.7	4.7	5.0	4.8	5.0	5.0	4.7	4.7	4.8	4.6	4.9
		%	-33%	-32%	-24%	-25%	-23%	-21%	-12%	-15%	-15%	-21%	-21%	-24%	-24%	-21%	-23%	-25%	-23%	-29%
	Speed (mph)	Modeled	58.4	57.7	56.5	55.2	54.3	53.5	51.3	49.9	50.4	50.6	52.4	52.7	52.3	54.5	54.8	55.5	56.5	57.1
		INRIX	53.1	53.9	58.8	56.8	56.2	58.0	61.2	58.4	57.8	54.5	56.6	54.3	54.5	58.2	57.9	57.0	58.8	55.4
		Difference	5.3	3.9	-2.3	-1.6	-1.9	-4.4	-9.9	-8.5	-7.4	-3.8	-4.2	-1.6	-2.2	-3.7	-3.0	-1.4	-2.3	1.7

Summer Sunday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
WB Segment 6	Travel Time (min)	Modeled	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
		INRIX	2.3	2.3	2.2	2.2	2.2	2.1	2.0	2.1	2.1	2.2	2.2	2.3	2.2	2.1	2.1	2.1	2.1	2.2
		%	-75%	-75%	-73%	-72%	-72%	-71%	-69%	-70%	-70%	-71%	-71%	-73%	-72%	-70%	-70%	-72%	-73%	-73%
	Speed (mph)	Modeled	59.8	59.0	57.0	56.0	55.8	55.5	53.8	53.3	53.3	53.3	53.8	54.8	54.5	55.0	55.8	56.3	57.3	57.5
		INRIX	56.1	55.4	59.9	59.5	59.4	60.7	63.6	60.9	61.0	59.0	59.4	55.6	57.5	62.3	61.4	60.9	60.9	59.1
		Difference	3.7	3.6	-2.9	-3.5	-3.6	-5.2	-9.8	-7.6	-7.8	-5.8	-5.6	-0.9	-3.0	-7.3	-5.7	-4.7	-3.6	-1.6
WB Segment 7	Travel Time (min)	Modeled	3.6	3.7	3.8	3.9	3.9	3.9	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.9	3.9	3.8	3.8	3.7
		INRIX	5.4	5.5	5.5	5.7	7.0	6.6	5.0	5.1	5.0	5.2	5.4	5.5	5.7	5.3	5.2	5.1	5.3	5.5
		%	-34%	-34%	-31%	-33%	-45%	-41%	-21%	-22%	-20%	-23%	-25%	-29%	-32%	-27%	-25%	-25%	-30%	-33%
	Speed (mph)	Modeled	62.9	62.3	60.3	58.3	58.6	58.0	56.0	55.0	55.1	54.9	56.1	57.7	57.3	57.7	58.3	59.1	60.0	61.1
		INRIX	60.3	59.7	59.9	57.2	46.6	49.7	65.1	64.1	65.8	63.2	61.4	59.9	57.3	61.6	63.3	64.5	61.4	59.8
		Difference	2.5	2.6	0.4	1.1	11.9	8.3	-9.1	-9.1	-10.6	-8.4	-5.2	-2.2	0.0	-3.9	-5.0	-5.3	-1.4	1.4
WB Segment 8	Travel Time (min)	Modeled	0.9	0.9	0.9	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9
		INRIX	2.2	2.1	2.2	2.7	3.9	3.6	2.1	2.0	2.0	2.1	2.2	2.1	2.5	2.4	2.1	2.0	2.5	2.4
		%	-60%	-59%	-58%	-65%	-76%	-73%	-54%	-52%	-51%	-53%	-56%	-55%	-62%	-60%	-55%	-54%	-63%	-63%
	Speed (mph)	Modeled	65.8	64.8	62.2	60.6	60.8	60.4	59.2	58.2	58.0	58.4	59.2	60.0	59.6	60.4	60.8	61.6	62.6	63.2
		INRIX	61.3	61.8	60.3	48.6	33.7	37.0	63.0	64.5	66.9	64.1	59.7	62.7	53.0	56.0	63.4	65.0	52.8	54.4
		Difference	4.5	3.0	1.9	12.1	27.1	23.4	-3.8	-6.3	-8.9	-5.7	-0.5	-2.7	6.7	4.4	-2.6	-3.4	9.8	8.8
WB Segment 9	Travel Time (min)	Modeled	5.8	5.9	6.1	6.2	6.2	6.2	6.3	6.4	6.4	6.3	6.3	6.3	6.3	6.2	6.2	6.1	6.1	6.0
		INRIX	5.9	5.8	6.0	6.0	6.2	5.9	5.5	5.7	5.6	5.8	5.9	5.7	5.9	5.8	5.8	5.6	6.1	6.1
		%	-1%	1%	3%	3%	0%	5%	15%	13%	14%	10%	7%	9%	5%	6%	5%	9%	-1%	-2%
	Speed (mph)	Modeled	64.8	64.5	61.8	60.5	61.5	60.8	59.3	59.0	58.8	59.3	60.5	60.3	60.5	60.8	61.3	61.3	62.3	63.3
		INRIX	64.3	64.7	63.0	62.7	61.2	63.7	68.4	66.5	67.3	65.4	64.4	65.9	63.4	64.5	64.5	67.1	61.7	62.2
		Difference	0.4	-0.2	-1.3	-2.2	0.3	-2.9	-9.2	-7.5	-8.5	-6.1	-3.9	-5.7	-2.9	-3.7	-3.3	-5.9	0.6	1.0

Exhibit 58: Summer, Eastbound Segment-by-Segment Comparison— Exit 228 (Georgetown) to Exit 252 (SH 74/Evergreen Parkway)

Winter Saturday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
EB Segment 1	Travel Time (min)	Modeled	5.8	5.9	6.0	6.0	6.1	6.3	6.5	6.8	7.5	6.9	6.9	7.4	7.2	6.5	6.4	6.2	6.1	5.9
		INRIX	1.0	1.0	1.0	1.0	0.9	0.9	0.9	1.1	1.0	1.3	1.7	2.1	1.0	0.9	1.0	0.9	0.9	0.9
		%	508%	518%	521%	514%	555%	610%	599%	513%	643%	436%	308%	247%	593%	636%	568%	583%	588%	553%
	Speed (mph)	Modeled	62.2	61.7	60.3	60.1	58.9	57.0	53.9	49.2	45.0	48.6	47.6	46.1	46.9	53.8	56.1	58.3	59.4	60.7
		INRIX	63.4	63.9	63.7	62.0	65.5	69.3	65.3	55.0	60.4	47.3	35.9	28.6	58.8	69.5	64.5	68.0	69.3	67.3
		Difference	-1.3	-2.2	-3.4	-1.9	-6.6	-12.3	-11.4	-5.8	-15.4	1.4	11.7	17.5	-11.9	-15.7	-8.4	-9.7	-10.0	-6.5
EB Segment 2	Travel Time (min)	Modeled	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3
		INRIX	2.0	2.0	2.0	2.1	2.0	1.8	1.9	3.0	2.2	2.9	3.9	2.6	2.5	1.9	1.9	1.9	1.9	1.9
		%	-39%	-39%	-36%	-39%	-34%	-27%	-28%	-53%	-35%	-52%	-65%	-47%	-46%	-28%	-30%	-29%	-31%	-35%
	Speed (mph)	Modeled	61.8	61.5	60.0	59.3	58.8	56.5	53.8	52.5	52.8	53.8	53.5	53.8	53.0	54.5	55.5	57.0	59.0	60.3
		INRIX	63.8	63.9	65.0	62.0	65.2	70.3	66.6	42.8	58.3	44.3	32.2	48.6	49.9	66.5	66.3	68.6	68.7	66.1
		Difference	-2.0	-2.4	-5.0	-2.7	-6.4	-13.8	-12.9	9.7	-5.6	9.4	21.3	5.2	3.1	-12.0	-10.8	-11.6	-9.7	-5.9
EB Segment 3	Travel Time (min)	Modeled	3.5	3.5	3.7	3.7	3.8	3.9	4.1	4.2	4.2	4.2	4.2	4.2	4.2	4.1	4.0	3.9	3.8	3.7
		INRIX	5.9	5.3	5.5	5.7	5.3	5.1	5.4	7.1	7.0	9.2	9.8	8.2	7.3	5.3	5.5	5.3	5.2	5.3
		%	-41%	-34%	-33%	-35%	-29%	-23%	-24%	-40%	-39%	-54%	-57%	-49%	-43%	-23%	-27%	-27%	-27%	-32%
	Speed (mph)	Modeled	59.8	59.7	57.5	56.7	55.3	52.8	50.5	48.7	48.7	48.8	48.8	49.3	49.3	50.7	51.8	53.8	55.3	57.0
		INRIX	59.1	66.1	64.1	61.9	65.6	68.7	65.1	49.6	50.1	38.1	35.9	42.6	47.9	66.0	64.0	66.4	68.0	65.7
		Difference	0.8	-6.4	-6.6	-5.2	-10.3	-15.9	-14.6	-1.0	-1.5	10.7	13.0	6.8	1.4	-15.3	-12.2	-12.6	-12.6	-8.7
EB Segment 4	Travel Time (min)	Modeled	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9
		INRIX	1.9	2.3	1.8	1.9	1.8	1.7	1.8	1.9	2.1	2.7	2.6	2.8	2.1	1.8	1.9	1.8	1.7	1.8
		%	-54%	-61%	-50%	-51%	-49%	-45%	-45%	-49%	-52%	-64%	-62%	-66%	-53%	-47%	-50%	-48%	-46%	-49%
	Speed (mph)	Modeled	57.0	58.5	56.0	54.5	52.5	52.0	50.5	49.5	49.0	49.5	49.5	49.5	49.5	50.5	51.0	52.5	53.0	55.0
		INRIX	60.4	51.2	63.0	61.0	63.6	66.7	65.2	60.6	56.1	42.6	45.1	40.8	55.5	63.6	60.6	62.9	66.7	64.0
		Difference	-3.4	7.3	-7.0	-6.5	-11.1	-14.7	-14.7	-11.1	-7.1	6.9	4.5	8.7	-6.0	-13.1	-9.6	-10.4	-13.7	-9.0
EB Segment 5	Travel Time (min)	Modeled	3.1	3.2	3.3	3.3	3.4	3.5	3.6	3.6	3.7	3.7	3.7	3.7	3.7	3.6	3.5	3.4	3.4	3.3
		INRIX	4.4	4.6	4.3	4.4	4.2	4.0	4.0	4.3	4.6	5.2	5.7	6.0	4.8	4.2	4.3	4.2	4.0	4.3
		%	-29%	-32%	-25%	-24%	-20%	-13%	-11%	-16%	-19%	-28%	-35%	-38%	-23%	-15%	-19%	-19%	-15%	-24%
	Speed (mph)	Modeled	56.3	55.9	54.5	53.4	52.6	51.1	49.4	47.9	46.8	46.3	46.3	45.9	46.3	48.4	49.8	51.2	52.7	53.8
		INRIX	59.1	56.5	60.2	59.8	61.7	65.5	65.1	60.3	57.1	50.0	45.7	43.2	54.4	62.1	60.2	61.7	65.7	60.8
		Difference	-2.9	-0.6	-5.7	-6.4	-9.1	-14.4	-15.7	-12.4	-10.4	-3.7	0.7	2.7	-8.1	-13.7	-10.5	-10.5	-13.0	-7.0

Winter Saturday			4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
EB Segment 6	Travel Time (min)	Modeled	4.0	4.0	4.1	4.1	4.2	4.3	4.4	4.5	4.7	4.7	4.7	4.7	4.8	4.5	4.4	4.3	4.2	4.1
		INRIX	6.0	5.1	5.4	5.9	5.7	4.9	4.9	5.2	5.5	5.8	6.4	6.2	5.9	5.1	5.2	5.2	4.8	5.5
		%	-33%	-22%	-25%	-30%	-27%	-12%	-12%	-13%	-15%	-19%	-26%	-24%	-19%	-12%	-17%	-17%	-14%	-26%
	Speed (mph)	Modeled	54.7	54.4	53.6	53.0	52.2	51.1	50.1	48.9	47.6	47.6	47.3	46.9	46.9	49.3	50.1	51.1	52.1	53.0
		INRIX	52.6	61.5	58.1	53.7	55.6	64.9	63.9	60.8	57.4	54.5	49.7	51.1	53.3	62.2	60.2	61.0	65.2	57.0
		Difference	2.1	-7.2	-4.4	-0.6	-3.5	-13.8	-13.8	-11.9	-9.9	-6.9	-2.4	-4.2	-6.5	-12.9	-10.1	-9.9	-13.1	-4.0
EB Segment 7	Travel Time (min)	Modeled	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.4	1.5	1.4	1.4	1.4	1.4	1.4
		INRIX	3.9	3.2	3.4	3.8	3.7	3.0	3.0	3.2	3.4	3.4	4.0	3.8	3.6	3.1	3.2	3.2	3.0	3.4
		%	-65%	-56%	-58%	-63%	-62%	-52%	-53%	-55%	-57%	-57%	-64%	-63%	-60%	-54%	-56%	-56%	-53%	-59%
	Speed (mph)	Modeled	63.3	63.0	62.8	62.8	62.3	61.5	61.3	60.3	59.5	59.5	59.8	60.0	59.3	60.5	61.3	61.5	62.0	62.5
		INRIX	53.0	65.1	61.7	54.0	56.3	69.7	68.9	64.6	60.7	60.8	51.9	54.0	56.7	67.0	64.6	64.5	70.1	60.3
		Difference	10.2	-2.1	1.0	8.8	5.9	-8.2	-7.6	-4.4	-1.2	-1.3	7.9	6.0	2.5	-6.5	-3.3	-3.0	-8.1	2.2
EB Segment 8	Travel Time (min)	Modeled	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.8	3.0	3.0	2.9	2.9	3.0	2.8	2.7	2.7	2.6	2.6
		INRIX	3.4	3.1	3.2	3.3	3.3	2.9	2.9	3.0	3.1	3.0	3.3	4.3	3.3	3.1	3.1	3.1	3.0	3.1
		%	-22%	-16%	-20%	-21%	-21%	-8%	-6%	-7%	-6%	-3%	-12%	-33%	-7%	-9%	-13%	-14%	-11%	-17%
	Speed (mph)	Modeled	62.5	63.0	62.9	62.5	62.0	61.4	60.1	57.9	55.6	55.3	55.5	56.9	53.9	58.4	60.0	61.0	61.8	62.0
		INRIX	63.1	68.7	65.4	64.3	63.4	73.0	73.0	70.9	67.6	69.8	63.9	49.3	64.9	68.9	68.0	68.2	71.2	67.2
		Difference	-0.6	-5.7	-2.5	-1.8	-1.4	-11.6	-12.9	-13.0	-12.0	-14.5	-8.4	7.6	-11.0	-10.5	-8.0	-7.2	-9.4	-5.2
EB Segment 9	Travel Time (min)	Modeled	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.1	1.1	1.1
		INRIX	6.7	6.7	6.7	6.9	6.5	6.2	6.5	7.8	7.1	9.0	11.9	14.9	7.3	6.1	6.6	6.3	6.2	6.3
		%	-84%	-84%	-84%	-84%	-83%	-82%	-82%	-85%	-83%	-86%	-90%	-92%	-82%	-81%	-82%	-82%	-82%	-82%
	Speed (mph)	Modeled	62.0	61.7	62.0	61.3	61.0	60.0	58.3	56.0	53.7	53.3	54.0	54.7	52.0	56.3	58.0	59.7	61.0	61.3
		INRIX	61.8	67.8	65.2	63.3	62.1	72.2	72.0	70.1	66.6	69.0	63.9	43.3	54.4	66.1	66.5	66.2	70.1	65.6
		Difference	0.2	-6.2	-3.2	-1.9	-1.1	-12.2	-13.7	-14.1	-12.9	-15.6	-9.9	11.4	-2.4	-9.8	-8.5	-6.5	-9.1	-4.2

Discussion of Results

When examining the segment-by-segment results, it is important to note that the exact limits of the IRNIX data and the modeled results do not match up. This discrepancy is a limitation of the data outputs obtained from INRIX. Therefore, some segments may appear to be outside of targets when the results match in-the-field conditions. An example of this can be seen in the winter Saturday results for westbound Segment 3 (see Exhibit 39 and Exhibit 40). For this segment, the INRIX travel time is about double the modeled travel time; however, when looking at the speed data, the modeled results are very close to the INRIX data. Therefore, the discrepancy in travel time is being caused by the combination of low speeds—less than 10 mph during the peak period—and the additional two to three miles of length included in the INRIX segment as compared to the modeled segment. This kind of discrepancy should be considered when interpreting the results.

A review of the data indicates most of the congestion for westbound I-70 occurs within the first four to five segments (Evergreen Parkway to SH 103), which coincide with the project limits. The model accurately represents congestion in terms of location, magnitude, and duration on the first five segments. For Segments 6 to 9, the travel times on these segments typically are less than five minutes. There is some congestion on the approach to US 40 and the model shows some of this congestion. Although the model does not capture the minor congestion near the eastern portion of the corridor, it is still considered well calibrated for this project. This is because westbound Segments 6 through 9 (SH 103 to Georgetown) are several miles downstream of the project limits. Congestion in this area is unlikely to impact operations in the project area and will, therefore, not reduce the model's ability to provide a comparison of the design options.

Most congestion along eastbound I-70 occurs within the first few eastbound segments (Georgetown to Downieville), on the approach to and through the US 40 interchange. The model does show some indications of congestion in this area; however, these segments are several miles upstream of the project limits and the congestion in this area is unlikely to impact the operations in the project area. Therefore, it was determined that the model can analyze design options well for this project. For eastbound Segments 5 to 9 (SH 103 to Evergreen Parkway), which coincide with the project limits, the travel times on these segments are much less than five minutes and show very little or no fluctuation across the day, which is consistent with little or no congestion in the project limits for eastbound I-70. The model shows similar overall magnitude of travel times for all segments of eastbound I-70.

Very similar patterns are seen in the summer Sunday model, with the model accurately capturing congestion within the study area, but not capturing congestion quite as well near the western end of the model. As with the winter Saturday model, this will not affect the model's ability to evaluate design options within the study area.

Queues

A visual review of the model was completed to check the overall operation of all roadways and intersections within the modeling area. This check verified that intersections are operating with queue levels that are consistent with in-the-field observations and/or input from stakeholders. This comparison was done on a qualitative basis because no quantitative queueing data were available. Exhibit 59 summarizes the comparison between observed and modeled queues.

Exhibit 59. Comparison Between Observed vs. Modeled Queues

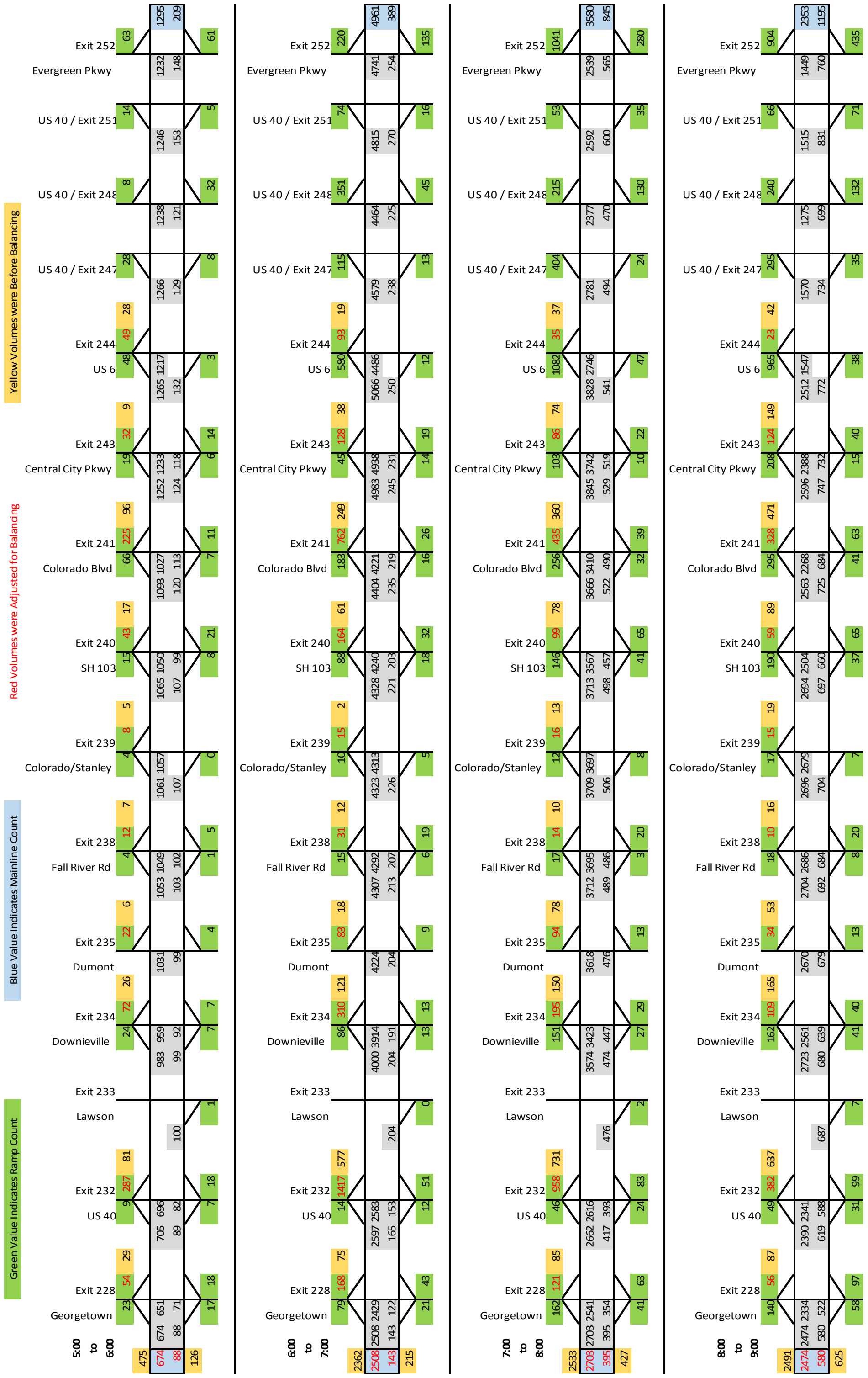
Scenario	Observation	Modeled Results
Winter Saturday	During the AM peak, queues are observed at the intersection of US 6 and US 40. Often, queues are observed to extend more than 1,000 feet along US 40.	During the peak period, queues along US 40 form at the US 6 intersection and extend back approximately two miles, reaching the Homestead Road interchange.
Winter Saturday	During the AM peak, queues form along US 6 at the merge point with westbound I-70. These queues typically extend several hundred feet.	During the peak period, queues along US 6 at the merge point with westbound I-70 extend back approximately 1,000 feet.
Winter Saturday	During the AM peak, queues form along US 40 westbound between the stop-controlled intersections at Homestead Road and CR 65 that provide access to split diamond interchanges with I-70. Congestion also occurs along Homestead Road, CR 65, and the I-70 westbound ramps as queues on US 40 restrict traffic flow. Queues along US 40 often extend more than 1,000 feet.	The westbound queue on US 40 begins at the US 6 intersection and extends up the hill, past the Homestead Road interchange, to the CR 65 interchange. This queue restricts movements to and from Homestead Road and CR 65.
Winter Saturday	During the AM peak, the I-70 westbound mainline experiences queueing from the bottom of Floyd Hill and the US 6 merge, past the lane-drop from three to two westbound lanes, and east of the Beaver Brook interchange with CR 65. The I-70 mainline queueing often extends upwards of five miles at its maximum and lasts for several hours.	Queueing on westbound I-70 begins at the US merge with westbound US 6 and extends approximately 1,500 feet past the CR 65 interchange. This queue begins to form around 6:30 a.m. and peaks around 8:30 a.m.
Summer Sunday	During the PM peak, queues are observed at the entrance ramp to I-70 eastbound from US 40 near Empire. These queues typically extend several hundred feet.	Queues on the US 40 on-ramp to eastbound I-70 generally are minor and form at the stop bar of the metering light. This queue does not exceed 100 feet in length.
Summer Sunday	The I-70 eastbound mainline experiences little to no queueing within the study area throughout the day, including during the PM peak.	No queueing occurs on the I-70 eastbound mainline.

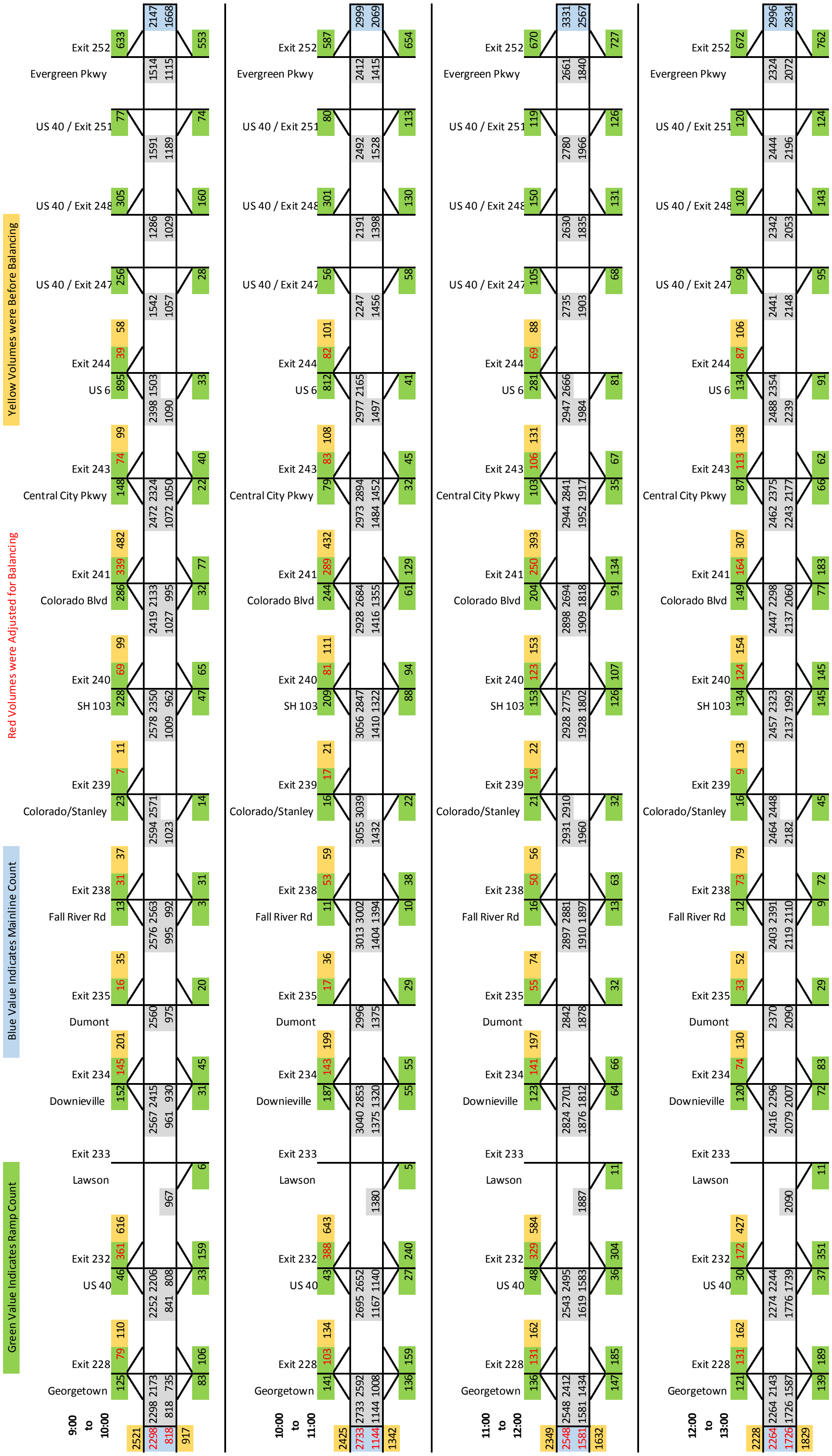
Conclusion

The purpose of this traffic model is to accurately compare different design options as part of the Floyd Hill to Veterans Memorial Tunnels EA. The results of the calibration analysis show that the model is capturing typical travel patterns within the study area. Although some elements of the model do not meet the predefined calibration targets, the causes of these errors will not affect the overall outcomes of the comparative analysis process. Therefore, this model is considered calibrated and ready for use during the design options evaluation process of the Floyd Hill to Veterans Memorial Tunnels EA Project.

Appendix A

I-70 Mainline and Ramp Volume Adjustments for AM Hours for Winter Saturday Conditions




Yellow Volumes were Before Balancing
Red Volumes were Adjusted for Balancing
Blue Value Indicates Mainline Count
Green Value Indicates Ramp Count
Exit 252
Evergreen Pkwy
US 40 / Exit 251
US 40 / Exit 248
US 40 / Exit 247
Exit 244
US 6
Exit 243
Central City Pkwy
Exit 241
Colorado Blvd
Exit 240
SH 103
Exit 239
Colorado/Stanley
Exit 238
Fall River Rd
Exit 235
Dumont
Exit 234
Downieville
Exit 233
Lawson
Exit 232
US 40
Exit 228
Georgetown
9:00 to 10:00
10:00 to 11:00
11:00 to 12:00
12:00 to 13:00

Appendix B

Hourly Origin-Destination Matrices (4:00 a.m. to 10:00 p.m.) for Winter Saturday Conditions

4:00 to 5:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	0			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				2	6			17
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	1	0	0		1	0	0			1	0	1	0	0	11	3	1	0	34
CO 65	**144**	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	0	0	8
Hyland Dr	**145**						0	0			0			0				0	0			3
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	0			2
Evergreen Pkwy	**148**	0	0	0	0	0	0	0	0	0		7	0	0	0	0	0	1	0	0	0	29
Swede Gulch Rd	**149**							0			4			0				0	0			4
I-70 EB	**150**	1	0	4	0	0	3	2	1	0	2	2	4	2	3	2	10	1		6	1	33
Miner St W	**151**						0	0			0			0				1	3			7
CO 103	**152**	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	1	2	0	0	0
Miner St E	**153**						0	0			0			0				1	2			7
Fall River Rd	**154**						0	0			0			0				0	2			4
Mountain St	**157**						0	0			0			0				0	0			1
US 40	**158**	0	0	1	0	0	1	0	0	0	1	1	1	1	1	1	0		2	2	0	12
Argentine St	**161**						0	0			0			0				1	4			6
15th St	**162**						0	0			0			0				1	3			4
I-70 WB	**165**	0	0	5	0	0	7	5	2	1	13	13	8	3	8	2	1	5	154	4	0	

5:00 to 6:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	3			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				4	15			13
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	4	0	0		1	1	0	0		18	2	17	2	1	2	8	7	1	0
CO 65	**144**	0	0	1	0	0	1		0	0	0	0	4	1	1	1	0	3	0	2	0	15
Hyland Dr	**145**						0	0			0			0				1	3			5
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	2			3
Evergreen Pkwy	**148**	0	0	1	0	0	0	0	0	0		13	2	1	1	1	0	3	0	2	0	52
Swede Gulch Rd	**149**							0			6			0				0	2			9
I-70 EB	**150**	8	0	5	0	0	2	6	3	2	2	2	6	2	6	1	1	8		12	2	22
Miner St W	**151**						1	0			0			0				8	30			14
CO 103	**152**	0	0	0	0	0	0	0	0	0	0	0	6		0	1	0	3	0	2	0	3
Miner St E	**153**						1	0			0			0				8	26			12
Fall River Rd	**154**						0	0			0			0				1	3			5
Mountain St	**157**						0	0			0			0				0	2			0
US 40	**158**	2	0	1	0	0	0	1	1	0	0	1	1	1	1	0	0		5	3	0	37
Argentine St	**161**						0	0			0			0				3	10			11
15th St	**162**						0	0			0			0				2	9			9
I-70 WB	**165**	1	0	25	0	0	34	7	3	3	30	33	104	14	100	9	5	232	555	36	5	

6:00 to 7:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				4	13			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				10	134			18
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	17	0	0		13	8	4	0		65	7	58	4	5	36	122	22	3	3
CO 65	**144**	0	0	5	0	0	2		2	1	0	0	20	2	4	1	1	25	44	7	1	43
Hyland Dr	**145**						0	0			0			0				4	15			7
Beaver Brook Canyon Rd	**146**						0	0			0			0				2	7			4
Evergreen Pkwy	**148**	0	0	5	0	0	0	4	2	1		31	11	2	4	1	1	11	0	7	1	94
Swede Gulch Rd	**149**							0			0			0				5	17			41
I-70 EB	**150**	0	0	10	0	0	16	2	2	1	5	4	13	5	11	5	1	13		16	2	37
Miner St W	**151**						1	0			0			0				29	104			28
CO 103	**152**	0	0	1	0	0	0	0	0	0	0	0	8		1	1	1	6	0	7	1	6
Miner St E	**153**						1	0			0			0				26	93			25
Fall River Rd	**154**						1	0			0			0				3	12			18
Mountain St	**157**						0	0			0			0				2	256			16
US 40	**158**	9	0	3	0	0	4	1	0	0	1	1	4	1	3	1	0		203	4	1	51
Argentine St	**161**						1	0			0			0				11	138			26
15th St	**162**						1	0			0			0				8	128			19
I-70 WB	**165**	2	0	75	0	1	121	59	35	19	72	53	291	31	285	18	20	791	2989	92	12	

7:00 to 8:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				3	10			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				23	80			21
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	11	0	0		9	3	2	0		37	4	34	2	4	124	525	17	2	12
CO 65	**144**	0	0	4	0	0	3		1	1	1	0	12	1	2	1	1	48	142	5	1	66
Hyland Dr	**145**						0	0			0			0				5	17			7
Beaver Brook Canyon Rd	**146**						0	0			0			0				2	9			4
Evergreen Pkwy	**148**	0	0	4	0	0	0	3	1	1		48	9	1	2	1	1	8	0	5	1	193
Swede Gulch Rd	**149**							0			0			0				3	11			73
I-70 EB	**150**	0	0	7	0	0	35	6	2	2	12	2	29	9	25	2	3	24		32	4	203
Miner St W	**151**						2	0			0			0				42	149			48
CO 103	**152**	0	0	0	0	0	1	0	0	0	1	0	12		1	1	1	10	15	5	1	11
Miner St E	**153**						2	0			0			0				38	134			43
Fall River Rd	**154**						1	0			0			0				4	13			19
Mountain St	**157**						0	0			0			0				3	10			15
US 40	**158**	7	0	2	0	0	9	1	1	0	3	0	8	3	7	1	1		126	9	1	106
Argentine St	**161**						2	0			0			0				21	72			34
15th St	**162**						1	0			0			0				17	59			28
I-70 WB	**165**	2	0	83	0	0	63	70	28	15	272	86	274	30	276	15	24	495	1685	112	15	

8:00 to 9:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	5			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						2	0			0			0				46	61			38
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	15	0	0		11	2	1	0		27	3	25	1	3	135	360	10	1	13
CO 65	**144**	0	0	5	0	0	2		1	0	1	1	9	1	2	0	1	23	62	3	0	43
Hyland Dr	**145**						1	0			0			0				7	26			14
Beaver Brook Canyon Rd	**146**						0	0			0			0				4	13			7
Evergreen Pkwy	**148**	0	0	5	0	0	0	4	1	0		81	9	1	2	0	1	11	15	3	0	333
Swede Gulch Rd	**149**							0			96			0				3	11			89
I-70 EB	**150**	48	0	10	0	0	31	9	2	1	23	9	31	12	27	6	56	21		57	6	262
Miner St W	**151**						3	0			0			0				51	179			58
CO 103	**152**	0	0	1	0	0	1	0	0	0	1	1	9		1	0	1	12	31	3	0	14
Miner St E	**153**						2	0			0			0				46	161			52
Fall River Rd	**154**						1	0			0			0				4	14			19
Mountain St	**157**						0	0			0			0				3	10			53
US 40	**158**	5	0	3	0	0	9	3	0	0	7	3	9	3	8	2	1		157	16	2	102
Argentine St	**161**						3	0			0			0				20	68			58
15th St	**162**						2	0			0			0				13	47			40
I-70 WB	**165**	32	1	86	0	1	25	67	9	5	657	170	145	19	149	8	13	18	1023	52	6	

9:00 to 10:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	5			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						2	0			0			0				32	114			38
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	9	0	0		11	6	3	0		28	4	25	4	3	175	496	12	1	17
CO 65	**144**	0	0	3	0	0	2		2	1	1	1	9	1	2	1	1	20	46	4	0	52
Hyland Dr	**145**						1	0			0			0				7	26			20
Beaver Brook Canyon Rd	**146**						0	0			0			0				4	13			10
Evergreen Pkwy	**148**	0	0	3	0	0	0	4	2	1		111	9	1	2	1	1	14	24	4	0	463
Swede Gulch Rd	**149**							0			189			0				2	8			68
I-70 EB	**150**	60	0	14	0	0	49	6	3	2	25	18	31	17	27	2	54	23		73	9	446
Miner St W	**151**						3	0			0			0				54	188			64
CO 103	**152**	0	0	1	0	0	1	0	0	0	1	1	9		1	1	1	13	32	4	0	15
Miner St E	**153**						3	0			0			0				48	169			57
Fall River Rd	**154**						1	0			0			0				3	10			30
Mountain St	**157**						0	0			0			0				3	109			53
US 40	**158**	6	0	4	0	0	13	2	1	0	7	6	8	5	7	1	1		84	20	2	226
Argentine St	**161**						3	0			0			0				18	64			66
15th St	**162**						2	0			0			0				12	43			44
I-70 WB	**165**	22	1	49	0	1	74	67	32	17	300	225	147	25	153	23	116	77	766	65	8	

10:00 to 11:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	7			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						2	0			0			0				17	60			42
Idaho Springs Rd	**141**						0	0			0			0				0	1			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	11	0	0		13	5	3	0		25	4	22	7	3	123	419	15	2	12
CO 65	**144**	0	0	3	0	0	3		2	1	2	2	8	1	1	2	1	8	1	5	1	73
Hyland Dr	**145**						2	0			0			0				4	13			39
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	7			19
Evergreen Pkwy	**148**	0	0	3	0	0	0	4	2	1		133	8	1	1	2	1	15	25	5	1	562
Swede Gulch Rd	**149**							0			265			0				2	7			76
I-70 EB	**150**	73	0	23	0	0	41	13	6	3	38	40	57	27	48	8	56	23		116	14	609
Miner St W	**151**						4	0			0			0				47	165			101
CO 103	**152**	0	0	1	0	0	1	1	0	0	2	2	8		3	2	1	14	34	5	1	12
Miner St E	**153**						4	0			0			0				42	149			90
Fall River Rd	**154**						2	0			0			0				2	9			36
Mountain St	**157**						0	0			0			0				3	112			54
US 40	**158**	6	0	6	0	0	11	4	1	1	11	12	16	7	14	2	2		194	31	4	176
Argentine St	**161**						5	0			0			0				21	74			102
15th St	**162**						3	0			0			0				14	48			67
I-70 WB	**165**	12	0	60	0	1	103	74	31	16	273	288	132	24	137	39	115	305	1308	82	9	

11:00 to 12:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	9			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				22	76			61
Idaho Springs Rd	**141**						0	0			0			0				0	1			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	13	0	0		10	5	3	0		25	6	22	7	3	40	138	20	2	4
CO 65	**144**	0	0	4	0	0	3		2	1	2	3	8	2	1	2	1	12	16	6	1	61
Hyland Dr	**145**						2	0			0			0				7	24			37
Beaver Brook Canyon Rd	**146**						1	0			0			0				4	12			18
Evergreen Pkwy	**148**	0	0	4	0	0	0	3	2	1		142	8	2	1	2	1	21	42	6	1	577
Swede Gulch Rd	**149**							0			371			0				5	18			140
I-70 EB	**150**	65	0	24	0	0	74	26	12	7	41	45	81	37	68	10	58	33		128	16	896
Miner St W	**151**						5	0			0			0				36	127			105
CO 103	**152**	0	0	1	0	0	1	1	1	0	2	3	8		4	2	1	15	33	6	1	10
Miner St E	**153**						4	0			0			0				32	114			95
Fall River Rd	**154**						3	0			0			0				4	12			60
Mountain St	**157**						0	0			0			0				2	106			54
US 40	**158**	7	0	7	0	0	20	7	3	2	12	14	22	10	20	3	2		115	35	4	254
Argentine St	**161**						5	0			0			0				20	72			120
15th St	**162**						3	0			0			0				13	45			75
I-70 WB	**165**	12	1	76	0	2	80	63	27	14	310	339	129	36	134	37	116	360	1487	106	13	

12:00 to 13:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	6			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				19	66			57
Idaho Springs Rd	**141**						0	0			0			0				0	1			0
Local St	**142**						0	0			0			0				0	1			0
US 6	**143**	0	0	15	0	0		7	4	2	0		19	6	17	10	1	18	60	20	2	2
CO 65	**144**	0	0	5	0	0	3		1	1	2	2	6	2	1	3	1	12	16	6	1	70
Hyland Dr	**145**						1	0			0			0				5	17			30
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	9			15
Evergreen Pkwy	**148**	0	0	5	0	0	0	2	1	1		155	6	2	1	3	1	22	50	6	1	636
Swede Gulch Rd	**149**							0			328			0				4	13			109
I-70 EB	**150**	37	0	47	0	1	73	37	21	11	41	43	82	39	69	7	58	27		119	14	1019
Miner St W	**151**						6	0			0			0				28	97			139
CO 103	**152**	0	0	2	0	0	1	2	1	1	2	2	6		4	3	1	17	42	6	1	11
Miner St E	**153**						6	0			0			0				25	88			124
Fall River Rd	**154**						3	0			0			0				3	9			69
Mountain St	**157**						0	0			0			0				2	105			55
US 40	**158**	5	0	13	0	0	20	10	6	3	12	13	22	10	20	2	2		101	33	4	297
Argentine St	**161**						6	0			0			0				18	65			123
15th St	**162**						3	0			0			0				12	40			78
I-70 WB	**165**	2	0	83	0	2	89	43	23	14	313	333	99	32	102	54	109	205	1378	105	13	

13:00 to 14:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	9			32
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						2	0			0			0				14	49			54
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	1			1
US 6	**143**	0	0	18	0	0		6	4	2			30	7	27	9	2	3	3	22	3	7
CO 65	**144**	0	0	6	0	0	3		1	0	3	2	9	2	2	3	0	10	4	7	1	65
Hyland Dr	**145**						1	0			0			0				4	14			29
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	7			14
Evergreen Pkwy	**148**	0	0	6	0	0	0	2	1	0		171	9	2	2	3	0	21	39	7	1	546
Swede Gulch Rd	**149**							0			211			0				6	22			164
I-70 EB	**150**	4	0	52	0	0	101	48	31	12	62	34	97	53	83	17	105	54		137	19	1106
Miner St W	**151**						8	0			0			0				31	109			169
CO 103	**152**	0	0	3	0	0	2	3	2	1	3	2	9		4	3	0	19	44	7	1	17
Miner St E	**153**						7	0			0			0				28	97			152
Fall River Rd	**154**						3	0			0			0				2	8			62
Mountain St	**157**						0	0			0			0				1	104			105
US 40	**158**	1	0	15	0	0	27	13	9	3	19	10	26	15	24	5	1		76	37	5	352
Argentine St	**161**						6	0			0			0				18	62			139
15th St	**162**						4	0			0			0				11	40			87
I-70 WB	**165**	2	0	101	1	1	134	38	24	8	475	259	160	38	166	47	108	408	1030	119	17	

14:00 to 15:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				3	9			12
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				13	45			65
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	1			1
US 6	**143**	0	0	21	0	0		7	4	2			27	6	25	7	1	14	17	18	3	32
CO 65	**144**	0	0	6	0	0	3		1	0	4	2	7	2	2	2	0	8	0	6	1	72
Hyland Dr	**145**						2	0			0			0				4	13			38
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	6			19
Evergreen Pkwy	**148**	0	0	6	0	0	0	2	1	0		179	9	2	2	2	0	23	52	6	1	564
Swede Gulch Rd	**149**							0			296			0				7	23			162
I-70 EB	**150**	15	0	50	0	0	126	55	33	12	65	35	101	53	86	12	106	43		139	20	1445
Miner St W	**151**						8	0			0			0				29	104			191
CO 103	**152**	0	0	3	0	0	1	3	2	1	4	2	9		5	2	0	18	43	6	1	15
Miner St E	**153**						8	0			0			0				26	93			171
Fall River Rd	**154**						3	0			0			0				2	6			79
Mountain St	**157**						0	0			0			0				1	54			105
US 40	**158**	1	0	15	0	0	34	16	10	3	19	11	27	14	25	3	2		105	38	5	538
Argentine St	**161**						6	0			0			0				16	57			138
15th St	**162**						3	0			0			0				9	32			79
I-70 WB	**165**	2	0	115	1	1	106	41	23	8	505	275	147	32	149	37	58	446	1074	97	13	

15:00 to 16:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				3	9			37
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						4	0			0			0				13	47			84
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	1			1
US 6	**143**	0	0	21	0	0		7	3	1			24	5	21	7	1	8	9	18	3	18
CO 65	**144**	0	0	6	0	0	3		1	0	3	1	7	1	1	2	0	10	10	6	1	69
Hyland Dr	**145**						1	0			0			0				4	15			30
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	8			14
Evergreen Pkwy	**148**	0	0	6	0	0	0	2	1	0		164	7	1	1	2	0	19	39	6	1	530
Swede Gulch Rd	**149**							0			265			0				7	26			202
I-70 EB	**150**	5	0	63	1	0	136	54	27	10	49	25	105	46	89	21	108	45		150	21	1624
Miner St W	**151**						10	0			0			0				24	86			232
CO 103	**152**	0	0	3	0	0	1	3	1	1	3	1	7		5	2	0	16	39	6	1	12
Miner St E	**153**						9	0			0			0				22	77			208
Fall River Rd	**154**						4	0			0			0				3	9			84
Mountain St	**157**						0	0			0			0				0	52			105
US 40	**158**	1	0	18	0	0	37	16	8	3	15	8	29	12	26	6	2		97	41	6	582
Argentine St	**161**						7	0			0			0				18	64			156
15th St	**162**						4	0			0			0				9	33			78
I-70 WB	**165**	2	0	116	1	1	126	39	18	7	453	240	126	25	130	39	57	299	1114	97	13	

16:00 to 17:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	9			42
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				16	55			69
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	1			1
US 6	**143**	0	0	27	0	0		7	4	1			19	4	17	5	1	9	11	17	2	20
CO 65	**144**	0	0	3	0	0	3		1	0	3	1	2	1	1	2	0	5	0	5	1	63
Hyland Dr	**145**						2	0			0			0				4	12			47
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	6			23
Evergreen Pkwy	**148**	0	0	8	0	0	0	2	1	0		153	6	1	1	2	0	15	25	5	1	506
Swede Gulch Rd	**149**							0			236			0				5	19			174
I-70 EB	**150**	44	0	60	1	0	116	50	27	10	45	24	88	42	75	25	109	43		213	30	1662
Miner St W	**151**						10	0			0			0				22	79			224
CO 103	**152**	0	0	3	0	0	1	3	1	1	3	1	6		4	2	0	16	41	5	1	13
Miner St E	**153**						9	0			0			0				20	70			202
Fall River Rd	**154**						2	0			0			0				2	5			44
Mountain St	**157**						0	0			0			0				0	52			105
US 40	**158**	1	0	17	0	0	31	14	7	3	14	7	24	12	22	7	3		117	58	8	679
Argentine St	**161**						8	0			0			0				16	56			180
15th St	**162**						4	0			0			0				8	28			91
I-70 WB	**165**	2	0	156	1	1	138	43	21	8	404	213	103	24	103	28	56	257	831	93	13	

17:00 to 18:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	23			17
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				12	41			72
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	1			1
US 6	**143**	0	0	20	0	0		6	2	1			17	3	15	5	1	22	27	11	1	50
CO 65	**144**	0	0	2	0	0	3		1	0	3	2	2	1	1	2	0	4	0	3	1	52
Hyland Dr	**145**						2	0			0			0				3	10			44
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	5			22
Evergreen Pkwy	**148**	0	0	6	0	0	0	2	1	0		135	5	1	1	2	0	16	32	3	1	438
Swede Gulch Rd	**149**							0			176			0				7	25			199
I-70 EB	**150**	19	0	50	1	0	117	66	24	9	51	28	107	40	91	16	109	57		229	31	1752
Miner St W	**151**						9	0			0			0				18	65			201
CO 103	**152**	0	0	3	0	0	1	3	1	0	3	2	5		5	2	0	12	29	3	1	4
Miner St E	**153**						8	0			0			0				17	58			181
Fall River Rd	**154**						1	0			0			0				1	5			34
Mountain St	**157**						0	0			0			0				0	51			104
US 40	**158**	1	0	14	0	0	32	19	7	2	16	9	29	11	26	4	2		62	62	9	479
Argentine St	**161**						8	0			0			0				13	46			187
15th St	**162**						4	0			0			0				6	21			84
I-70 WB	**165**	17	0	115	1	1	148	34	13	5	373	206	93	18	94	29	54	195	700	56	9	

18:00 to 19:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	5			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						4	0			0			0				10	33			79
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	1			1
US 6	**143**	0	0	19	0	0		6	3	1			15	3	14	3	1	11	13	9	1	24
CO 65	**144**	0	0	6	0	0	3		1	0	2	1	4	1	1	1	0	5	0	3	0	53
Hyland Dr	**145**						1	0			0			0				2	8			26
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	4			12
Evergreen Pkwy	**148**	0	0	6	0	0	0	2	1	0		92	5	1	1	1	0	12	23	3	0	289
Swede Gulch Rd	**149**							0			143			0				7	26			170
I-70 EB	**150**	3	0	48	0	0	65	36	20	8	40	23	88	35	77	12	4	32		98	14	1995
Miner St W	**151**						7	0			0			0				16	58			152
CO 103	**152**	0	0	3	0	0	1	2	1	0	2	1	5		2	1	0	7	16	3	0	1
Miner St E	**153**						6	0			0			0				15	52			137
Fall River Rd	**154**						1	0			0			0				2	5			22
Mountain St	**157**						0	0			0			0				0	31			3
US 40	**158**	1	0	14	0	0	18	10	6	2	12	7	24	9	22	3	1		41	27	4	260
Argentine St	**161**						4	0			0			0				6	22			99
15th St	**162**						3	0			0			0				4	16			68
I-70 WB	**165**	1	0	104	1	1	112	33	17	6	301	178	82	15	83	17	34	190	504	48	7	

19:00 to 20:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	3			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						2	0			0			0				5	19			55
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			1
US 6	**143**	0	0	13	0	0		3	2	1			12	2	11	4	1	11	6	8	1	33
CO 65	**144**	0	0	3	0	0	2		1	0	2	1	1	1	1	1	0	3	0	2	0	42
Hyland Dr	**145**						1	0			0			0				2	7			28
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	3			14
Evergreen Pkwy	**148**	0	0	4	0	0	0	1	1	0		57	4	1	1	1	0	9	15	2	0	175
Swede Gulch Rd	**149**							0			94			0				5	18			100
I-70 EB	**150**	1	0	33	0	0	24	27	17	6	28	15	39	16	33	6	2	23		59	9	869
Miner St W	**151**						5	0			0			0				16	58			118
CO 103	**152**	0	0	2	0	0	0	1	1	0	2	1	4		2	1	0	5	9	2	0	2
Miner St E	**153**						5	0			0			0				15	51			105
Fall River Rd	**154**						1	0			0			0				0	2			12
Mountain St	**157**						0	0			0			0				0	32			2
US 40	**158**	0	0	10	0	0	7	8	5	2	8	5	11	4	10	1	0		0	16	2	141
Argentine St	**161**						3	0			0			0				5	18			58
15th St	**162**						2	0			0			0				4	12			39
I-70 WB	**165**	1	0	76	1	0	96	21	13	5	233	131	68	13	67	20	33	157	347	42	6	

20:00 to 21:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	2			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				6	19			61
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			1
US 6	**143**	0	0	13	0	0		3	2	1			7	2	7	3	1	15	4	6	1	50
CO 65	**144**	0	0	0	0	0	1		1	0	1	1	0	1	0	1	0	2	0	2	0	31
Hyland Dr	**145**						1	0			0			0				1	2			11
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	1			6
Evergreen Pkwy	**148**	0	0	4	0	0	0	1	1	0		45	2	1	0	1	0	6	9	2	0	141
Swede Gulch Rd	**149**							0			99			0				4	12			82
I-70 EB	**150**	1	0	20	0	0	19	16	14	6	18	10	29	16	26	7	2	15		44	6	527
Miner St W	**151**						3	0			0			0				11	40			77
CO 103	**152**	0	0	1	0	0	0	1	1	0	1	1	2		0	1	0	3	5	2	0	1
Miner St E	**153**						3	0			0			0				10	36			68
Fall River Rd	**154**						0	0			0			0				1	2			7
Mountain St	**157**						0	0			0			0				0	32			1
US 40	**158**	0	0	6	0	0	5	5	4	1	5	3	8	4	7	2	0		0	12	2	78
Argentine St	**161**						2	0			0			0				3	10			43
15th St	**162**						1	0			0			0				2	8			32
I-70 WB	**165**	1	0	78	1	0	86	15	12	5	198	109	41	11	39	17	33	101	274	30	4	

21:00 to 22:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	2			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				6	21			69
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			1
US 6	**143**	0	0	7	0	0		2	1	0			6	2	6	3	0	20	0	4	1	69
CO 65	**144**	0	0	0	0	0	1		0	0	0	0	0	1	0	0	0	1	0	0	0	25
Hyland Dr	**145**						0	0			0			0				0	1			10
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	0			5
Evergreen Pkwy	**148**	0	0	2	0	0	0	1	0	0		37	2	1	0	1	0	3	1	1	0	128
Swede Gulch Rd	**149**							0			74			0				1	5			61
I-70 EB	**150**	1	0	21	0	0	16	21	9	3	7	4	17	10	15	6	1	9		29	4	216
Miner St W	**151**						3	0			0			0				10	35			68
CO 103	**152**	0	0	1	0	0	0	1	0	0	0	0	2		1	1	0	3	6	1	0	2
Miner St E	**153**						3	0			0			0				9	31			60
Fall River Rd	**154**						0	0			0			0				0	1			6
Mountain St	**157**						0	0			0			0				0	11			1
US 40	**158**	0	0	6	0	0	4	6	2	1	2	1	5	3	4	1	0		1	8	1	85
Argentine St	**161**						1	0			0			0				3	9			26
15th St	**162**						1	0			0			0				2	7			20
I-70 WB	**165**	0	0	43	1	0	66	14	5	2	188	93	37	9	35	18	12	59	260	21	3	

Appendix C

Hourly Origin-Destination Matrices (4:00 a.m. to 10:00 p.m.) for Summer Sunday Conditions

4:00 to 5:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	1			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				2	12			16
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	1	0	0		0	0	0			1	1	0	0	0	6	17	0	1	18
CO 65	**144**	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	0	0	7
Hyland Dr	**145**						0	0			0			0				0	1			4
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	0			2
Evergreen Pkwy	**148**	0	0	0	0	0	0	0	0	0		13	0	0	0	0	0	0	1	0	0	33
Swede Gulch Rd	**149**							0			21			0				0	1			15
I-70 EB	**150**	1	0	2	0	0	5	0	0	0	3	2	2	2	2	0	10	2		2	2	77
Miner St W	**151**						0	0			0			0				1	5			6
CO 103	**152**	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0	0	2
Miner St E	**153**						0	0			0			0				1	4			5
Fall River Rd	**154**						0	0			0			0				0	2			5
Mountain St	**157**						0	0			0			0				0	1			0
US 40	**158**	0	0	1	0	0	2	0	0	0	1	0	0	1	0	0	0		0	0	0	23
Argentine St	**161**						0	0			0			0				1	3			4
15th St	**162**						0	0			0			0				1	3			4
I-70 WB	**165**	1	0	6	1	0	12	0	0	0	43	26	7	7	8	3	0	15	63	6	7	

5:00 to 6:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	1			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				2	9			15
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	0	0	0		0	0	0	0		2	1	1	0	0	4	10	2	2	11
CO 65	**144**	0	0	0	0	0	0		0	0	0	0	1	1	0	0	0	0	1	1	1	13
Hyland Dr	**145**						0	0			0			0				0	1			5
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	0			3
Evergreen Pkwy	**148**	0	0	0	0	0	0	0	0	0		34	1	1	0	0	0	1	0	1	1	92
Swede Gulch Rd	**149**							0			30			0				0	1			19
I-70 EB	**150**	2	0	8	1	1	13	1	0	0	5	2	3	2	2	1	0	1		2	3	109
Miner St W	**151**						1	0			0			0				2	12			15
CO 103	**152**	0	0	0	0	0	0	0	0	0	0	0	1		0	0	0	2	9	1	1	9
Miner St E	**153**						1	0			0			0				2	11			13
Fall River Rd	**154**						0	0			0			0				0	2			7
Mountain St	**157**						0	0			0			0				0	1			1
US 40	**158**	1	0	3	0	0	4	0	0	0	1	1	1	1	1	0	0		11	1	1	26
Argentine St	**161**						0	0			0			0				1	5			10
15th St	**162**						0	0			0			0				1	4			10
I-70 WB	**165**	2	0	5	0	0	11	1	0	0	83	49	20	4	32	3	1	58	192	21	25	

6:00 to 7:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	2			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				2	114			14
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	2	0	0		1	0	0	0		3	2	2	1	0	4	12	4	4	14
CO 65	**144**	0	0	1	0	0	0		0	0	1	0	2	1	0	1	0	1	1	3	3	7
Hyland Dr	**145**						0	0			0			0				0	3			6
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	1			3
Evergreen Pkwy	**148**	0	0	1	0	0	0	1	0	0		61	1	1	0	1	0	3	3	3	3	154
Swede Gulch Rd	**149**							0			21			0				1	5			54
I-70 EB	**150**	4	0	6	0	0	19	8	0	0	9	5	11	7	9	2	0	7		11	12	234
Miner St W	**151**						1	0			0			0				4	25			28
CO 103	**152**	0	0	0	0	0	0	0	0	0	1	0	1		0	1	0	2	4	3	3	6
Miner St E	**153**						1	0			0			0				4	22			25
Fall River Rd	**154**						0	0			0			0				1	3			8
Mountain St	**157**						0	0			0			0				0	252			16
US 40	**158**	1	0	2	0	0	6	3	0	0	3	2	3	2	3	0	0		35	3	4	52
Argentine St	**161**						1	0			0			0				3	114			23
15th St	**162**						1	0			0			0				2	112			19
I-70 WB	**165**	2	0	17	1	0	14	8	1	0	74	46	27	8	37	7	1	55	438	37	42	

7:00 to 8:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	3			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						1	0			0			0				6	80			14
Idaho Springs Rd	**141**						0	0			0			0				0	0			0
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	3	0	0		1	0	0	0		5	4	4	2	0	7	119	9	10	20
CO 65	**144**	0	0	2	0	0	1		0	0	1	0	4	3	1	1	0	1	0	7	7	11
Hyland Dr	**145**						1	0			0			0				1	7			18
Beaver Brook Canyon Rd	**146**						0	0			0			0				1	3			10
Evergreen Pkwy	**148**	0	0	2	0	0	0	1	0	0		86	1	3	1	1	0	6	12	7	7	202
Swede Gulch Rd	**149**							0			54			0				2	14			78
I-70 EB	**150**	5	0	9	0	0	42	7	0	0	14	8	20	19	16	2	1	3		17	19	364
Miner St W	**151**						2	0			0			0				8	43			45
CO 103	**152**	0	0	0	0	0	1	0	0	0	1	0	4		1	1	0	4	3	7	7	14
Miner St E	**153**						2	0			0			0				7	39			40
Fall River Rd	**154**						1	0			0			0				1	5			25
Mountain St	**157**						0	0			0			0				0	10			14
US 40	**158**	1	0	3	0	0	14	2	0	0	5	3	6	6	6	1	0		126	5	6	90
Argentine St	**161**						1	0			0			0				3	72			29
15th St	**162**						1	0			0			0				2	59			22
I-70 WB	**165**	26	0	43	1	1	44	13	0	0	195	115	70	44	80	22	1	65	490	121	136	

8:00 to 9:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	3			2
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						2	0			0			0				5	31			46
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	4	0	0		1	0	0	0		8	7	7	3	0	8	21	4	5	23
CO 65	**144**	0	0	3	0	0	1		0	0	2	1	6	5	1	3	0	2	1	3	4	33
Hyland Dr	**145**						1	0			0			0				2	13			36
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	7			17
Evergreen Pkwy	**148**	0	0	3	0	0	0	1	0	0		158	6	5	1	3	0	7	17	3	4	399
Swede Gulch Rd	**149**							0			95			0				2	14			129
I-70 EB	**150**	38	0	15	0	0	58	11	3	2	32	21	34	33	29	3	51	22		26	29	483
Miner St W	**151**						3	0			0			0				11	60			61
CO 103	**152**	0	0	1	0	0	2	1	0	0	2	1	6		2	3	0	8	32	3	4	30
Miner St E	**153**						2	0			0			0				9	52			52
Fall River Rd	**154**						2	0			0			0				2	10			44
Mountain St	**157**						0	0			0			0				0	3			52
US 40	**158**	2	0	5	0	0	18	4	1	1	11	7	11	11	10	1	0		58	8	9	154
Argentine St	**161**						2	0			0			0				5	28			49
15th St	**162**						2	0			0			0				4	24			43
I-70 WB	**165**	35	1	52	2	1	43	19	5	3	509	180	100	38	154	43	2	56	740	54	61	

9:00 to 10:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	5			2
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				9	54			70
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	1	0	7	0	0		2	1	0	0		10	9	9	5	0	5	12	6	6	14
CO 65	**144**	0	0	5	0	0	2		0	0	2	2	8	7	1	3	0	3	1	4	5	44
Hyland Dr	**145**						2	0			0			0				2	14			39
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	7			19
Evergreen Pkwy	**148**	0	0	5	0	0	0	1	0	0		194	8	7	1	3	0	11	26	4	5	475
Swede Gulch Rd	**149**							0			188			0				3	20			148
I-70 EB	**150**	51	0	31	1	1	68	22	8	5	41	27	41	53	34	12	52	29		42	46	871
Miner St W	**151**						4	0			0			0				15	84			89
CO 103	**152**	0	0	2	0	0	2	1	0	0	2	2	8		2	3	0	10	35	4	5	34
Miner St E	**153**						3	0			0			0				13	77			81
Fall River Rd	**154**						2	0			0			0				1	6			59
Mountain St	**157**						0	0			0			0				1	103			53
US 40	**158**	4	0	10	0	0	22	7	2	1	14	10	13	17	12	4	0		108	13	15	278
Argentine St	**161**						4	0			0			0				9	53			90
15th St	**162**						3	0			0			0				8	44			76
I-70 WB	**165**	28	1	90	3	1	68	24	7	5	344	229	129	76	184	59	102	82	829	72	81	

10:00 to 11:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	5			3
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						4	0			0			0				11	66			95
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	1	0	7	0	0		3	1	1	0		13	11	11	5	0	6	17	8	9	18
CO 65	**144**	1	0	6	0	0	3		1	1	3	2	9	8	2	4	0	5	1	6	6	65
Hyland Dr	**145**						2	0			0			0				3	18			40
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	9			20
Evergreen Pkwy	**148**	1	0	6	0	0	0	2	1	1		237	9	8	2	4	0	12	21	6	6	594
Swede Gulch Rd	**149**							0			191			0				4	22			198
I-70 EB	**150**	63	0	48	2	1	92	33	12	8	51	32	58	69	49	12	52	30		52	58	1299
Miner St W	**151**						5	0			0			0				18	100			130
CO 103	**152**	1	0	3	0	0	3	2	1	0	3	2	9		3	4	0	15	57	6	6	50
Miner St E	**153**						5	0			0			0				16	90			117
Fall River Rd	**154**						3	0			0			0				3	15			69
Mountain St	**157**						0	0			0			0				1	103			54
US 40	**158**	4	0	16	0	0	29	11	4	2	18	12	19	22	17	4	0		125	17	18	323
Argentine St	**161**						5	0			0			0				10	54			117
15th St	**162**						4	0			0			0				8	44			96
I-70 WB	**165**	41	0	99	3	2	85	44	16	9	459	296	159	102	216	70	103	20	1214	100	110	

11:00 to 12:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	6			3
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				14	83			81
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	1	0	10	0	0		3	2	1	0		15	8	13	6	0	26	71	8	9	78
CO 65	**144**	1	0	8	0	0	3		1	1	4	2	11	6	2	5	0	5	1	6	6	63
Hyland Dr	**145**						2	0			0			0				3	15			40
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	8			20
Evergreen Pkwy	**148**	1	0	8	0	0	0	2	1	1		259	11	6	2	5	0	11	17	6	6	657
Swede Gulch Rd	**149**							0			245			0				3	15			156
I-70 EB	**150**	57	0	45	1	1	65	41	23	13	63	41	101	109	86	15	53	40		74	83	1584
Miner St W	**151**						6	0			0			0				17	99			147
CO 103	**152**	1	0	2	0	0	2	2	1	1	4	2	11		5	5	0	14	50	6	6	43
Miner St E	**153**						6	0			0			0				16	90			135
Fall River Rd	**154**						5	0			0			0				3	15			115
Mountain St	**157**						0	0			0			0				1	104			54
US 40	**158**	5	0	15	0	0	21	14	7	5	22	14	32	34	29	5	1		139	23	26	468
Argentine St	**161**						11	0			0			0				10	57			265
15th St	**162**						9	0			0			0				8	48			223
I-70 WB	**165**	57	0	141	4	2	82	45	23	14	429	277	187	38	269	81	103	29	1296	96	108	

12:00 to 13:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	7			3
Idaho Springs Rd	**138**						0	0			0			0				0	0			1
Central City Pkwy	**140**						4	0			0			0				13	74			102
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	1	0	10	0	0		3	2	1	0		15	10	14	5	0	22	60	7	8	67
CO 65	**144**	1	0	8	0	0	3		1	1	3	2	11	8	2	4	0	5	1	6	6	77
Hyland Dr	**145**						2	0			0			0				3	15			42
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	8			21
Evergreen Pkwy	**148**	1	0	8	0	0	0	3	1	1		279	11	8	2	4	0	16	39	6	6	686
Swede Gulch Rd	**149**							0			264			0				4	25			194
I-70 EB	**150**	37	0	58	2	1	63	34	17	10	59	37	83	84	70	17	53	47		65	74	2032
Miner St W	**151**						8	0			0			0				19	108			199
CO 103	**152**	1	0	3	0	0	3	2	1	1	3	2	11		4	4	0	18	75	6	6	64
Miner St E	**153**						7	0			0			0				16	92			169
Fall River Rd	**154**						4	0			0			0				3	17			92
Mountain St	**157**						0	0			0			0				1	103			54
US 40	**158**	6	0	20	0	0	20	12	6	3	21	13	27	27	24	5	1		7	21	24	419
Argentine St	**161**						9	0			0			0				11	64			219
15th St	**162**						7	0			0			0				9	49			169
I-70 WB	**165**	63	1	135	3	3	99	50	23	14	470	298	194	64	276	68	103	33	1141	94	107	

13:00 to 14:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	7			33
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				14	77			85
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	10	0	0		3	2	1			12	8	11	5	1	27	49	9	4	107
CO 65	**144**	0	0	7	0	0	3		2	1	4	2	9	6	2	4	0	6	1	7	3	74
Hyland Dr	**145**						2	0			0			0				3	15			39
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	8			19
Evergreen Pkwy	**148**	0	0	7	0	0	0	2	2	1		174	9	6	2	4	0	15	43	7	3	627
Swede Gulch Rd	**149**							0			233			0				4	21			158
I-70 EB	**150**	5	0	60	1	0	58	47	30	10	72	32	84	90	71	17	105	42		99	50	1728
Miner St W	**151**						9	0			0			0				17	95			216
CO 103	**152**	0	0	3	0	0	6	2	2	1	4	2	9		4	4	0	17	77	7	3	121
Miner St E	**153**						8	0			0			0				15	85			191
Fall River Rd	**154**						6	0			0			0				3	18			144
Mountain St	**157**						0	0			0			0				1	103			4
US 40	**158**	1	0	20	0	0	18	16	10	3	25	11	27	28	24	6	1		51	31	16	394
Argentine St	**161**						7	0			0			0				11	61			173
15th St	**162**						5	0			0			0				8	47			133
I-70 WB	**165**	40	0	132	1	1	82	47	29	9	514	225	150	4	256	60	107	118	1182	112	57	

14:00 to 15:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	8			13
Idaho Springs Rd	**138**						0	0			0			0				0	1			1
Central City Pkwy	**140**						5	0			0			0				13	74			122
Idaho Springs Rd	**141**						0	0			0			0				0	1			2
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	20	0	0		5	4	1			12	6	11	5	1	29	52	8	4	114
CO 65	**144**	0	0	15	0	0	3		3	1	3	1	7	4	2	3	0	5	1	6	3	60
Hyland Dr	**145**						2	0			0			0				3	19			38
Beaver Brook Canyon Rd	**146**						1	0			0			0				2	9			19
Evergreen Pkwy	**148**	0	0	15	0	0	0	4	3	1		179	9	4	2	3	0	14	28	6	3	654
Swede Gulch Rd	**149**							0			239			0				5	27			222
I-70 EB	**150**	15	0	51	1	0	52	82	58	19	59	23	92	69	79	12	110	51		105	52	1812
Miner St W	**151**						10	0			0			0				16	93			249
CO 103	**152**	0	0	3	0	0	6	4	3	1	3	1	9		4	3	0	19	84	6	3	28
Miner St E	**153**						9	0			0			0				14	77			309
Fall River Rd	**154**						5	0			0			0				3	15			119
Mountain St	**157**						0	0			0			0				1	53			4
US 40	**158**	1	0	17	0	0	17	28	20	6	21	8	29	22	26	4	3		8	33	17	420
Argentine St	**161**						8	0			0			0				10	56			203
15th St	**162**						7	0			0			0				8	45			164
I-70 WB	**165**	62	0	266	2	1	48	76	51	17	511	195	157	79	160	58	58	84	875	103	52	

15:00 to 16:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				2	13			40
Idaho Springs Rd	**138**						1	0			0			0				1	4			15
Central City Pkwy	**140**						6	0			0			0				5	26			141
Idaho Springs Rd	**141**						0	0			0			0				0	0			2
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	1	0	10	0	0		2	2	1			13	5	12	3	1	23	40	5	3	88
CO 65	**144**	0	0	7	0	0	3		1	0	2	1	10	4	2	3	1	4	1	4	2	71
Hyland Dr	**145**						1	0			0			0				2	9			30
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	4			15
Evergreen Pkwy	**148**	0	0	7	0	0	0	2	1	0		165	10	4	2	3	1	14	41	4	2	598
Swede Gulch Rd	**149**							0			218			0				3	16			121
I-70 EB	**150**	10	0	37	0	0	51	34	23	8	43	18	157	99	134	84	122	170		105	53	1437
Miner St W	**151**						17	0			0			0				24	139			411
CO 103	**152**	0	0	2	0	0	6	2	1	0	2	1	10		7	3	1	17	81	4	2	21
Miner St E	**153**						10	0			0			0				14	78			331
Fall River Rd	**154**						7	0			0			0				5	29			175
Mountain St	**157**						0	0			0			0				0	53			104
US 40	**158**	3	0	12	0	0	16	11	7	2	15	6	50	32	45	27	7		0	33	17	331
Argentine St	**161**						8	0			0			0				8	49			193
15th St	**162**						6	0			0			0				6	36			140
I-70 WB	**165**	235	0	129	2	1	83	33	21	6	493	205	165	72	171	43	59	108	772	70	35	

16:00 to 17:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	7			43
Idaho Springs Rd	**138**						0	0			0			0				0	1			2
Central City Pkwy	**140**						5	0			0			0				8	49			125
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	9	0	0		2	2	0			9	5	8	4	1	38	68	6	3	150
CO 65	**144**	0	0	1	0	0	3		1	0	4	2	3	3	1	3	0	5	5	5	2	79
Hyland Dr	**145**						1	0			0			0				2	10			32
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	5			15
Evergreen Pkwy	**148**	0	0	6	0	0	0	2	1	0		128	7	3	1	3	0	10	25	5	2	468
Swede Gulch Rd	**149**							0			206			0				5	28			233
I-70 EB	**150**	45	0	76	1	0	48	50	36	11	70	32	57	55	48	30	114	0		83	42	1408
Miner St W	**151**						12	0			0			0				15	86			279
CO 103	**152**	0	0	4	0	0	5	3	2	1	4	2	7		3	3	0	15	66	5	2	2
Miner St E	**153**						10	0			0			0				13	72			329
Fall River Rd	**154**						3	0			0			0				3	17			80
Mountain St	**157**						0	0			0			0				0	53			104
US 40	**158**	2	0	25	0	0	15	17	12	4	25	12	18	17	16	10	4		0	26	13	424
Argentine St	**161**						7	0			0			0				8	48			157
15th St	**162**						5	0			0			0				7	37			122
I-70 WB	**165**	78	0	121	2	1	98	30	21	7	439	204	120	62	121	47	58	11	693	77	39	

17:00 to 18:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	19			17
Idaho Springs Rd	**138**						0	0			0			0				0	0			1
Central City Pkwy	**140**						4	0			0			0				7	39			102
Idaho Springs Rd	**141**						0	0			0			0				0	1			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	7	0	0		2	1	0			8	2	7	2	0	34	60	4	2	131
CO 65	**144**	0	0	1	0	0	3		1	0	2	1	3	2	1	2	0	4	8	3	2	80
Hyland Dr	**145**						1	0			0			0				1	8			28
Beaver Brook Canyon Rd	**146**						1	0			0			0				1	3			14
Evergreen Pkwy	**148**	0	0	5	0	0	0	1	1	0		115	6	2	1	2	0	9	28	3	2	416
Swede Gulch Rd	**149**							0			171			0				3	19			152
I-70 EB	**150**	17	0	56	1	0	36	35	21	7	41	18	71	49	61	12	105	38		71	36	1291
Miner St W	**151**						8	0			0			0				12	71			191
CO 103	**152**	0	0	3	0	0	4	2	1	0	2	1	6		3	2	0	13	61	3	2	14
Miner St E	**153**						7	0			0			0				11	61			242
Fall River Rd	**154**						2	0			0			0				1	7			49
Mountain St	**157**						0	0			0			0				0	53			3
US 40	**158**	1	0	19	0	0	12	12	7	2	14	6	22	16	20	4	1		0	23	11	228
Argentine St	**161**						6	0			0			0				5	30			137
15th St	**162**						4	0			0			0				4	22			103
I-70 WB	**165**	18	0	95	1	1	84	27	15	5	392	170	105	32	106	26	56	84	787	57	28	

18:00 to 19:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	4			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						11	0			0			0				9	49			278
Idaho Springs Rd	**141**						0	0			0			0				0	0			2
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	10	0	0		2	2	1			7	3	6	2	0	10	18	4	2	40
CO 65	**144**	0	0	8	0	0	2		1	0	2	1	4	2	1	1	0	4	3	3	1	47
Hyland Dr	**145**						1	0			0			0				1	6			12
Beaver Brook Canyon Rd	**146**						0	0			0			0				1	3			6
Evergreen Pkwy	**148**	0	0	8	0	0	0	2	1	0		87	5	2	1	1	0	7	18	3	1	310
Swede Gulch Rd	**149**							0			123			0				4	20			149
I-70 EB	**150**	2	0	40	1	0	74	23	15	5	36	16	47	32	42	9	2	33		39	20	1032
Miner St W	**151**						6	0			0			0				11	64			146
CO 103	**152**	0	0	2	0	0	3	1	1	0	2	1	5		0	1	0	10	46	3	1	22
Miner St E	**153**						5	0			0			0				10	58			182
Fall River Rd	**154**						2	0			0			0				0	1			55
Mountain St	**157**						0	0			0			0				0	32			2
US 40	**158**	0	0	14	0	0	23	8	5	2	13	6	15	10	13	3	0		0	12	6	186
Argentine St	**161**						4	0			0			0				5	30			97
15th St	**162**						3	0			0			0				4	24			76
I-70 WB	**165**	20	0	136	3	1	67	33	21	6	332	148	84	37	86	25	33	99	771	47	25	

19:00 to 20:00	Destinations	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				1	4			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						5	0			0			0				6	36			126
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	6	0	0		1	1	0			6	2	5	2	0	21	31	2	1	92
CO 65	**144**	0	0	3	0	0	1		1	0	1	1	1	1	1	2	0	1	1	2	1	34
Hyland Dr	**145**						1	0			0			0				1	3			15
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	2			8
Evergreen Pkwy	**148**	0	0	4	0	0	0	1	1	0		67	4	1	1	2	0	8	26	2	1	227
Swede Gulch Rd	**149**							0			71			0				4	20			106
I-70 EB	**150**	2	0	27	1	0	30	10	8	2	25	11	31	19	26	8	3	17		34	17	741
Miner St W	**151**						4	0			0			0				9	54			101
CO 103	**152**	0	0	1	0	0	2	1	0	0	1	1	4		1	2	0	6	26	2	1	3
Miner St E	**153**						4	0			0			0				8	48			130
Fall River Rd	**154**						1	0			0			0				1	3			26
Mountain St	**157**						0	0			0			0				0	33			2
US 40	**158**	0	0	9	0	0	10	4	2	1	9	4	10	6	9	3	1		10	11	5	156
Argentine St	**161**						2	0			0			0				4	21			60
15th St	**162**						2	0			0			0				3	17			46
I-70 WB	**165**	10	0	77	1	0	61	21	13	5	260	108	76	23	76	28	34	47	537	31	15	

20:00 to 21:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	2			1
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				4	25			70
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	3	0	0		1	1	0			4	2	4	1	0	14	9	2	1	69
CO 65	**144**	0	0	0	0	0	2		1	0	1	0	1	1	1	1	0	1	1	1	1	47
Hyland Dr	**145**						1	0			0			0				0	3			14
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	1			8
Evergreen Pkwy	**148**	0	0	2	0	0	0	0	1	0		53	3	1	1	1	0	5	16	1	1	186
Swede Gulch Rd	**149**							0			94			0				2	11			77
I-70 EB	**150**	2	0	23	0	0	27	9	14	5	19	8	24	18	21	5	2	16		24	13	501
Miner St W	**151**						3	0			0			0				7	41			81
CO 103	**152**	0	0	1	0	0	1	0	1	0	1	0	3		0	1	0	5	19	1	1	12
Miner St E	**153**						3	0			0			0				6	36			91
Fall River Rd	**154**						1	0			0			0				1	3			13
Mountain St	**157**						0	0			0			0				0	32			1
US 40	**158**	0	0	7	0	0	9	3	5	1	7	3	8	6	7	1	0		1	8	4	82
Argentine St	**161**						2	0			0			0				3	16			50
15th St	**162**						2	0			0			0				2	13			39
I-70 WB	**165**	12	0	44	1	0	66	9	14	5	191	81	59	24	59	16	33	98	369	23	12	

21:00 to 22:00	**Destinations**	Dumont Rd	Idaho Springs Rd	Central City Pkwy	Idaho Springs Rd	Local St	US 6	CO 65	Hyland Dr	Beaver Brook Canyon Rd	Evergreen Pkwy	Swede Gulch Rd	Miner St W	CO 103	Miner St E	Fall River Rd	Mountain St	US 40	I-70 WB	Argentine St	15th St	I-70 EB
Origins	**Centroid ID**	**135**	**138**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**148**	**149**	**151**	**152**	**153**	**154**	**157**	**158**	**160**	**161**	**162**	**163**
Dumont Rd	**135**						0	0			0			0				0	2			0
Idaho Springs Rd	**138**						0	0			0			0				0	0			0
Central City Pkwy	**140**						3	0			0			0				5	26			64
Idaho Springs Rd	**141**						0	0			0			0				0	0			1
Local St	**142**						0	0			0			0				0	0			0
US 6	**143**	0	0	3	0	0		0	0	0			3	1	2	2	0	17	6	1	1	91
CO 65	**144**	0	0	0	0	0	1		0	0	1	0	1	1	0	0	0	0	1	1	0	20
Hyland Dr	**145**						0	0			0			0				0	1			8
Beaver Brook Canyon Rd	**146**						0	0			0			0				0	0			4
Evergreen Pkwy	**148**	0	0	2	0	0	0	0	0	0		32	2	1	0	1	0	3	12	1	0	112
Swede Gulch Rd	**149**							0			65			0				2	10			61
I-70 EB	**150**	1	0	10	0	0	16	0	2	1	13	5	14	11	11	0	1	10		19	10	224
Miner St W	**151**						2	0			0			0				6	33			48
CO 103	**152**	0	0	1	0	0	1	0	0	0	1	0	2		1	1	0	2	5	1	0	2
Miner St E	**153**						2	0			0			0				5	30			51
Fall River Rd	**154**						0	0			0			0				1	3			9
Mountain St	**157**						0	0			0			0				0	11			1
US 40	**158**	0	0	3	0	0	5	0	1	0	5	2	4	3	4	0	0		2	6	3	55
Argentine St	**161**						1	0			0			0				1	6			23
15th St	**162**						1	0			0			0				1	6			21
I-70 WB	**165**	2	0	46	1	0	67	1	3	1	143	61	34	3	47	20	12	54	312	14	6	

Appendix D

Observed vs. Modeled Volumes by Count Location for Winter Saturday Conditions

Count Location	AM Peak (6:00 a.m. to 8:00 a.m.)			PM Peak (4:00 p.m. to 6:00 p.m.)			Daily (4:00 a.m. to 10:00 p.m.)		
	Model	Count	%	Model	Count	%	Model	Count	%
I-70 e/o Evergreen WB	8,496	8,541	-1%	4,579	4,638	-1%	42,025	42,677	-2%
I-70 e/o Evergreen EB	1,159	1,234	-6%	8,474	8,013	6%	38,156	38,639	-1%
Exit 252 (SH 74/ Evergreen Pkwy) Off WB	1,421	1,261	13%	1,201	1,228	-2%	9,770	9,755	0%
Exit 252 (SH 74/ Evergreen Pkwy) On EB	404	415	-3%	1,347	1,343	0%	8,253	8,354	-1%
Exit 251 (El Rancho) On WB	102	127	-20%	210	198	6%	1,431	1,408	2%
Exit 251 (El Rancho) Off EB	33	51	-35%	210	215	-2%	1,375	1,383	-1%
Exit 248 (Beaver Brook/Floyd Hill) Off WB	206	566	-64%	133	140	-5%	1,410	2,224	-37%
Exit 248 (Beaver Brook/Floyd Hill) On EB	122	175	-30%	340	384	-11%	2,088	2,357	-11%
Exit 247 (Hyland Hills/Floyd Hill) On WB	53	519	-90%	95	118	-19%	833	1,876	-56%
Exit 247 (Hyland Hills/Floyd Hill) Off EB	21	37	-43%	203	228	-11%	1,075	1,132	-5%
Exit 244 (US 6/Golden) Off WB	128	56	129%	282	324	-13%	1,635	1,651	-1%
Exit 244 (US 6/Golden) On WB	1,583	1,662	-5%	238	151	58%	6,344	5,371	18%
Exit 244 (US 6/Golden) Off EB	78	59	32%	476	336	42%	1,906	1,393	37%
Exit 243 (Hidden Valley/Central City) Off WB	125	112	12%	346	345	0%	1,919	1,926	0%
Exit 243 (Hidden Valley/Central City) On WB	250	148	69%	130	131	-1%	1,261	1,251	1%
Exit 243 (Hidden Valley/Central City) On EB	39	41	-5%	158	155	2%	1,000	996	0%

Count Location	AM Peak (6:00 a.m. to 8:00 a.m.)			PM Peak (4:00 p.m. to 6:00 p.m.)			Daily (4:00 a.m. to 10:00 p.m.)		
	Model	Count	%	Model	Count	%	Model	Count	%
Exit 243 (Hidden Valley/Central City) Off EB	26	24	8%	163	151	8%	765	753	2%
Exit 241 (Idaho Springs/Colorado Blvd) Off WB	445	609	-27%	262	356	-26%	2,955	4,450	-34%
Exit 241 (Idaho Springs/Colorado Blvd) On WB	243	439	-45%	187	170	10%	1,824	2,504	-27%
Exit 241 (Idaho Springs/Colorado Blvd) On EB	82	65	26%	462	519	-11%	2,118	2,367	-11%
Exit 241 (Idaho Springs/Colorado Blvd) Off EB	79	48	65%	261	151	73%	1,440	887	62%
Exit 240 (SH 103/Mt Evans) Off WB	423	139	204%	303	182	66%	3,097	1,516	104%
Exit 240 (SH 103/Mt Evans) On WB	282	234	21%	251	227	11%	2,299	2,094	10%
Exit 240 (SH 103/Mt Evans) On EB	123	97	27%	521	443	18%	2,483	2,122	17%
Exit 240 (SH 103/Mt Evans) Off EB	59	59	0%	300	361	-17%	1,556	1,767	-12%
Exit 239 (Idaho Springs) Off WB	2	15	-87%	17	28	-39%	122	247	-51%
Exit 239 (Idaho Springs) On WB	150	22	582%	41	17	141%	775	200	288%
Exit 239 (Idaho Springs) Off EB	8	13	-38%	31	105	-70%	165	459	-64%
Exit 238 (Fall River Rd) Off WB	35	22	59%	90	77	17%	659	618	7%
Exit 238 (Fall River Rd) On WB	38	32	19%	15	13	15%	190	164	16%
Exit 238 (Fall River Rd) On EB	40	39	3%	86	81	6%	650	637	2%
Exit 238 (Fall River Rd) Off EB	12	9	33%	59	52	13%	233	210	11%
Exit 235 (Dumont) Off WB	2	96	-98%	6	57	-89%	56	597	-91%
Exit 235 (Dumont) On EB	0	22	-100%	0	49	-100%	1	328	-100%
Exit 234 (Downieville) Off WB	111	271	-59%	8	149	-95%	506	1,909	-73%

Count Location	**AM Peak (6:00 a.m. to 8:00 a.m.)**			**PM Peak (4:00 p.m. to 6:00 p.m.)**			**Daily (4:00 a.m. to 10:00 p.m.)**		
	Model	**Count**	**%**	**Model**	**Count**	**%**	**Model**	**Count**	**%**
Exit 234 (Downieville) On WB	270	237	14%	128	119	8%	1,189	1,522	-22%
Exit 234 (Downieville) On EB	28	42	-33%	190	305	-38%	765	1,162	-34%
Exit 234 (Downieville) Off EB	3	40	-93%	26	265	-90%	218	997	-78%
Exit 233 (Lawson) Off EB	1	2	-50%	38	37	3%	193	138	40%
Exit 232 (US 40/Empire/Granby) Off WB	997	1,308	-24%	725	485	49%	6,973	6,295	11%
Exit 232 (US 40/Empire/Granby) On WB	337	60	462%	188	79	138%	1,540	507	204%
Exit 232 (US 40/Empire/Granby) On EB	218	134	63%	1,508	1,519	-1%	6,198	5,356	16%
Exit 232 (US 40/Empire/Granby) Off EB	15	36	-58%	15	71	-79%	130	458	-72%
Exit 228 (Georgetown) Off WB	184	160	15%	277	217	28%	2,062	1,699	21%
Exit 228 (Georgetown) On WB	398	241	65%	150	133	13%	1,536	1,473	4%
Exit 228 (Georgetown) On EB	114	106	8%	559	386	45%	2,665	2,158	23%
Exit 228 (Georgetown) Off EB	80	62	29%	606	604	0%	2,315	2,113	10%
I-70 w/o Georgetown WB	4,692	4,895	-4%	2,861	2,718	5%	29,897	28,168	6%
I-70 w/o Georgetown EB	570	642	-11%	5,780	5,539	4%	23,517	24,274	-3%
US 40 b/w US 6 and Homestead Rd	1,014	743	36%	211	379	-44%	2,741	4,012	-32%
US 6 n/o US 40	1,398	1,151	21%	1,014	1,110	-9%	8,639	8,073	7%
Central City Pkwy	441	136	224%	776	611	27%	4,852	3,381	44%
SH 103	177	70	153%	357	221	62%	2,415	1,429	69%

Count Location	AM Peak (6:00 a.m. to 8:00 a.m.)			PM Peak (4:00 p.m. to 6:00 p.m.)			Daily (4:00 a.m. to 10:00 p.m.)		
	Model	Count	%	Model	Count	%	Model	Count	%
Colorado Blvd e/o 13th Ave	110	62	77%	3	317	-99%	442	1,624	-73%
Colorado Blvd w/o 13th Ave	161	104	55%	135	416	-68%	1,091	2,036	-46%
Stanley Rd b/w Exit 239 and Exit 235	3	46	-93%	108	185	-42%	332	861	-61%
CR 308 b/w Ex 234 and Alvarado Rd	139	135	3%	54	316	-83%	816	1,609	-49%
US 40 n/o I-70	1,565	1,575	-1%	2,437	2,248	8%	14,834	13,147	13%
Alvarado Rd b/w 15th St and CR 308	105	54	94%	266	291	-9%	1,324	1,217	9%

Observed vs. Modeled Volumes by Count Location for Summer Sunday Conditions

Count Location	AM Peak (6:00 a.m. to 8:00 a.m.)			PM Peak (4:00 p.m. to 6:00 p.m.)			Daily (4:00 a.m. to 10:00 p.m.)		
	Model	Count	%	Model	Count	%	Model	Count	%
I-70 e/o Evergreen WB	2,310	2,580	-10%	4,303	4,671	-8%	35,634	36,427	-2%
I-70 e/o Evergreen EB	1,513	1,427	6%	8,106	8,476	-4%	45,400	45,211	0%
Exit 252 (SH 74/ Evergreen Pkwy) Off WB	439	437	0%	1,214	1,239	-2%	8,798	8,783	0%
Exit 252 (SH 74/ Evergreen Pkwy) On EB	483	498	-3%	1,305	1,300	0%	9,184	9,421	-3%
Exit 251 (El Rancho) On WB	93	81	15%	201	187	7%	1,492	1,394	7%
Exit 251 (El Rancho) Off EB	55	55	0%	258	245	5%	1,502	1,490	1%
Exit 248 (Beaver Brook/Floyd Hill) Off WB	28	28	0%	122	111	10%	967	852	13%
Exit 248 (Beaver Brook/Floyd Hill) On EB	100	115	-13%	559	346	62%	2,791	2,270	23%
Exit 247 (Hyland Hills/Floyd Hill) On WB	69	54	28%	100	115	-13%	903	844	7%
Exit 247 (Hyland Hills/Floyd Hill) Off EB	21	22	-5%	240	207	16%	1,162	980	19%

Count Location	AM Peak (6:00 a.m. to 8:00 a.m.)			PM Peak (4:00 p.m. to 6:00 p.m.)			Daily (4:00 a.m. to 10:00 p.m.)		
	Model	Count	%	Model	Count	%	Model	Count	%
Exit 244 (US 6/Golden) Off WB	59	60	-2%	181	230	-21%	1,081	1,378	-22%
Exit 244 (US 6/Golden) On WB	213	38	461%	287	426	-33%	1,803	1,641	10%
Exit 244 (US 6/Golden) Off EB	94	82	15%	246	139	77%	1,744	1,382	26%
Exit 243 (Hidden Valley/Central City) Off WB	77	74	4%	276	256	8%	1,995	2,025	-1%
Exit 243 (Hidden Valley/Central City) On WB	207	60	245%	109	124	-12%	1,095	1,063	3%
Exit 243 (Hidden Valley/Central City) On EB	34	30	13%	242	282	-14%	1,676	2,095	-20%
Exit 243 (Hidden Valley/Central City) Off EB	24	20	20%	188	191	-2%	885	877	1%
Exit 241 (Idaho Springs/Colorado Blvd) Off WB	108	182	-41%	295	420	-30%	2,233	3,347	-33%
Exit 241 (Idaho Springs/Colorado Blvd) On WB	84	120	-30%	188	262	-28%	1,448	1,991	-27%
Exit 241 (Idaho Springs/Colorado Blvd) On EB	80	89	-10%	505	563	-10%	2,601	2,846	-9%
Exit 241 (Idaho Springs/Colorado Blvd) Off EB	44	58	-24%	245	128	91%	1,378	1,076	28%
Exit 240 (SH 103/Mt Evans) Off WB	175	119	47%	417	191	118%	3,510	2,197	60%
Exit 240 (SH 103/Mt Evans) On WB	114	64	78%	315	185	70%	2,186	1,386	58%
Exit 240 (SH 103/Mt Evans) On EB	105	85	24%	729	621	17%	3,590	3,088	16%
Exit 240 (SH 103/Mt Evans) Off EB	64	45	42%	293	248	18%	1,930	1,812	7%
Exit 239 (Idaho Springs) Off WB	22	13	69%	175	28	525%	773	275	181%
Exit 239 (Idaho Springs) On WB	8	14	-43%	24	40	-40%	166	298	-44%
Exit 239 (Idaho Springs) Off EB	6	13	-54%	58	148	-61%	258	947	-73%

Count Location	AM Peak (6:00 a.m. to 8:00 a.m.)			PM Peak (4:00 p.m. to 6:00 p.m.)			Daily (4:00 a.m. to 10:00 p.m.)		
	Model	Count	%	Model	Count	%	Model	Count	%
Exit 238 (Fall River Rd) Off WB	39	37	5%	110	92	20%	896	848	6%
Exit 238 (Fall River Rd) On WB	12	10	20%	30	28	7%	228	203	12%
Exit 238 (Fall River Rd) On EB	37	34	9%	138	134	3%	1,167	1,138	3%
Exit 238 (Fall River Rd) Off EB	6	5	20%	87	56	55%	338	319	6%
Exit 235 (Dumont) Off WB	0	40	-100%	0	58	-100%	0	542	-100%
Exit 235 (Dumont) On EB	0	20	-100%	1	86	-99%	1	420	-100%
Exit 234 (Downieville) Off WB	4	51	-92%	122	115	6%	891	905	-2%
Exit 234 (Downieville) On WB	276	62	345%	141	126	12%	1,234	935	32%
Exit 234 (Downieville) On EB	32	39	-18%	117	152	-23%	543	902	-40%
Exit 234 (Downieville) Off EB	6	37	-84%	239	161	48%	971	931	4%
Exit 233 (Lawson) Off EB	7	2	250%	54	37	46%	244	138	77%
Exit 232 (US 40/Empire/Granby) Off WB	190	149	28%	357	341	5%	2,539	2,641	-4%
Exit 232 (US 40/Empire/Granby) On WB	173	28	518%	79	51	55%	850	415	105%
Exit 232 (US 40/Empire/Granby) On EB	225	166	36%	979	918	7%	6,231	5,885	6%
Exit 232 (US 40/Empire/Granby) Off EB	5	8	-38%	3	79	-96%	93	411	-77%
Exit 228 (Georgetown) Off WB	351	403	-13%	367	236	56%	2,862	2,481	15%
Exit 228 (Georgetown) On WB	360	64	463%	144	142	1%	1,426	1,174	21%
Exit 228 (Georgetown) On EB	102	91	12%	565	477	18%	3,614	3,194	13%

Count Location	**AM Peak (6:00 a.m. to 8:00 a.m.)**			**PM Peak (4:00 p.m. to 6:00 p.m.)**			**Daily (4:00 a.m. to 10:00 p.m.)**		
	Model	**Count**	**%**	**Model**	**Count**	**%**	**Model**	**Count**	**%**
Exit 228 (Georgetown) Off EB	69	72	-4%	288	288	0%	2,008	1,857	8%
I-70 w/o Georgetown WB	2,057	1,306	58%	2,762	2,822	-2%	21,678	20,919	4%
I-70 w/o Georgetown EB	927	832	11%	4,210	4,212	0%	26,701	26,684	0%
US 40 b/w US 6 and Homestead Rd	44	123	-64%	346	370	-6%	1,467	2,608	-44%
US 6 n/o US 40	411	277	48%	1,018	1,061	-4%	5,932	5,746	3%
Central City Pkwy	337	118	186%	798	650	23%	5,526	4,448	24%
SH 103	178	153	16%	561	548	2%	4,099	4,072	1%
Colorado Blvd e/o 13th Ave	192	91	111%	484	577	-16%	3,680	3,693	0%
Colorado Blvd w/o 13th Ave	28	81	-65%	219	569	-62%	1,025	3,073	-67%
Stanley Rd b/w Exit 239 and Exit 235	26	31	-16%	278	190	46%	1,063	993	7%
CR 308 b/w Ex 234 and Alvarado Rd	11	39	-72%	76	275	-72%	352	1,436	-75%
US 40 n/o I-70	593	310	91%	1,409	1,271	11%	9,707	8,649	12%
Alvarado Rd b/w 15th St and CR 308	41	36	14%	76	115	-34%	1,040	705	48%

Appendix C

Safety Performance Evaluation Technical Report

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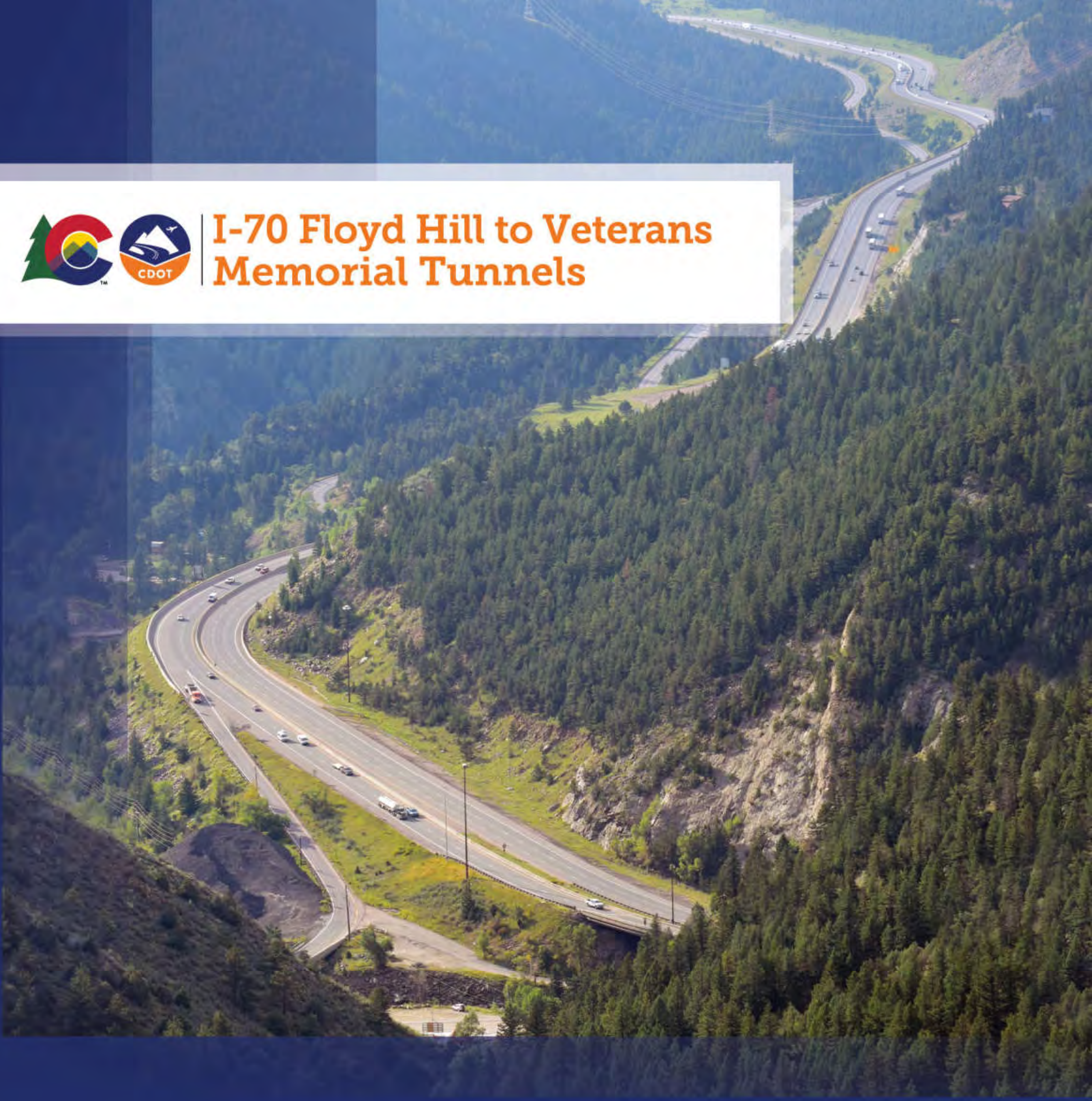

I-70 Floyd Hill to Veterans Memorial Tunnels

Safety Performance Evaluation Technical Report

September 2020

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List of Exhibits

List of Acronyms

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
CDOT	Colorado Department of Transportation
CMF	Crash Modification Factor
CR	County Road
CSS	Context Sensitive Solutions
EA	Environmental Assessment
FHWA	Federal Highway Administration
FI	Fatal injury
GP	General Purpose
GVWR	Gross Vehicle Weight Rating
HOT	High-occupancy toll
HOV	High-occupancy vehicle
HSM	*Highway Safety Manual*
I-70	Interstate 70
IHSDM	Interactive Highway Safety Design Model
MP	Milepost
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
PDO	Property damage only
PEIS	Programmatic Environmental Impact Statement
PPSL	Peak Period Shoulder Lane
ROD	Record of Decision
SH	State Highway
SPF	Safety Performance Function
US	United States Highway

1.0 Introduction and Purpose of this Report

The Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA), in cooperation with local communities and other agencies, are conducting the Interstate 70 (I-70) Floyd Hill to Veterans Memorial Tunnels Environmental Assessment (EA) to advance a portion of the program of improvements for the I-70 Mountain Corridor identified in the 2011 Tier 1 *Final I-70 Mountain Corridor Programmatic Environmental Impact Statement* (PEIS) and approved in the 2011 *I-70 Mountain Corridor Record of Decision* (ROD). The EA is a Tier 2 National Environmental Policy Act (NEPA) process and is supported by resource-specific technical reports.

The purpose of this technical report is to document the safety performance alternatives analysis. Included in the discussion is the methodology for analyzing safety performance, quantitative analysis of existing conditions and Action Alternatives, and qualitative analysis of the Action Alternatives, which are discussed in Section 2.0.

2.0 Proposed Action and Alternatives

2.1 Description of Proposed Action and Alternatives

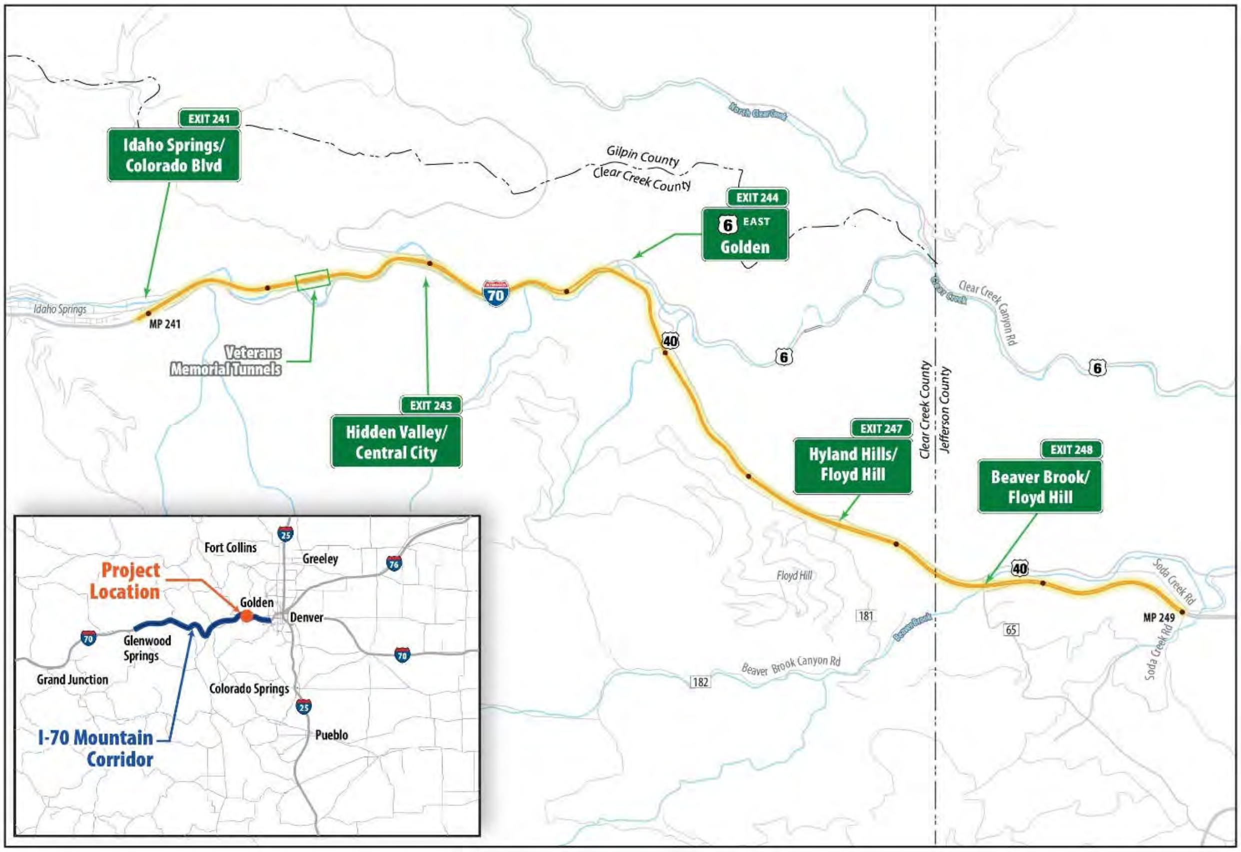
CDOT and FHWA propose improvements along approximately 8 miles of the I-70 Mountain Corridor from the top of Floyd Hill through the Veterans Memorial Tunnels to the eastern edge of Idaho Springs. The purpose of the Project is to improve travel time reliability, safety, and mobility, and address the deficient infrastructure through this area.

The major Project elements include:

- Adding a third westbound travel lane to the two-lane section of I-70 from the current three-lane to two-lane drop (approximately milepost (MP) 246) through the Veterans Memorial Tunnels
- Constructing a new frontage road between the U.S. Highway 6 (US 6) interchange and the Hidden Valley/Central City interchange
- Improving interchanges and intersections throughout the Project area
- Improving design speeds and stopping sight distance on horizontal curves
- Improving the multimodal trail (Clear Creek Greenway) between US 6 and the Veterans Memorial Tunnels
- Reducing animal-vehicle conflicts and improving wildlife connectivity with new and/or improved wildlife overpasses or underpasses

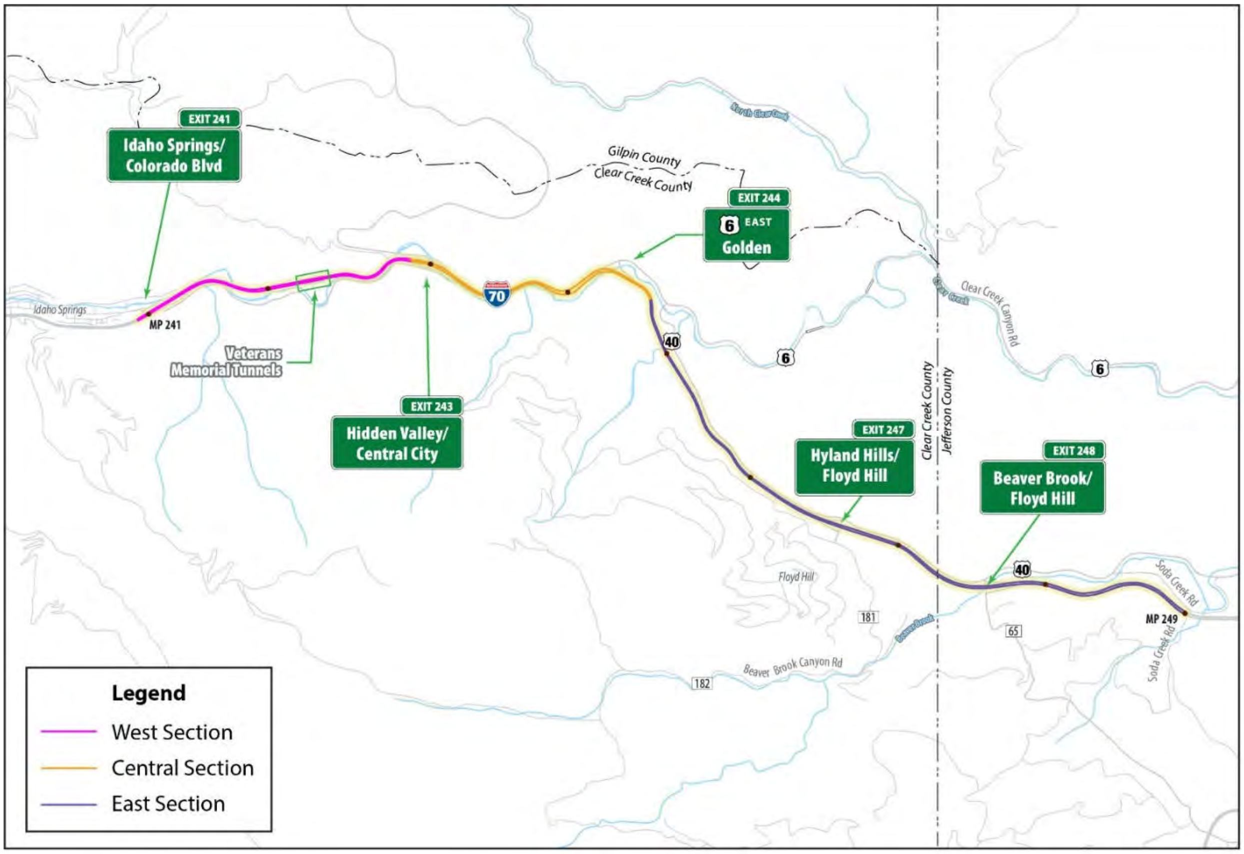
The Project is located on I-70 between MP 249 (east of the Beaver Brook/Floyd Hill interchange) and MP 241 (Idaho Springs/Colorado Boulevard), west of the Veterans Memorial Tunnels. It is located mostly in Clear Creek County, with the eastern end in Jefferson County (see Exhibit 1). The primary roadway construction activities would occur between County Road (CR) 65 (the Beaver Brook/Floyd Hill interchange) and the western portals of the Veterans Memorial Tunnels (MP 247.6 and MP 242.3, respectively), with the Project area extended east and west to account for signing, striping, and fencing.

Exhibit 1. Project Location



Three alternatives are being evaluated in the EA: (1) No Action Alternative, (2) Tunnel Alternative, and (3) Canyon Viaduct Alternative. The Project improvements are grouped into three geographic sections: (1) East Section (top of Floyd Hill to US 6 interchange), (2) Central Section (US 6 interchange to Hidden Valley/Central City interchange), and (3) West Section (Hidden Valley/Central City interchange through Veterans Memorial Tunnels) (see Exhibit 2).

Exhibit 2. East, Central, and West Project Sections



The Action Alternatives—the Tunnel Alternative and Canyon Viaduct Alternative—include the same improvements in the East Section and West Section to flatten curves, add a third westbound travel lane (new lane would be an Express Lane), provide wildlife and water quality features, and improve interchange/intersection operations.

Through the Central Section between the US 6 interchange and the Hidden Valley/Central City interchange, the Action Alternatives vary in how they provide for the third westbound I-70 travel lane and frontage road connections as follows:

- The **Tunnel Alternative** would realign westbound I-70 to the north (along the curve between MP 244.3 and MP 243.7) through a new 2,200-foot-long tunnel west of US 6. Eastbound I-70 would be realigned within the existing I-70 roadway template to flatten curves to improve design speed and sight distance. This alternative also would include two design options for the alignment of the new frontage road north or south of Clear Creek.
- The **Canyon Viaduct Alternative** would realign approximately one-half mile of both the westbound and eastbound I-70 lanes (along the curve between MP 244 and MP 243.5) on viaduct structures approximately 400 feet south of the existing I-70 alignment on the south side of Clear Creek Canyon. Through the realigned area, the frontage road would be constructed under the viaduct on the existing I-70 roadway footprint north of Clear Creek. The Clear Creek Greenway (Greenway) would be reconstructed along its current alignment on the south side of Clear Creek, north of the viaduct. The viaduct would cross above Clear Creek and the Greenway twice.

Additional information regarding the alternatives evaluated in the EA can be found in the *I-70 Floyd Hill to Veterans Memorial Tunnel Alternatives Analysis Technical Report* (CDOT, 2020a).

2.2 No Action Alternative

The No Action Alternative includes ongoing highway maintenance. In addition, due to its poor condition, the westbound I-70 bridge at the bottom of Floyd Hill is programmed to be replaced regardless of whether CDOT moves forward with one of the Action Alternatives. Therefore, replacing the bridge in kind (as a two-lane bridge) is part of the No Action Alternative. Under the No Action Alternative, the bridge would be replaced in its current location but would need to be designed to current standards, with a 55-mph design speed and improved sight distance with wider shoulders.

2.3 Action Alternatives: East Section

In the East Section between the top of Floyd Hill and the US 6 interchange, the Action Alternatives are the same. Through this section, westbound I-70 would be widened to the south to accommodate a third travel lane. The typical section would include an additional 12-foot travel lane and inside and outside shoulders of varying widths, depending on sight distance needs around curves. The proposed footprint would include a 4-foot buffer between the new planned Express Lane and the existing (general purpose) lanes.

In the eastbound direction, the three travel lanes would be retained but the roadway would be realigned where needed to accommodate westbound widening or curve modifications to improve sight distance and safety. An approximately one-mile-long eastbound auxiliary (climbing) lane would be added in the uphill (eastbound) direction from the bottom of Floyd Hill to the Hyland Hills/Floyd Hill interchange (Exit 247). Water quality features would be added along the south side of the eastbound lanes.

At the Beaver Brook/Floyd Hill and Hyland Hills/Floyd Hill interchange systems, the split-diamond interchange configuration (with on- and off-ramps connected by U.S. Highway 40 [US 40]) would remain, and no new accesses would be provided. However, to improve the operations of both interchanges and mitigate effects of local and interstate traffic conflicts along US 40—which acts as a frontage road for the split diamond interchange and the primary local access road for the Floyd Hill neighborhoods—intersections at US 40 and CR 65 and US 40 and Homestead Road would be reconstructed as roundabouts. The roundabouts would provide more capacity for through movements at the intersections, improve traffic circulation along CR 65 and Homestead Road, and accommodate turning movements for heavy trucks.

Wildlife fencing would be added along the north and south sides of I-70 between the Hyland Hills/Floyd Hill interchange on the west and Soda Creek Road on the east to reduce wildlife-vehicle collisions.

2.4 Action Alternatives: Central Section

The Central Section of the Project involves the most substantial improvements—including realigning curves, adding a third westbound travel lane, improving the Greenway, and providing the frontage road connection. These improvements occur within the most-constrained section of the Project area, where the existing I-70 footprint and planned roadway improvements are located between canyon rock walls north and south of existing I-70 and Clear Creek. Because of these constraints, the Action Alternatives within this section include the same improvements but differ with respect to the I-70 mainline and frontage road alignments and the relationship of the roadway improvements to the rock walls and the

Creek. The Greenway would be reconstructed generally along its existing alignment under both Action Alternatives, but the Greenway's location to the Creek and roadway infrastructure would differ.

2.4.1 I-70 Mainline

The I-70 mainline through this section continues the same roadway typical section from the East Section. Both alternatives would provide an additional westbound 12-foot travel lane; inside and outside shoulders of varying widths, depending on sight distance needs around curves; and a 4-foot buffer between the new planned Express Lane and the existing (general purpose) lanes.

Under the Tunnel Alternative, approximately one mile of westbound I-70 would be realigned to the north near the US 6 interchange through a 2,200-foot-long tunnel that would tie in to the existing westbound I-70 alignment and elevation just east of the Hidden Valley/Central City interchange. The three eastbound I-70 lanes through this area would remain within the existing roadway prism but would be realigned, moving approximately 100 feet north into the rock face adjacent to the existing westbound lanes to flatten horizontal curves and improve the design speed and sight distance.

Under the Canyon Viaduct Alternative, the westbound I-70 alignment would shift to the south on a new 5,300-foot-long viaduct beginning at approximately MP 245 east of the exit ramp to US 6 and it would rejoin the existing alignment about one-half mile east of the Hidden Valley/Central City interchange at approximately MP 243.5. Through this area, eastbound I-70 also would be realigned on a separate viaduct structure next to westbound I-70 from MP 243.4 east to just beyond MP 244.3. Both viaduct structures would cross Clear Creek and the Greenway twice near MP 243.9 and MP 243.5 (approximately 60 feet above ground level).

2.4.2 Frontage Road

Both alternatives include a new approximately 1.5-mile-long frontage road connection between the Hidden Valley/Central City interchange and the US 6 interchange. The frontage road would run from the intersection of CR 314 and Central City Parkway (south of the I-70 eastbound off-ramp at the Hidden Valley/Central City interchange where CR 314, which acts as a frontage road from east Idaho Springs, terminates) to the US 6/I-70 ramp terminal. The roadway section for the frontage road would consist of two 11-foot lanes (one in the eastbound direction and one in the westbound direction) with consistent 2-foot shoulders. The design speed would be 30 mph and the roadway would be constructed to comply with Clear Creek County local access standards.

The Tunnel Alternative includes two design options for this frontage road:

- **North Frontage Road Option** would provide the new frontage road connection between the two interchanges mostly on the north side of Clear Creek. The I-70 mainline would be realigned north into the mountainside, requiring substantial rock cuts (150 feet high) to make room for the frontage road between the Creek and existing I-70. The Greenway would be reconstructed along its current alignment south of Clear Creek.

- **South Frontage Road Option** would provide the new frontage road connection between the two interchanges mostly on the south side of Clear Creek. Moving the frontage road to the south side of the creek would require new rock cuts on the south side of Clear Creek Canyon and less substantial rock cuts on the north side of I-70. The Greenway would be reconstructed generally along its current alignment south of Clear Creek; the Greenway would be located closer to the frontage road alignment than under the North Frontage Road Option, but the design seeks to maximize horizontal and vertical separation between the facilities.

Under the Canyon Viaduct Alternative, the existing I-70 pavement under the elevated structures would be repurposed for the frontage road; excess right of way would be available for other uses—presumably Creek and recreation access—through this approximately one-mile area of the canyon.

2.5 Action Alternatives: West Section

The West Section between the Hidden Valley/Central City interchange and the Veterans Memorial Tunnels continues the widening of the interstate to add the third westbound travel lane and to flatten the S-curve in this location. Improvements in this section are the same under both Action Alternatives. The curve modifications require realigning both the I-70 mainline and frontage road through this section. The I-70 mainline alignment would shift south approximately 100 feet around the first curve from the Hidden Valley/Central City interchange, then north around the second curve approximately 50 feet, continuing a slight (25-foot) shift north before tying in to the existing alignment at the Veterans Memorial Tunnels. Much of CR 314 would be realigned south between the Doghouse Rail Bridge over Clear Creek near the Veterans Memorial Tunnels east portal and the Hidden Valley/Central City interchange. A small section of CR 314 (between MP 242.6 and MP 242.7) would remain and connect to the reconstructed portions west and east.

These alignment shifts result in substantial rock cuts on both the north and south sides of the canyon. On the north side, rock cuts up to 160 feet high would be required next to the I-70 westbound lanes (along the curve in the area where CR 314 is not reconstructed). To realign CR 314 south, rock cuts from 70 feet to 100 feet high are required on the south side of the canyon. Additionally, a 1,200-foot section of Clear Creek, which is located between I-70 and CR 314, would need to be relocated south near MP 242.5.

The Hidden Valley/Central City interchange would not be reconstructed, and the I-70 bridges would remain because they are wide enough to accommodate the widened I-70 footprint without being replaced. All the on- and off-ramps for the interchange would be reconstructed, but the bridges over Clear Creek for the I-70 westbound off-ramp and I-70 eastbound on-ramp also can be retained. New bridges over Clear Creek to the west would be needed for the I-70 westbound on-ramp and I-70 eastbound off-ramp to accommodate the curve flattening and shift of I-70 to the south in this location. The CDOT maintenance facility would need to be relocated.

No changes are required west of the Veterans Memorial Tunnels. Within the westbound tunnel, the roadway would be restriped for the third lane (the expansion of the tunnel to accommodate the third lane was completed in 2014). After the tunnel, restriping and signing would continue west to the next interchange at Idaho Springs/Colorado Boulevard (Exit 241), where the third lane would terminate. The Express Lane would operate in conjunction with the westbound Mountain Express Lane (MEXL) during peak periods (winter and summer weekends).

2.6 Construction of Action Alternatives

CDOT is planning to use a Construction Manager/General Contractor delivery method for construction of the Project. This contracting method involves a contractor advising in the design phases to better define Project technical requirements and costs, improve design quality and constructability, and reduce risks through the construction phase. This method promotes innovation and aligns well with the multidisciplinary Context Sensitive Solutions (CSS) process. It was used successfully on the Twin Tunnels projects to reduce environmental impacts and accommodate community values in the design and construction phases.

It is anticipated that construction of either Action Alternative would require four to five years and generally could occur within the proposed right of way. Specific construction methods and phasing will be determined with contractor input and could affect the duration and/or physical requirements for construction activities. The focus of environmental impact analysis during the NEPA process is to identify resources and locations sensitive to construction impacts and incorporate reasonable mitigation measures, including potential to avoid impacts by avoiding sensitive areas, to inform the contractor's plans. Final design and construction plans will consider changes in resource impacts, and reevaluations will be completed as needed during final design.

3.0 Safety Analysis Methodology

3.1 Background

The safety performance evaluation to assess the impacts associated with modifications of geometric elements was conducted using the American Association of State Highway and Transportation Officials (AASHTO) *Highway Safety Manual* (HSM) (2014) predictive methods. The HSM provides predictive methods for evaluating freeways, ramps, and interchanges and two-lane rural roads, among other facility types. The models can be used to evaluate the impact of design alternatives on crash frequency, to diagnose safety issues, and to assess future safety conditions. These models provide several important advantages, including:

- Measuring the effects of roadway geometry, physical features, and traffic volumes on crash frequency
- Allowing for a thorough understanding of safety performance and creating opportunities to improve performance

Each model predicts average crash frequency using Safety Performance Functions (SPF) and Crash Modification Factors (CMFs). An SPF expresses the nonlinear relationship between traffic volume and crash frequency. It is established by modeling road segments and the crashes that are recorded on them. The SPF is based on the most frequent or common set of road characteristics, referred to as the "base condition."

The CMFs included as part of the predictive models are used to adjust the predicted average crash frequency, estimated by the SPF for a site with base conditions, to local conditions of the site under evaluation. A CMF represents the relative change in estimated average crash frequency because of a change in one specific condition. It provides an estimate of the effectiveness of the implementation of a particular safety countermeasure (e.g., transportation solutions such as paving gravel shoulders, adding a left-turn lane, or increasing the radius of a horizontal curve).

HSM models require the application of a calibration factor, which serves to address differences in databases associated with the state in which the analysis is performed versus the underlying database research. Some of these differences include changes in driver behavior, vehicle design, vehicle crash worthiness, crash reporting processes, and road design policy changes over time. Since CDOT does not have calibration factors, results of the analysis were used to establish relative comparisons between the alternatives and the no action scenario.

The general form of the predictive models is as follows:

$$N_{Pred} = N_b \times (CMF_1 \times CMF_2 \times CMF_3 \times \cdots \times CMF_n) \times C$$

N_{Pred} = Predicted average fatal and injury crash frequency for a specific year for site type x
N_b = Base predicted average fatal and injury crash frequency determined for base conditions of the SPF developed for site type x
CMF = Crash Modification Factor specific to site type x and specified geometric design and traffic control features
C = Calibration factor to account for local conditions

Based on the alternatives being compared, the HSM freeway predictive methods have some limitations, including:

- Tolled express vehicle lanes cannot be modeled

- Impacts of grade
- Tunnel and viaduct considerations

3.1.1 Tolled Express Lanes

During the literature review for this analysis, it was found that the experience with analyzing the safety performance of freeway facilities with high-occupancy tolled (HOT) lanes has been increasing over the years. Some of the information found included:

- General safety-related issues and trends associated with managed lanes operation and design
- Safety performance of HOT lanes with continuous access versus limited access
- Safety impacts of converting a high-occupancy vehicle (HOV) lane to an HOT lane
- Safety impacts of truck restrictions

Some studies that are under way or may not be directly applicable to the Project also were found. For instance, in National Cooperative Highway Research Program (NCHRP) Report 17-89A, “HOV/HOT Freeway Crash Prediction Method for the Highway Safety Manual,” the project team is in the process of developing safety prediction methods for estimating crash frequency and severity for freeway facilities and associated ramps with managed lanes.

Srinivasan *et al*. developed crash prediction models for freeway facilities with HOV and HOT lanes by number of freeway lanes using Florida data. Models were developed for 6-, 8-, 10-, and 12-lane freeways (number of lanes reflect both directions and include the managed lanes). For all the models, segment length and average annual daily traffic (AADT) were significant and included. For most of the models, left-shoulder width was the only other significant variable. An increase in left-shoulder width was associated with decreases in crashes. The effect of buffer type on crashes was found to be statistically significant only in the model for 10-lane freeways. The inclusion of a 2-foot to 3-foot buffer was associated with fewer fatal and injury crashes. Application of these predictive models would require calibration to local conditions. For this reason, the Florida HOV predictive models cannot be used for the I-70 Floyd Hill to Veterans Memorial Tunnels Project.

Since the HSM does not provide SPF models developed to consider managed lanes, as would be present in the proposed design, CMFs are required to adjust base SPF conditions on mainline freeway segments. Abuzwidah *et al*. conducted a study to investigate the safety impact of converting an HOV lane to an HOT lane. The study shows that the HOV-to-HOT conversion does not significantly affect the safety performance of the roadway. CMFs are provided for HOT lanes, general-purpose (GP) lanes, and the whole roadway section by severity type and crash type. The proposed approach to model the build scenarios will assume that the additional lane is an HOV lane. The HOV-to-HOT CMF will be applied to obtain the final adjusted predicted crash frequency. This analysis used a CMF of 0.96 and 1.28 for fatal injury (FI) and property damage only (PDO) crashes as proposed by the research to model express lane segments contained in this Project.

3.1.2 Tunnel and Viaduct Considerations

While certain elements of the proposed Tunnel Alternative and Canyon Viaduct Alternative can be compared using the HSM approach described (horizontal curvature, cross sectional elements, etc.), the HSM methodology does not account for specific adjustments for the portions of the highway within a tunnel or on a viaduct. An extensive literature review was conducted to assess the differences between the Tunnel Alternative and the Canyon Viaduct Alternative. As a result of this analysis, it was determined that external SPFs and/or CMFs are not available for this analysis. Therefore, the quantitative analysis can only be used to quantify the safety performance differences of the geometric elements that are part of the HSM predictive models.

3.1.3 Qualitative Evaluation

To account for the fact that quantitative evaluation of the tunnel and viaduct portions of the alternatives cannot be compared using only quantitative analysis, a qualitative evaluation was conducted to assess the differences between the Tunnel Alternative and the Canyon Viaduct Alternative. The alternative comparison considered factors with a potential impact to safety and other factors specific to tunnels and viaducts. Based on the literature review, these factors may include, but are not limited to, lighting, icing of roadways, other safety factors, and driver behavior, among others. An assessment of these different factors was conducted and summarized using a rating scale to indicate which alternative yields more benefits. This assessment could be used as an additional consideration for evaluating the safety of the alternatives to support the decision-making process. Results of the analysis are discussed in Section 6 of this report.

3.2 Analysis Tool

The FHWA’s Interactive Highway Safety Design Model (IHSDM) is a suite of software analysis tools used to evaluate operational effects of geometric design decisions on highways. IHSDM was designed originally to provide “decision support” in the highway design process—comparing existing or proposed roadway designs against relevant design and operations policy values. A crash prediction module, which incorporates the HSM methodology, was added to estimate the safety impacts of design decisions.

3.2.1 IHSDM Data Input

IHSDM requires the same data needed for HSM predictive models, which is specific to each facility type. IHSDM uses geometric data, speed limit, area type, AADT, and other data variables to create homogenous segments. The HSM predictive methods for each facility type embedded into IHSDM require different data input elements to generate predicted crash frequencies. Some of these include, but are not limited to:

- Facility type
- Horizontal alignment
- AADT
- Cross section elements, including number of lanes, lane width, inside and outside shoulder width, median width, clear zone, presence of ramps, inside and outside median barrier, and presence of shoulder rumble strips
- Intersection elements, including traffic control type; lane configuration; presence of bus stops, schools, and alcohol establishments; and right- and left-turn information

All the roadways, ramp terminals, and intersections were coded as part of a single network except for the roundabouts. These junctions were coded as separate facilities because the IHSDM does not allow roundabouts to be coded as ramp terminals. The separate network includes all the legs associated with each roundabout, and results from both networks were combined in the final summaries.

Traffic Volume Data

Existing conditions in the corridor are defined by consistent weekday conditions and seasonal weekend peaks. Winter Saturdays are characterized by large, severe westbound morning peaks with much smaller and more gradual eastbound afternoon peaks. Summer Sundays are characterized by gradual midday westbound peaks and large eastbound peaks that last throughout the afternoon. Due to winter

Saturdays having a slightly higher demand than summer Sundays within the study area, winter Saturday AADT was used in the safety analysis modeling to achieve the most conservative result.

3.2.2 Freeway Predictive Models

HSM Chapter 18, Freeways and Interchanges, contains SPFs for four-lane, six-lane, eight-lane, and ten-lane freeway segments. The models are based on AADT and are used to predict crash frequency. Crash frequency is influenced by lane width and shoulder width dimensions, the presence and location of roadside and median barriers, mainline horizontal alignment, and the presence of entrance and exit ramps, with CMFs calculated for each of these factors.

Mainline crashes are influenced by the proximity of ramps, with specific sensitivity to weaving. The location of ramps (left hand versus right hand) and their design (lane balance versus lane drop) also influence crash frequency. Finally, congestion influences safety performance, which is described by the number of hours during a typical day in which traffic volume exceeds 1,000 vehicles per hour per lane. All of these factors are applied in the form of a CMF. In practice, CMFs are multiplied with the crash frequency predicted by the SPF to account for the difference between site conditions and specified base conditions. Exhibit 3 lists the applicable CMFs included in the freeways chapter for which data need to be collected.

Exhibit 3. HSM Chapter 18 Freeway Crash Modification Factors

Applicable SPF(s)	CMF Description
Freeway segments or speed-change lanes	Horizontal curve
	Lane width
	Inside shoulder width
	Median width
	Median barrier
	High volume
Multiple-vehicle crashes on freeway segments	Lane change
Single-vehicle crashes on freeway segments	Outside shoulder width
	Shoulder rumble strip
	Outside clearance
	Outside barrier
Ramp entrances	Ramp entrance
Ramp exits	Ramp exit

3.2.3 Ramps and Interchanges Predictive Models

HSM Chapter 19, Predictive Method for Ramps, was used to estimate the safety performance for ramps, ramp terminals, and interchanges located along the corridor and the arterials. Similarly, the models are AADT-based and generate predicted average annual fatal and injury crash frequency and property damage only crash frequency. A severity distribution function is available to further quantify the crash frequency by the following severity levels: fatal, incapacitating injury, non-incapacitating injury, and possible injury. The ramp models use several CMFs, including but not limited to number of through lanes, presence of horizontal curve, radius of the curve, widths of lanes, and widths of right and left shoulders. The ramp terminal model CMFs include ramp terminal control type, skew angle, distance to adjacent ramp terminal, presence of protected left-turn operation, crossroad median width, and number of through lanes on the inside and outside crossroad approach, among others. Exhibit 4 and Exhibit 5 summarize the applicable CMFs included in the HSM for different ramp segments and ramp terminal configurations, which are the data elements that need to be collected.

Exhibit 4. Ramp Segment Crash Modification Factors

Applicable SPF(s)	CMF Description
Ramp or C-D Road Segments	Horizontal curve
	Lane width
	Right shoulder width
	Left shoulder width
	Right side barrier
	Left side barrier
	Lane add or drop
Multiple-vehicle crashes on ramp or C-D road segments	Ramp speed-change lane
C-D road segments	Weaving section

Exhibit 5. Ramp Terminal Crash Modification Factors

Applicable SPF(s)	CMF Description
Signal-controlled or one-way stop-controlled ramp terminals	Exit ramp capacity
	Crossroad left-turn lane
	Crossroad right-turn lane
	Access point frequency
	Segment length
	Median width
Signal-controlled crossroad ramp terminals	Protected left-turn operation
	Channelized right turn on crossroad
	Channelized right turn on exit ramp
	Non-ramp public street leg
One-way stop-controlled terminals	Skew angle

3.2.4 Two-Lane Rural Roads

HSM Chapter 10, Predictive Method for Rural Two-Lane, Two-Way Roads, was used to estimate the safety performance for rural two-lane roads and intersections. Models are AADT-based and predict average fatal and injury and property damage only crash frequencies. The model uses various CMFs, including but not limited to lane width, shoulder geometry, roadside hazard rating, and driveway density, among others. Exhibit 6 summarizes the CMFs that are part of the predictive model, for which data needs to be collected.

Exhibit 6. **HSM Chapter 10 Rural Two-Lane Crash Modification Factors**

Applicable SPF(s)	CMF Description
Roadway Segments	Lane width
	Shoulder width and type
	Horizontal curves, length, radius, and spiral transitions
	Horizontal curves superelevation
	Grades
	Driveway density
	Centerline rumble strips
	Passing lanes
	Two-way left turn lanes
	Roadside design
	Lighting
	Automated speed enforcement
	Horizontal curve

3.2.5 Roundabouts

NCHRP Research Report 888, "Roundabout Crash Prediction Models," provides the results of NCHRP Project 17-70, "Development of Roundabout Crash Prediction Models and Methods." The contents of this research project will be included in the second version of the HSM as part of Chapters 4 and 12. The document contains crash prediction models for planning-, intersection-, and leg-level models. The intersection-level models are implemented in the IHSDM software.

The models are based on AADT and are used to predict crash frequency for crashes that occur within the limits of the intersections and intersection-related crashes. SPFs are available for three-leg and four-leg roundabouts with one or two circulating lanes. Crash frequency is influenced by the inscribed circle diameter, outbound-only leg, right-turn bypass lane, access point frequency, entry width, circulating width, and the inscribed circle diameter. Exhibit 7 lists the CMFs included in the roundabout chapter for which data need to be collected.

Exhibit 7. **HSM 2 Chapter 12 Roundabout Crash Modification Factors**

Applicable SPF(s)	CMF Description
Roundabouts	Inscribed circle diameter
	Outbound-only leg
	Right-turn bypass lane
	Access point frequency
	Entry width
	Circulating lane

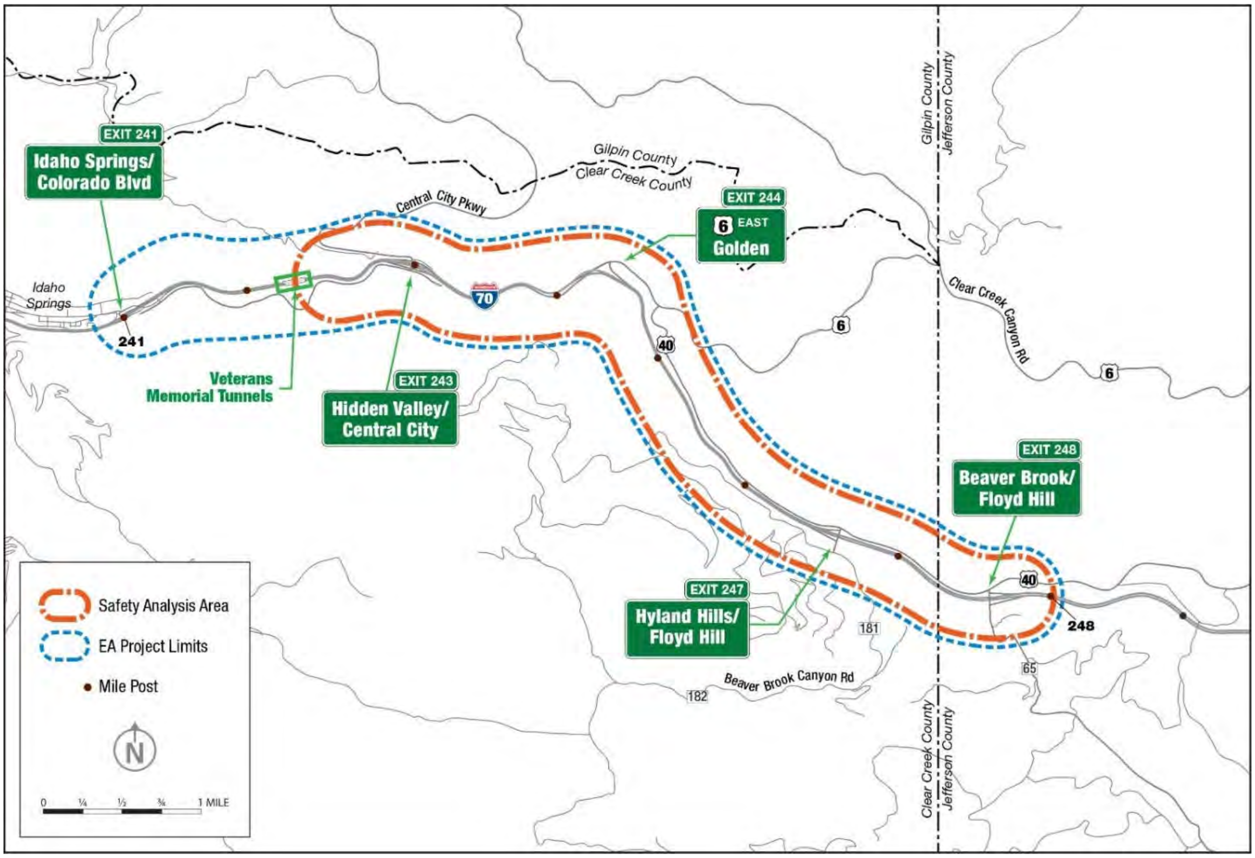
4.0 Alternatives Evaluated

The alternatives evaluated in the safety performance analysis include an existing model (2018), a No Action Model (2045), a Canyon Viaduct Alternative (2045), and a Tunnel Alternative (2045).

4.1 Existing (2018) Roadway

This section describes the existing geometry of I-70, its interchanges, and portions of the connecting local road system that were evaluated in the safety performance analysis for this study. The safety analysis area is slightly different than the overall EA project limits (see Exhibit 8) because the safety performance analysis only evaluated areas where the roadway design changed. The safety analysis area stretches from the Veterans Memorial Tunnels to just east of the Beaver Brook/Floyd Hill interchange and includes the four service interchanges.

Exhibit 8. Safety Analysis Study Area



4.1.1 I-70 Mainline

Within the analysis area, I-70 is a full access-controlled freeway that travels generally on an east-west alignment through mountainous terrain with steep grades and sharp curves. It passes through the Veterans Memorial Tunnels near MP 242. Westbound I-70 is comprised of three general-purpose lanes from the eastern limit of the study area to approximately MP 247. From MP 247 to the western limit of the study area, the westbound direction is comprised of two general-purpose lanes.

Eastbound I-70 consists of two general-purpose lanes and contains a peak period shoulder lane (PPSL), which is operational only during peak hours. The PPSL is located approximately between MP 232 and MP 241. At approximately MP 241, the PPSL becomes a regular express toll lane and continues until MP 243.7, where it becomes a general-purpose lane for the remaining stretch of I-70 to Denver. Trucks are not allowed in the PPSL or express lane and are restricted to the right-most lane from about Exit 241 to Exit 247.

Exhibit 9 and Exhibit 10 summarize the geometric characteristics for westbound and eastbound I-70, respectively.

Exhibit 9. Existing Conditions—Westbound I-70 Geometric Characteristics

Mileposts		Lanes		Speed Limit (mph)	Features
Start	End	GPL*	Other		
252	247	3[1]	0	65	Sharp curves and steep upgrade
247	244	2[2]	0	55/45[4]	Sharp curves and steep downgrade
244	242	2[2]	0[3]	55/45[4]	Sharp curves, tunnel, relatively flat
242	240.5	2[2]	0	60	Curves and relatively flat

**GPL—General-purpose lane*

1. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to the right two lanes.

2. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to the right lane.

3. The westbound bore for the Veterans Memorial Tunnels has been widened to accommodate a third lane, but this extra width is currently striped off as an extra wide shoulder.

4. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to a speed of 45 mph and all other vehicles are restricted to a speed of 55 mph.

Exhibit 10. Existing Conditions—Eastbound I-70 Geometric Characteristics

Mileposts		Lanes		Speed Limit (mph)	Features
Start	End	GPL*	Other		
240.5	241	2[1]	1[2]	60	Relative flat and straight
241	243.7	2[1]	1[2]	55	Sharp curves, tunnel, and relatively flat
243.7	244	3[3]	0[4]	55	Sharp curves and relatively flat
244	247	3[3]	0	65	Sharp curves and steep upgrade
247	252	3	0	65	Sharp curves and steep downgrade

**GPL—General-purpose lanes*

1. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to the right lane.

2. Eastbound PPSL.

3. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to the right two-lanes.

4. PPSL transitions to a general-purpose lane.

4.1.2 Local Roadway Network

Due to the mountainous terrain, the local roadway network is minimal within the study area. Most local roadways in the study area serve local traffic and provide access to residential development. Very few of the local roadways provide connectivity to other major roadways and most do not provide an alternative route through the study area.

US 40 provides some alternate routing opportunity because it runs parallel to I-70 between Exit 252 (State Highway [SH] 74/Evergreen Parkway) and Exit 244 (US 6/Golden). This two-way, two-lane regional highway is located on the south side of I-70 between Exit 252 (SH 74/Evergreen Parkway) and Exit 251 (El Rancho), then it crosses over to the north side of I-70. US 40 remains on the north side of I-70 while providing connectivity to Exit 248 (Beaver Brook/Floyd Hill), Exit 247 (Hyland Hills/Floyd Hill), and finally Exit 244 (US 6/Golden). The roadway has posted speed limits between 25 mph and 45 mph. US 40 intersects with US 6 about one-half mile east of the Exit 244 (US 6/Golden) interchange.

CR 65 is a two-way, two-lane rural collector that provides access between I-70 and Bergen Park, which is located along SH 74 south of I-70. The roadway has a posted speed limit of 35 mph. This roadway is an alternate route for drivers going to and from the City of Evergreen and I-70.

US 6 is a two-way, two-lane regional highway that can act as a regional alternative route to I-70 by allowing drivers an alternate route between Denver and Golden. US 6 has less grade than I-70, but many more sharp curves and passes through tunnels that have height restrictions of 13 feet. Speed limits along US 6 range between 40 mph and 55 mph.

4.2 2045 No Action

The 2045 No Action model was created from the 2018 existing conditions model by forecasting traffic demand to 2045. As with the existing conditions model, 2045 No Action was modeled using only winter Saturday AADT volumes. Future volumes were estimated by applying a growth factor (1.34) to the 2018 AADT data. Exhibit 11 shows the No Action IHSDM model covering the entire study area.

Exhibit 11. Sample IHSDM Model—No Action

4.3 Action Alternatives

Two distinct roadway configurations are proposed for the I-70 Floyd Hill to Veterans Memorial Tunnels Project: The Tunnel Alternative and the Canyon Viaduct Alternative. Both alternatives follow the requirements of the Proposed Action identified as part of the EA. Both involve reconfiguring I-70 between the US 6/Golden interchange and the Hidden Valley/Central City interchange, as well as the addition of a new frontage road connection between US 6 and the Hidden Valley/Central City interchange. Interchange configurations are the same in both alternatives; roundabouts will be added on the north side of the Beaver Brook and Homestead Road interchanges, and the two signalized intersections at Hidden Valley will be replaced with roundabouts.

In the eastbound direction, the eastbound off-ramp at Exit 244 (US 6) is removed and replaced with an eastbound on-ramp. A continuous auxiliary lane is added between the eastbound on-ramp at Exit 244 and the off-ramp at Exit 247, resulting in a four-lane cross-section in the eastbound direction (three general-purpose lanes and one auxiliary lane).

In the westbound direction, a left-lane express toll lane, which operates at all times, is constructed from approximately MP 247.5 until it becomes a PPSL at approximately the Veterans Memorial Tunnels. I-70 consists of three general-purpose lanes and an express lane from the easternmost limit of the study area to approximately MP 246.8, where there are only two general-purpose lanes and an express lane. Trucks are limited to the rightmost lane and are not allowed in the express lane or PPSL. Additionally, the left-side on-ramp from US 6 is converted into a right-side on-ramp.

4.3.1 Tunnel Alternative

The Tunnel Alternative (2045) IHSDM model includes I-70 freeway alignment changes from approximately US 6 to the Hidden Valley/Central City interchange. Within this section of freeway, a tunnel will carry westbound traffic from the US 6 interchange for approximately one-half mile until the freeway reconnects with its old alignment. The tunnel allows curvature to be less sharp on westbound I-70 than it is currently. Eastbound I-70 is realigned using the full existing I-70 right of way, with space to smooth curvature and address existing geometric deficiencies. The Tunnel Alternative also includes braiding the US 6 westbound on-ramp with the westbound Hidden Valley/Central City off-ramp.

Due to IHSDM limitations, the eastbound and westbound alignments for the tunnel alternative were evaluated separately. Results from the eastbound and westbound directions were averaged within the central section from the Hidden Valley/Central City interchange to US 6.

4.3.2 Canyon Viaduct Alternative

The Canyon Viaduct Alternative consists of both directions of I-70 on an elevated viaduct between US 6 and the Hidden Valley/Central City interchange. Elevating the freeway allows for smoothing of curvature and creates space below for the new frontage road. The westbound US 6 on-ramp can be accommodated farther east in the Canyon Viaduct Alternative and is not braided with the westbound Hidden Valley/Central City off-ramp.

5.0 Evaluation Results

The results of the crash prediction models for the No Action scenario and the two alternatives are presented below. Prediction results are reported by freeway, interchanges, and arterials. Detailed results from IHSDM are provided in Appendix A.

5.1 Safety Performance Evaluation Results

In general, both alternatives are anticipated to provide safety benefits as compared to the No Action scenario and generate lower predicted crash frequencies. The decrease in predicted crashes is associated with:

- Smoothing and/or eliminating harsh curvature between the Veterans Memorial Tunnels and the US 6 interchange in both action alternatives
- Cross-section element improvements in many areas, such as number of lanes, lane width, inside and outside shoulder width, median width, clear zone, presence of ramps, speed-change lane length, inside and outside median barrier, and presence of shoulder rumble strips

A comparison of the predicted crash frequencies between the two alternatives and the No Action scenario is summarized in Exhibit 12 through Exhibit 22.

5.1.1 Canyon Viaduct Alternative

The Canyon Viaduct Alternative mainline results indicate a reduction in fatal and injury crashes of 17 percent and an overall decrease in crashes of 16 percent. As stated previously, the reduction is primarily attributed to the improved horizontal geometry and enhanced cross-section elements. The roadway section west of US 6 is the area with the greatest reduction in crash frequency. Predicted crash frequency by crash type also is presented for the mainline (see Exhibit 16 and Exhibit 17). All crash types will be reduced with the Canyon Viaduct Alternative in place.

The service interchange results indicate a reduction of fatal and injury crashes by 55 percent and overall decrease in crashes of 30 percent. This reduction is due primarily to ramp cross-section improvements, as well as the installation of roundabouts in place of existing ramp terminals on the Hidden Valley/Central City interchange, at Homestead Road, and at CR 65. Roundabouts, in some cases, are consolidating two intersections into a single facility, thereby reducing the number of traffic conflicts. The Hidden Valley/Central City interchange experiences higher crash frequency than under the No Action scenario because the new frontage road is diverting some traffic from the mainline and carrying traffic from US 6. The frontage road connection between US 6 and the Hidden Valley/Central City interchange does not exist in the No Action scenario, but it was included in the analysis because it generates some traffic diversion from the mainline.

Overall, the Canyon Viaduct Alternative showed a decrease in fatal and injury crashes of 19 percent, and a decrease in all crash types of 15 percent. The systemwide total predicted crash frequency is 206.1 crashes/year and 174.5 crashes/year for the No Action scenario and the Canyon Viaduct Alternative, respectively.

5.1.2 Tunnel Alternative

The Tunnel Alternative mainline results indicate a reduction in fatal and injury crashes and total crashes of 9 percent and 8 percent, respectively. Similar to the Canyon Viaduct Alternative, the crash reduction is attributed to the enhanced roadway geometry. The roadway section west of US 6 is the area with the greatest reduction in crash frequency. Predicted crashes by crash type indicate an overall slight reduction in all crash types along the study area.

The service interchanges experience a decrease in fatal and injury crashes of 58 percent and a reduction in total crashes of 31 percent. The reduction is attributed to traffic diversion and changes in latent demand, as well as ramp cross-section improvements and the installation of roundabouts at the north ramp terminals on CR 65 and Homestead Road and on both ramp terminals at the Hidden Valley/Central City interchange. The Hidden Valley/Central City interchange experiences higher crash frequency under the Tunnel Alternative than the No Action scenario because of the new frontage road, which is serving as a parallel route between US 6 and the Hidden Valley/Central City interchange.

The frontage road between US 6 and the Hidden Valley/Central City interchange also is included in this alternative to properly capture the traffic diversion generated by this parallel route. Overall, the Tunnel Alternative showed a decrease in fatal and injury crashes by 12 percent and a decrease in all crash types by 8 percent. The systemwide total predicted crash frequency is 206.1 crashes/year and 189.7 crashes/year for the No Action scenario and the Tunnel Alternative, respectively.

Exhibit 12. Overall Summary Design Year Safety Performance Results—Canyon Viaduct Alternative

Facility	2045 No Action			Canyon Viaduct Alternative			Difference			Percentage		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
I-70 Mainline	47.5	146.1	193.6	39.5	123.7	163.2	-8.0	-22.4	-30.4	-17%	-15%	-16%
Service Interchanges	5.1	7.4	12.5	2.3	6.4	8.7	-2.8	-1.0	-3.8	-55%	-13%	-30%
Arterial Segments	N/A	N/A	N/A	0.9	1.8	2.7	N/A	N/A	N/A	N/A	N/A	N/A
Overall Total	52.6	153.5	206.1	42.7	131.9	174.5	-9.9	-21.6	-31.5	-19%	-14%	-15%

1. Evaluated arterial segments only include the constructed US 6 frontage road between the US 6 and Central City Parkway/Hidden Valley interchanges in the Action Alternatives. These values are included in the results to capture all crashes within this section of the project due to some demand shifting from the mainline to the frontage road.

Exhibit 13. Overall Summary Design Year Safety Performance Results—Tunnel Alternative

Facility	2045 NoAction			Tunnel Alternative			Difference			Percentage		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
I-70 Mainline	47.5	146.1	193.6	43.0	134.5	177.5	-4.5	-11.6	-16.1	-9%	-8%	-8%
Service Interchanges	5.1	7.4	12.5	2.1	6.5	8.6	-2.9	-0.9	-3.9	-58%	-13%	-31%
Arterial Segments	N/A	N/A	N/A	1.1	2.4	3.5	N/A	N/A	N/A	N/A	N/A	N/A
Overall Total	52.6	153.5	206.1	46.3	143.4	189.7	-6.3	-10.1	-16.4	-12%	-7%	-8%

1. Evaluated arterial segments only include the constructed US 6 frontage road between the US 6 and Central City Parkway/Hidden Valley interchanges in the Action Alternatives. These values are included in the results to capture all crashes within this section of the project due to some demand shifting from the mainline to the frontage road.

Exhibit 14. Mainline Safety Performance Results—Total Predicted Crashes per Year

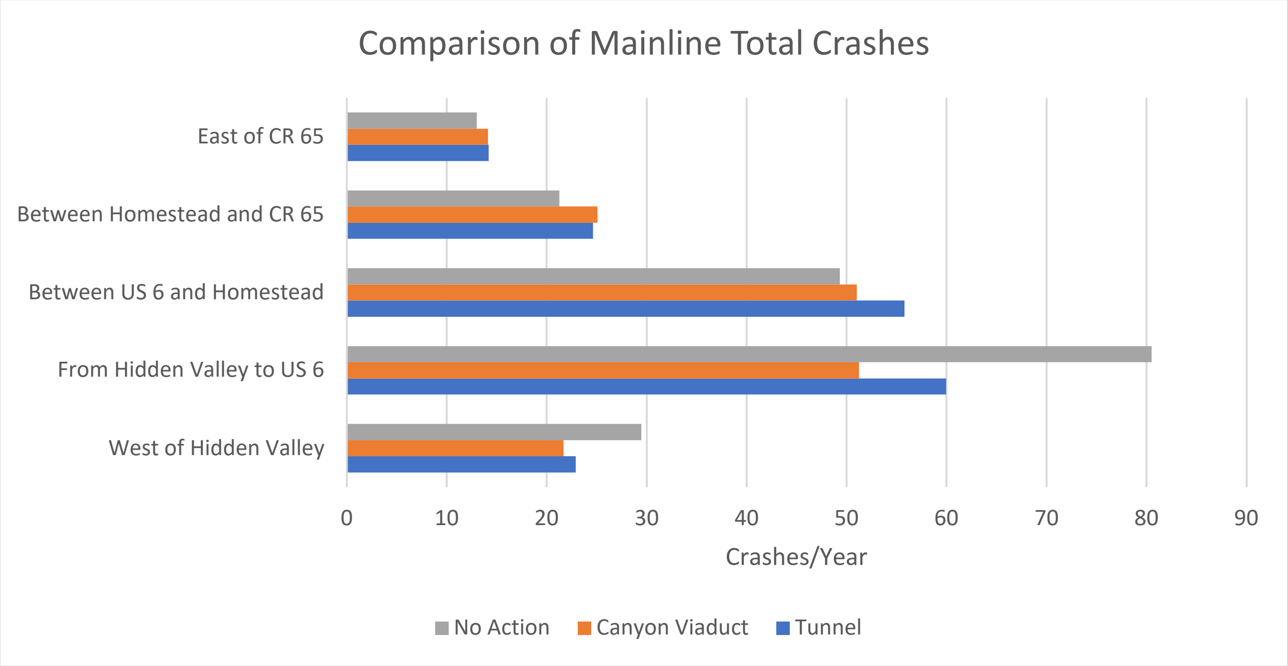


Exhibit 15. Mainline Safety Performance Results—Fatal and Injury Predicted Crashes per Year

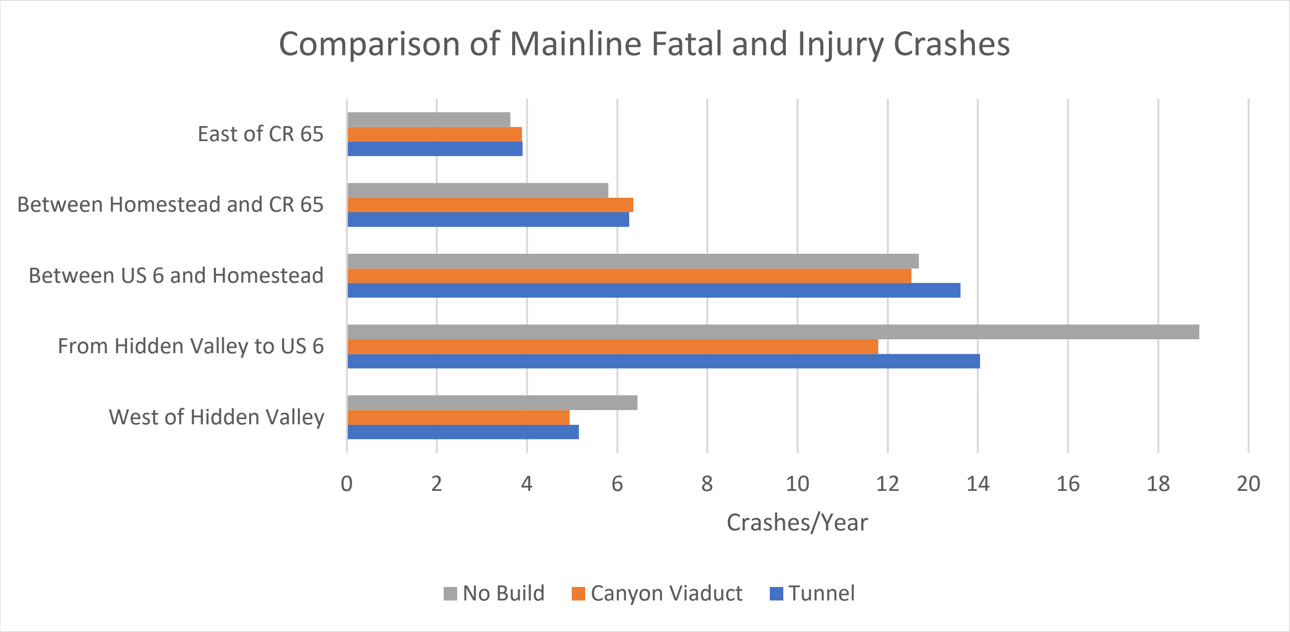


Exhibit 16. Mainline Safety Performance Results—Total Predicted Crashes by Crash Type

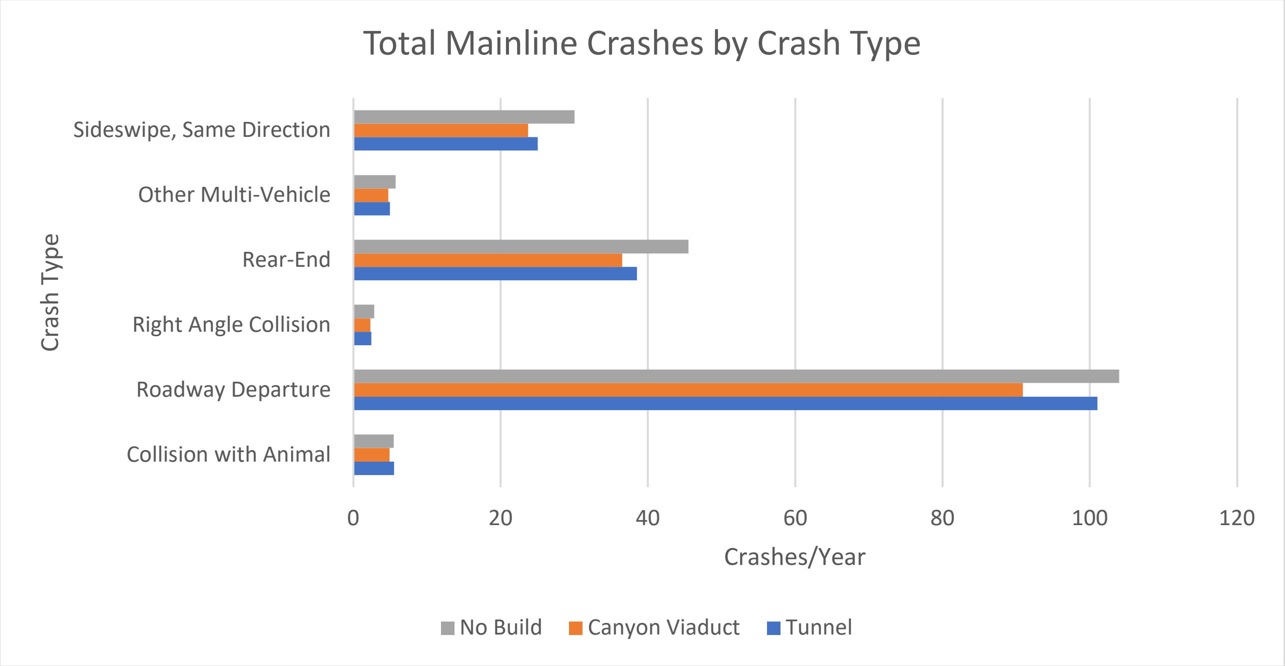


Exhibit 17. Mainline Safety Performance Results—Fatal+Injury Predicted Crashes by Crash Type

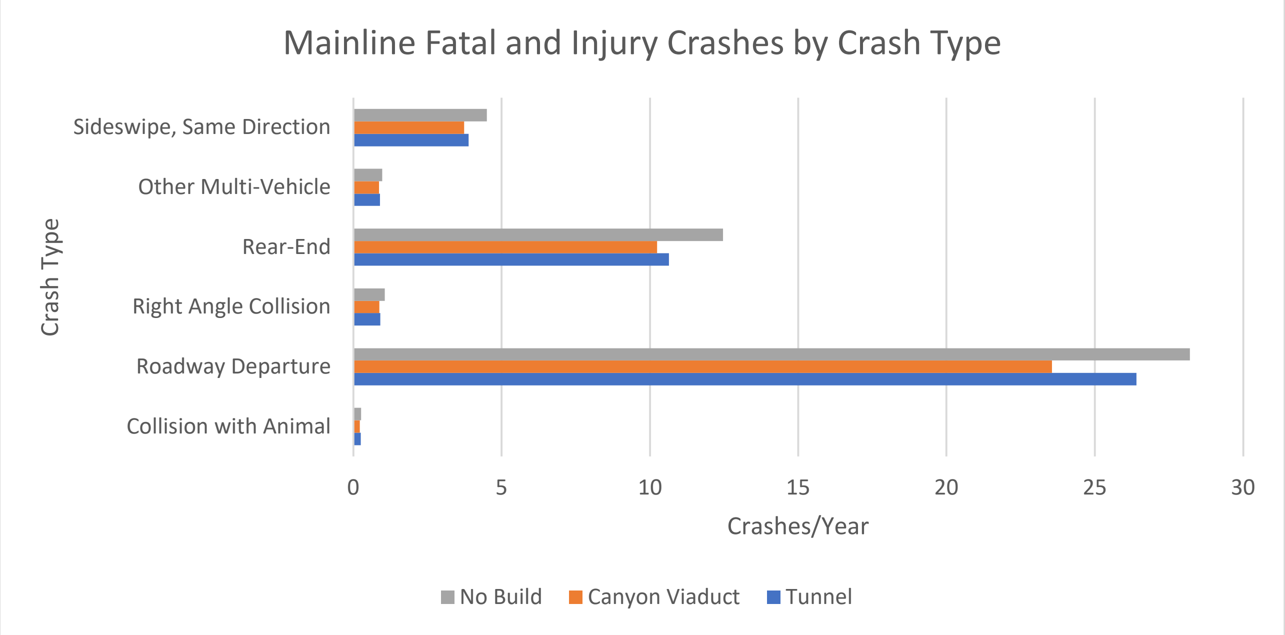


Exhibit 18. Interchange Safety Performance Results—Total Predicted Crashes per Year

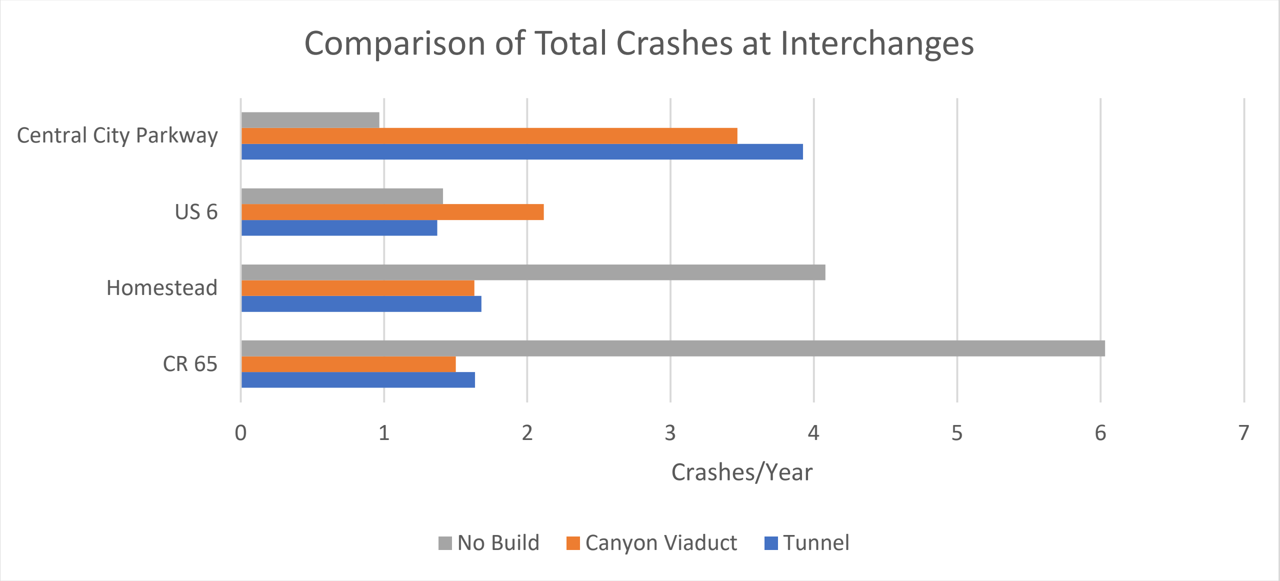
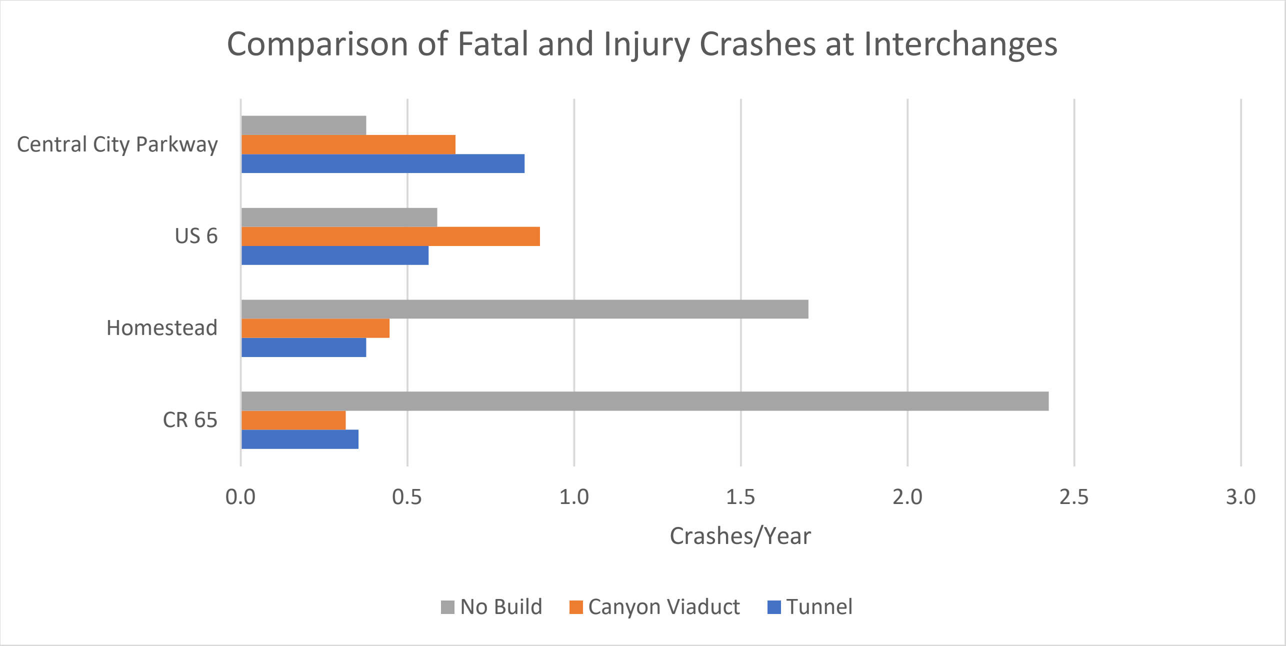


Exhibit 19. Interchange Safety Performance Results—Fatal+Injury Predicted Crashes per Year



5.1.3 Canyon Viaduct Alternative versus Tunnel Alternative

The two alternatives were compared against one another to understand the safety performance differences associated with the geometric designs. The mainline crash prediction shows that the Canyon Viaduct Alternative results in 9 percent fewer crashes than the Tunnel Alternative. This is primarily because the Canyon Viaduct Alternative contains fewer curves than the Tunnel Alternative in the Central Section of the study area from the Hidden Valley/Central City interchange to US 6.

Service interchange predicted crash frequencies are slightly different between alternatives primarily because of demand changes. For the CR 65 and Homestead Road interchanges, the Tunnel Alternative yields a 9 percent and 3 percent higher crash rate, respectively. For the US 6 interchange, the Tunnel Alternative has a 30 percent lower total crash rate primarily because of demand changes. At the Hidden Valley/Central City interchange, the Tunnel Alternative has a 13 percent higher total crash rate. The differences between each interchange's crash rate are driven primarily by changes in traffic demand. Exhibit 20 through Exhibit 22, below, illustrate the comparison between the Tunnel Alternative and the Canyon Viaduct Alternative.

Exhibit 20. **Alternative Safety Performance Results—Mainline Fatal+Injury Predicted Crashes per Year**

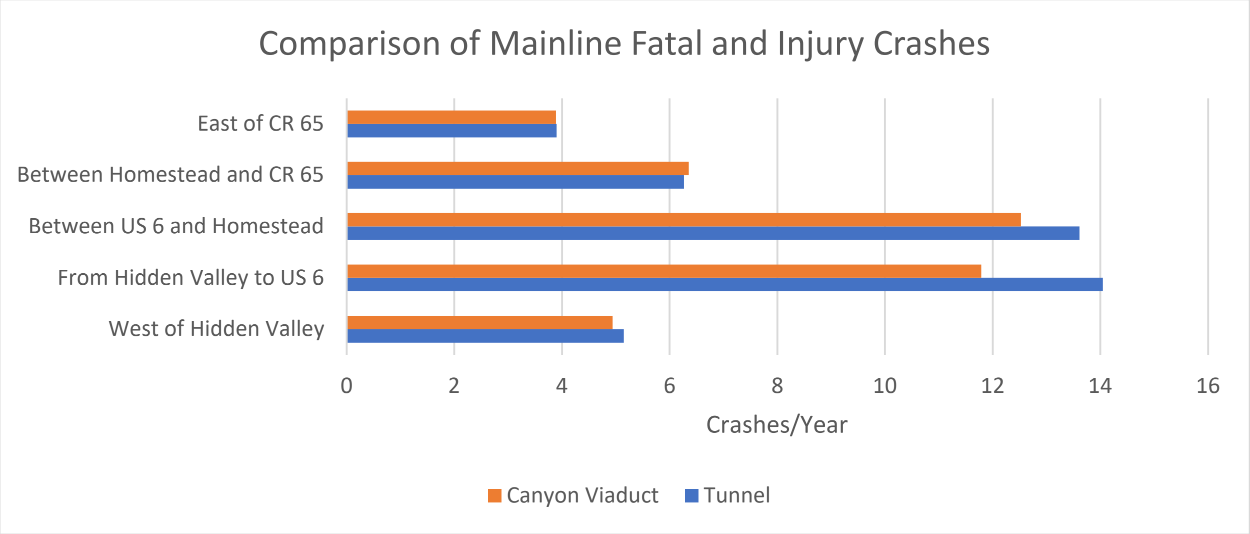


Exhibit 21. **Alternative Safety Performance Results—Interchange Fatal+Injury Predicted Crashes per Year**

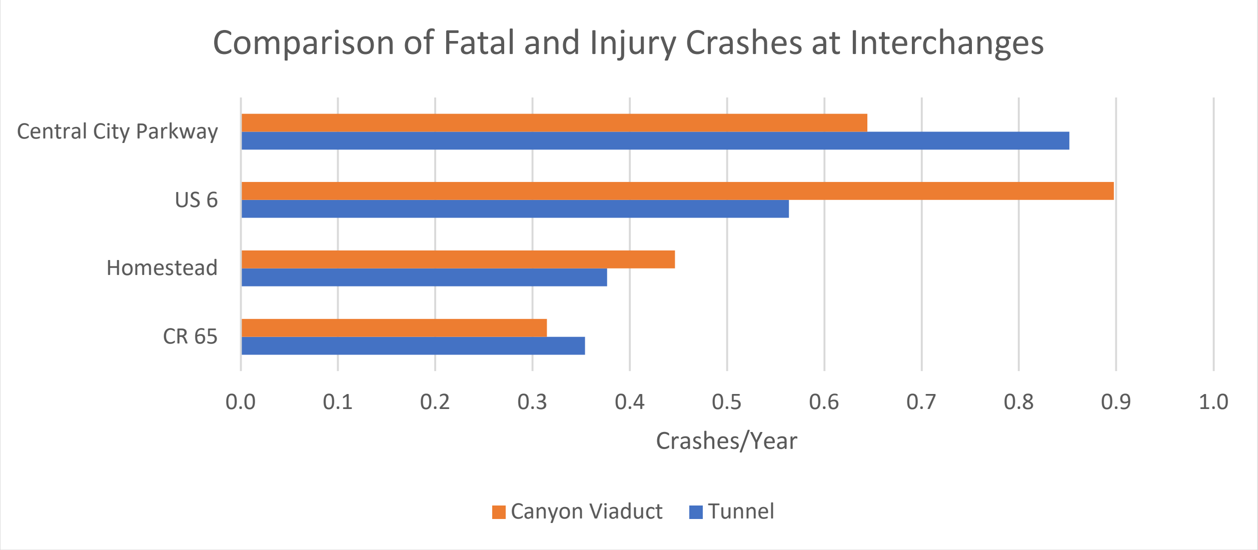


Exhibit 22. Overall Comparison Summary Between Alternatives

Facility	Canyon Viaduct Alternative			Tunnel Alternative			Difference			Percentage		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
I-70 Mainline	39.5	123.7	163.2	43.0	134.5	177.5	3.5	10.9	14.3	9%	9%	9%
Service Interchanges	2.3	6.4	8.7	2.1	6.5	8.6	-0.2	0.1	-0.1	-7%	1%	-1%
Arterial Segments	0.9	1.8	2.7	1.1	2.4	3.5	0.3	0.6	0.9	34%	34%	34%
Overall Total	42.7	131.9	174.5	46.3	143.4	189.7	3.6	11.5	15.1	8%	9%	9%

5.2 Statistical Comparison

A test was conducted to evaluate the results of the analysis and determine whether they are statistically significant. Crashes are discrete events that follow a Poisson distribution. For Poisson distributions, a common method to calculate the confidence interval is the normal approximation method. This method requires a minimal sample size of 30. The bullet points below summarize some of the assumptions and details of the statistical test.

- For Poisson, the mean and the variance are both lambda (λ).
- The standard error is calculated as: $\text{sqrt}(\lambda / n)$ where λ is the Poisson mean and n is sample size or total exposure
- The confidence interval can be calculated as:
    - $\lambda \pm z(\alpha/2)*\text{sqrt}(\lambda/n)$.
- The 95-percent confidence interval is calculated as: $\lambda \pm 1.96*\text{sqrt}(\lambda/n)$.

Exhibit 23. Z-Test Statistical Comparison

Alternative	Crashes	Annual VMT	Annual MVMT	λ_1	n_1	Z	CI Delta	Confidence Interval 95%	
								Low	High
Viaduct	174.5	204,087,622	204	0.86	204	1.96	0.13	0.73	0.98
Tunnel	189.7	201,512,708	202	0.94	202	1.96	0.13	0.81	1.08

Results of the statistical test (Exhibit 23) show no significant difference between the two alternatives predicted crash frequencies.

6.0 Qualitative Analysis

An extensive literature review was conducted as part of a qualitative evaluation to assess the differences between the Tunnel Alternative and the Canyon Viaduct Alternative. As a result of this analysis, no external SPFs and/or CMFs were found that could be used to supplement the quantitative analysis. However, several differentiating factors that affect safety and other aspects related to both alternatives were found, and they are discussed and rated in the section below.

6.1 Differentiating Factors

6.1.1 Safety

Tunnels

Tunnels may provide some benefits to drivers, including reducing travel time, and may improve drivers' convenience, since tunnels overcome environmental obstacles such as mountains and rivers. Tunnels reduce the damage to nature and the environment, preserve natural scenery, and reduce traffic congestion and air pollution. Innovative tunnel technologies, such as removing and controlling smoke in the event of fire, are key features to enhance tunnel safety. Since tunnels are enclosed tubes, crashes associated with adverse weather conditions such as rain, snow, hail, fog, and wind are excluded, as are animal crashes. Drivers tend to be more careful driving inside tunnels. The likelihood of crash occurrence is lower in a tunnel than on an open highway, although there is a greater likelihood of higher crash injury severity and fatalities, especially due to fires and expansion of heat and smoke (Ma, 2009). To prevent such elements during crashes, tunnels are required to be equipped with fire safety tools, communications, 24-hour illumination, and emergency access points, among other elements. Accessibility to emergency medical services in a tunnel also poses more challenges than on the open road, as a tunnel may not have sufficient ROW to provide full shoulders.

There are also some behavioral changes associated with driving in tunnels, including driver anxiety caused by the fact that tunnels are dark, narrow, and monotonous (PIARC, 2008). Drivers may be afraid of hitting the tunnel walls or vehicles in adjacent lanes. This causes drivers to modify both their lateral position and speed to avoid the disturbing effects due to the tunnel wall is too close to the traffic lane.

Another factor is that sunshine—either reflected from the tunnel portal or direct exposure to sun—might cause a temporary blinding effect before entering the tunnel This effect, combined with the darkness in the access zone of the tunnel, also might cause sight issues as drivers' eyes slowly adapt to the dark. A blinding light effect also can be experienced at the tunnel exit zone at sunset, as well as being negatively affected by unexpected weather and/or traffic conditions (rain, fog, snow, lateral winds, traffic jams (Caliendo, 2012). Horizontal curves inside the tunnel also may cause crashes, because the tunnel walls reduce the view of the road and possible vehicle queues. Lastly, a single tunnel tube that accommodates both directions of traffic is considered to be less safe than two separate tunnel tubes with one driving direction in each because head-on collisions also can occur.

Viaducts

A viaduct is a bridge, and traffic on a bridge is exposed to different safety factors than traffic on the regular open road. Traffic can be more exposed to high crosswinds than traffic at ground level. The bridge surface gets slippery more easily than a typical road at ground level, where the ground stores heat. Low friction and ice on the road surface can be major contributing factors to crashes on bridges. Bridges, like tunnels, are an enclosed space with limited room for evasive maneuvers. Bridges may have steep slopes to allow enough height for heavy traffic to pass under them. It is not uncommon to see bridges with horizontal curves at both ends introducing risk for crashes on either end of the bridge.

Tunnel and Viaduct Differentiating Safety Factors

Some of the main differentiating factors between tunnels and viaducts may include, but are not limited to:

- Lighting
- Provision of complimentary systems (fire safety, ventilation, etc.)
- Accessibility to emergency medical services
- Driver behavior
- Weather
- Surface condition
- Higher number of crashes
- High injury and fatality resulting from crashes
- Visual disturbances due to sunshine/sunset
- Fire outbreak and/or expansion of heat and smoke

6.1.2 Design

Tunnel geometric design plays a critical role in its safety. According to the National Highway Institute (2009), the preferred grade in a tunnel is limited to 4 percent. This standard closely aligns with the freeway's grade specifications as outlined in the AASHTO *A Policy on Geometric Design of Highways and Streets* (2011). Depending on the terrain, both viaducts and tunnels can exceed the allowable grade. Further, a review by Bassan (2016) suggested that tunnels often are characterized by much flatter grades. This constant grade reduces the necessity for vehicular deceleration and acceleration, thus reducing gas consumption. For haulage companies, this controlling factor reduces their effective haulage cost.

Also, according to the National Highway Institute (2009), tunnel walls tend to lower sight distance, thus contributing significantly to most crashes occurring in tunnels.

6.2 Qualitative Analysis

This section presents the qualitative evaluation and the score results. Exhibit 24 shows the results of the qualitative evaluation. For the differentiating factors, the two engineering solutions were compared to identify their trade-offs. Each alternative's qualitative criteria were converted to the following five-point scale:

(++)	**(+)**	**(0)**	**(-)**	**(- -)**
(best performance)	□	(no change)	□	(worst performance)

For example, comparing the number of crashes, tunnels revealed a lower number of crashes compared to viaducts, so a lower score is assigned. Based on this scenario, tunnel construction was assigned a (+) sign, while viaduct construction was assigned a (-). The pros and cons were counted and reported separately in Exhibit 25.

Exhibit 24. Exhibit Qualitative Evaluation Results

Categories	Differentiating Factors	Tunnel	Viaduct
Safety	Accessibility to emergency medical services	Y	N
	Driver behavior/perception reaction time	H	L
	Weather	L	H
	Surface condition	L	H
	Higher number of crashes	L	H
	High injury and fatality rate resulting from crashes	H	L
	Visual disturbances due to sunshine/sunset	H	L
	Fire outbreak can affect the structural integrity	H	L
Operations	Complementary systems required		
	Fire safety devices required	Y	N
	Communication systems required	Y	N
	24-hr illumination/appropriate illumination	Y	N
	Emergency access point/ventilation	Y	N

Note: Y = Yes, N = No, L = Low, H = High

Exhibit 25. Qualitative Evaluation Scores

Categories	Differentiating factors	Tunnels	Viaduct
Safety	Accessibility to emergency medical services	(-)	(+)
	Driver behavior/perception reaction time	(-)	(+)
	Weather	(+)	(-)
	Surface condition	(+)	(-)
	Higher number of crashes	(+)	(-)
	High injury and fatality rate resulting from crashes	(- -)	(+)
	Visual disturbances due to sunshine/sunset	(-)	(+)
	Fire outbreak can affect the structural integrity	(- -)	(+)
Operations	Complementary systems required		
	Fire safety devices required	(-)	(+)
	Communication systems required	(-)	(+)
	24-hr illumination/appropriate illumination	(-)	(+)
	Emergency access point/ventilation	(-)	(+)
Sum Pros		3	9
Sum Cons		11	3

6.3 Qualitative Analysis Conclusion

Tunnels and viaducts have been used extensively in areas with challenging topography. The alternatives comparison of differentiating factors did not apply any weights for the comparison. There are other factors, such as cost, that could play a deciding role in the qualitative evaluation. Based on the set of differentiating factors aforementioned, the results of the scored qualitative evaluation show that the Canyon Viaduct Alternative has more pros than the Tunnel Alternative.

7.0 Conclusions

The safety analysis was conducted to understand the safety performance differences between the No Action scenario, the Canyon Viaduct Alternative, and the Tunnel Alternative along the I-70 Floyd Hill corridor. The outcome of the quantitative analysis indicated that the Canyon Viaduct Alternative and the Tunnel Alternative resulted in a 15 percent and 8 percent reduction in total crashes, respectively. The statistical test shows that the results are not statistically significant. In the qualitative analysis, the results of the scored evaluation indicated that the Canyon Viaduct Alternative has more pros than the Tunnel Alternative.

Considering both the quantitative and qualitative analyses, the Canyon Viaduct Alternative appears to yield the largest reduction in crashes and largest safety benefits when compared to the No Action scenario and the Tunnel Alternative.

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Appendix A. Detailed Safety Performance Results

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Mainline and Interchange Existing (2018) and No Action (2045) Results

Major Road	Name	2018 Existing			2045 No Action			Difference			Percentage		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
I-70 Mainline		32.6	92.7	125.3	41.1	123.7	164.8	8.5	31.1	39.6	26%	34%	32%
I-70 Mainline Speed Change Lanes		4.5	17.2	21.7	6.4	22.4	28.8	1.9	5.2	7.0	41%	30%	32%
CR 65	I-70 EB Entrance	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	28%	32%	30%
	I-70 EB Entrance & CR 65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	0%	0%
	I-70 WB Exit	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	38%	38%	38%
	US 40 & CR 65	1.0	1.3	2.3	2.2	3.1	5.2	1.2	1.7	2.9	127%	127%	127%
	I-70 WB Exit & CR 65	0.1	0.2	0.3	0.1	0.4	0.6	0.1	0.2	0.3	98%	85%	88%
	Total	1.1	1.7	2.8	2.4	3.6	6.0	1.3	1.9	3.2	118%	115%	116%
Homestead	I-70 WB Entrance	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	70%	76%	74%
	US 40 & Homestead	0.8	1.1	1.9	1.5	2.1	3.5	0.7	1.0	1.7	88%	88%	88%
	I-70 WB Entrance & Homestead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	0%	0%
	I-70 EB Exit	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	23%	23%	23%
	I-70 EB Exit & Homestead	0.1	0.1	0.2	0.1	0.2	0.3	0.1	0.1	0.1	58%	55%	56%
	Total	0.9	1.3	2.2	1.7	2.4	4.1	0.8	1.1	1.8	82%	82%	82%
US 6	I-70 WB Exit	0.1	0.1	0.2	0.1	0.0	0.1	0.0	0.0	-0.1	-49%	-49%	-49%
	I-70 WB Exit & US 6	0.3	0.4	0.7	0.2	0.2	0.4	-0.2	-0.2	-0.4	-50%	-50%	-50%
	I-70 WB Entrance	0.2	0.3	0.5	0.3	0.4	0.7	0.1	0.1	0.2	39%	47%	44%
	I-70 EB Exit	0.1	0.1	0.2	0.1	0.1	0.2	0.0	0.0	0.0	21%	21%	21%
	Total	0.7	0.9	1.6	0.6	0.8	1.4	-0.1	-0.1	-0.2	-16%	-9%	-12%
Central City Parkway	I-70 WB Exit	0.1	0.1	0.2	0.1	0.2	0.3	0.0	0.0	0.0	21%	21%	21%
	I-70 WB Exit/I-70 WB Entrance & CCP	0.1	0.1	0.2	0.1	0.2	0.3	0.0	0.1	0.1	51%	50%	51%
	I-70 WB Entrance	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	23%	25%	24%
	I-70 EB Exit	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	21%	20%	20%
	I-70 EB Exit/I-70 EB Entrance & CCP	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.1	60%	91%	80%
	I-70 EB Entrance	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	96%	108%	104%
	Total	0.3	0.4	0.7	0.4	0.6	1.0	0.1	0.2	0.3	39%	46%	43%
Interchange Total		3.0	4.3	7.3	5.1	7.4	12.5	2.1	3.1	5.2	68%	73%	71%
Mainline Total		37.1	109.8	147.0	47.5	146.1	193.6	10.4	36.3	46.6	28%	33%	32%
Grand Total		**40.1**	**114.1**	**154.3**	**52.6**	**153.5**	**206.1**	**12.4**	**39.4**	**51.8**	**31%**	**34%**	**34%**

Mainline and Interchange No Action (2045) and Canyon Viaduct (2045) Results

Major Road	Name	2045 No Action			2045 Canyon Viaduct			Difference			Percentage		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
I-70 Mainline		41.1	123.7	164.8	36.4	113.3	149.7	-4.7	-10.4	-15.2	-12%	-8%	-9%
I-70 Mainline Speed Change Lanes		6.4	22.4	28.8	3.1	10.3	13.5	-3.2	-12.0	-15.3	-51%	-54%	-53%
CR 65	I-70 EB Entrance	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	-16%	-18%	-17%
	I-70 EB Entrance & CR 65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	0%	0%
	I-70 WB Exit	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	-9%	-8%	-9%
	I-70 WB Exit & CR 65 **and** US 40 & CR 65	2.3	3.5	5.8	0.2	1.1	1.3	-2.1	-2.4	-4.5	-90%	-69%	-78%
	Total	2.4	3.6	6.0	0.3	1.2	1.5	-2.1	-2.4	-4.5	-87%	-67%	-75%
Homestead	I-70 WB Entrance	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	-22%	-13%	-17%
	I-70 WB Entrance & Homestead **and** US 40 and Homestead	1.5	2.1	3.5	0.1	0.8	1.0	-1.3	-1.2	-2.6	-90%	-60%	-72%
	I-70 EB Exit	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	33%	34%	33%
	I-70 EB Exit & Homestead	0.1	0.2	0.3	0.2	0.2	0.4	0.1	0.0	0.1	48%	19%	31%
	Total	1.7	2.4	4.1	0.4	1.2	1.6	-1.3	-1.2	-2.4	-74%	-50%	-60%
US 6	I-70 WB Exit	0.1	0.0	0.1	0.2	0.3	0.5	0.2	0.3	0.4	373%	574%	467%
	I-70 WB Exit & US 6	0.2	0.2	0.4	0.4	0.6	1.0	0.3	0.4	0.7	172%	196%	186%
	I-70 WB Entrance	0.3	0.4	0.7	0.2	0.2	0.4	-0.1	-0.2	-0.3	-40%	-48%	-45%
	I-70 EB Exit	0.1	0.1	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	I-70 EB Entrance	N/A	N/A	N/A	0.1	0.1	0.2	N/A	N/A	N/A	N/A	N/A	N/A
	Total	0.6	0.8	1.4	0.9	1.2	2.1	0.3	0.4	0.7	52%	48%	50%
Central City Parkway	I-70 WB Exit	0.1	0.2	0.3	0.1	0.1	0.2	0.0	0.0	-0.1	-24%	-27%	-26%
	I-70 WB Exit/I-70 WB Entrance & CCP	0.1	0.2	0.3	0.2	1.2	1.4	0.1	1.0	1.2	119%	567%	419%
	I-70 WB Entrance	0.0	0.0	0.1	0.1	0.1	0.2	0.0	0.1	0.1	134%	144%	139%
	I-70 EB Exit	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	136%	149%	143%
	I-70 EB Exit/I-70 EB Entrance & CCP	0.0	0.1	0.1	0.1	1.2	1.3	0.1	1.1	1.2	279%	1285%	984%
	I-70 EB Entrance	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	-17%	-26%	-23%
	Total	0.4	0.6	1.0	0.6	2.8	3.5	0.3	2.2	2.5	71%	378%	258%
US 6		N/A	N/A	N/A	0.9	1.8	2.7	N/A	N/A	N/A	N/A	N/A	N/A
Arterial Total		N/A	N/A	N/A	0.9	1.8	2.7	N/A	N/A	N/A	N/A	N/A	N/A
Interchange Total		5.1	7.4	12.5	2.3	6.4	8.7	-2.8	-1.0	-3.8	-55%	-13%	-30%
Mainline Total		47.5	146.1	193.6	39.5	123.7	163.2	-8.0	-22.4	-30.4	-17%	-15%	-16%
Grand Total		**52.6**	**153.5**	**206.1**	**42.7**	**131.9**	**174.5**	**-9.9**	**-21.6**	**-31.5**	**-19%**	**-14%**	**-15%**

Mainline and Interchange No Action (2045) and Tunnel (2045) Results

Major Road	Name	2045 No Action			2045 Tunnel			Difference			Percentage		
		Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total	Fatal and Injury	Property Damage Only	Total
I-70 Mainline		41.1	123.7	164.8	39.9	124.0	163.9	-1.2	0.2	-1.0	-3%	0%	-1%
I-70 Mainline Speed Change Lanes		6.4	22.4	28.8	3.1	10.6	13.6	-3.3	-11.8	-15.1	-52%	-53%	-53%
CR 65	I-70 EB Entrance	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	-15%	-16%	-15%
	I-70 EB Entrance & CR 65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%	0%	0%
	I-70 WB Exit	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	32%	34%	33%
	I-70 WB Exit & CR 65 **and** US 40 & CR 65	2.3	3.5	5.8	0.2	1.1	1.4	-2.1	-2.3	-4.4	-90%	-67%	-76%
	Total	2.4	3.6	6.0	0.4	1.3	1.6	-2.1	-2.3	-4.4	-85%	-65%	-73%
Homestead	I-70 WB Entrance	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	-26%	-18%	-22%
	I-70 WB Entrance & Homestead **and** US 40 and Homestead	1.5	2.1	3.5	0.1	1.0	1.0	-1.4	-1.1	-2.5	-95%	-54%	-71%
	I-70 EB Exit	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	59%	33%	45%
	I-70 EB Exit & Homestead	0.1	0.2	0.3	0.2	0.2	0.4	0.1	0.0	0.1	45%	16%	28%
	Total	1.7	2.4	4.1	0.4	1.3	1.7	-1.3	-1.1	-2.4	-78%	-45%	-59%
US 6	I-70 WB Exit	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	-41%	-9%	-26%
	I-70 WB Exit & US 6	0.2	0.2	0.4	0.0	0.0	0.1	-0.1	-0.2	-0.3	-86%	-86%	-86%
	I-70 WB Entrance	0.3	0.4	0.7	0.4	0.6	1.0	0.1	0.2	0.3	56%	36%	44%
	I-70 EB Exit	0.1	0.1	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	I-70 EB Entrance	N/A	N/A	N/A	0.1	0.1	0.2	N/A	N/A	N/A	N/A	N/A	N/A
	Total	0.6	0.8	1.4	0.6	0.8	1.4	0.0	0.0	0.0	-4%	-2%	-3%
Central City Parkway	I-70 WB Exit	0.1	0.2	0.3	0.3	0.3	0.6	0.2	0.2	0.3	122%	115%	118%
	I-70 WB Exit/I-70 WB Entrance & CCP	0.1	0.2	0.3	0.2	1.2	1.4	0.1	1.0	1.1	113%	557%	410%
	I-70 WB Entrance	0.0	0.0	0.1	0.1	0.1	0.2	0.0	0.1	0.1	168%	176%	172%
	I-70 EB Exit	0.0	0.0	0.1	0.1	0.1	0.3	0.1	0.1	0.2	197%	211%	204%
	I-70 EB Exit/I-70 EB Entrance & CCP	0.0	0.1	0.1	0.1	1.2	1.4	0.1	1.1	1.3	288%	1312%	1006%
	I-70 EB Entrance	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	-0.1	-33%	-40%	-37%
	Total	0.4	0.6	1.0	0.9	3.1	3.9	0.5	2.5	3.0	126%	420%	305%
US 6		N/A	N/A	N/A	1.1	2.4	3.5	N/A	N/A	N/A	N/A	N/A	N/A
Arterial Total		N/A	N/A	N/A	1.1	2.4	3.5	N/A	N/A	N/A	N/A	N/A	N/A
Interchange Total		5.1	7.4	12.5	2.1	6.5	8.6	-2.9	-0.9	-3.9	-58%	-13%	-31%
Mainline Total		47.5	146.1	193.6	43.0	134.5	177.5	-4.5	-11.6	-16.1	-9%	-8%	-8%
Grand Total		**52.6**	**153.5**	**206.1**	**46.3**	**143.4**	**189.7**	**-6.3**	**-10.1**	**-16.4**	**-12%**	**-7%**	**-8%**

Mainline Existing (2018) and No Action (2045) Crash Type Results

Crash Type	2018 Mainline			2045 No Action			Difference			Percentage		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
Collision with Animal	0.2	4.2	4.4	0.3	5.2	5.5	0.0	1.1	1.1	19%	25%	25%
Collision with Fixed Object	13.2	40.0	53.2	15.9	50.4	66.3	2.6	10.4	13.0	20%	26%	24%
Collision with Other Object	0.8	8.2	9.0	0.9	10.4	11.3	0.2	2.2	2.3	19%	26%	26%
Other Single-Vehicle Collision	8.7	10.3	19.0	10.4	13.0	23.4	1.7	2.7	4.4	20%	26%	23%
Collision with Parked Vehicle	0.6	1.4	2.0	0.7	1.8	2.5	0.1	0.4	0.5	19%	25%	24%
Total Single Vehicle Crashes	23.5	64.1	87.5	28.1	80.7	108.8	4.6	16.6	21.3	20%	26%	24%
Right-Angle Collision	0.7	1.1	1.8	1.1	1.8	2.8	0.3	0.7	1.0	46%	61%	54%
Head-On Collision	0.3	0.2	0.4	0.4	0.3	0.6	0.1	0.1	0.2	38%	59%	49%
Other Multi-Vehicle Collision	0.7	3.0	3.7	1.0	4.8	5.7	0.3	1.8	2.1	45%	59%	56%
Rear-End Collision	8.7	21.1	29.8	12.5	33.0	45.5	3.8	12.0	15.7	44%	57%	53%
Sideswipe, Same Direction Collision	3.1	16.4	19.5	4.5	25.5	30.0	1.4	9.2	10.5	44%	56%	54%
Total Multiple Vehicle Crashes	13.4	41.7	55.2	19.4	65.4	84.7	5.9	23.6	29.6	44%	57%	54%
Total Crashes	**36.9**	**105.8**	**142.7**	**47.5**	**146.1**	**193.6**	**10.6**	**40.3**	**50.9**	**29%**	**38%**	**36%**

Mainline No Action (2045) and Canyon Viaduct (2045) Crash Type Results

Crash Type	2045 No Action			2045 Canyon Viaduct			Difference			Percentage		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
Collision with Animal	0.3	5.2	5.5	0.2	4.7	4.9	0.0	-0.5	-0.6	-14%	-10%	-10%
Collision with Fixed Object	15.9	50.4	66.3	13.3	44.8	58.1	-2.6	-5.6	-8.2	-16%	-11%	-12%
Collision with Other Object	0.9	10.4	11.3	0.8	9.1	9.9	-0.2	-1.3	-1.4	-18%	-12%	-13%
Other Single-Vehicle Collision	10.4	13.0	23.4	8.7	11.6	20.3	-1.7	-1.4	-3.1	-17%	-11%	-13%
Collision with Parked Vehicle	0.7	1.8	2.5	0.6	1.6	2.2	-0.1	-0.1	-0.3	-17%	-8%	-11%
Total Single Vehicle Crashes	28.1	80.7	108.8	23.5	71.8	95.3	-4.6	-8.9	-13.5	-16%	-11%	-12%
Right-Angle Collision	1.1	1.8	2.8	0.9	1.5	2.3	-0.2	-0.3	-0.5	-17%	-18%	-18%
Head-On Collision	0.4	0.3	0.6	0.3	0.2	0.5	-0.1	-0.1	-0.1	-17%	-22%	-21%
Other Multi-Vehicle Collision	1.0	4.8	5.7	0.9	3.9	4.7	-0.1	-0.9	-1.0	-11%	-19%	-18%
Rear-End Collision	12.5	33.0	45.5	10.2	26.3	36.5	-2.2	-6.8	-9.0	-18%	-20%	-20%
Sideswipe, Same Direction Collision	4.5	25.5	30.0	3.7	20.0	23.8	-0.8	-5.5	-6.3	-17%	-22%	-21%
Total Multiple Vehicle Crashes	19.4	65.4	84.7	16.0	51.8	67.8	-3.4	-13.6	-16.9	-17%	-21%	-20%
Total Crashes	**47.5**	**146.1**	**193.6**	**39.5**	**123.7**	**163.2**	**-8.0**	**-22.5**	**-30.4**	**-17%**	**-15%**	**-16%**

Mainline No Action (2045) and Tunnel (2045) Crash Type Results

Crash Type	2045 No Action			2045 Tunnel			Difference			Percentage		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
Collision with Animal	0.3	5.2	5.5	0.3	5.3	5.5	0.0	0.0	0.0	-2%	1%	1%
Collision with Fixed Object	15.9	50.4	66.3	14.9	49.7	64.6	-1.0	-0.7	-1.7	-6%	-1%	-3%
Collision with Other Object	0.9	10.4	11.3	0.9	10.1	10.9	-0.1	-0.3	-0.4	-9%	-3%	-3%
Other Single-Vehicle Collision	10.4	13.0	23.4	9.7	12.9	22.6	-0.7	-0.1	-0.8	-6%	-1%	-3%
Collision with Parked Vehicle	0.7	1.8	2.5	0.6	1.8	2.4	-0.1	0.1	0.0	-8%	3%	0%
Total Single Vehicle Crashes	28.1	80.7	108.8	26.3	79.7	106.1	-1.8	-1.0	-2.8	-6%	-1%	-3%
Right-Angle Collision	1.1	1.8	2.8	0.9	1.5	2.4	-0.2	-0.2	-0.4	-14%	-14%	-14%
Head-On Collision	0.4	0.3	0.6	0.3	0.2	0.5	-0.1	-0.1	-0.1	-17%	-20%	-19%
Other Multi-Vehicle Collision	1.0	4.8	5.7	0.9	4.1	5.0	-0.1	-0.7	-0.8	-7%	-15%	-14%
Rear-End Collision	12.5	33.0	45.5	10.6	27.8	38.5	-1.8	-5.2	-7.0	-15%	-16%	-15%
Sideswipe, Same Direction Collision	4.5	25.5	30.0	3.9	21.2	25.0	-0.6	-4.4	-5.0	-14%	-17%	-17%
Total Multiple Vehicle Crashes	19.4	65.4	84.7	16.6	54.8	71.5	-2.7	-10.6	-13.3	-14%	-16%	-16%
Total Crashes	**47.5**	**146.1**	**193.6**	**43.0**	**134.5**	**177.5**	**-4.5**	**-11.6**	**-16.1**	**-9%**	**-8%**	**-8%**

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