COLORADO DEPARTMENT OF TRANSPORTATION

INTERSTATE 70 EXIT 203 & EASTBOUND AUXILIARY LANE

FEASIBILITY STUDY

June 03, 2020

COLORADO
Department of Transportation

INTERSTATE 70 EXIT 203 & EASTBOUND AUXILIARY LANE

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FINAL DOCUMENT VERSION 1.0

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AASHTO	..... American Association of State Highway and Transportation Officials
AGS	..... Advanced Guideway Systems
AST	.....Aboveground Storage Tank
CDA	..... Colorado Department of Agriculture
CDOT	..... Colorado Department of Transportation
CDPHE	..... Colorado Department of Public Health and Environment
CFI	.....Continuous Flow Intersection
COMPASS	
CSS	.....Context Sensitive Solutions
DDHV	..... Directional Design Hourly Volume
DDI	..... Diverging Diamond Interchange
DDR	..... Dillon Dam Road
DOT	..... Department of Transportation
DSMD	..... Dynamic Speed Monitoring Display
EB	..... Eastbound
e_{max}	..... Superelevation
FHWA	.....Federal Highway Administration
GPL	..... General Purpose Lane
GVWR	..... Gross Vehicle Weight Rating
HAZMAT	.....Hazardous Materials

HCM	Highway Capacity Manual
HCS	Highway Capacity Software
I-70	Interstate 70
LOS	Level of Service
LOSS	Level of Safety Service
LUST	Leaking Underground Storage Tank
MP	Milepost
NA	No Action
NB	Northbound
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
PDO	Property Damage Only
PEIS	Programmatic Environmental Impact Statement
PEL	Planning Environmental Linkages Study
PLT	Project Leadership Team
PMP	Project Management Plan
ROD	Record of Decision
ROW	Right of Way
SAR	Safety Analysis Report
SB	Southbound
SOW	Scope of Work
SPUI	Single Point Urban Interchange

TIA	Traffic Impact Assessment
TP	Time Period
TPR	Transportation Planning Region
TUDI	Tight Urban Diamond Interchange
USFS	United States Forest Service
UST	Underground Storage Tank
VMS	Variable Message Sign
VSL	Variable Speed Limit
WB	Westbound

1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

Several studies have been conducted in previous years related to this corridor and include the Interstate 70 (I-70) Mountain Corridor Final Programmatic Environmental Impact Statement (PEIS) and the State Highway 9 / U.S. Highway 6 Improvement Project at The Interstate 70 Silverthorne/Dillon Interchange - Planning and Environmental Linkages (PEL) Study.

In June 2011, the Federal Highway Administration (FHWA) signed the Record of Decision (ROD) for the I-70 Mountain Corridor Final PEIS, a Tier 1 National Environmental Policy Act (NEPA) document. This document focuses on a high-level vision of the I-70 Mountain Corridor for the horizon year of 2050. The PEIS notes that the Exit 203 interchange and the segment of I-70 between Exit 203 and Exit 205 require further study for safety purposes and calls out Exit 203 for "potential interchange modifications" and I-70 EB from Frisco to Silverthorne for "auxiliary lane improvements" as part of the Minimal Action Alternative.

The Silverthorne/Dillon Interchange (Exit 205) PEL study evaluated options for the Exit 205 interchange and so provided forecasting and volume information data for year 2035 within the I-70 project corridor. The PEL study was reviewed to understand proposed interchange conditions that affect the lane balance from a potential EB I-70 auxiliary lane between Exit 203 and Exit 205.

In response to the PEIS, the Colorado Department of Transportation (CDOT) prepared this feasibility study to identify possible solutions for ongoing safety, mobility, and operational issues on I-70 at the State Highway 9 (CO 9) Frisco interchange, the adjacent intersection on Lusher Court/Dillon Dam Road (DDR) and the two-mile eastbound segment of I-70 between CO 9 (Exit 203) and Silverthorne (Exit 205) (see Figure 2-1).

The WB direction of I-70 regularly experiences congestion and queuing on to I-70 that is caused by the inadequate capacity of the Exit 203 interchange. This issue is significant in that even though the I-70 safety report conducted for the project shows no safety issue at WB 203 off, this is a high-risk area due to high speed differential with off-ramp traffic stopped next to through-lane. This traffic congestion can extend from the off-ramp at Exit 203 eastward towards the on-ramp from the scenic overlook/chain-up station (EB) and create dangerous merging and weaving conditions. This has the potential for serious consequences.

The uphill WB I-70 segment between Exit 205 and the WB rest area is also an area where large trucks park on the WB shoulder to cool hot brakes after coming down from the Eisenhower &

Johnson Tunnels. Many trucks do not make it to the rest area before they need to stop and choose to pull over on the WB I-70 shoulder instead. The existing shoulder is not wide enough in this segment (especially adjacent to guardrail) for a truck to park. This situation also adds to the safety concerns in the corridor.

The EB downhill direction of I-70 experiences heavy congestion and safety problems related to the steep grade (>6%) and the slow-moving, heavy vehicles in the right-hand lane. The presence of the scenic overlook/chain-up station (WB) also adds to the downhill issues. While the on-ramp lane is sufficiently long, the mainline truck traffic is moving much slower and the merging interaction occurs near the steep grade, which does not help the congestion problem.

This feasibility study evaluates interchange, intersection, and highway options to meet the critical success factors (See Section 2.3) identified by the Project Leadership Team (PLT). When feasible alternatives are developed, and construction money identified, CDOT will begin a Tier 2 NEPA study, which is assumed to be either a Categorical Exclusion or possibly an Environmental Assessment. During the Tier 2 NEPA study, a preferred alternative will be selected.

Figure 1-1: Study Area

1.2 STUDY PROCESS

In keeping with the requirements of the PEIS, this feasibility study incorporated the Context Sensitive Solutions (CSS) process into the decision-making (refer to Section 2.3). As required by the CSS process, CDOT formed a Project Leadership Team (PLT) prior to initiation of the Study. The PLT ensured that the CSS process was followed and that conclusions from the Study were developed in an open, collaborative process. Section 6.2 documents the issues and concerns raised by the PLT and considered by the project team. These included topics such as bike and

pedestrian connectivity within the SH 9 corridor (from Exit 203 to the south), the ongoing development surrounding the interchange and Lusher/DDR intersection, and the proposed improvements to the transit center.

The PLT was comprised of representatives of key stakeholder agencies and organizations within the project study corridor. The following organizations were represented on the PLT:

- Federal Highway Administration
- CDOT Region 3
    - Roadway
    - Traffic
    - Environmental
- Summit County
- Town of Frisco
- Town of Silverthorne (invited)
- I-70 Mountain Corridor Coalition
- The Consultant Team

1.2.1 STAKEHOLDER ENGAGEMENT

As part of the collaborative approach, CDOT engaged stakeholders to define the critical results or activities (also called critical success factors) necessary to reach a positive or successful outcome to the project. The PLT established six critical success factors by which to gauge the success of the project.

1. Address Safety and Capacity of I-70 Corridor
2. Improve I-70 Corridor Operations
3. Address the I-70 lane balance at Exit 205
4. Comply with the PEIS
5. Consider Local Planning Efforts
6. Evaluate CO 9 / Dillon Dam Road Intersection

Throughout the development of the project from August 2018 to May 2019 three PLT meetings were held. At each meeting the PLT was given an opportunity to review and respond to project work to date and see the next steps in the project. This included:

- proposed approaches to traffic forecasting and operations analysis
- environmental overview considerations
- initial interchange, intersection, and EB auxiliary lane concepts
- reaffirm critical success factors
- existing/future operations analysis
- preparations for the public meeting
- DRAFT project documents

1.2.2 PUBLIC ENGAGEMENT

An afternoon public meeting was advertised and held in Frisco in February 2019. The meeting materials provided an overview of the project, existing conditions and the proposed outcomes of the feasibility study. During the meeting a 25-minute presentation was given by the project team and included the meeting purpose, an overview of the PEIS and the CSS process, an outline of the critical success factors as well as descriptions of the work completed to date. Staff from project team were present to answer questions and comment cards were distributed to attendees. The comments received covered an array of topics including: concerns about congestions, pedestrian and bicycle access, possibility for an HOV/Express Lane, removal of the roundabout, the scenic overlook, and freight access. All comments were addressed after the meeting by CDOT and the Project Team.

1.3 FEASIBILITY ANALYSIS

1.3.1 CONCEPT DESIGNS

The feasibility study examined concept designs for the I-70 EB auxiliary lane, the scenic overlook/chain-up station, the interchange at Exit 203, and the adjacent intersection at Lusher/DDR. For each of these four project elements, the project team reviewed the ability of design concepts to address the critical success factors as appropriate.

I-70 EB AUXILIARY LANE

The concept for the EB auxiliary lane provides a general I-70 cross-section and plan/profile that meets current design standards. The proposed cross-section includes two 12-foot travel lanes, one 12-foot auxiliary lane, a 12-foot inside shoulder (four-foot minimum), and a 12-foot outside shoulder (10-foot minimum). The widest inside shoulder was used to introduce the most conservative concept possible to the corridor to determine potential conflicts. The design team notes that the widest possible cross section does create some potential need for guardrail and/or

retaining walls in several areas. The segment near the scenic overlook/chain-up station may require guardrail/cable rail to mitigate cross section encroachment into the median area. The steep downhill segment west of Exit 205 includes steep cross slopes that may require retaining walls in the median area to accommodate the wider cross section.

Near the Blue River bridge west of Exit 205, the current I-70 geometry includes the development of a third EB lane, which becomes the EXIT ONLY lane at Exit 205. The auxiliary lane concept ties into this geometry. Several options were considered for the lane balance including:

- No change to the existing condition (the auxiliary lane drops at Exit 205).
- EB auxiliary lane continues as a through lane with an optional exit lane at 205. This option, however, requires a third lane to be added to the existing bridge over Blue River Parkway (US 6).

The operational analysis prepared for this feasibility study does not provide the level of detailed analysis needed to make this lane balance determination. A more detailed operational analysis will be required to determine the best configuration. However, a conservative operations assessment suggests that the lane changing/weaving issue for large/heavy vehicles approaching Exit 205 in the existing condition would be challenging. The challenges include a steep substandard downgrade and a large sweeping curve at the bottom of the hill at Exit 205. The combination of these issues may create undesirable maneuvering conditions for large vehicle, especially in poor weather conditions. Future project development activities will analyze the extension of the auxiliary lane through the Exit 205 interchange connecting to the third eastbound lane east of Exit 205 along with widening of both bridges to provide the safest configuration and meets 2045 capacity needs.

SCENIC OVERLOOK/CHAIN-UP STATION

The project does not propose to correct the current operational issues within the scenic overlook/chain-up station. However, any proposed increase in capacity or improvement in operations within the scenic overlook/chain-up station may affect decisions made about the alignment of I-70. As such, several options for the scenic overlook/chain-up station are proposed for consideration. It is assumed that the current south edge of the chain-up/overlook will not change because of the steep side slope to the south. Any option that moves the south edge will likely have retaining wall costs that will be greater than costs associated with other options. The options evaluated do not necessarily improve utilization issues that might be better served with technology solutions such as call ahead parking reservations, overhead open space indicators, in-cab parking information, or variable message sign (VMS) information posted in advance.

Three layouts were evaluated:

- Modified Existing Scenic Overlook/Chain-up – this option adds minor capacity to the existing chain-up stations for large vehicles. Additional capacity may be added to the outside shoulders that provide additional spaces. This option adds capacity, but does not improve the truck-vehicle interaction – in fact, it may make conditions even less desirable. This option has little effect on the proposed auxiliary lane alignment of I-70.
- Parallel Parking Scenic Overlook/Chain-up – this option separates truck movements from passenger cars after entering the chain-up station. Trucks are directed to the left upon exiting I-70 and passenger vehicle parking would not change. Existing truck parking would be utilized, but a new driving aisle and a new row of up to nine additional parallel parking spaces could be added to the north side. This layout minimizes truck and passenger car interactions and provides additional spaces. The layout has an impact on the proposed auxiliary lane alignment of I-70, moving the auxiliary lane farther north into the median.
- Diagonal Parking Scenic Overlook/Chain-up – this option is like the parallel parking option, as it separates truck movements from passenger cars after entering the chain-up station. However, trucks would be directed into a diagonal parking chain-up area. This layout provides additional parking spaces and some separation of vehicle interactions. This option has the greatest impact on the proposed auxiliary lane alignment of I-70, moving the auxiliary lane farther north into the median to accommodate revised layout and the diagonal parking spaces.

In either the parallel or diagonal options, shifting the auxiliary lane into the median can be minimized with narrowed shoulder widths on I-70 and the use of concrete barrier to separate I-70 from the parking spaces.

EXIT 203 INTERCHANGE

The evaluation of the interchange options is based on the need to address safety and capacity issues related to the westbound (WB) off-ramp from I-70. Initial options for the interchange were developed to fit within the existing right of way and utilize existing infrastructure. As operation challenges were better understood additional alternatives requiring full reconstruction were developed to meet capacity needs. Interchange options were evaluated using a year 2045 planning horizon and included five alternatives:

1. Two-lane roundabout at the WB ramps and a signalized intersection at the eastbound (EB) ramps
2. Signalized intersection at the WB ramps and a signalized intersection at the EB ramps

3. Diverging Diamond Interchange (DDI)
4. Single point urban interchange (SPUI) combining the EB and WB ramps
5. Tight urban diamond interchange (TUDI), which includes a signalized intersection at the WB ramps, a signalized intersection at the EB ramps, access control at CO 9/DDR, and includes a new frontage road underpass providing bypass operations for east-west movements under CO 9.

LUSHER COURT/DILLON DAM ROAD

The evaluation of the Lusher Court/Dillon Dam Road (DDR) intersection options was conducted using SYNCHRO traffic operations analysis software and a year 2045 planning horizon. For all options, it was assumed that a new interchange configuration was implemented and operating at LOS D or better and did not restrict flow into the intersection. This allows a more conservative analysis of the Lusher/DDR intersection for comparative purposes. General options that were evaluated include:

- Enhanced Detection – assumes full intersection detection at the CO9/DDR, signal coordination along CO 9 through the interchange, and a higher capacity WB ramp intersection and a signalized EB ramp intersection.

- Minor Widening and Realignment – widening to three lanes in each direction along the length of CO9 from the Exit 203 interchange to Hawn Drive/10 Mile Road to accommodate additional through movements. This includes conversion of all southbound (SB) and northbound (NB) right turn only lanes on CO 9 to shared through/right and enhanced signal coordination along CO 9.

- Major Widening and Realignment - includes the minor widening plus additional capacity improvements on Lusher Court/DDR. These improvements include additional through lanes (EB and WB) on the west leg and an additional WB through lane on the east leg. This option also includes a realignment of the east leg of the intersection to a location between the Starbucks and the Kentucky Fried Chicken properties. This alignment allows the additional through lane capacity for WB at CO9 and may relieve some of the operations pressure at 10-Mile and DDR.

- Controlled Access Intersection – the objective of these options is to reduce signal phases at the signalized intersection by restricting EB and WB movements at Lusher/DDR. Two options were considered to accomplish this objective - remove EB and WB left turns or remove EB and WB through movements. In each case, the eliminated movements are redirected to other facilities on the existing roadway network including 10 Mile Road, Meadow Drive, 10 Mile Drive, and Hawn Drive. Specifically, in the case of removing through movements, a potential new frontage road and underpass adjacent to I-70 option was considered.

- Partial continuous flow intersection (CFI) - the objective of a continuous flow intersection is to provide additional signal timing capacity by combining left and through movements to reduce phases in the signal cycle. This is done by realigning left turns in the intersection to move with opposing through movements. The partial CFI considered the north and south legs only on CO 9. The east and west legs on DDR and Lusher Court were not considered because of the likely ROW and access impacts on both the north and south sides of DDR and Lusher Court. In addition, the focus is on the higher volume north and south movements in the intersection. A CFI in this location is challenging due to the proximity with the Exit 203 interchange EB ramps, driver understanding and comfort, and snow removal.

1.3.2 OPERATIONS SUMMARY

I-70 EB AUXILIARY LANE

The addition of the eastbound auxiliary lane from Exit 203 to Exit 205 will alleviate much of the congestion on I-70 in this area. LOS D or better is expected to occur. However, the forecast traffic volumes indicate the section of I-70 that is west of Exit 203 will be over capacity and will operate at LOS F, which will act to meter traffic heading east beyond Exit 203. The conceptual-level assessment of the EB auxiliary lane drop at Exit 205 shows that the diverge condition is LOS D. As stated earlier, a more detailed operational analysis will be required to determine the best configuration for auxiliary lane at or through Exit 205 taking large vehicle operations into consideration.

EXIT 203 INTERCHANGE

Given the 2045 traffic volumes, only the SPUI and DDI options operate at LOS D or better without a new frontage road underpass and access control at CO 9/DDR. However, given the proximity of the Lusher Court/DDR intersection, the DDI option would have geometric challenges to developing appropriate lane configurations.

The SPUI has similar issues with developing the proper geometry in proximity to Lusher Court/DDR. A traditional SPUI alignment centered over I-70 will be affected by the geometry and SB queuing at Lusher Court/DDR and will not provide a movement from the EB off ramp to EB DDR left turn lane.

All interchange options would have improved traffic operations and capacity with a new frontage road underpass and access control at CO 9/DDR.

LUSHER COURT/DILLON DAM ROAD

The analysis of the Lusher Court/DDR intersection indicates a need to combine or remove signal phases from the intersection timing. Enhanced signal timing/detection, minor, and major

widening efforts will not accommodate the 2045 demand. The analysis shows that only access controlled or high capacity intersections that combine or remove signal phases from the intersection timing will provide the necessary capacity for 2045 demand.

Much of the Exit 203 interchange operations is driven by operations at CO 9/DDR. Any improvements at Exit 203 need to be combined with improvements to the CO 9/DDR intersection.

1.3.3 REVISED EXIT 203 INTERHCNAGE AND CO 9/DDR INTERSECTION CONCEPT

Following the initial alternative development, evaluation, and documentation in the Draft Feasibility Study the project team met with local agency stakeholders and CDOT to discuss comments and questions related to Exit 203 and CO 9/DDR intersection options studied and the potential new frontage road underpass concept. Benefits and impacts of adding the new frontage road underpass to each of the Exit 203 options along with additional access control at CO 9/DDR were evaluated and discussed at a high level.

To better understand the benefits of a new frontage road the consultant team revised and advanced the Exit 203 Option 1, Two Lane Roundabout. This includes adding the new frontage road underpass concept including roundabout connections to local roads on Lusher Court to the west and on DDR to the east. This revised concept also includes additional access control at CO 9/DDR and developed pedestrian and bikeway connections. The additional access control at CO 9/DDR includes changing the intersection to right-in/right-out movements to and from CO 9, and an unsignalized northbound left turn lane to Lusher Court. This eliminates left turns from DDR and Lusher Court to CO 9, and the southbound CO 9 left turn to DDR. These movements would be displaced to the new frontage road underpass. This revised option is shown in Figure 1-2.

Initial high level operation analysis was completed to understand the benefits of this revised concept. This analysis showed that the access control at CO 9/DDR reduces the queue lengths at the Eastbound signals. This analysis also shows that the traffic modeling will need to be expanded south along CO 9 and a detailed review of turning movements and redistribution is needed to analyze all benefits and impacts to the local network. The heavy right turn movements from DDR to northbound CO 9 may need some signal control during peak periods.

Figure 1-2: Revised Exit 203 and CO 9/DDR Intersection Concept

1.4 NEXT STEPS

1.4.1 SHORT-TERM RECOMMENDATIONS (< 5 YEARS)

Short-term solutions, within the next five years, are necessary to address immediate needs and concerns related to the I-70 corridor. These solutions include:

I-70 EXIT 203

- I-70 EB auxiliary lane
- Safety signing such as VMS and warning signs (speed, curve, grade) and additional guardrail installation
- Exit 203 WB ramp storage lane

- Exit 203 WB ramp two-lane roundabout or signalized intersection
- Restripe CO 9 bridge over I-70 to three lanes - two SB and one NB lane (consider a separate pedestrian crossing)
- Optimize signal operations along CO 9

These recommendations provide capacity (LOS D or better) for the interchange through 2040. Additional intersection laneage and storage lanes at the WB ramp intersection remove the I-70 congestion and queuing issues related to the WB ramp intersection.

1.4.2 LONG-TERM RECOMMENDATIONS (>15 YEARS)

Long-term solutions, beyond 2035, are necessary to address future capacity needs related to the I-70 corridor and the CO 9/DDR intersection. The interchange at Exit 203 will continue to see increased vehicle demand beyond 2040 that will lead to failing levels of service even with short-term improvements. Long-term recommendations include higher capacity ramp intersections and ramp improvements combined with significant changes to CO 9/DDR.

The CO 9/DDR intersection in its current configuration will begin to fail in 2035 even with improved signal timing on CO 9 and improvements at Exit 203.

I-70 EXIT 203 AND LUSHER COURT/DILLON DAM ROAD

The Revised Exit 203 Interchange and CO 9/DDR Intersection Concept as shown in Figure 1-2, addresses the future capacity needs related to I-70 and CO 9. This includes:

- Higher capacity Exit 203 ramp terminal intersections (multiple lane roundabouts or DDI) and storage length in combination with,
- Implementation of a new frontage road underpass and access control at CO 9/DDR

Several interchange options were evaluated and only the SPUI provided acceptable operations and geometric configurations without significant changes to CO 9/DDR. The SPUI option has high costs and requires realigning I-70 mainline. Multiple options to improve CO 9/DDR were evaluated, and the only options that include eliminating and redirecting movements provided needed capacity. Access control at CO 9/DDR combined with an adjacent new frontage road underpass improves the operations and provides greater flexibility to improve the Exit 203 interchange intersections and ramps.

2 STUDY OVERVIEW

2.1 STUDY AREA

The study area for this feasibility study begins west of the I-70 and CO 9 interchange (Exit 203 - Frisco) and continues to the east side of the I-70 and US 6 interchange (Exit 205 – Silverthorne) (see Figure 2-1). It is a relatively narrow area extending less than approximately 200 feet from the edge of pavement, except at the CO 9 interchange and the Dillon Dam Road area. The study area is wider at these locations to accommodate design updates to the interchange and adjacent intersections and roadways.

Figure 2-1: Study Area

2.2 PROJECT PURPOSE

In June 2011, the Federal Highway Administration (FHWA) signed the Record of Decision (ROD) for the Interstate 70 (I-70) Mountain Corridor Final Programmatic Environmental Impact Statement (PEIS), a Tier 1 National Environmental Policy Act (NEPA) document that establishes a high-level vision of the I-70 Mountain Corridor for the horizon year of 2050. The study area for the PEIS is a 144-mile stretch of I-70 between Glenwood Springs, Colorado, and the Denver metropolitan area. The Preferred Alternative selected in the PEIS includes three basic elements: travel mode, capacity, and general location. Subsequent Tier 2 NEPA studies are

required to identify specific project alternatives, alignments, and interchange types consistent with the Tier 1 NEPA Decision. The PEIS notes that the Exit 203 interchange and the segment of I-70 between Exit 203 and Exit 205 require further study for safety purposes. The PEIS calls out Exit 203 for "potential interchange modifications" and I-70 EB from Frisco to Silverthorne for "auxiliary lane improvements" as part of the Minimal Action Alternative.

In response to the PEIS, the Colorado Department of Transportation (CDOT) is conducting this feasibility study to identify possible solutions for ongoing safety, mobility, and operational issues on I-70 at the State Highway 9 (CO 9) Frisco interchange and the two-mile eastbound segment of I-70 between CO 9 (Exit 203) and Silverthorne (Exit 205). These issues include:

- There are a high number of documented crashes in the project area. The Safety Assessment, performed by CDOT, indicates one of three segments operates at a IV Level of Service of Safety (LOSS), indicating a high potential for crash reduction. This segment is from MP 204.11 to 205.8, which is a steep section with a large, sweeping curve.
- The westbound (WB) Exit 203 interchange off ramp consistently operates over capacity, which creates heavy congestion and queuing along the entirety of the ramp and into the I-70 auxiliary lane. This creates a significant and dangerous speed differential on I-70 between the mainline and auxiliary lane. The WB Exit 203 off ramp queues past the Scenic Overlook/Chain-up Station acceleration lane (WB) creating both operational and safety concerns. Additionally, during congested conditions, unfamiliar drivers may not realize that the queue for the off ramp begins so far in advance of the exit and may miss the exit or force their way into the queue.
- The eastbound I-70 corridor between Exit 203 and Exit 205 is a steep grade and often experiences heavy downhill congestion in the right lane. This issue created by the mix of driver and vehicle characteristics including local, recreational, delivery, and commuter drivers in passenger cars, vehicles towing campers and boats, freight vehicles, and tractor-trailer combinations. The congestion issue becomes worse during inclement weather events because of conditions and use of the scenic overlook/chain-up station east of Exit 203.

Opportunities for growth along the I-70 corridor from the Front Range and the local jurisdictions (Summit County and the Town of Frisco) will create additional demand for corridor capacity and mobility in all its forms including passenger vehicle, transit, pedestrian, and bicycle. The increased commuter, recreational, and local demands will exacerbate the congestion and queuing on the ramp, the SH 9 bridge, and through the Lusher/DDR intersection.

This feasibility study evaluates interchange, intersection, and highway options to meet the critical success factors (See Section 2.3) identified by the Project Leadership Team (PLT). When

feasible alternatives are developed, and construction money identified, CDOT will begin a Tier 2 NEPA study, which is assumed to be either a Categorical Exclusion or possibly an Environmental Assessment. During the Tier 2 NEPA study, a preferred alternative will be selected.

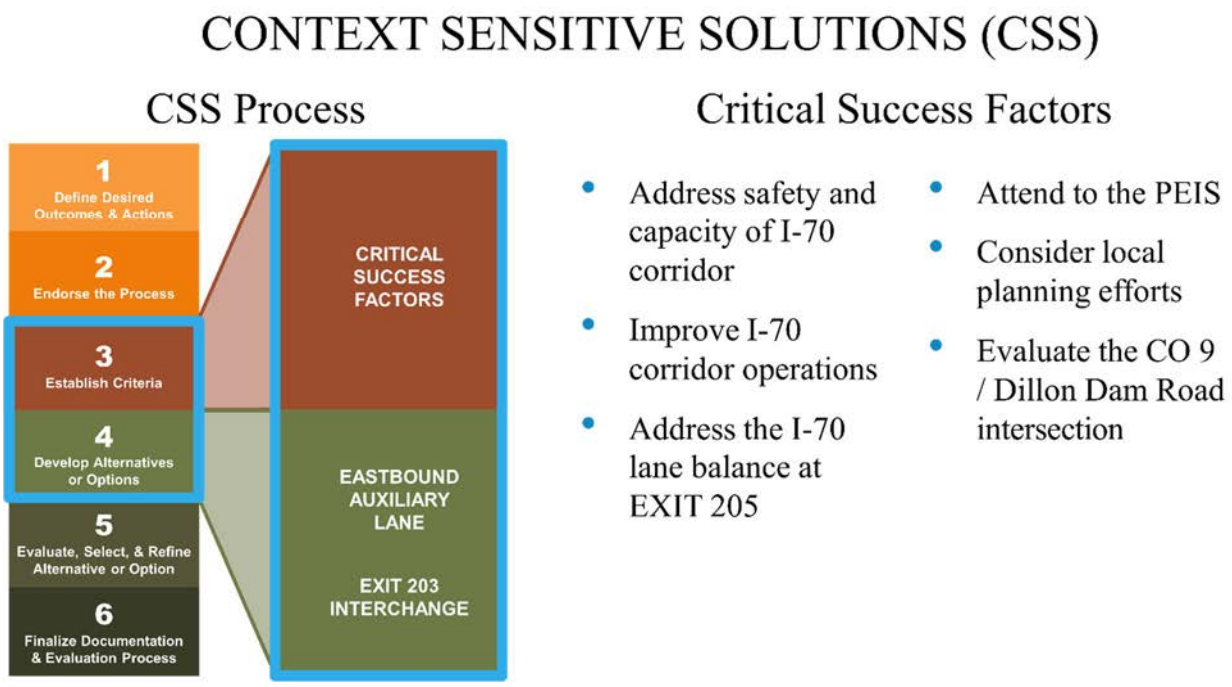
2.3 CONTEXT SENSITIVE SOLUTIONS APPROACH (CSS)

In keeping with the requirements of the PEIS, this feasibility study incorporated the CSS process into the decision-making. The CSS process in the I-70 Mountain Corridor is well-established and is being continued through this project. The process begins early and continues throughout the entire project development process – from project concepts through alternative studies and into construction, and beyond into maintenance and monitoring improvements. CSS means maintaining commitments to communities.

CSS establishes a six-step process in delivering projects (Figure 2-2). This process calls for the interdisciplinary collaboration of technical professionals, local community interest groups, landowners, facility users, and the public – including all stakeholders who live and work near the road, and those who will use it. It is through this process and this team approach that CDOT gains an understanding and appreciation of community values and strives to incorporate or address these values in the evolution of its projects. As part of the collaborative approach, CDOT engaged local agencies as part of a Project Leadership Team (PLT), including Summit County, the Town of Frisco, and the Town of Silverthorne, to define the critical results or activities (also called critical success factors) necessary to reach a positive or successful outcome to the project. The PLT established six critical success factors by which to gauge the success of the project.

Within the six-step CSS process, the conclusion of this feasibility study will fall in *Step 4: Develop Alternatives or Options*.

Figure 2-2: Context Sensitive Solutions 6-Step Process and Project Critical Success Factors



Chapter 6 includes the documentation of the CSS process for this project. This chapter includes the meeting summaries of three PLT meetings and one public meeting held for the project.

2.4 PREVIOUS STUDIES

Several studies were reviewed to gather corridor information and background, identify any ongoing issues, and understand commitments within the project corridor. The following studies were selected for review because of their specific relevance to the corridor and this study in particular. In addition to these studies, a number of studies, memos and plans were reviewed for relevance as part of the environmental overview. A list of those studies can be found in the reference section of that document, *I-70, Exit 203 Feasibility Study Environmental Overview (CDOT, November 2018)*.

2.4.1 I-70 MOUNTAIN CORRIDOR PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

The I-70 Mountain Corridor PEIS focuses on a high-level vision of the I-70 corridor for the year 2050. The PEIS notes that the Exit 203 interchange and the segment of I-70 between Exit 203 and Exit 205 require further study for safety purposes. The PEIS calls out Exit 203 for "potential interchange modifications" and I-70 EB from Frisco to Silverthorne for "auxiliary lane improvements" as part of the Minimal Action Alternative.

In addition, Exit 203 was carried forward as one of the "Localized Highway Improvement Alternative Elements" advanced for development.

"Localized highway improvements focus on reducing Corridor congestion and improving overall mobility on the existing I-70 highway by making spot improvements to specific locations along the Corridor rather than adding capacity throughout the Corridor. This alternative element family includes an integrated package of strategies that maximize the operational efficiency, safety, and person-moving capacity of the Corridor by correcting structural and functional deficiencies of interchanges, curves, and localized areas of congestion. Localized highway improvements include interchange modifications, curve safety modifications, and auxiliary lanes."

As part of the PEIS review, it is noted that the development of any new interchange structures would need to consider a center-running alignment of the Advanced Guideway System (AGS) which may require additional clearance requirements.

2.4.2 INTERMOUNTAIN REGIONAL TRANSPORTATION PLAN

In evaluating the future travel demands of the corridor, the CDOT 2040 Intermountain Regional Transportation Plan was referenced in understanding larger goals and demands for the region. This report provides a broader perspective of issues and challenges in the Intermountain region, as well as shedding light on stakeholder comments. The Intermountain Transportation Planning Region includes Eagle, Lake, Garfield, Pitkin and Summit Counties.

2.4.3 STATE HIGHWAY 9 / U.S. HIGHWAY 6 IMPROVEMENT PROJECT AT THE INTERSTATE 70 SILVERTHORNE/DILLON INTERCHANGE - PLANNING AND ENVIRONMENTAL LINKAGES STUDY (PEL)

The Silverthorne/Dillon Interchange (Exit 205) PEL study was reviewed as it relates to the I-70 EB auxiliary lane and the forecast volumes for the project. The PEL study provided forecasting and volume data for year 2035, which was used to verify forecast volumes for this feasibility study (see Section 4. Future Conditions I-70 and CO 9) at Exit 205. The study was also reviewed to identify any proposed interchange conditions that might affect the lane balance from the EB auxiliary lane. The PEL did not assess the need for an EB auxiliary lane and did not recommend any changes to the EB off-ramp gore point.

3 EXISTING CONDITIONS I-70 AND CO 9

3.1 EXISTING (2018 ROADWAY CHARACTERISTICS)

3.1.1 I-70 MAINLINE

GEOMETRIC CHARACTERISTICS

Within the project limits, I-70 is classified as a full-access-controlled freeway that generally travels on an east-west alignment through mountainous terrain with steep grades and sharp curves. Table 3-1 and Table 3-2 summarize the geometric characteristics for westbound I-70 and eastbound I-70, respectively.

Table 3-1: Existing Conditions—Westbound I-70 Geometric Characteristics

Mile Posts		Lanes		Speed Limit	Features
Start	End	GPL[1]	Other	(mph)	
206	205.76	3	0	65	Relatively moderate grade on the approach to Exit 205, where one lane is an exit-only lane.
205.76	205.2	2	0	65/45[3]	Start of upgrade through the Exit 205 interchange, with sweeping horizontal curve to the left.
205.2	202.5	2	1[2]	65/45[3]	Mostly upgrade with a continuous auxiliary lane between the interchanges and exit/entrance ramps for the scenic overlook. Several horizontal curves, grade flattening out near the scenic overlook, and the auxiliary lane is an exit-only lane at Exit 203.
202.5	202	2	0	65/45[3]	Relatively flat grade west of Exit 203.

1. General-purpose lane
2. Lane is considered an auxiliary lane.
3. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to a speed of 60 mph and all other vehicles are restricted to a speed of 65 mph.

Table 3-2: Existing Conditions—Eastbound I-70 Geometric Characteristics

Mile Posts		Lanes		Speed Limit	Features
Start	End	GPL[1]	Other	(mph)	
202	202.48	2	0	65/45[3]	Relatively flat grade on the approach to Exit 203 and through the interchange.
202.48	203.11	2	1[2]	65/45[3]	Relatively flat grade with a continuous auxiliary lane that is an exit-only lane at the scenic overlook.
203.11	205.76	2	0	65/45[3]	Mostly downgrade with horizontal curves between the scenic overlook on-ramp and the Exit 205 interchange.
205.76	206	3	0	60	Begin upgrade through the traffic analysis area east of Exit 205.

1. General-purpose lane
2. Lane is considered an auxiliary lane.
3. Vehicles with gross vehicle weight rating (GVWR) greater than 26,000 pounds are restricted to a speed of 60 mph and all other vehicles are restricted to a speed of 65 mph.

INTERCHANGE FORMS

There are two major roadways that intersect with I-70 at grade-separated interchanges within the traffic analysis area. Each interchange provides full access to I-70 in the form of ramps that have acceleration/deceleration lanes of varying lengths. In addition, there are scenic overlook/chain-up stations in each direction of I-70 that have partial access to I-70 via ramps. Table 3-3 provides a summary of the interchange types located within the traffic analysis area.

Table 3-3: Existing Conditions—Interchange Forms

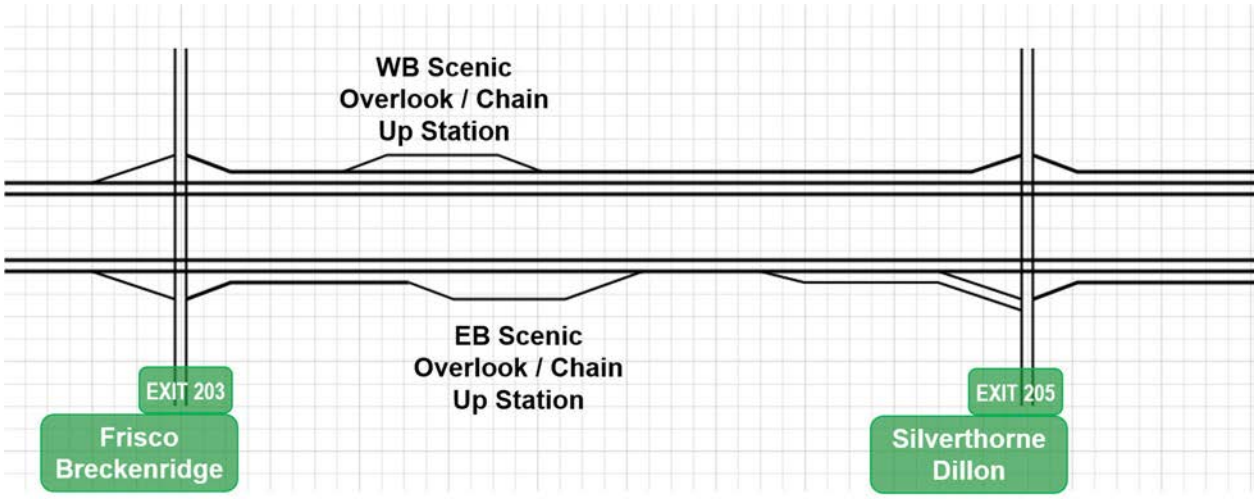
Intersecting Roadway	Interchange Form
Exit 203 (Frisco/Breckenridge)	Full Movement Diamond
Westbound Scenic Overlook/Chain-Up Station	Partial Movement Single Entrance/Exit[1]
Eastbound Scenic Overlook/Chain-Up Station	Partial Movement Single Entrance/Exit[2]
Exit 205 (Dillon/Silverthorne)	Full Movement Diamond

1. Access to and from westbound I-70 and the scenic overlook/chain-up station parking lot only; no eastbound I-70 access.
2. Access to and from eastbound I-70 the scenic overlook/chain-up station parking lot only; no westbound I-70 access.

I-70 LANAGE LINE DIAGRAM

There are two continuous general purpose lanes in both directions along the I-70 corridor between the Exit 203 and Exit 205 interchange. In the westbound direction there is a continuous auxiliary lane between Exit 205 and Exit 203 with a diverge exit ramp to the WB scenic overlook and merge entrance ramp to the aux lane east of the Exit 203. The auxiliary lane drops at the WB Exit 203 off-ramp. In the eastbound direction the two lane Exit 203 on-ramp merges to one lane and becomes an auxiliary lane that drops as an exit lane at the scenic overlook. A merge on-ramp from the scenic overlook connects to the general purpose lane, and then a deceleration auxiliary lane develops as the second off-ramp lane at eastbound Exit 205. The eastbound Exit 205 on-ramp becomes a third eastbound I-70 lane east of 205.

Figure 3-1: I-70 Lane Diagram



EXIT 203

Figure 3-2, below, depicts the full-movement tight diamond interchange of I-70 at Exit 203. CO 9 passes over I-70 with a roundabout intersection at the westbound I-70 ramp junction and a one-way stop-controlled intersection at the eastbound I-70 ramp junction. CO 9 is classified as a four-lane principal arterial that provides access to Frisco and Breckenridge. The westbound exit ramp is a single lane with a 35-mph advisory speed and the westbound on-ramp is a single lane with no ramp meters. The eastbound exit ramp is a single lane with a 35-mph advisory speed and the eastbound on-ramp is two lanes with ramp metering.

Figure 3-2: Exit 203 Interchange

SCENIC OVERLOOK/CHAIN-UP STATION

Figure 3-3, below, shows the scenic overlook/chain-up station ramps between Exit 203 and Exit 205; there are on/off ramps for the scenic overlook/ area chain-up station in the eastbound and westbound directions. Both scenic-overlooks include a parking lot with approximately 17 to 19 vehicle parking spaces and 6 to 8 heavy vehicle parking spaces. The exits only provide access to the scenic overlook parking lot and the chain-up stations with only a return to I-70 in the same

direction. The EB on-ramp from Exit 203 is an auxiliary lane that exits at the EB scenic overlook/chain-up station. The EB on-ramp from the scenic overlook/chain-up station merges with EB I-70. The WB off-ramp into the WB scenic overlook/chain-up station is a direct exit from the WB auxiliary lane, but is often mistaken for the Exit 203 off-ramp. The WB on-ramp from the scenic overlook/chain-up station merges into the EB auxiliary lane and off-ramp to Exit 203. During congested conditions this can create significant merging and weaving issues.

Figure 3-3: Scenic Overlook/Chain-Up Station Ramps

EXIT 205

The full-movement interchange of I-70 at Exit 205 is shown in Figure 3-4. CO 9/US 6 passes under I-70 with two signalized intersections at the eastbound and westbound I-70 ramp junctions. CO 9 is classified as a four-lane minor arterial that provides access to Silverthorne. US 6 is classified as a four-lane minor arterial that provides access to Dillon and Keystone Ski Resort. In addition, the segment of US 6 east of Exit 205 is used as an alternative to I-70 and as a HAZMAT route around the Eisenhower-Johnson Tunnels. The westbound exit ramp is two lanes

with a 45-mph advisory speed and the westbound on-ramp is one lane with no ramp meters. The eastbound exit ramp is two lanes with a 35-mph advisory speed and the eastbound on-ramp is two lanes with ramp metering.

Figure 3-4: Exit 205 Interchange

3.1.2 CO 9

The project limits along CO 9 are shown in Figure 3-2 and include the following three intersections:

- Exit 203 westbound ramp and CO 9
- Exit 203 eastbound ramp and CO 9
- Lusher Court/Dillon Dam Road and CO 9

CO 9 is classified as a principal arterial with a speed limit of 35 mph, generally traveling on a north-south alignment from I-70 through Frisco. The intersection of the Exit 203 westbound ramp and CO 9 is a single-lane five-legged roundabout. The five legs include the on- and off-ramps, CO 9 to the south, a private road to the north, and a trailhead access to the west. The intersection of the Exit 203 eastbound ramp and CO 9 is stop-controlled for the eastbound leg, while the northbound and southbound movements are not stop-controlled. The intersection of Lusher Court/Dillon Dam Road and CO 9 is a full-movement signalized intersection.

3.1.3 DESIGN CRITERIA REVIEW

The project corridor on I-70 between milepost (MP) 202 and MP 205 was reviewed for consistency with applicable design criteria. The design criteria proposed for the project is shown in Table 3-4.

The review included

- design speed
- minimum horizontal curve radius
- minimum clear zones
- minimum lane widths and shoulder widths
- minimum vertical curvature (crest and sag) and maximum grade
- minimum acceleration lane lengths

The review was based on design data from I-70 as-constructed design plan (1972) information provided by CDOT. The as-constructed design plans were reviewed for technical data such as curve and grade data and cross-section information. Aerial information was also used to confirm clear zone widths, lane widths, and acceleration lane lengths.

Table 3-4: Design Criteria

Design Element	I-70	CO 9	Ramps
Standards Applied		CDOT/AASHTO	
General			
Roadway Classification	Freeway	4-lane principal arterial	Ramp
Posted Speed (MPH)	65	35	65
Design Speed (MPH)	70	40	70
Design Vehicle	WB-67	WB-67	WB-67
Horizontal Alignment Criteria			

Design Element	I-70	CO 9	Ramps
Curve Radius – Minimum (ft)	2,040	762	2,040
Stopping Sight Distance (ft) - At level grade	730	305	730
Stopping Sight Distance (ft) - At 3% Down Grade	771	315	771
Stopping Sight Distance (ft) - At 6% Down Grade	825	333	825
Stopping Sight Distance (ft) - At 3% Up Grade	690	289	690
Stopping Sight Distance (ft) - At 6% Up Grade	658	278	658
Cross Slope	2%	2%	2%
Superelevation (e_{max})	7%	NC	6%
Clear Zone on Tangent			
Minimum (ft)	30	N/A	30
Desirable (ft)	34	N/A	34
Lane Widths (ft)	12	12	12
Shoulder Widths			
Inside (min) (ft)	4* / 12*	4	10* / 12*
*Where DDHV for truck traffic exceeds 250 veh/hr, a paved shoulder width of 12 feet should be considered.			
Outside (min) (ft)	12	10	4
Auxiliary Lanes (ft)	12	N/A	8
Side Slopes			

Design Element	I-70	CO 9	Ramps
Cut Slope	Equal to or flatter than 6:1	Equal to or flatter than 6:1	Equal to or flatter than 6:1
Fill Slope	Equal to or flatter than 6:1	Equal to or flatter than 6:1	Equal to or flatter than 6:1
Vertical Alignment Criteria			
K-Values			
Crest Vertical Curve	247	44	247
Sag Vertical Curve	181	64	181
Grade			
Maximum	5%	5%	5%
Minimum	0.50%	0.50%	0.50%

DESIGN SPEED

The design criteria standard for design speed is 70 mph. The as-constructed design speed is 70 mph and meets the standard.

MINIMUM HORIZONTAL CURVE RADIUS

The design criteria standard for horizontal curve radius (R_{design}) is 2,040 feet. There are six horizontal curves for both eastbound and westbound directions. The as-constructed design shows that both directions use the same curve radius. As shown in Table 3-5, the as-constructed horizontal curve radii (R_{Exist}) meet the minimum design standard. Refer to Figure 5-2 for aerial photo and milepost information for the I-70 corridor.

Table 3-5: Minimum Horizontal Curve Radius

Approx. MP	202.3	203.0	203.4	203.8	204.3	205.1
R_{Exist} (ft)	5,730	2,292	2,865	2,292	2,292	2,865
R_{Design} (ft)	2,040	2,040	2,040	2,040	2,040	2,040

MINIMUM CLEAR ZONES

Clear zones were reviewed, and no locations were identified that do not meet the standard. Locations where the 30-foot clear zone was not met, was protected with guardrail.

MINIMUM LANE WIDTHS AND SHOULDER WIDTHS

The design criteria standard for lane and shoulder widths (minimum) are 12 feet for travel and auxiliary lanes, 4 feet for inside shoulders and 12 feet for outside shoulders. The analysis shows that the lane and shoulder widths meet the minimum standards. The lane widths were spot verified using aerial information.

MINIMUM VERTICAL CURVATURE (CREST AND SAG) AND MAXIMUM GRADE

Refer to Figure 5-2 for aerial photo and milepost information for the I-70 corridor.

EASTBOUND

There are ten vertical curves in the eastbound direction from just west of mile post 202 to the Silverthorne interchange. The curve and grade data are presented in Table 3-6 where K_{Exist} is the existing K-value from the as-constructed design plans and K_{Design} is the design criteria standard.

Table 3-6: Minimum Vertical Curvature (Crest and Sag) And Maximum Grade - EASTBOUND

Approx. MP	201.9	202.4	202.7	203.0	203.3	203.8	204.5	204.7	204.9	205.1
Length (ft)	400	1,200	600	1,100	400	2400	400	400	400	1,600
grade$_1$	-0.47%	-1.63%	1.96%	3.64%	0.28%	2.57%	-6.00%	-5.48%	-6.44%	-5.96%
grade$_2$	-1.63%	1.96%	3.64%	0.28%	2.57%	-6.00%	-5.48%	-6.44%	-5.96%	2.39%
K_{Exist}	345	334	357	327	175*	280	667	364	741	192
K_{Design}	247	181	181	247	181	247	181	247	181	181
Sag/Crest	Crest	Sag	Sag	Crest	Sag	Crest	Sag	Crest	Sag	Sag

* Equivalent design speed for K_{Exist} = 175 is 69 mph

There are several locations in the eastbound direction that do not meet the design criteria standard for either minimum vertical curve (k-value) or maximum grade of 5% (g).

1. At milepost (MP) 203.3, just west of the eastbound scenic overlook/chain-up station, the vertical curvature for a sag vertical curve does not meet the minimum design criteria. The design criteria for the k_{sag}-value is 181 (70 mph) and the calculated k_{sag}-value is 175 (69 mph), which is just below the standard.
2. Between MP 203.8 and 205.1, west of Old Dillon Dam Reservoir to just west of the ramps at Exit 205, the grade does not meet the maximum grade design criteria. The design criteria for maximum grade is +/- 5.0% and the actual grade (based on the design plans) ranges between 5.48% and 6.44%.

WESTBOUND

There are nine vertical curves in the westbound direction from just west of mile post 202 to the Silverthorne interchange. The curve and grade data are presented in Table 3-7.

Table 3-7: Minimum Vertical Curvature (Crest and Sag) And Maximum Grade - WESTBOUND

Approx. MP	201.9	202.4	202.7	203.0	203.3	203.7	204.4	204.7	205.2
Length (ft)	400	1,100	600	1,000	400	2,200	400	400	1,600
grade$_1$	-0.88%	-1.54%	1.96%	3.64%	0.28%	2.57%	-6.00%	-4.97%	-5.96%
grade$_2$	-1.54%	1.96%	3.64%	0.28%	2.57%	-6.00%	-4.97%	-5.96%	2.39%
K_{Exist}	606	314	357	298	175*	257	388	404	192
K_{Design}	247	181	181	247	181	247	181	247	181
Sag/Crest	Crest	Sag	Sag	Crest	Sag	Crest	Sag	Crest	Sag

* Equivalent design speed for K_{Exist} = 175 is 69 mph

There is one location in the westbound direction that does not meet the design criteria standard for vertical curve (k-value).

1. At milepost (MP 203.3, just west of the westbound scenic overlook/chain-up station, the vertical curvature for a sag vertical curve does not meet the minimum design criteria. The design criteria for the k_{sag}-value is 181 (70 mph) and the calculated k_{sag}-value is 175 (69 mph), which is just below the standard.
2. Between MP 203.7 and 205.2, west of the Old Dillon Reservoir to just west of the ramps at Exit 205, the grade does not meet the maximum grade design criteria. The design criteria for maximum grade is +/- 5.0% and the actual grade (based on the design plans) ranges between 5.96% and 6.00%.

MINIMUM ACCELERATION LANE LENGTHS.

Each acceleration lane onto the I-70 corridor in the project area was reviewed and checked for appropriate length. Each accel lane has a different criterion for length based on the design standards from Chapter 10 of the American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets. Using those design standards, Table 3-8 was prepared to evaluate the accel lane lengths in the corridor.

The evaluation reviewed the four on-ramps for Exit 203 and the scenic overlook/chain-up stations. The accel lengths for each of the four on-ramps are shown in Table 3-8 where L_{Exist} and L_{Design} are the existing length and design criteria length, respectively. The assumed speed shown in the table represents the speed of the vehicle upon entering the beginning of the accel lane as

defined by the AASHTO standards. The design vehicle (semi-truck) was used to determine the entrance speed assuming an acceleration characteristic of 3.0 feet per second^2.

Table 3-8: Minimum Acceleration Lane Lengths

	Exit 203		Scenic Overlook / Chain-up Station	
	WB ON	EB ON	WB ON	EB ON
Approx. MP	202.1	202.5	202.8	203.4
Accel Lane Type	1-lane parallel	1-lane into auxiliary lane parallel	1-lane taper	1-lane parallel
L_{Exist} (ft)	700	830[1]	>580	1,100
L_{Design} (ft)	580	720	580	1,230
S_{Design} (mph)	70	50	70	70
$S_{Initial}$ (mph)	50	20	50	35
grade	<2%	<2%	<2%	+2.60%

1. There are two lanes at the EB on-ramp meter that merge into one lane within approximately 800 feet. This allows the merge into the single auxiliary lane to occur at approximately 40 mph. The single lane then continues for approximately 1/2 mile as the auxiliary lane that drops into the scenic overlook.

The evaluation shows that three of the accel lengths meets the design standard. The accel lane length for the eastbound on ramp from the scenic overlook/chain-up station does not meet the standard and is short by approximately 130 feet.

3.2 CRASH DATA

CDOT performed a safety assessment (*Safety Assessment Report*, November 2018) that included I-70 from Exit 203 to Exit 205, as well as CO 9 from just south of Ten Mile Drive to the I-70 interchanges. The study was done to identify current safety issues along these segments of highway and potential countermeasures to improve safety. The following sections summarize the findings of the safety study.

3.2.1 I-70 MAINLINE

The crash history on I-70 for the period January 1, 2012, through December 31, 2016, was examined to locate crash clusters and identify crash causes. Within the study period, 283 mainline crashes were reported along I-70 between MP 200.70 and MP 205.80. Of these, there were 74 injury crashes (126 injured), and two fatal crashes (three fatalities). Table 3-9 summarizes the crash totals for this segment of I-70 over the five-year study period.

Fixed-object collisions were the most common crash type (29%). Other common crash types along this corridor include rear-end collisions (20%) and sideswipes by cars going in the same direction (17%).

Table 3-9: Summary of Crash Totals for I-70 (January 1, 2012, to December 31, 2016)

Year	PDO[1] Crashes	Injury Crashes	Injuries	Fatal Crashes	Fatalities	Total Crashes
2012	32	21	37	1	2	54
2013	55	19	32	0	0	74
2014	47	13	24	0	0	60
2015	41	13	23	0	0	54
2016	32	8	10	1	1	41
Total	207	74	126	2	3	283
Average/Year	41.4	14.8	25.2	0.4	0.6	56.6

1. Property Damage Only.

I-70 was divided in three segments for analysis. Table 3-10 provides the results of the level of service of safety (LOSS) analysis for each segment along the I-70 corridor. LOSS is used to characterize the safety of a roadway segment in reference to its expected performance. As shown in Table 3-10, Segment 3 is in the LOSS III category for frequency of crashes and the LOSS IV category for severity of crashes, which indicates high potential for crash reduction. One of the recommendations from the safety assessment was to construct an eastbound auxiliary lane between Exit 203 and Exit 205 to reduce congestion and potentially reduce rear-end crashes through the segment.

Table 3-10: I-70 Level of Service of Safety

Segment	Total Crashes	Severe Crashes
Segment 1: MP 200.70 to MP 202.35	II	II
Segment 2: MP 202.36 to MP 204.10	II	III
Segment 3: MP 204.11 to MP 205.80	III	IV

3.2.2 CO 9

The crash history for the period January 1, 2012, through December 31, 2016, was examined between MP 96.60 to MP 97.23 on CO 9 to locate crash clusters and identify crash causes. During the same period, 61 crashes were reported along the CO 9 corridor, including two ramp terminal crashes that were coded to I-70. Of these 61 crashes, there were 14 injury crashes (14 injured), and no fatal crashes. Table 3-11 summarizes the crash totals for this segment of CO 9 over the five-year study period.

Rear-end collisions were the most common crash type (51%). Other common crash types along this corridor include fixed-object collisions (18%) and sideswipes by cars going in the same direction (13%).

Table 3-11: Summary of Crash Totals for I-70 (January 1, 2012, to December 31, 2016)

Year	PDO[1] Crashes	Injury Crashes	Injuries	Fatal Crashes	Fatalities	Total Crashes
2012	8	3	3	0	0	11
2013	6	4	4	0	0	10
2014	6	2	2	0	0	8
2015	11	1	1	0	0	12
2016	16	4	4	0	0	20
Total	47	14	14	0	0	61
Average/Year	9.4	2.8	2.8	0	0	12.2

1. Property Damage Only.

Along CO 9 within the study segment, intersections accounted for 84 percent of all crashes observed (51 of 61). Table 3-12 provides the results of the LOSS for each intersection on CO 9. As shown, each of the intersections operates at LOSS I or II; roundabouts are not evaluated by the LOSS analysis. The intersections are performing well and do not indicate a high potential for crash reductions. There were no crash patterns found at the CO 9 intersections. No major intersection improvements were recommended along CO 9.

Table 3-12: CO 9 Intersection Level of Service of Safety

Intersection	All Crashes	Severe Crashes (Injury and Fatal)
Lusher Court/Dillon Dam Road (signalized)	II	I
I-70 Eastbound Ramps (two-way stop-controlled)	II	I
I-70 Westbound Ramps (roundabout)	N/A	N/A

3.2.3 SAFETY RECOMMENDATION SUMMARY

- Install eastbound auxiliary lane between Exit 203 and Exit 205 to reduce congestion and potential for rear-end crashes.
- Install curve warning signs in both eastbound and westbound directions for the curve between MP 204 and MP 204.5. May also need advisory speed plaques along the curve and a weather warning system. Increasing maintenance on this curve may also help in reducing slickness during snowy conditions, as Silverthorne Hill is north-facing and tends to ice up more quickly.
- Consider using existing variable message sign (VMS) signs to warn of deer during peak deer season (summer months around dusk).
- Install variable speed limit (VSL) signs or dynamic speed monitoring display (DSMD) in the EB direction prior to the curve (MP 204 and MP 204.5) and downgrade (MP 203.90) could help in reducing crashes.
- Consider installing guardrail on the curve between MP 204 and MP 204.5 to reduce the severity of crashes.
- On SH 9, it is recommended that sign placement around Lusher Court (MP 96.89) be reviewed and to verify all signs are breakaway or protected.
- Additional safety features that should be provided as part of any improvement project:
    - Good skid resistance and drainage of the roadway surface.

- Adjustment, repair, and upgrade of existing guardrail to meet current standards.
- Elimination of pavement edge drop-offs (Safety Edge Application).
- Super-elevation and crown correction where required.
- Appropriate pavement markings (highly reflective and durable), signing and delineation.
- Appropriate advance warning signing of curves.
- Replace all button reflectors and guardrail reflectors to insure good nighttime and inclement weather (fog, snow, rain, etc.) delineation.

3.3 EXISTING TRAFFIC VOLUMES AND PATTERNS

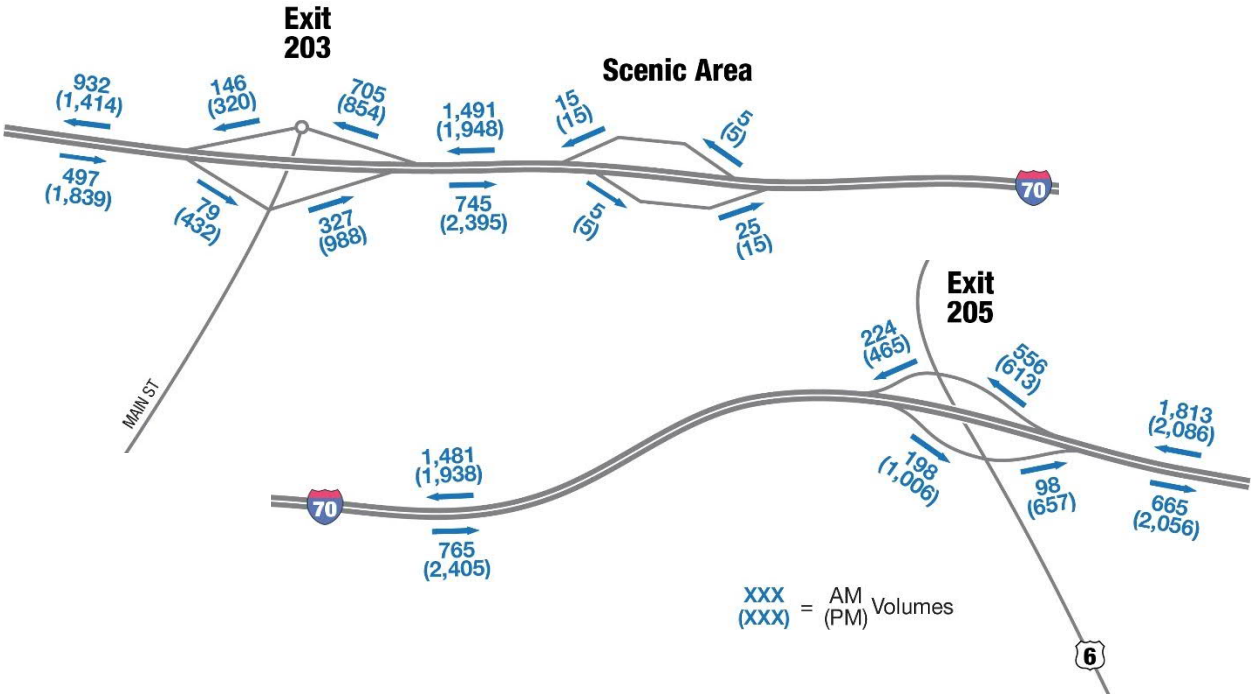
3.3.1 I-70 MAINLINE

Figure 3-5 represents the AM and PM peak hour traffic volumes along I-70 eastbound and I-70 westbound from Exit 203 to Exit 205. The eastbound and westbound through traffic volumes were determined by balancing multiple count locations from COGNOS data collected on Saturday, December 30, 2017. The data selected from December 30, 2017, represent high-volume winter weekend traffic patterns on I-70 caused by recreational travel to ski areas.

For the study area, a year of hourly volumes from 2017 was ranked to determine the range of peak hour volumes and analyzed to identify a best-fit for the design hour. It was determined that a design hour within the 20th and 30th highest hourly volumes is most suitable. For I-70, December 30, 2017 fits within the range and coincides with the date field traffic counts were obtained.

The traffic counts indicated westbound traffic in the AM peak is double the eastbound traffic with about 1,500 vph heading westbound and less than 800 heading eastbound between Exit 203 and Exit 205. This is consistent with travelers arriving in the area early in the morning to begin their visits and daily activities. However, the PM peak traffic is more balanced with about 2,000 vph traveling westbound and about 2,400 vph heading eastbound. The eastbound traffic is consistent with travelers heading back toward the Front Range after a day of activity in the area, but the westbound volume indicates a high number of travelers arriving late in the day to most likely stay overnight and complete activities on the following day. The PM peak also shows the highest level of activity at the exit and entrance ramps at Exit 203 and Exit 205 with patterns similar to the mainline volumes.

Figure 3-5: Existing (2017) AM and PM Peak Hour Traffic Volumes along I-70

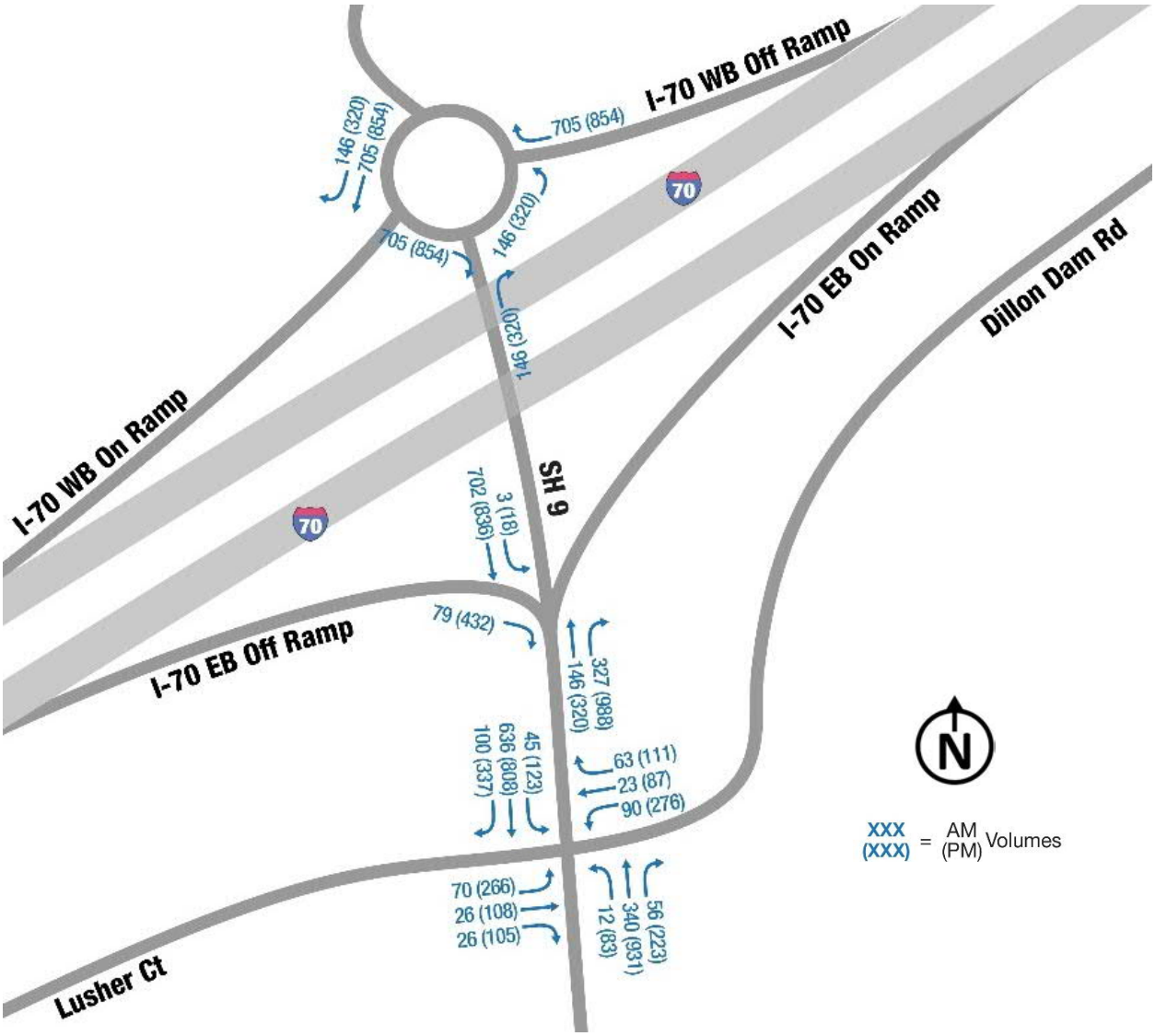


3.3.2 CO 9

Peak hour turning movement counts were collected on Saturday, December 30, 2017, by All Traffic Data, Inc., at the intersections of the I-70 eastbound ramps and CO 9, I-70 westbound ramps and CO 9, and Lusher Court/Dillon Dam Road and CO 9 from 7:00 a.m. to 9:00 a.m. and 3:00 p.m. to 5:00 p.m. Figure 3-6 displays the peak hour turning movement counts for the AM and PM existing traffic conditions.

Based on the count data, there is very little or no demand for vehicles to exit I-70 and head north on CO 9 or for the SB CO 9 to EB I-70 movements. This is due to the lack of any major destination north of CO 9. Traffic counts at Exit 203 show that basically all the I-70 exiting traffic (westbound and eastbound) tend to travel south on CO 9 beyond the Lusher Court/DDR intersection during both peaks. Similarly, the NB CO 9 traffic tends to continue through the Lusher Court/DDR intersection with about 75 percent of the traffic heading east on I-70 toward the Front Range and the remaining 25 percent heads west. Finally, vehicle volumes on Dillon Dam Road and Lusher Court are relatively low during the AM peak (less than 200 vph on each roadway) but show a significant increase in activity during the PM peak with more than 500 vph on each roadway. In addition, the volume of CO 9 traffic turning (left or right) onto Dillon Dam Road and Lusher Court more than triples in the PM peak compared to the AM peak. Overall, the traffic at the interchange and the Dillon Dam Road/Lusher Court intersection are highest in the PM peak and also represents the most turning movement interaction between the roadways.

Figure 3-6: CO 9 Existing (2017) Peak Hour Turning Movement Counts



3.4 EXISTING OPERATIONAL CONDITIONS

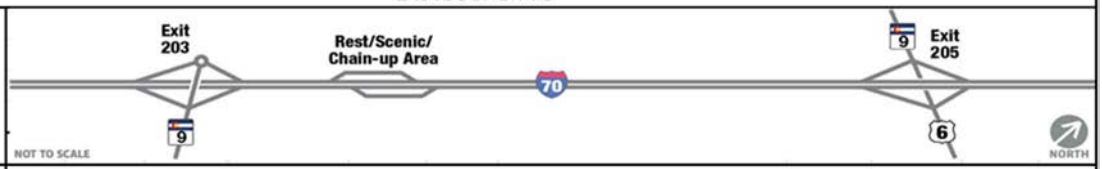
3.4.1 I-70 MAINLINE

Figure 3-7 shows the Highway Capacity Software (HCS) Analysis results for the existing traffic conditions on eastbound I-70. The top part of the figure shows the freeway broken into analysis segments per the definitions in the freeway facility analysis methodology from the *Highway*

Capacity Manual (HCM), 6th edition. The lower half of the figure shows the level of service[1] (LOS) for each segment for each 15-minute analysis period (i.e., time period TP #1, #2, #3, #4) within the PM peak hour. The PM peak hour was identified for analysis because of higher overall volumes as compared to the AM peak hour on I-70 and at the intersections along CO 9. For eastbound I-70, the segments operate at LOS C or better, with the worst conditions on the segments between the scenic overlook and off-ramp at Exit 205. LOS is measured from LOS A, representing free-flow traffic conditions, to LOS F, representing heavily congested traffic. LOS A through LOS D generally are considered acceptable.

Figure 3-7: Eastbound I-70 Existing Conditions HCS Results

EASTBOUND I-70



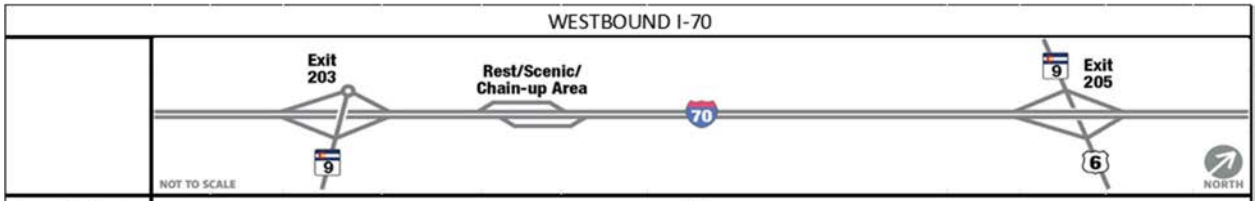
Time Period	LOS										
4:00 - 4:15 PM	B	B	B	B	C	C	C	C	B	B	C
4:15 - 4:30 PM	B	B	B	B	C	C	C	C	B	B	C
4:30 - 4:45 PM	B	B	B	B	C	C	C	C	B	B	C
4:45 - 5:00 PM	B	B	B	B	C	C	C	C	B	B	C
Segment #	1	2	3	4	5	6	7	8	9	10	11
Segment Type	B	D	B	W	B	M	B	D	B	M	B

Note: B= Basic Segment, D = Diverge Segment, M = Merge Segment, O = Overlap Segement, and W = Weave Segment.

Figure 3-8 shows the results of the westbound I-70 existing conditions. Due to the capacity limitation of the roundabout at the Exit 203 westbound off-ramp and CO 9 intersection, the demand to use the off-ramp exceeds the ability of the roundabout to process vehicles. This results in LOS F for segments of I-70 and queuing that spills back onto I-70 and extends back to the east beyond the scenic overlook.

[1] Level of service (LOS) is a quantitative scale used to determine how well a transportation facility is operating from the traveler's perspective. Typically, six levels of service are defined and each is assigned a letter designation from A to F, with LOS A representing the best operating conditions, and LOS F the worst.

Figure 3-8: Westbound I-70 Existing Conditions HCS Results



Time Period	LOS										
4:00 - 4:15 PM	A	A	A	F	F	B	B	B	B	B	B
4:15 - 4:30 PM	A	B	A	F	F	B	B	B	B	B	B
4:30 - 4:45 PM	A	B	A	F	F	F	A	B	B	B	B
4:45 - 5:00 PM	A	B	A	F	F	F	F	B	B	B	B
Segment #	11	10	9	8	7	6	5	4	3	2	1
Segment Type	B	M	B	W	B	D	B	M	B	D	B

Note: B= Basic Segment, D = Diverge Segment, M = Merge Segment, O = Overlap Segement, and W = Weave Segment.

3.4.2 CO 9

Table 3-13 shows the results for the existing LOS, 95th percentile queue lengths, and delay in seconds/vehicle for the intersections along CO 9. The LOS and delay results were generated using Synchro software and the 95th percentile queue lengths were obtained from performing a SimTraffic microsimulation of the interchange system of intersections. The roundabout intersection of the I-70 westbound ramps and CO 9 is found to function poorly in the PM conditions with LOS F. The intersection has more than six minutes of delay and queues that exceed 2,000 feet, which would result in queue spill-back onto several segments of I-70 east of the off-ramp. The signalized intersection of Lusher Court/Dillon Dam Road and CO 9 also is operating poorly during the PM conditions, with an LOS D. However, in the PM conditions, the eastbound and westbound approaches operate with LOS E/F.

Table 3-13: Existing (2017) CO 9 Intersection Synchro Summary

Intersection Name	Type	Approach Direction	LOS	Delay (sec/veh)	95%ile Queue
I-70 Eastbound Ramps and CO 9	Roundabout	EB	B	25	18
		WB	F	442	1,745
		NB	A	3	73
		SB	B	27	14
		Overall	F	365	-
I-70 Westbound Ramps and CO 9	One-way stop-controlled	EB	A	0.0	105
		NB	A	0.0	64
		SB	A	0.3	28
		Overall	--	--	-
Lusher Ct/Dillon Dam Rd and CO 9	Signalized	EB	F	85	421
		WB	E	71	205
		NB	B	20	266
		SB	B	18	205
		Overall	D	36	-

3.5 EXISTING CONDITIONS SUMMARY

I-70 from Silverthorne to Frisco is a four-lane divided highway that is made up of mountainous terrain with steep grades and seasonably high traffic volumes in the winter months. Safety and operational issues are prevalent in this area due to the terrain and congestion. At the I-70 westbound ramp and CO 9 intersection, the roundabout causes safety and operational issues as a result of high conflicting volumes and an undersized geometry for the conditions. At the

signalized intersection of Lusher Court/Dillon Dam Road and CO 9, there are operational issues in both the eastbound and westbound directions.

3.6 ENVIRONMENTAL OVERVIEW

3.6.1 AIR QUALITY

Compliance with the National Ambient Air Quality Standards (NAAQS) in the state of Colorado is enforced by the Colorado Department of Public Health and Environment (CDPHE), and transportation projects are expected to conform to these standards. Geographic areas that violate a NAAQS for a criteria pollutant are considered “nonattainment areas” for that pollutant, while areas that are below a criteria pollutant standard are considered “attainment” area.

Currently, the study area is designated as attainment/unclassified by the Environmental Protection Agency (EPA) (EPA, 2018b). Historically, the primary NAAQS pollutant of concern in the study area has been particulate matter (PM) (CDOT, 2011c). The dry climate in Summit County contributes to the PM10 pollution from the windblown dust. Re-entrained dust from highway and street sanding also contributes to PM10 missions in the winter. Tailpipe emissions of PM10 are expected to decrease significantly in future years as older, higher-polluting vehicles are replaced by newer, low-polluting vehicles and strict regulatory controls continue to be effective in reducing emissions. However, re-entrained road dust associated with highway sanding (winter only) is the primary source of particulate emissions (PM10 and PM2.5) from motor vehicles (CDOT, 2011e). Unlike tailpipe emissions, which will continue to decrease in the future due to improved engine technologies, re-entrained dust emissions increase as traffic volumes increase. Therefore, re-entrained dust (PM10) in future years is anticipated to be higher than current levels because future traffic volumes would be higher.

Other sources of fugitive dust are sand and gravel mining and construction. Controlled and uncontrolled burns also are a substantial source of air pollution in the Western Slope region.

There are no ambient air quality monitors near the proposed project, or within Summit County. Monitoring has not been conducted in the Summit County area by CDPHE since 2011. In 2012 CDPHE decommissioned the PM10 monitor due to a ten-year downward trend in observed concentrations, as well as difficulty accessing the site. Air quality in the study area is assumed to meet the NAAQS because of the lack of large-scale emission sources in or near the area.

3.6.2 BIOLOGICAL RESOURCES

Resources discussed in this section include threatened, endangered, and sensitive species; general wildlife; migratory birds; vegetation; noxious weeds; Senate Bill 40; and Waters of the

U.S./wetlands. Figure 3-9 and Table 3-14 summarize the findings of the biological resources survey.

Figure 3-9: Biological Resources

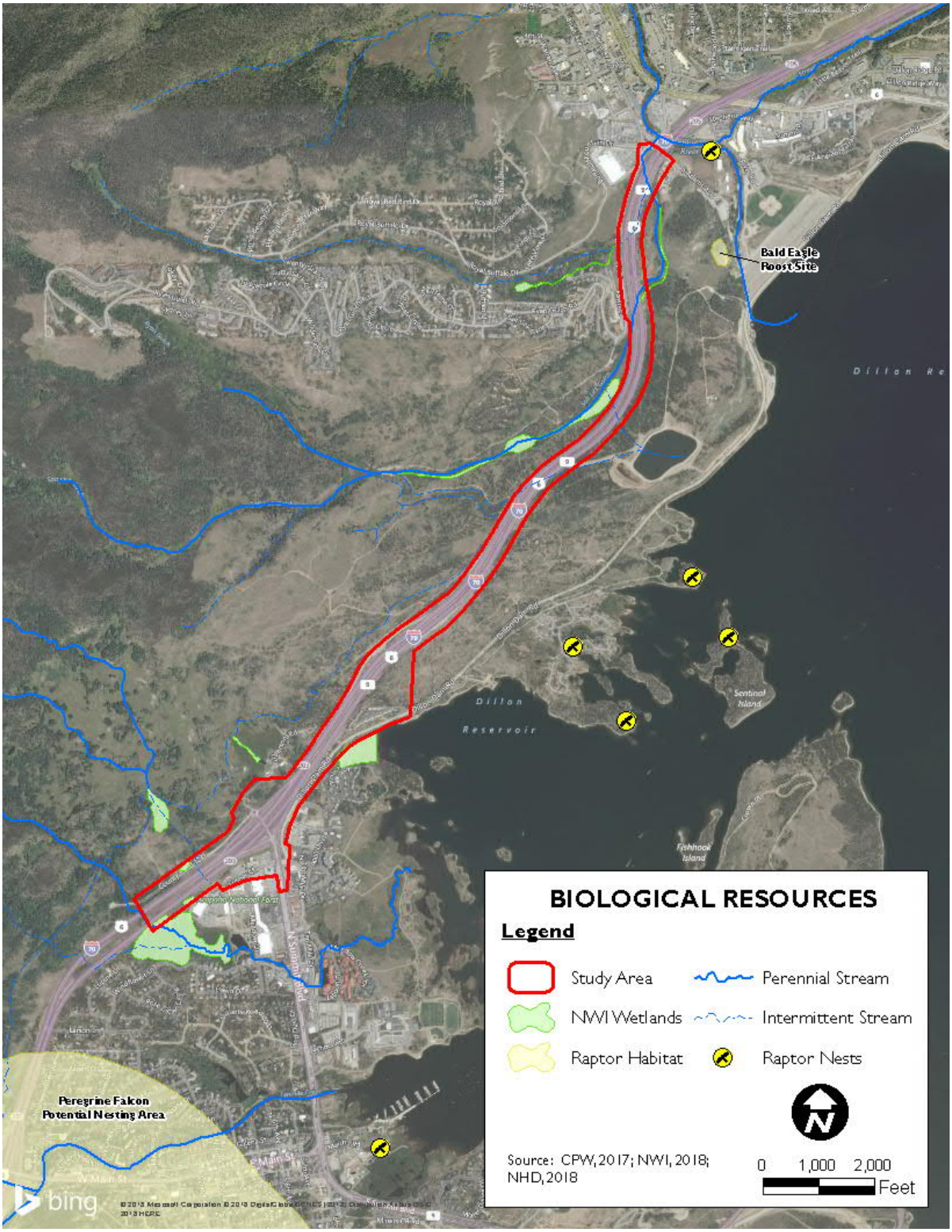


Table 3-14: Biological Resources Summary

Resource	Summary
Threatened and Endangered Species	A habitat review indicated that the Canada lynx, has the potential to occur in or near the study area. No lynx linkage area (areas of critical lynx-specific interference zones that provide broad lynx habitat for various life history stages) has been mapped in the study area. Seven species that are either state-listed or state Species of Special Concern have the potential to be impacted by work occurring in the study area. These species are the American Peregrine Falcon, Bald Eagle, Whooping Crane, Greater Sage Grouse, Colorado River cutthroat trout, boreal toad, and Northern leopard frog.
Wildlife	Potential mapped habitat for elk, mule deer, bighorn sheep, and black bear is in and near the study area. Although these species may occur in the study area.
Migratory Birds	The study area contains suitable habitat for foraging and nesting migratory birds. Potential habitat and known nests for three raptor species—Bald Eagle, Peregrine Falcon, and Osprey—are near the study area.
Vegetation	Based on aerial imagery and ground-based photography, the study area is dominated by upland grasses and is mowed regularly for safety purposes. The dominant habitat mapped in the study area is barren land. The remaining land is dominated by lodgepole pine forest, followed by sagebrush shrubland and aspen forest. Small amounts of grass/forb meadows and riparian forest and shrub habitats also are in the study area. No rare plant communities as designated by the CNHP were mapped in the study area.
Noxious Weeds	Three species of weeds on the Colorado Department of Agriculture's (CDA) Noxious Weed List are known to occur within the study area, and numerous other noxious weeds have been documented in Summit County and have the potential to occur there. Summit County has a Weed Management Plan that defers to the state management goals for noxious weeds.

3.6.3 ENVIRONMENTAL JUSTICE

MINORITY POPULATIONS

Minority populations are identified in census blocks; a total of eight census blocks are located within the socioeconomic analysis area. As shown in Table 3-15, three block groups have a higher minority percentage than Summit County does at 16.4 percent (U.S. Census, 2010).

Table 3-15: Minority Populations

Area	Total Population	Minority Populations (%)					
		Black/African American	Native American	Asian	Hispanic or Latino	Hawaiian/ Pacific Islander	Total Minority
State	5,029,196	4.0	1.1	2.8	20.7	0.1	28.7
Summit County	27,994	0.8	0.3	1.0	14.2	0.1	16.4
Town of Frisco	2,683	0.4	0.3	1.3	5.2	0.1	7.3
Town of Silverthorne	3,887	2.4	0.3	1.3	27.6	0.1	31.7
Census Block Groups in Community Study Area							
Census Tract 100, Block Group 4	1,168	9	—	—	42	0	51
Census Tract 300, Block Group 2	1,929	—	—	2	3	—	5
Census Tract 100, Block Group 5	1,433	—	<1	—	6	1	6

Area	Total Population	Minority Populations (%)					
		Black/African American	Native American	Asian	Hispanic or Latino	Hawaiian/ Pacific Islander	Total Minority
Census Tract 300, Block Group 3	486	—	—	—	5	—	5
Census Tract 300, Block Group 1	432	—	—	—	<1	—	<1
Census Tract 100, Block Group 3	3,016	5	—	—	36	3	44
Census Tract 100, Block Group 2	1,997	—	—	—	20	—	20
Census Tract 200, Block Group 3	1,062	—	<1	<1	21	2	24

LOW-INCOME POPULATIONS

Low-income populations within the study area are identified in census block groups where the percentage of low-income residents exceeds that of Summit County (22 percent).

3.6.4 HAZARDOUS MATERIALS

Eleven facilities (see Figure 3-10) were identified at or within 0.25 mile of the study area, most of which were located within the cities of Frisco and Silverthorne, Colorado. Additionally, many facilities were identified with multiple database listings. During the time of this review, a total of six closed leaking underground storage tank (LUST) sites (one of which closed under Tier II standards), one open LUST site (Ski Country Shell), four operating gas stations with operating underground storage tanks (USTs), two closed aboveground storage tank (AST) sites, one auto repair facility, and two closed spills that required emergency response were reported (see Figure

4). Additionally, one facility—Fulton Concrete/Silverthorne Texaco—was reported in Enforcement and Compliance History Information (ECHOR08), Facility Registry System (FRSCO), Hazardous Materials Incident Reporting System (HMIRSR08), and Resource Conservation and Recovery Act—Non-Generator (RCRANGR08). HMIRSR08 involved a closed spill incident.

3.6.5 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Five previously recorded historic resources have been identified in the study area (see Figure 3-11). The COMPASS search also indicates archaeological resources are present in the study area; these resources have not been mapped due to their sensitive nature. An archaeological survey may be required when the Section 106 process is initiated.

A review of Summit County Assessor data suggests that potentially historic resources from the 1930s to 1950s are located north of the Exit 203 intersection and are likely to be directly impacted by some of the alternatives. Dillon Dam Road, located parallel to the east of I-70, is potentially historic and will require survey if impacted. CO 9/Summit Boulevard, which extends north to south and intersects at Exit 203, also may be eligible for the National Register of Historic Places (NRHP).

3.6.6 NOISE

Due to the proposed improvements at the Frisco interchange (Exit 203) and the addition of an eastbound auxiliary lane (greater than 2,500 feet) from the Frisco on-ramp to the Silverthorne off-ramp, this project is classified as a Type I project, as defined in 23 CFR 772.5 and the CDOT noise guidance. Therefore, potential noise impacts to all noise sensitive receptors within 500 feet of the edge of improvements need to be analyzed.

This desktop analysis identified approximately 22 receptors within the noise analysis area (Figure 3-12). More specifically, there are nine residential, three recreational, and ten commercial receptors. One of the residential receptor points does include the proposed Lake Hill development. The commercial properties include four hotels or motels, four restaurants, one medical facility, and one grocery store with outside seating. The recreational properties include three trailheads with parking. A site visit will be required to ground truth these data.

3.6.7 RECREATIONAL RESOURCES

Figure 3-13 shows the recreational properties in the project study area. Numerous recreational trails can be found near the project study area; however, only four trails are within the project study area. The Dillon Dam Recreational Trail is a hard surface trail that extends for 18 miles

around Dillon Reservoir. The path is managed for recreational use, but it is also heavily used for commuting purposes in the summer. A segment of this trail is within the study area just north of the Town of Frisco. On the southeast side of the interstate, just north of the Heaton Bay Campground, the Mishler and Teller trails are near, or possibly within, the I-70 ROW. On the northwest side of the interstate, the Bohdi and Sunrise trails, both managed by the USFS, are available for hiking, mountain biking, and non-motorized recreational purposes.

While the trail itself is not within the project area, the heavily used Meadow Creek Trail trailhead, located just northwest of the study area, can only be accessed from Frisco through the Exit 203 interchange with a frontage road connection to the roundabout. When the trailhead parking is full, hikers and mountain bikers will park south of the interchange and use the interchange bridge to cross I-70 to get to the trailhead.

Old Dillon Reservoir located south of I-70 ROW is an important local recreational area for fishing. There is a trail from DDR up to the reservoir.

In addition, Summit County Open Space & Trails is currently working on planning and construction of a trail linking existing recreation trails in the Salt Lick Gulch area (north of and adjacent to the study area) with the Exit 203 interchange.

Figure 3-10: Hazardous Materials

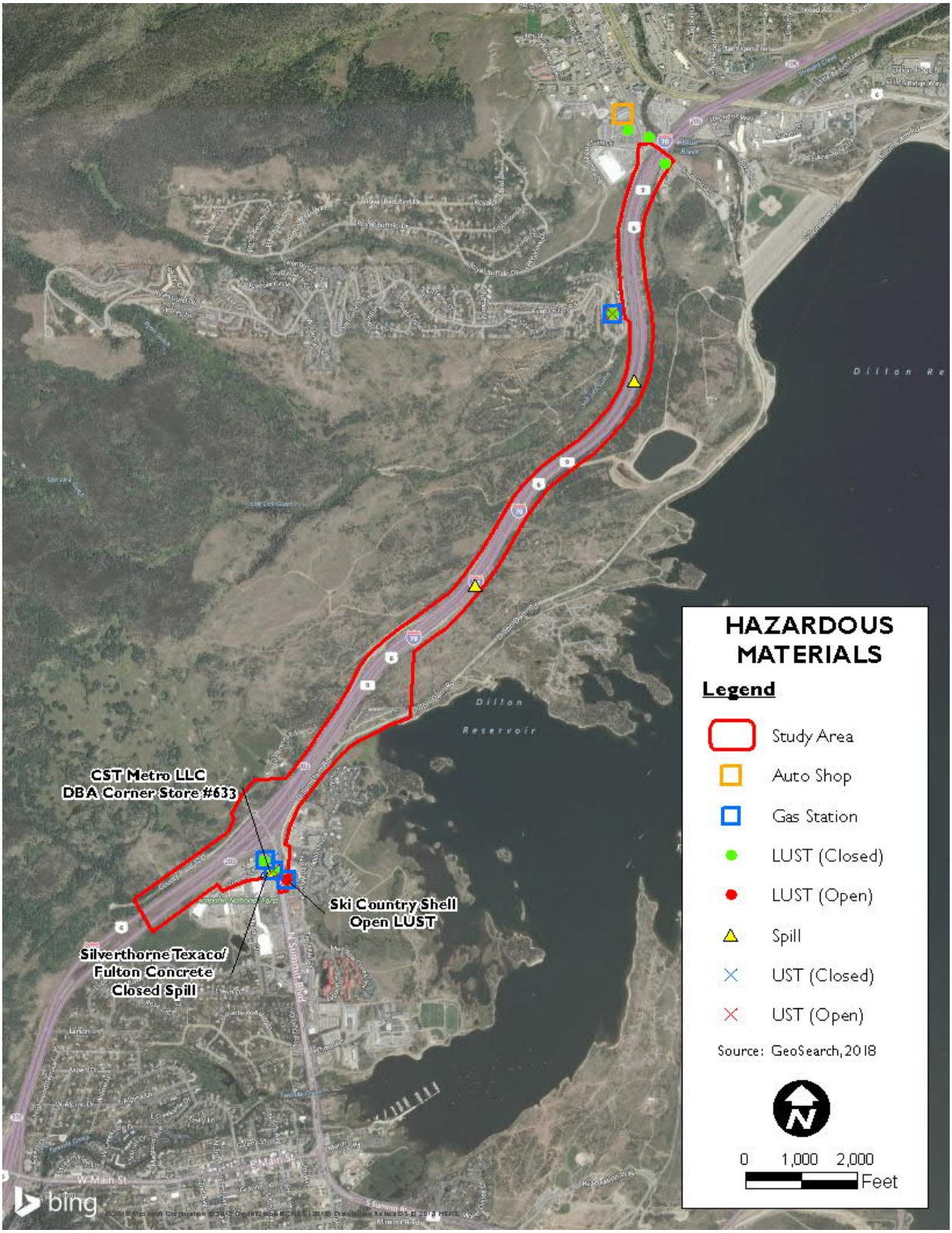


Figure 3-11: Historic Resources

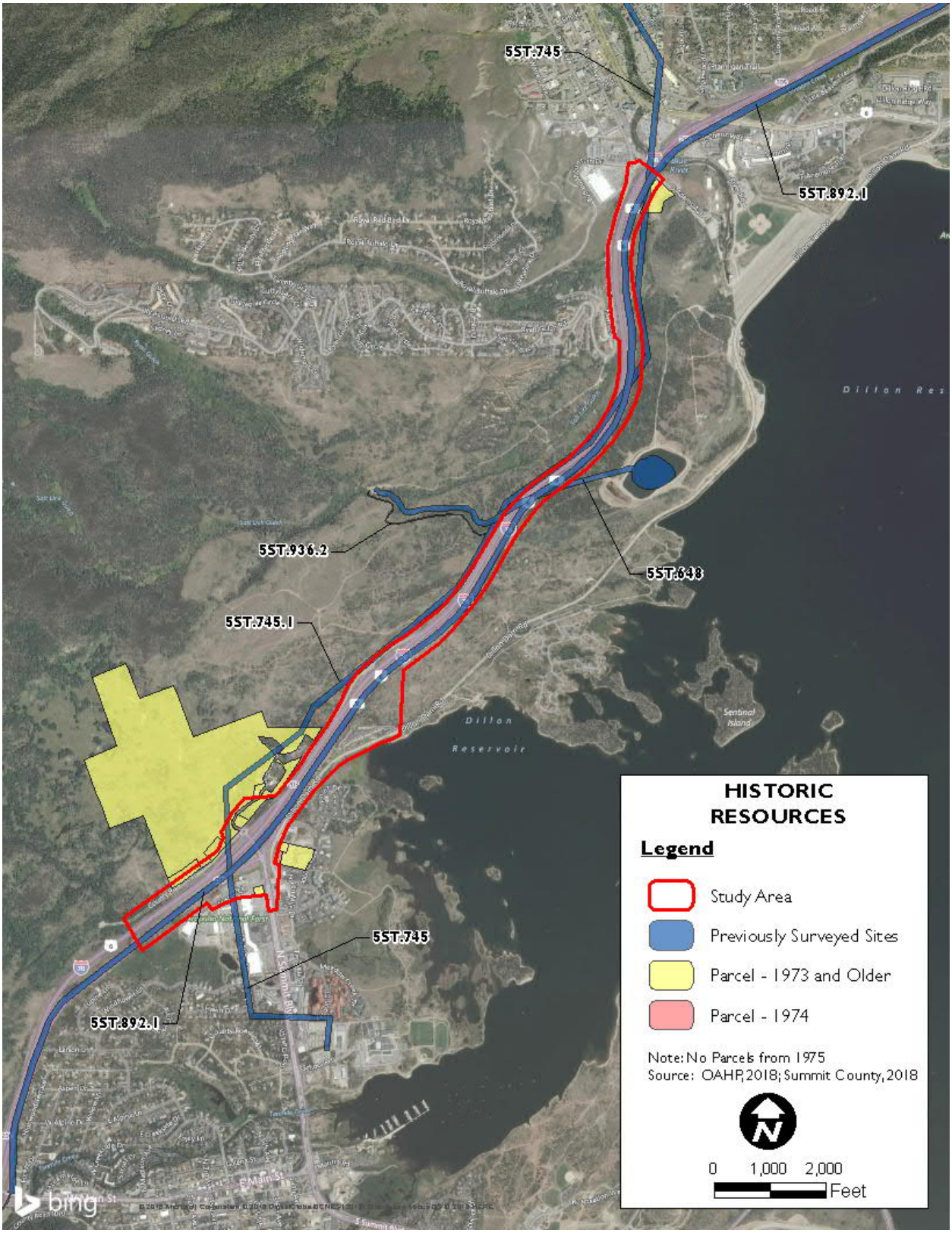


Figure 3-12: Noise Receptor Locations

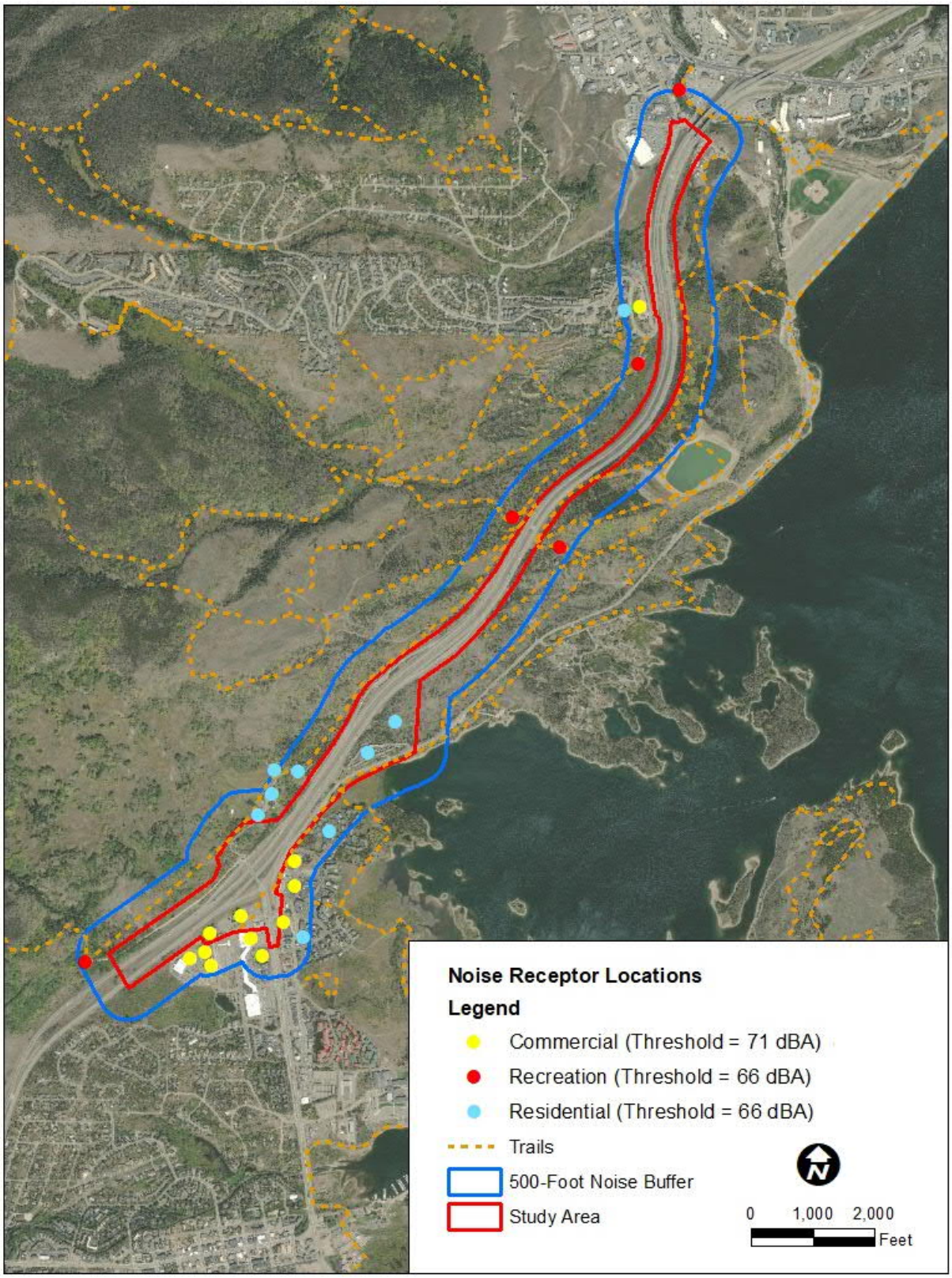
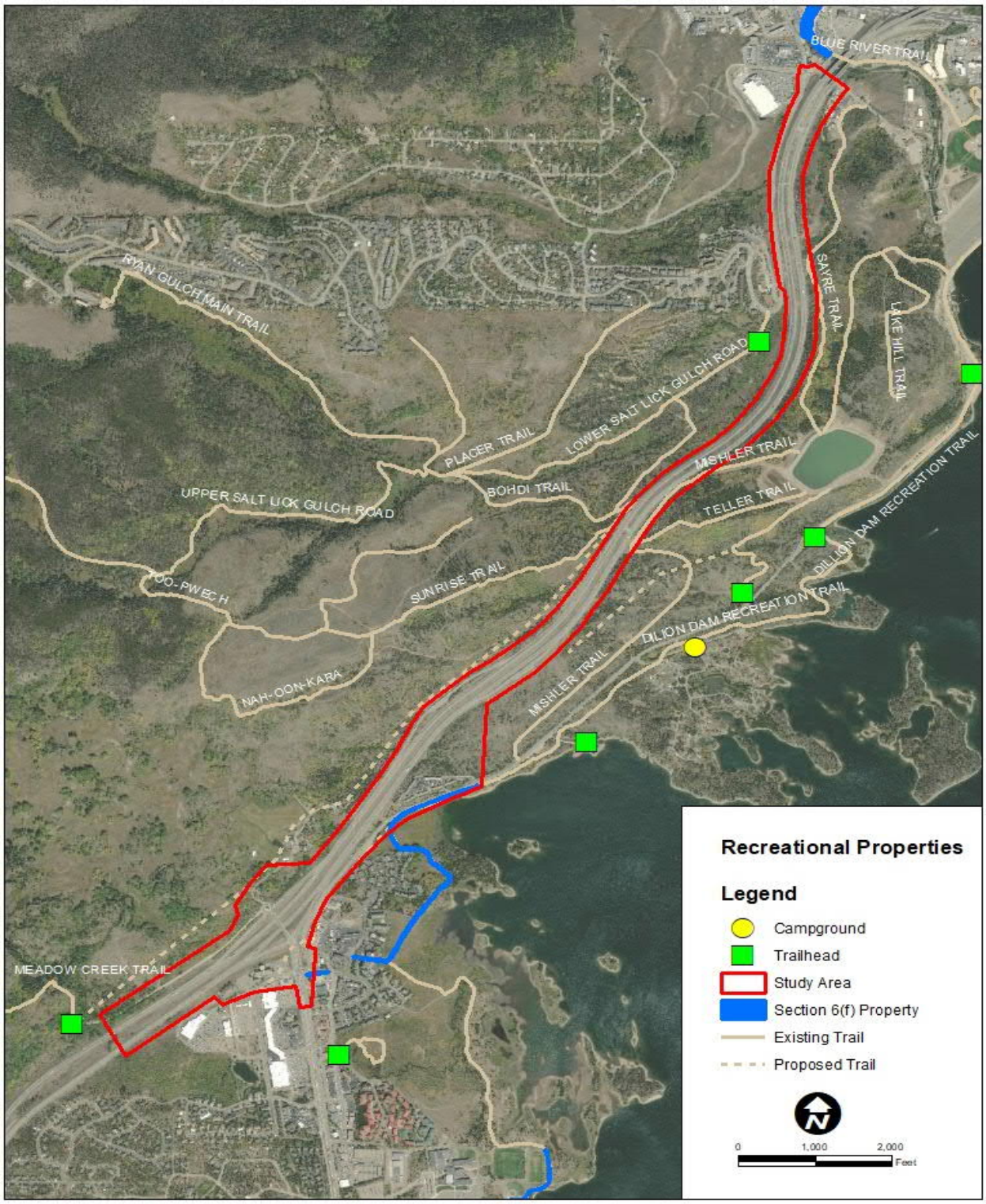


Figure 3-13: Recreational Properties



3.6.8 LAND USE

The gateway area to the Town of Frisco at the CO 9 interchange primarily consists of short-term lodging facilities, grocery stores, gas stations, fast-food restaurants, and other small commercial properties. Adjacent to this is a small, high-density residential area that includes single-family homes and townhomes (CDOT, 2011 and Town of Frisco, 2018).

To the east is a 135-acre natural area preserved for, and managed by, Denver Water. The property serves as important habitat for birds, waterfowl, and small mammals. A multi-use trail also traverses the property, making it ideal for dispersed recreational opportunities. The Summit County zoning designation for this area is A-1, agricultural; however, the Town of Frisco's designated land use is Dispersed Recreation/Open Space (Town of Frisco, 2018).

To the west is recent development at the Base Camp Center at the end of Lusher Court, which includes medical and retail including grocery store. This redevelopment along with existing retail grocery on the west side of CO 9 has led to travel pattern changes at the CO 9 intersections in the past decade. Additionally, The Frisco Transit Center is located one block west of CO 9 along Meadow Drive at Lusher Court. This transit center receives local and regional transit including the Summit Stage, Bustang and Greyhound. There is a master plan in place to expand this transit center.

The Dillon Dam Road area, northeast of Frisco and south of the interstate, is an undeveloped recreation area historically managed by the United States Forest Service (USFS); however, Summit County recently purchased the Lake Hill area, a 44.8-acre parcel that will be used to construct a 436-unit affordable housing development (see Figure 2). The designated land use of this county-owned parcel is Community Facilities and/or Institutional Uses. The rest of the Dillon Dam Road area is still managed by the USFS as Open Space and Developed/Dispersed Recreation. This area includes the Giberson Bay and Heaton Bay Campgrounds.

On the north side of the interstate is an Open Space/Low Density Residential area called the Giberson Preserve. This is a 185-acre, privately owned parcel with 174 acres held under a conservation easement managed by the Continental Divide Land Trust. The remaining 11 acres are lots for single-family homes. The preserve is largely open with wooded areas and streams. The topography of this land ranges from hilly to steep, which limits future development in this area. The Giberson Preserve is bordered on the east, north, and west by White River National Forest lands that are managed primarily as the Eagles Nest Wilderness Area. However, the lands closest to I-70 are managed as elk habitat.

The portion of the project area within the Town of Silverthorne is designated as the Gateway District and encompasses the intersection of I-70, CO 9, and US 6 and includes a variety of

traveler-oriented land uses such as lodging, restaurants, and gas stations. Adjacent to the southern boundary of the town and west of the interstate is an area of mixed lodging and residential use.

3.6.9 SOCIOECONOMICS

POPULATION

From 2000 to 2010, the total population in Summit County increased from 23,548 individuals to 27,994, which is a 19-percent increase. The population in Silverthorne increased by 22 percent from 3,196 individuals to 3,887 in 2010. A similar population increase occurred in Frisco, which had a total population of 2,243 individuals in 2000 and 2,683 in 2010—a 20-percent increase. The population in Summit County had an estimated population of 30,585 in July 2017; a 9-percent increase. Population numbers are expected to increase at an annual rate of 2.8 percent through the year 2033.

ECONOMY

The estimated number of jobs in Summit County is 26,755 and the unemployment rate is less than 2.9 percent. Summit County projects that job numbers will continue to increase over the next 15 to 20 years due to improved technology and the increased ability to telecommute, and personal income being generated from more diverse sources including a growing percentage from investments. The dominant basic industry in Summit County is recreation-based tourism. Thus, the largest industries are Accommodation and Food Services, Retail Trade, Arts, Entertainment, and Recreation. Tourism rates are expected to increase over the next 15 to 20 years.

3.6.10 VISUAL

The project area is located within the Blue River Scenery Analysis Unit, as described in the PEIS. Most of the land in this analysis unit is publicly owned and managed by the White River National Forest. Privately owned lands are located predominantly along the Blue River and Snake River valley bottoms and adjacent to I-70, US 6, and CO 9. Four major corridor resorts are located within Summit County—Copper Mountain, Breckenridge, Keystone, and Arapahoe Basin—as well as many other outdoor year-round recreational opportunities. Historically, Summit County has been an agricultural and ranching area. While there are still some agricultural and large lot rural residential areas, private lands within Summit County have become increasingly urban over the past decade.

LANDSCAPE CHARACTER

The study area is located within the Blue River Valley, which is located at the confluence of Tenmile Creek, Blue River, Straight Creek, and Snake River. It is a broad river valley surrounded by the steep hillsides of the Gore Mountain Range to the west and the Williams Fork Mountain Range (part of the Continental Divide) to the east. Distinctive landscape features within this area include rugged peaks of the Gore Mountain Range within the Eagles Nest Wilderness Area and the rugged peaks of the Williams Fork Mountain Range within the Ptarmigan Wilderness Area. Both areas in the White River National Forest are rated as Class "A" scenery. Deviations from the natural landscape character are associated primarily with community development in Frisco, Silverthorne, and Dillon; minor cut-and-fill slopes associated with I-70, CO 9, and US 6; and Dillon Reservoir.

VIEWPOINTS AND I-70 VIEW

The portion of the I-70 highway within the study area is within foreground views from recreation sites such as the Eagles Nest Wilderness Area and the many trails that are adjacent to the interstate. Views along the interstate are enclosed by local terrain and are dominated by the peaks of the Gore and Tenmile mountain ranges.

The Blue River Valley is developed, and the study area is, therefore, almost completely within foreground views from the communities of Frisco and Silverthorne, as well as from the recreation areas, including the White River National Forest-designated recreation complexes, campgrounds, picnic areas, scenic overlooks, and trails. Sensitive viewpoints within the Blue River Valley also include residential areas, designated recreation areas, and roadways. Primary roads that traverse this area, in addition to the I-70 highway, include CO 9 and US 6.

4 FUTURE CONDITIONS I-70 AND CO 9

4.1 DEMAND FORECASTING

4.1.1 DATA SOURCES

Previous traffic studies, existing continuous traffic counters, CDOT's Cognos data, and additional field counts were utilized in understanding the flow and patterns of traffic in the area. Previous traffic impact assessments (TIAs) within the Town of Frisco were reviewed and provided some understanding of vehicular demand before and after developments have been built-out, including the Basecamp (2012), Lake Hill (2015), and Kum and Go (2015).

Through CDOT's Cognos network and OTIS data with continuous and short duration traffic counts, traffic volumes were available for mainline I-70. For the timeframe of analysis, historical data were considered within the past five years. These were utilized in determining direction demands, peak hour conditions, and for estimating ramp volumes and I-70 mainline' s ability to accept traffic from CO 9.

SEASONAL TRAFFIC

Due to the nature of recreational visitors in the I-70 mountain corridor, seasonal patterns and demand were studied to better understand the fluctuations in traffic throughout the year. To understand this, continuous counter data from CDOT's Cognos and OTIS networks was used to identify seasonal traffic patterns and compared to design traffic volumes.

30TH DESIGN HOURLY VOLUME

The 30th design hourly volume provides a reasonable estimate of peak traffic for design, helping to exclude outliers and finding a practical design volume. Additionally, the 30th design hourly volume helps to account for seasonality variations, given the high number of recreational land uses in the corridor. For the study area, a year of hourly volumes was ranked to determine the range of peak hour volumes, and analyzed to identify a best-fit for the design hour. It was determined that a design hour within the 20th and 30th highest hourly volumes is most suitable for the I-70 corridor. For I-70, field traffic counts were obtained on December 30, 2017, which ranks as the 21st highest volume for the year; therefore, because this count date falls within the acceptable range, no additional adjustments were necessary from the existing I-70 volumes. For CO 9 north of Main Street, July weekday traffic counts were factored up to adjust for the 30th peak hour volume.

4.1.2 DATA VERIFICATION

To ensure traffic data reflects the most accurate information and reasonable assumptions for future scenarios, traffic forecasting data was reviewed by CDOT at each decision point within the planning and traffic forecasting process. This review provided an opportunity for CDOT to verify traffic volumes, assumptions, and results. Some of the key decisions included:

- Existing traffic volumes (additional counts, count dates, seasonal adjustment, etc.)
- Traffic growth rates and planned developments (to be included with future traffic forecast)
- Future year traffic volumes

4.1.3 TRAFFIC FORECASTING

A Travel Demand Forecasting Approach Memo was prepared to obtain agreement from CDOT, FHWA, and CDOT's local partners. The methods and approach are based on the July 2018 CDOT Traffic Analysis and Forecasting Guidelines.

SKETCH PLANNING TECHNIQUE

Summit County, where the Exit 203 interchange is located, falls within the rural mountain areas of Colorado. As such, Summit County does not have a specific travel demand model for the local area. As of 2018, CDOT was finalizing the Statewide Travel Model, and the most current and acceptable modeling data available was utilized, however, a calibrated and verified future year was not yet available.

For this study, sketch planning tools were utilized to obtain a general order-of-magnitude estimate for future travel demand and operations. As noted in the CDOT *Traffic Analysis and Forecasting Guidelines*, sketch planning is a useful method for providing a simple, high-level estimate of traffic capacity to infrastructure improvements. This study used both factor and trip generation/distribution methods for forecasting.

- **Factor method** predicts future travel demands based on historical data and trends. Historical traffic counts and growth rates will be analyzed to predict an appropriate future growth rate, which will then be used in determining future travel demands.
- **Trip generation/trip distribution method** is used to predict future traffic based on anticipated future developments. With knowledge of some upcoming developments in the study area, these trips will be applied toward future traffic estimates.

GROWTH RATE

For traffic forecasting, it is typical to analyze traffic volumes with a 20-year horizon after construction. Based upon the upcoming CDOT 2045 Statewide Transportation Demand Model, volumes for the study reflect a future year of 2045. This will meet the 20-year horizon and provide forecasted traffic volume verification and consistency with planning efforts.

A flat annual growth rate of 1.62% was used to calculate the projected 2045 volumes. The growth rate reflects historic growth rates, travel demand forecasts from CDOT studies, the Intermountain Transportation Planning Region's (TPR) forecasts, as well as transportation and comprehensive plans for the Town of Frisco and Summit County. Considerations in those studies and plans included tourism traffic, population growth, and through traffic.

Trip generation and trip distribution from surrounding developments was considered in analyzing future travel demands. Some of these associated developments include, but are not limited to, the Basecamp Center, Lake Hill residential development, Frisco Transit Center, and Foote's Rest site redevelopment.

INTERMOUNTAIN REGIONAL TRANSPORTATION PLAN

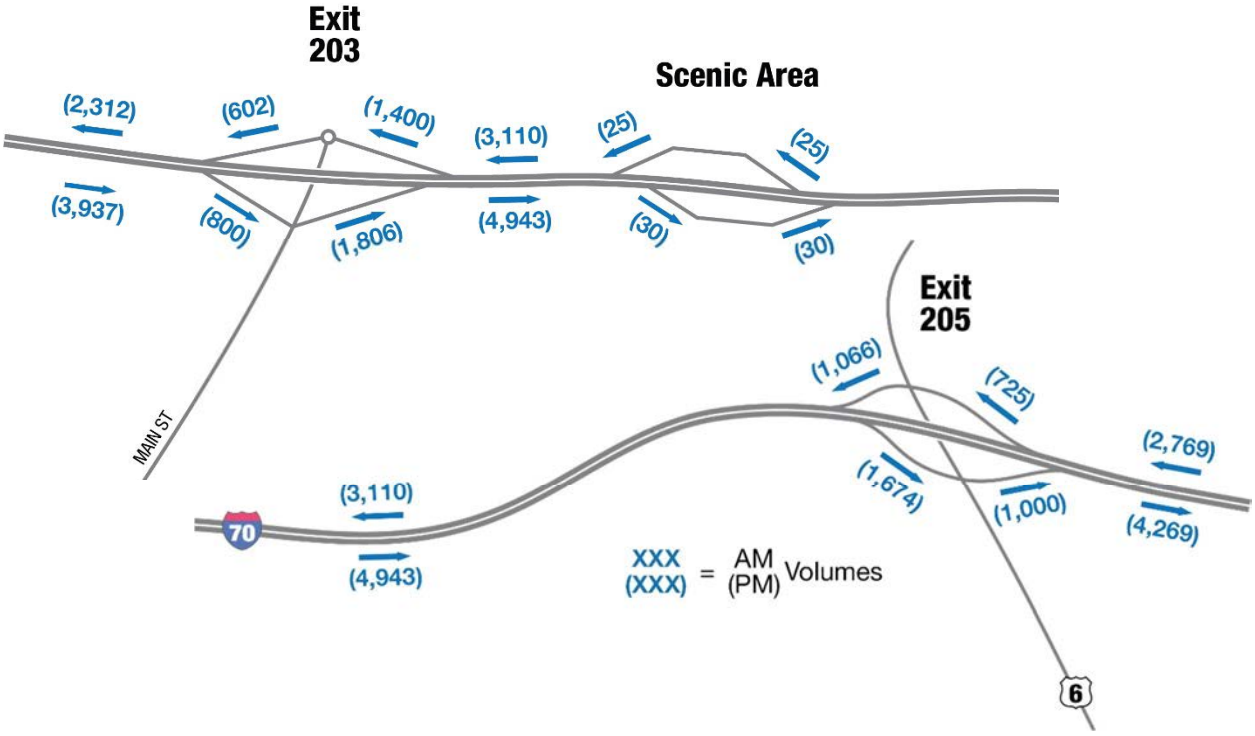
In evaluating the future travel demands of the corridor, the CDOT 2040 Intermountain Regional Transportation Plan was referenced in understanding larger goals and demands for the region. This report provided a broader perspective of issues and challenges in the Intermountain Region, as well as shedding light on stakeholder comments. The Intermountain Transportation Planning Region includes Eagle, Garfield, Lake, Pitkin, and Summit Counties.

4.2 20-YEAR TRAFFIC VOLUMES (2045)

4.2.1 I-70 MAINLINE

Figure 4-1 displays the 2045 projected PM peak hour traffic volumes along I-70 from Exit 203 to Exit 205. The eastbound and westbound through traffic volumes were determined by forecasting traffic demand to 2045 based on average annual growth, the Silverthorne Planning and Environmental Linkages (PEL) Study, and two recent traffic studies in the area (refer to *Travel Demand Forecasting Report* for this study).

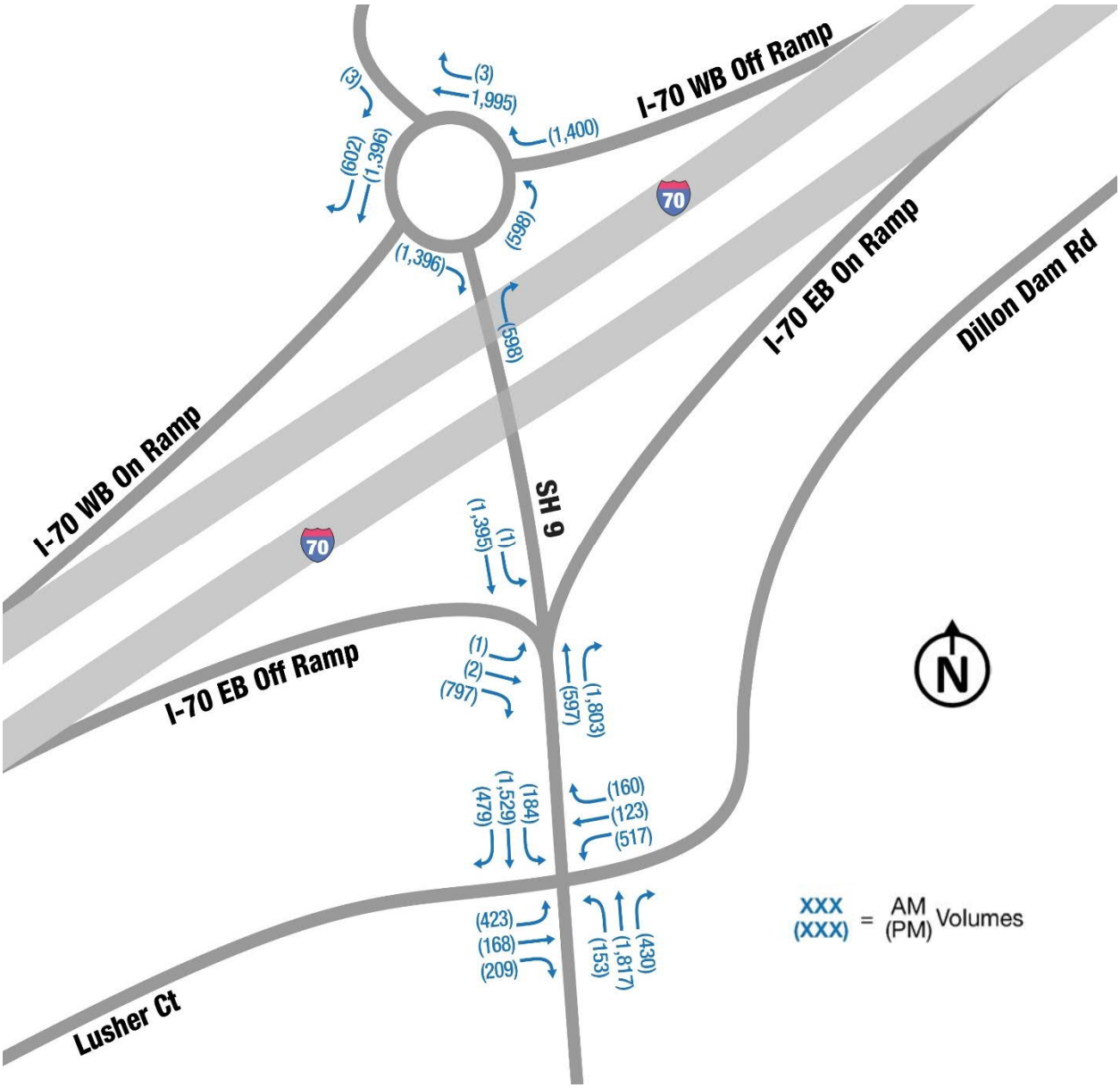
Figure 4-1: Future (2045) PM Peak Hour Traffic Volumes along I-70



4.2.2 CO 9

Figure 4-2 shows the projected 2045 turning movement counts for a PM peak hour along CO 9 from the I-70 westbound ramp to Lusher Court/Dillon Dam Road. The traffic volumes also were determined by forecasting traffic demand to 2045 based on average annual growth, the Silverthorne PEL, and two recent traffic studies in the area.

Figure 4-2: Future (2045) CO 9 PM Peak Hour Turning Movement Counts



4.3 2045 EXISTING CONDITION TRAFFIC OPERATIONS

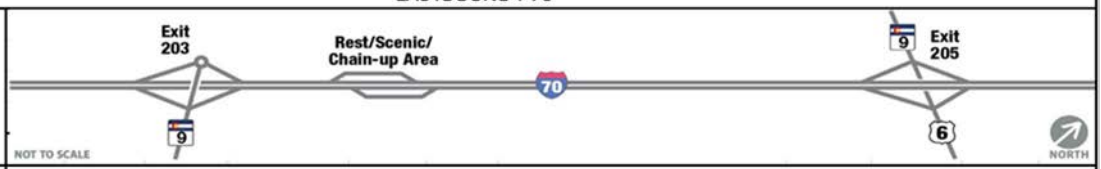
4.3.1 I-70 MAINLINE

The 2045 No Action (NA) model was developed from the 2017 existing conditions models by forecasting traffic demand to 2045 and incorporating planned changes in the corridor that are independent of the project. Currently, there are no planned changes to the geometry along the I-70 corridor within the project limits; thus, the 2045 NA model has the same geometry as the existing conditions.

Figure 4-3 shows the results of the 2045 NA analysis for eastbound I-70. As traffic volumes increase, the freeway will begin to experience more segments that operate at LOS F. Congestion will result at the Exit 205 off-ramp and will extend back to and beyond Exit 203.

Figure 4-3: Eastbound I-70 2045 No-Action Conditions HCS Results

EASTBOUND I-70



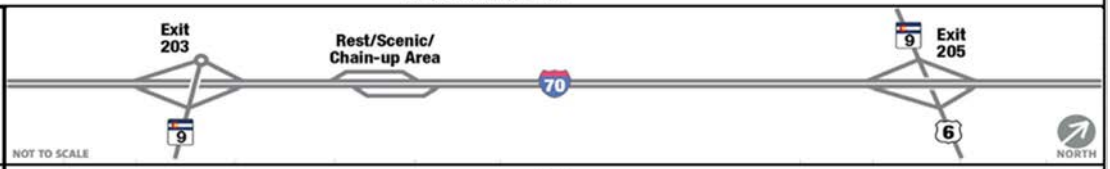
Time Period	LOS										
4:00 - 4:15 PM	F	F	C	F	F	F	F	F	C	C	B
4:15 - 4:30 PM	F	F	F	F	F	F	F	F	C	C	C
4:30 - 4:45 PM	F	F	F	F	F	F	F	F	C	C	C
4:45 - 5:00 PM	F	F	F	F	F	F	F	F	C	C	C
Segment #	1	2	3	4	5	6	7	8	9	10	11
Segment Type	B	D	B	W	B	M	B	D	B	M	B

Note: B= Basic Segment, D = Diverge Segment, M = Merge Segment, O = Overlap Segement, and W = Weave Segment.

Figure 4-4 shows the results for the 2045 NA analysis for westbound I-70, which is similar to the existing conditions, but the level of congestion on I-70 will increase due to the limited capacity of the Exit 203 off-ramp. Congestion on westbound I-70 will continue to increase back to the east toward and even beyond Exit 205.

Figure 4-4: Westbound I-70 2045 No-Action Conditions HCS Results

WESTBOUND I-70



Time Period	LOS										
4:00 - 4:15 PM	A	A	A	F	F	F	B	C	C	C	B
4:15 - 4:30 PM	B	B	A	F	F	F	F	C	C	C	B
4:30 - 4:45 PM	B	B	A	F	F	F	F	F	F	B	B
4:45 - 5:00 PM	B	B	A	F	F	F	F	F	F	F	F
Segment #	11	10	9	8	7	6	5	4	3	2	1
Segment Type	B	M	B	W	B	D	B	M	B	D	B

Note: B= Basic Segment, D = Diverge Segment, M = Merge Segment, O = Overlap Segement, and W = Weave Segment.

4.3.2 CO 9

The 2045 No Action (NA) model was developed from the 2018 existing conditions models by forecasting traffic demand to 2045 and incorporating planned changes in the corridor that are independent of the project. Currently, there are no planned changes to the geometry along the CO 9 corridor within the project limits. Thus, the geometry for the NA conditions is the same as

the existing conditions. It also was assumed that the traffic control at the intersection would remain the same as the existing conditions, except for optimizing the signal timing at the Lusher Court/Dillon Dam Road intersection. Table 4-1 shows that all intersections will experience worse operations compared to existing conditions and will be at LOS F in 2045. In addition, the WB I-70 exit ramp queues at the roundabout will increase to more than 200 vehicles or about one mile in length.

Table 4-1: Future (2045) No-Action Conditions

Intersection		Approach Direction	LOS	Delay (sec/veh)	95%ile Queue (ft)
Name	**Type**				
I-70 Westbound Ramps and CO 9	Roundabout	EB	D	26	28
		WB	F	571	1,739
		NB	A	8	99
		SB	D	27	25
		Overall	F	387	-
I-70 Eastbound Ramps and CO 9	One-Way Stop Control	EB	F	134	149
		NB	A	0.0	116
		SB	A	9	74
		Overall	--	--	-
Lusher Ct/Dillion Dam Rd and CO 9	Signalized	EB	F	153	624
		WB	F	171	583
		NB	F	106	251
		SB	F	84	510
		Overall	F	114	-

4.4 2045 FUTURE CONDITIONS SUMMARY

Westbound I-70 already experiences congestion and poor operations due to a lack of capacity at the Exit 203 off-ramp and the interchange intersections along CO 9, primarily the roundabout at the westbound ramp intersection. By 2045, the conditions will continue to degrade, with congestion and queuing issues expected to reach as far east as Exit 205. Making capacity improvements to the Exit 203 westbound off-ramp and/or intersections along CO 9 so that there is less chance of the WB off ramp queue extending back onto I-70 mainline, which will decrease the risk of rear-end crashes on WB I-70, but it is still expected that there will be congestion and operational issues in 2045.

Eastbound I-70 operates well under existing conditions, but in 2045 the lack of capacity between Exit 203 and Exit 205 is projected to result in LOS F for these segments of I-70, including the segments west of Exit 203. Adding additional capacity in the form of an auxiliary lane to eastbound I-70 is expected to improve the operations and reduce accidents between Exit 203 and Exit 205, but it will not resolve the need for improvements west of Exit 203.

The intersections along CO 9 will operate poorly (LOS F in most cases) without improvements. Increased capacity is expected to improve the operations of the westbound ramp intersection and help reduce spill-back queuing onto I-70, but the Lusher Court/Dillon Dam Road intersection will continue to operate at LOS F.

5 CONCEPT DESIGNS

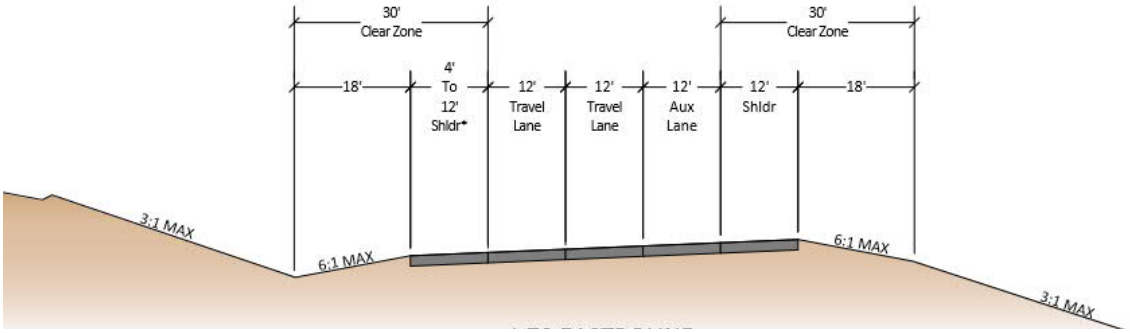
5.1 EASTBOUND I-70 AUXILIARY LANE

The 2045 eastbound I-70 option proposes widening eastbound I-70 to include one lane that is a continuous auxiliary lane from Exit 203 to Exit 205. At the scenic overlook/chain-up station, the auxiliary lane would continue through on I-70 with normal deceleration and acceleration lanes for the ramps. At Exit 205, the right-most lane (new continuous auxiliary lane) would be an exit-only lane. There would also be an optional exit lane at Exit 205, to match the existing two-lane exit ramp. The issue related to the lane balance at Exit 205 is discussed in more detail in Section 5.1.2.

The placement and alignment of the auxiliary lane is highly dependent on the cut and fill locations along the I-70 alignment. The proposed cross section for the I-70 is shown in the top half of Figure 5-1 and includes maximum standard lane widths (travel and shoulder), clear zones, and slope conditions. There are several locations where the additional lane may require modifications to the cross section (bottom half of Figure 5-1) including steeper slopes or retaining walls with clear zone protection (guardrail, crash barrier). Additional considerations could include narrower shoulder widths (i.e. four-foot to ten-foot shoulders) if allowable, to minimize slope impacts.

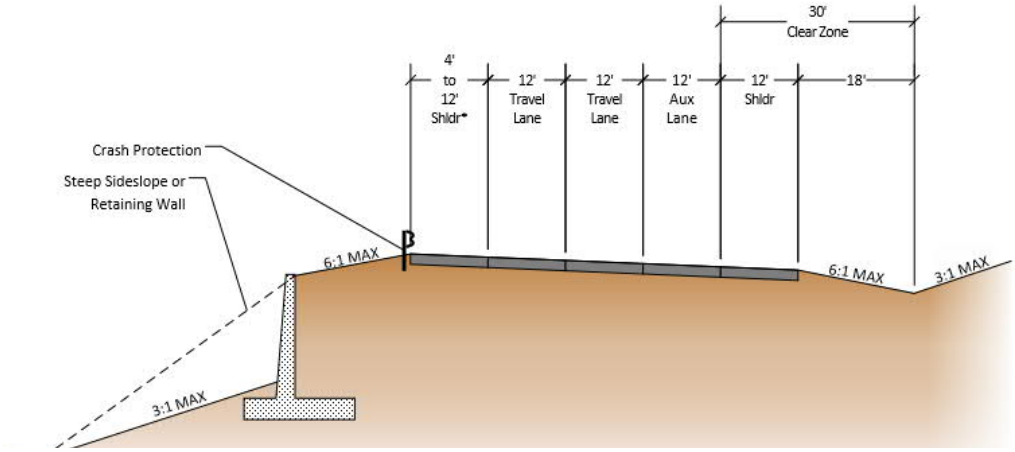
Figure 5-2 shows a proposed concept for the I-70 auxiliary lane. Depending on the location, the widening of I-70 to accommodate the auxiliary lane could be accomplished moving the I-70 alignment into the median or to the outside.

Figure 5-1: Proposed Eastbound I-70 Auxiliary Lane Typical Sections



EASTBOUND I-70

* Where design hour volumes for truck traffic exceeds 250 vehicles/hour, a paved shoulder width of 12 feet should be considered.



EASTBOUND I-70

Figure 5-2: I-70 Eastbound Auxiliary Lane Concept (Exit 203-205)

Figure 5-2: I-70 Eastbound Auxiliary Lane Concept (Exit 203-205) CONTINUED

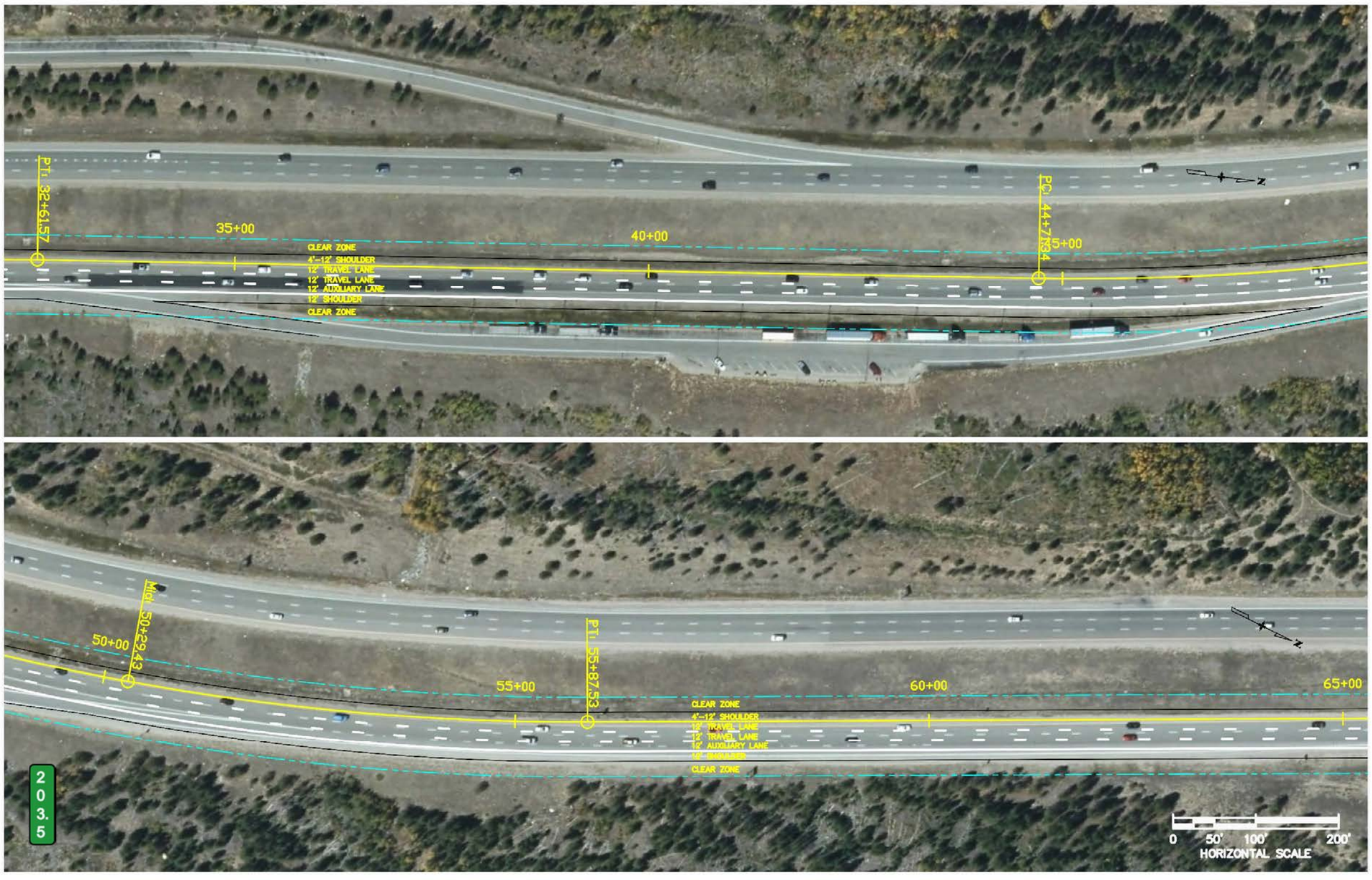


Figure 5-2: I-70 Eastbound Auxiliary Lane Concept (Exit 203-205) CONTINUED

Figure 5-2: I-70 Eastbound Auxiliary Lane Concept (Exit 203-205) CONTINUED

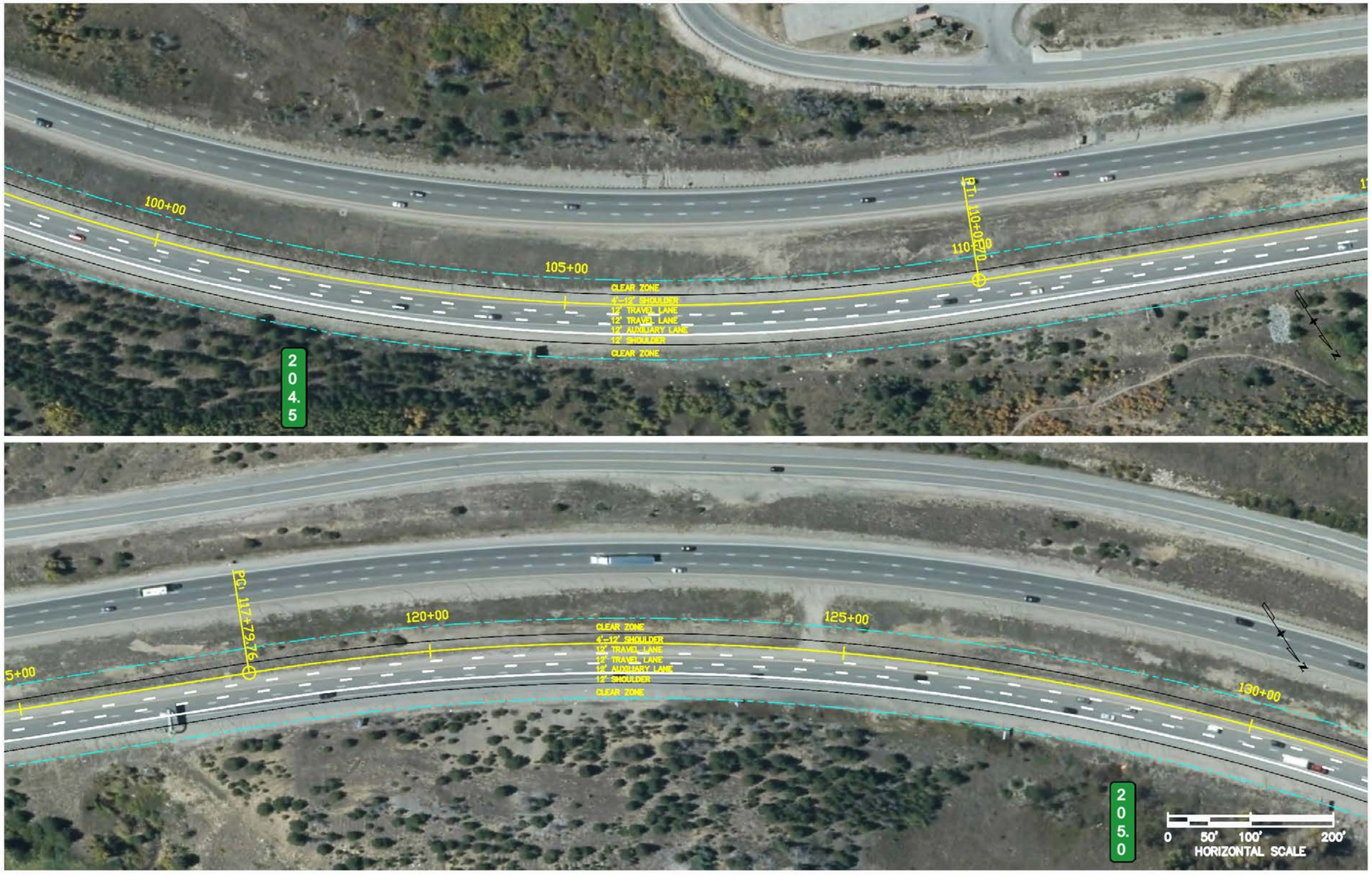


Figure 5-2: I-70 Eastbound Auxiliary Lane Concept (Exit 203-205) CONTINUED

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5.1.1 EXIT 203 TO EXIT 205

At the Exit 203 interchange, it is anticipated that the EB physical gore point would not change due to the widening. In this option, the existing on-ramp becomes the concept auxiliary lane to the scenic overlook/chain-up station. However, at the scenic overlook/chain-up station, the alignment of I-70 would shift into the median to allow for the development of the off-ramp into the scenic overlook/chain-up station and maintain the auxiliary lane. At this location, even though clear zone standards are meet in both directions, the EB and WB I-70 alignments are closer together and the slope conditions in the median will change. Considerations may need to be made for guardrail protection to prevent vehicle crossovers.

Adjacent to and east of the scenic overlook/chain-up station, the I-70 widening would continue into the median to maintain the outside shoulder edge. On I-70 east of the scenic overlook/chain-up station, the on-ramp would maintain the same geometry, but tie into the auxiliary lane instead of the mainline I-70 as it does in its current configuration.

East of the scenic overlook/chain-up station on-ramp merge point, the alignment of I-70 would then be balanced to take advantage of the existing topography and available shoulder and clear areas as much as possible. The location between Sta. 70+00 and 115+00 is particularly challenging topography because of the steep side slopes. In locations like this, the slope and clear zone criteria may not be met without the use of retaining walls and/or crash protection.

Near Sta. 140+00, the current I-70 geometry includes the development of an EB third lane across the Blue River bridge. This lane becomes the EXIT ONLY lane at Exit 205. The auxiliary lane concept ties into this geometry. The discussion of the lane balance at Exit 205 is discussed in Section 5.1.2 below.

5.1.2 EXIT 205 LANE BALANCE

The EB lane balance at Exit 205 is currently one mainline through lane, one mainline through/exit lane, and one exit lane for a total of three lanes Figure 5-3. In the current condition, the right most lane is developed as an exit lane approximately 1,200 feet west of the physical gore point. As a result, the I-70 bridge over the Blue River is three lanes wide. However, because of the lane drop at Exit 205, the I-70 bridge over Blue River Parkway is only two lanes wide.

The skew of I-70 over Blue River Parkway creates a short distance between the eastbound gore point and the EB ramp intersection with Blue River Parkway. The existing two-lane exit at Exit 205 is a condition required to accommodate the deceleration and storage needs at the EB ramp intersection with Blue River Parkway.

The options for tying the proposed eastbound auxiliary lane into Exit 205 are

- The lane balance remains as is; the eastbound auxiliary lane is an extension of the current exit lane to the west and becomes a dropped lane (EXIT ONLY) at Exit 205 (Figure 5-3). This condition creates a lane changing/weaving issue for through vehicles approaching Exit 205. Large vehicles in the auxiliary lane that are continuing through are trapped in the EXIT ONLY lane and must change lanes to continue through. This is similar to the condition for westbound traffic at the same interchange. However, the westbound direction has additional challenges that include a steep substandard downgrade and a large sweeping curve at the bottom of the hill at Exit 205. This condition suggests that EB trucks coming down the hill that will be traveling at a much slower speed than passenger vehicles and will merge from the aux lane into the through lane with a large speed differential. The combination of these issues may create undesirable maneuvering conditions for large vehicle, especially in poor weather conditions.
- The lane balance is modified; the eastbound auxiliary lane continues as a through lane with an optional exit lane at 205. This lane balance condition addresses the lane changing/weaving issue described above. Vehicles in the auxiliary lane will be able to remain in the lane and continue east across the I-70 bridge over Blue River Parkway (US 6). This option requires a third lane to be added to the existing bridge over Blue River Parkway (US 6). As discussed above, because of storage and alignment issues a two-lane exit is a consideration for eastbound I-70. There are two options to accommodate this condition.
    - The additional exiting lane could be developed off the auxiliary lane just after the I-70 bridge over the Blue River, approximately 650 feet west of the physical gore point (Figure 5-4). The lane cannot be developed prior to this location because the current bridge can only accommodate three lanes. Widening the bridge would allow for a full length second exit lane to meet appropriate deceleration length.
    - Although not an exit lane, an additional storage lane could be provided on the existing ramp lane (Figure 5-5). This lane could be developed to the left and tie into existing lane geometry on the ramp. This option forces the deceleration of exiting vehicles to occur in the auxiliary lane. The additional storage would begin just after the physical gore point.

  The ability and benefit to widen the bridge over the Blue River and the number of exit lanes from the continuous auxiliary lane will be studied in future project development activities.

Figure 5-3: Existing I-70 Eastbound Lane Balance at Exit 205

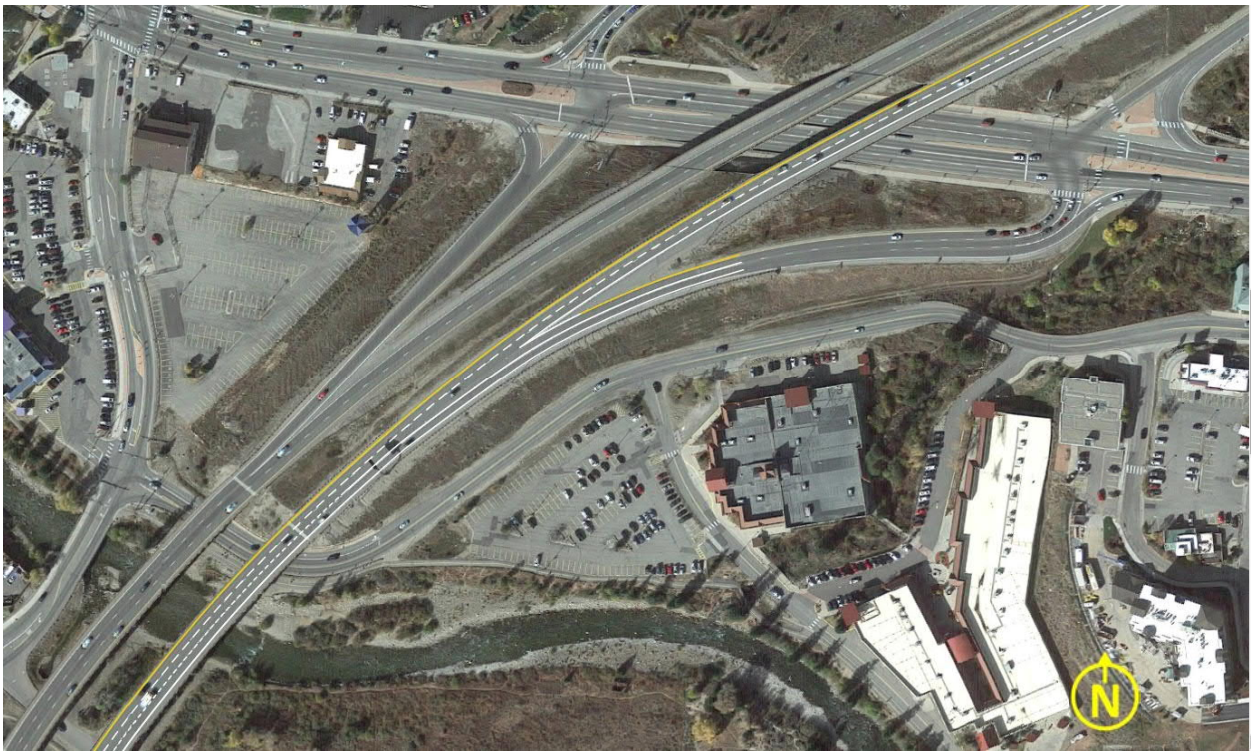
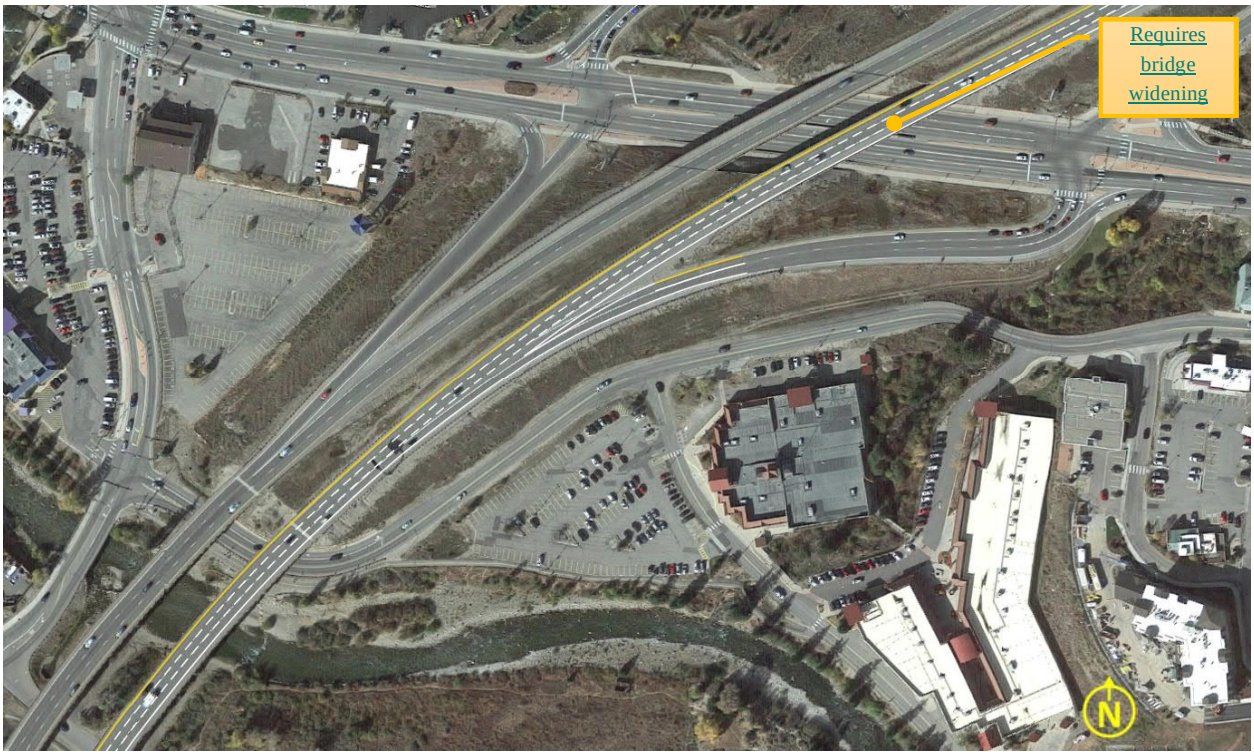


Figure 5-4: Modified I-70 Eastbound Lane Balance at Exit 205 – Exit Lane Developed on I-70

Figure 5-5: Modified I-70 Eastbound Lane Balance at Exit 205 – Exit Lane Developed on Ramp



5.2 SCENIC OVERLOOK/CHAIN-UP STATION

Current operations at the scenic overlook/chain-up station indicate a variety of issues including truck parking congestion during winter conditions, underutilized truck parking capacity, parking on the shoulders, and undesirable vehicle interactions between trucks and passenger vehicles. While this project does not propose to correct these issues at this time, any proposed increase in capacity or improvement in operations at the scenic overlook/chain-up station may affect decisions made about the alignment of I-70. As such, the layout of the scenic overlook/chain-up station was considered in this feasibility study.

Several options are proposed for consideration in future decision-making related to the auxiliary lane and the alignment of I-70. It is assumed that the current south edge of the scenic overlook/chain-up station will not change because of the steep side slope to the south. Any option that moves the south edge will likely have retaining wall costs that will be greater than costs associated with other options presented below.

It is also noted that the options presented below do not necessarily improve utilization issues that might be better served with technology solutions such as call ahead parking reservations, overhead open space indicators, in-cab parking information, or VMS information posted in advance.

5.2.1 MODIFIED EXSITING SCENIC OUTLOOK/CHAIN-UP STATION LAYOUT

This option adds minor capacity to the existing scenic overlook/chain-up stations for large vehicles. Figure 5-6 shows that additional capacity may be added to the outside shoulders and provide an additional eight spaces for truck parking and chain-up. This option only adds capacity and does not improve the vehicle interaction – in fact, it may make conditions even less desirable.

This option has little effect on the proposed auxiliary lane alignment of I-70.

Figure 5-6: Modified Existing Scenic Overlook/Chain-up Station Layout

5.2.2 PARALLEL PARKINGSCENIC OVERLOOK/CHAIN-UP STATION LAYOUT

Figure 5-7 shows a layout that separates truck movements from passenger cars after entering the scenic overlook/chain-up station. Trucks would be directed to the left upon exiting I-70 and into the scenic overlook/chain-up station. Passenger vehicle parking would not change. Existing truck parking would be utilized, but a new driving aisle and a new row of up to nine additional parallel parking spaces could be added to the north side. Trucks would enter/exit the scenic overlook/chain-up station using the new driving aisle and access the exit ramp to the east. This layout minimizes truck and passenger car interactions and provides nine additional spaces for truck chain-up and parking.

This option has an impact on the proposed auxiliary lane alignment of I-70, moving the alignment farther north into the median to accommodate the additional parallel parking spaces. This impact can be minimized with narrowed shoulder widths on I-70 and the use of concrete barrier to separate I-70 from the parking spaces.

Figure 5-7: Parallel Parking Scenic Overlook/ Chain-up Station Layout

5.2.3 DIAGONAL PARKING SCENIC OVERLOOK/CHAIN-UP STATIONLAYOUT

Like the parallel parking option, Figure 5-8 shows a layout that separates truck movements from passenger cars after entering the scenic overlook/chain-up station. Trucks would be directed left upon exiting I-70 into the diagonal parking chain-up area. Passenger vehicle parking would not change. This layout provides five additional parking spaces and some separation of vehicle interactions.

This option has the greatest impact on the proposed auxiliary lane alignment of I-70, moving the alignment farther north into the median to accommodate revised layout and the diagonal parking spaces. This impact can be minimized with narrowed shoulder widths on I-70 and the use of concrete barrier to separate I-70 from the parking spaces.

Figure 5-8: Diagonal Parking Scenic Overlook/Chain-up Station Layout

5.3 INTERCHANGE DESIGN OPTIONS

The evaluation of the interchange options is based on the need to address safety and capacity issues related to the westbound (WB) off-ramp from I-70. Initial options for the interchange were developed to fit within the existing right of way and utilize existing infrastructure. As operation challenges were better understood additional alternatives requiring full reconstruction were developed. Interchange options were evaluated using a year 2045 planning horizon and included five alternatives as noted below.

1. Two-lane roundabout at the WB ramps and a signalized intersection at the EB ramps
2. Signalized intersection at the WB ramps and a signalized intersection at the EB ramps
3. Diverging Diamond Interchange (DDI)
4. Single point urban interchange (SPUI) combining the EB and WB ramps
5. Tight urban diamond interchange (TUDI), which includes a signalized intersection at the WB ramps and a signalized intersection at the EB ramps

All options assume that the access to the Meadow Creek Trailhead is relocated from the existing roundabout to an intersection on Giberson Road to the north.

5.3.1 TWO-LANE ROUNDABOUT

The two-lane roundabout option adds an additional lane to the roundabout at the WB ramps and an additional lane on southbound (SB) CO 9 over I-70 and into the EB ramp intersection. Because of the limited space available on the existing bridge, the option would prohibit SB left turn access on to EB I-70. An additional storage lane (approximately 500 feet) is included on the WB ramp to provide additional queuing capacity for the WB exit traffic. The objective is to eliminate the queuing and congestion in the WB auxiliary lane on I-70. This option also includes a signalized intersection at the eastbound (EB) ramps and coordination with a signalized intersection at CO 9 and Lusher Court/Dillon Dam Road (DDR) intersection. The CO 9/DDR intersection options are discussed in more detail below in Section 5.4.

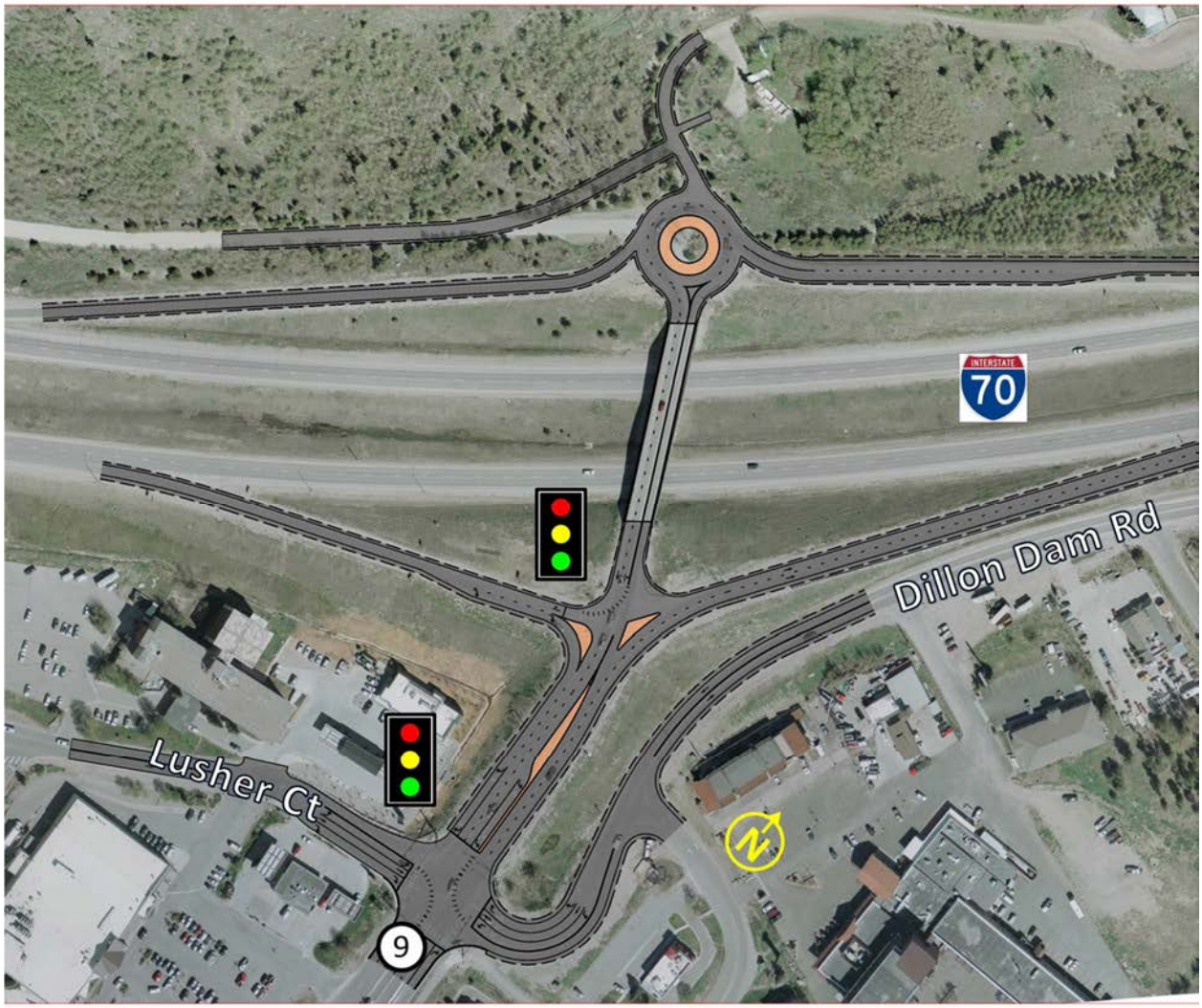
This option needs to consider several issues related to the existing bridge, potential right-of-way needs for the WB ramp, and the intersection of CO 9/DDR.

- The existing bridge is currently wide enough to allow a maximum of three lanes with no shoulders or allowance for pedestrians and cyclists. This option assumes that the existing bridge would be restriped for the additional SB lane across the bridge. The lack of pedestrian /bicycle access would require the consideration of pedestrian /bicycle access across I-70 either in the same location (widened bridge or separate),

separate but adjacent new pedestrian/bicycle bridge, or a new pedestrian/bicycle bridge located in a more advantageous across I-70 for trailhead access.

- The existing bridge is limited to a maximum of three lanes and the distance from the bridge structure to the EB ramp intersection is approximately 160 feet. The combination of these two constraints does not allow for the development of an appropriate SB left turn lane at the EB ramp intersection. This option would require the forecasted SB left turn volume (less than 5 vehicles in the peak hour) to either turn from the southbound through lane (without a protected phase, yielding to northbound traffic) or make a U-turn at the CO 9/DDR intersection.
- An additional lane in the existing roundabout and the relocation of the Meadow Creek trailhead access will likely require additional right-of-way from properties to the north, both east and west of the intersection.
- This option limits options at the CO 9/DDR intersection. The close spacing (less than 500 feet) between the EB ramp intersection and CO 9/DDR is not addressed and higher capacity intersection options are not possible at this spacing.

Figure 5-9: Exit 203 Two-Lane Roundabout



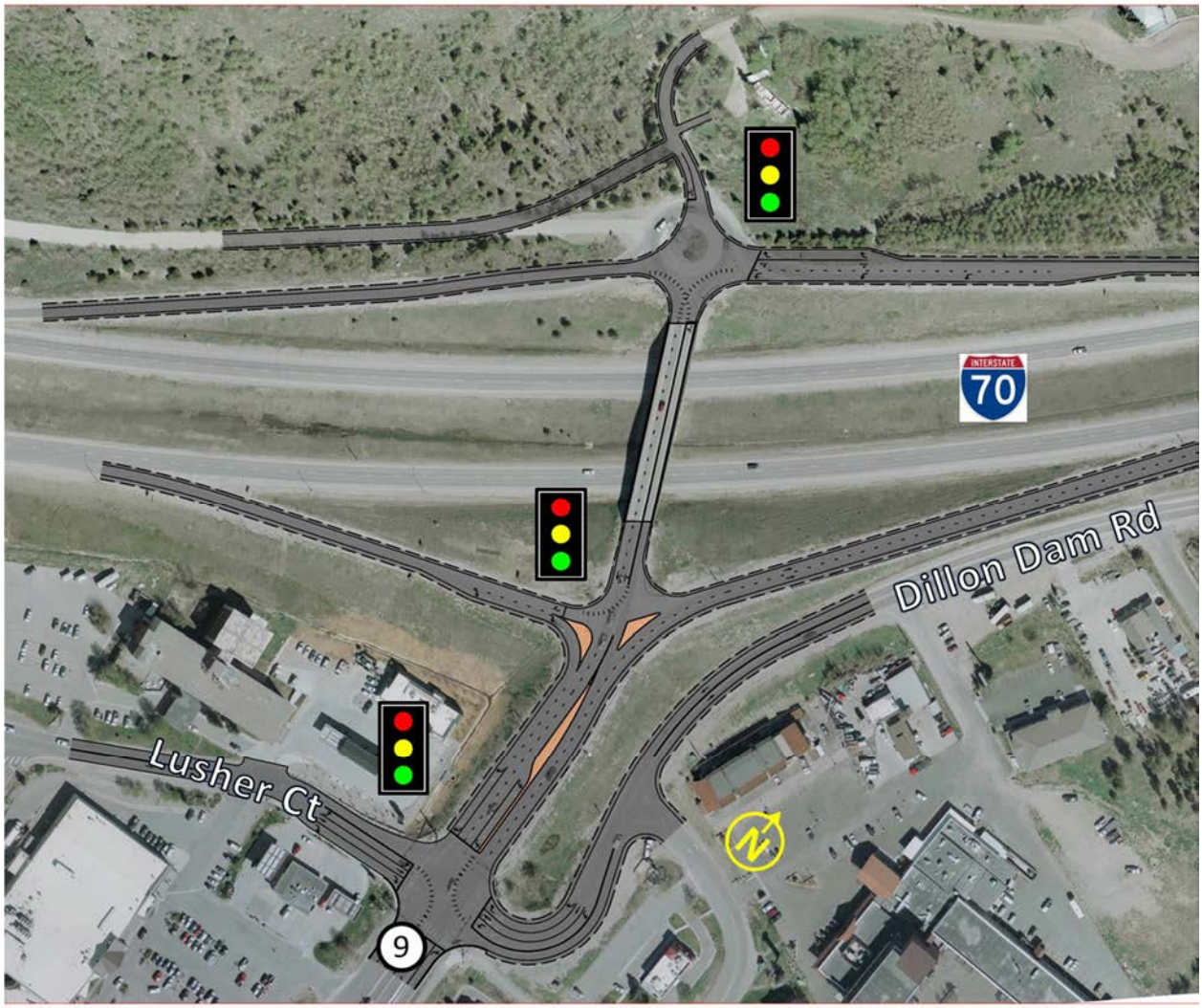
5.3.2 SIGNALIZED INTERSECTION

The signalized WB ramp intersection option includes an additional WB left turn lane, a WB right turn lane, and an additional lane on southbound (SB) CO 9 over I-70 and into the EB ramp intersection. Because of the limited space available on the existing bridge, the option would prohibit SB left turn access on to EB I-70. Like the option above, this option includes an additional storage lane (approximately 500 feet) on the WB ramp to provide additional queuing capacity for the WB exit traffic. This option also includes a signalized intersection at the EB ramps and coordination with a signalized intersection at CO 9 and Lusher Court/Dillon Dam Road (DDR) intersection.

This option needs to consider several issues related to the existing bridge and potential right-of-way needs for the WB ramp.

- The existing bridge is currently wide enough to allow a maximum of three lanes with no shoulders or allowance for pedestrians and cyclists. This option assumes that the existing bridge would be restriped for the additional SB lane across the bridge. The lack of pedestrian /bicycle access would require the consideration of pedestrian /bicycle access across I-70 either in the same location (widened bridge), separate but adjacent pedestrian/bicycle bridge, or a pedestrian/bicycle bridge located in a more advantageous across I-70 for trailhead access.
- The existing bridge is limited to a maximum of three lanes and the distance from the bridge structure to the EB ramp intersection is approximately 160 feet. The combination of these two constraints does not allow for the development of an appropriate SB left turn lane at the EB ramp intersection. This option would require the forecasted SB left turn volume (less than 5 vehicles in the peak hour) to either turn from the southbound inside through lane (without a protected phase, yielding to northbound traffic) or make a U-turn at the CO 9/DDR intersection.
- The additional WB left and right turn lanes at the WB ramp intersection and the relocation of the Meadow Creek trailhead access will likely require additional right-of-way from properties to the north, both east and west of the intersection.
- This option limits options at the CO 9/DDR intersection. The close spacing (less than 500 feet) between the EB ramp intersection and CO 9/DDR is not addressed and higher capacity intersection options are not possible. Additional spacing would provide more queuing capacity for the SB direction and allow for additional options such as a continuous flow intersection (CFI) at Lusher Court/DDR. The DDR intersection options are discussed in more detail below in Section 5.4.

Figure 5-10: Exit 203 Signalized Intersection



5.3.3 DIVERGING DIAMOND INTERCHANGE

The objective of the diverging diamond is to remove the operational conflict between left turning movements at the interchange. A DDI crosses traffic to the opposite side of the road through a cross-over intersection at the ramps. This allows vehicles to have access onto freeway ramps without conflict. Left-turn movements at the ramp intersections are eliminated in a DDI. Figure 5-11 shows a DDI concept for Exit 203.

This option includes a signalized cross-over intersection at both the WB ramps and EB ramps. The DDI also includes an additional storage lane (approximately 650 feet) on the WB ramp to provide additional queuing capacity for the WB exit traffic. The DDI requires two SB and one NB lane on the existing bridge over I-70; a widened/new bridge is not necessary for traffic operations. The DDI signals are assumed to be coordinated with a signalized intersection or access-controlled intersection at the CO 9/DDR intersection. Local traffic to and from Giberson

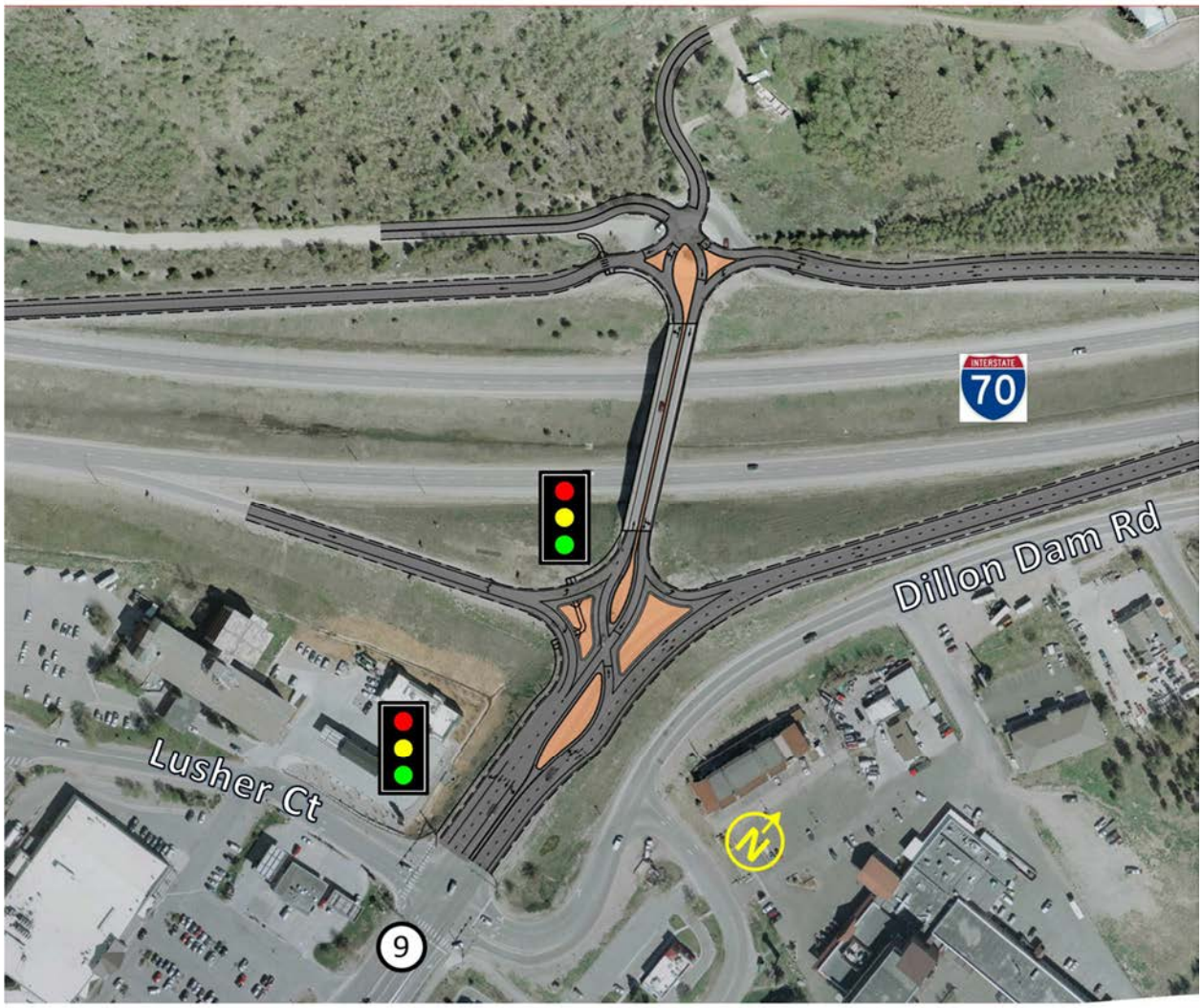
Road and the Meadow Creek trailhead would be accommodated with either a roundabout or a traditional stop-controlled intersection (shown).

During the geometric analysis of the DDI, it was determined that the intersection spacing between the EB ramps and the DDR intersection was too short for the NB through (eventual left to WB I-70) and free right movements. The short distance and width required to maintain a southbound left turn lane at CO/DDR does not allow the proper development of the full DDI geometry with appropriate laneage at the EB ramp. The NB right turn movements at the ramp will likely experience lane blocking and long queues from the signalized NB through movement. A potential solution would be to widen the DDR intersection and provide three (3) separated NB lanes to accommodate one (1) through and two (2) right turning movements, however, in developing this geometry the spacing condition becomes even more limiting. Figure 5-11 does not show the ideal configuration of the lanes at the eastbound traffic signal including the NB left turn storage, and two southbound approach legs at the EB Ramps signalized intersection.

The DDI option would need to consider several issues

- The existing bridge is currently wide enough to allow a maximum of three lanes with no shoulders or allowance for pedestrians and cyclists. This option assumes that the existing bridge would be restriped for the additional SB lane across the bridge. The lack of pedestrian /bicycle access would require the consideration of pedestrian /bicycle access across I-70 either in the same location (widened bridge), separate but adjacent pedestrian/bicycle bridge, or a pedestrian/bicycle bridge located in a more advantageous across I-70 for trailhead access.
- The new structure over I-70 needs to meet the aesthetic guidelines and bridge clearance for advanced guideway alignments as directed by the I-70 Mountain Corridor PEIS.
- The spacing issues between the EB ramps and the CO 9/DDR intersection.
- The realignment of the Meadow Creek trailhead access will likely require additional right-of-way from properties to the north and west of the intersection.
- This option limits options at the CO 9/DDR intersection. The close spacing (less than 500 feet) between the EB ramp intersection and CO 9/DDR is not addressed and higher capacity intersection options are not possible. A more compact DDI (bridge reconstruction) would provide more queuing capacity for the SB direction and may allow for additional options such as a continuous flow intersection (CFI) at Lusher Court/DDR. The DDR intersection options are discussed in more detail below in Section 5.4.

Figure 5-11. Exit 203 Diverging Diamond Interchange



5.3.4 SINGLE POINT URBAN INTERCHANGE (SPUI)

The objective of the SPUI option is to combine the EB and WB ramps into a single signalized intersection and provide additional space between the interchange signal and the CO 9/DDR intersection. The additional space provides opportunity for more queuing capacity for the SB direction and allow for alternative intersection options such as a CFI at Lusher Court/DDR. Figure 5-12 shows the SPUI option at Exit 203.

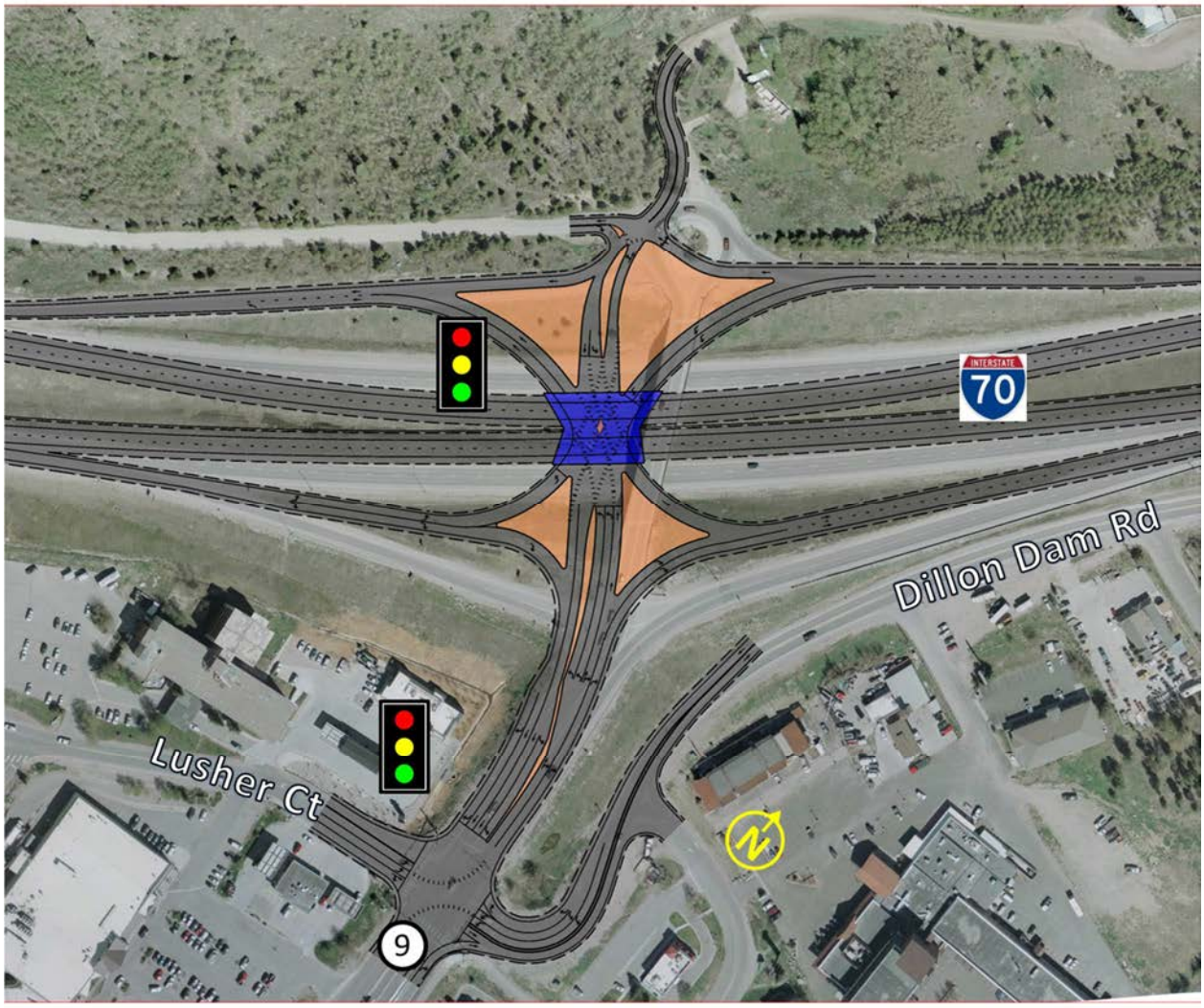
The SPUI option includes an additional storage lane (approximately 650 feet) on the WB ramp to provide additional queuing capacity for the WB exit traffic and a new bridge structure over I-70 to accommodate full turning movements within the interchange. Because of the proximity to the Lusher/DDR intersection, the new bridge on CO 9 includes two lanes in each direction plus appropriately sized storage lanes for NB and SB left turns. The SPUI signal is assumed to be coordinated with a signalized intersection at the CO 9/DDR intersection. Local traffic to and

from Giberson Road and the Meadow Creek trailhead would be accommodated with a traditional stop-controlled intersection or roundabout to the north.

The SPUI option would need to consider several issues

- The new structure over I-70 needs to meet the aesthetic guidelines and bridge clearance for advanced guideway alignments as directed by the I-70 Mountain Corridor PEIS.
- The new structure would need to consider multi-modal access across I-70.
- The new bridge structure would be designed to minimize costs and likely require a realignment of I-70 in both directions towards the center to reduce the bridge length and accommodate the ramps.
- The new bridge structure would likely be constructed off line of the existing bridge and require a shift of CO 9. This shift may also move the existing location of the WB ramp intersection and require new ROW to the north on both the east and west sides of existing CO 9 and Giberson Road.
- The alignment of the SPUI, the location of the WB ramps, and the realignment of the Meadow Creek trailhead access will likely require additional right-of-way from properties to the north and west of the intersection.

Figure 5-12: Exit 203 Single Point Urban Interchange



5.3.5 TIGHT URBAN DIAMOND INTERCHANGE (TUDI)

The objective of the TUDI option is to provide additional space between the interchange and the CO 9/DDR intersection. Although minor, the additional space provides opportunity for more queuing capacity for the SB direction and provides the space needed to consider options such as a frontage road underpass option as shown in Figure 5-13.

This TUDI option includes a signalized intersection at both the WB ramps EB ramps and a new frontage road underpass to provide bypass operations for traffic crossing CO 9. A TUDI alone will operate very similar to the signalized intersection option described in Section 5.3.2 above. The TUDI also includes an additional storage lane (approximately 650 feet) on the WB ramp to provide additional queuing capacity for the WB exit traffic and a new bridge structure over I-70 to accommodate full turning movements within the interchange. The new bridge on CO 9 includes two lanes in each direction plus appropriately sized storage lanes for NB and SB left

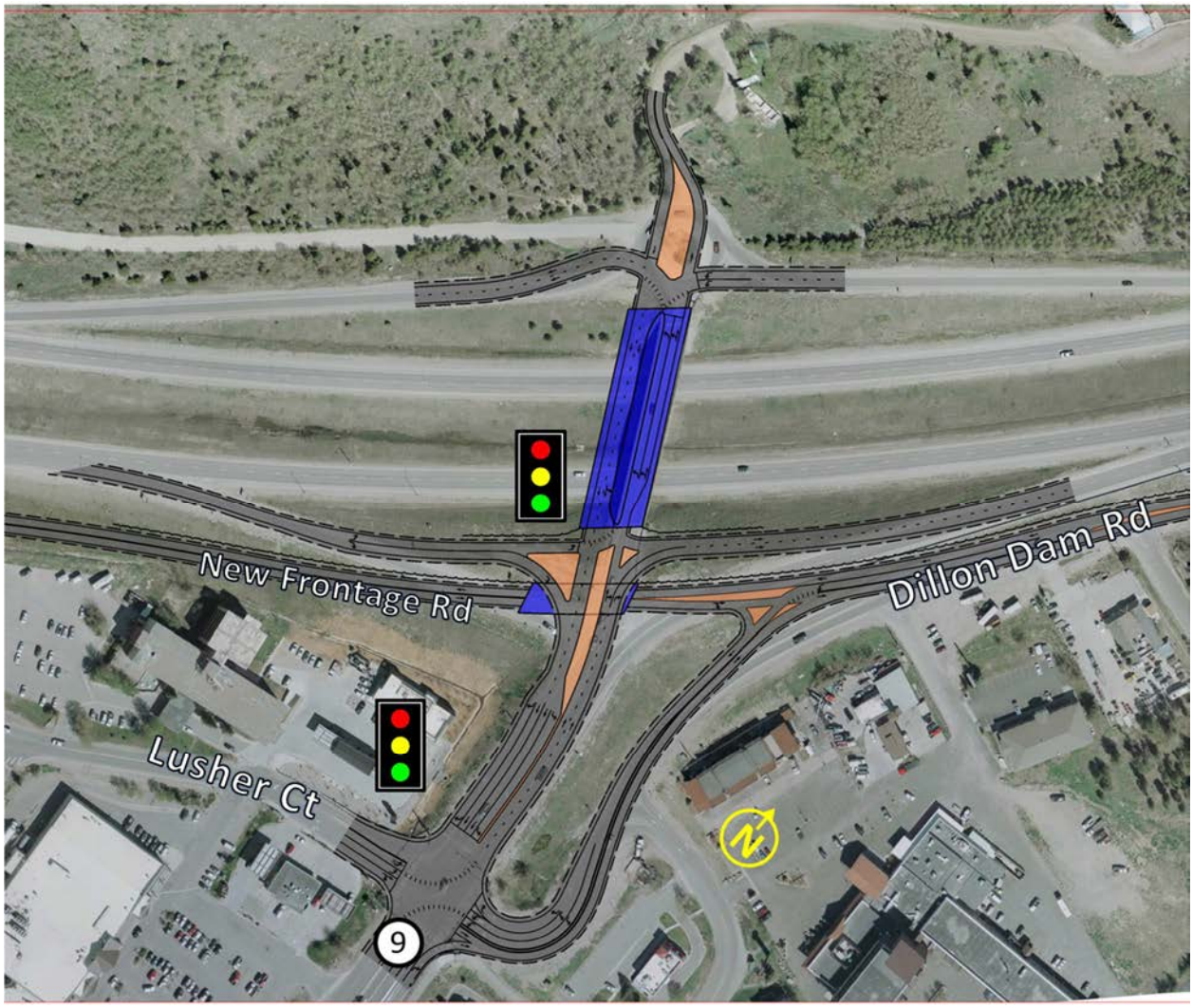
turns. To accommodate proper operations of the WB ramp intersection, the two NB lanes provide a dedicated left turn lane and through lane. The TUDI signal is assumed to be coordinated with a signalized intersection or access-controlled intersection (no cross street through movements at CO 9/DDR shown in Figure 5-13) at the CO 9/DDR intersection. Local traffic to and from Giberson Road and the Meadow Creek trailhead would be accommodated with a traditional stop-controlled intersection or roundabout to the north.

The TUDI option would need to consider several issues

- The new structure over I-70 needs to meet the aesthetic guidelines and bridge clearance for advanced guideway alignments as directed by the I-70 Mountain Corridor PEIS.
- The new structure would need to consider multi-modal access across I-70.
- The location and alignment of the frontage road underpass and connections to the local street network.

The new bridge structure would likely be constructed offline of the existing bridge and require a shift of CO 9. This shift may also require new ROW to the north on both the east and west sides of existing CO 9 and Giberson Road.

Figure 5-13: Exit 203 Tight Urban Diamond Interchange (TUDI)



5.4 LUSHER COURT/DILLON DAM ROAD INTERSECTION DESIGN OPTIONS

The evaluation of the Lusher Court/Dillon Dam Road (DDR) intersection options was conducted using SYNCHRO traffic operations analysis software and a year 2045 planning horizon. For all options, it was assumed that a new interchange was complete and operating at LOS D or better and did not restrict flow into the intersection. This allows a more conservative analysis of the Lusher/DDR intersection for comparative purposes.

General options that were evaluated include:

- Enhanced Detection

- Minor widening and realignment
- Major widening and realignment
- Controlled access intersection
- Partial continuous flow intersection (CFI)

5.4.1 ENHANCED DETECTION

The enhanced detection option assumes signalized coordination along CO 9 through the interchange. This includes

- Conversion of the WB ramp intersection to a signalized intersection or a two-lane roundabout.
- Conversion of the EB ramp intersection to a signalized intersection.
- Coordinated signal progression and full intersection detection at the CO9/DDR intersection

This option assumes an interchange at Exit 203 that is not capacity constrained and is operating at LOS D or better.

5.4.2 MINOR WIDENING

The minor widening option includes only widening on CO9 to accommodate additional through movements. The widening is along the length of CO 9 from the Exit 203 interchange to Hawn Drive/10 Mile Road. Specifically, the option includes

- Conversion of the southbound (SB) and northbound (NB) right turn only lanes at CO9/DDR to shared through/right lanes.
- Addition of a third NB lane outbound at the CO9/DDR intersection to become a right turn only lane at the eastbound (EB) on-ramp.
- Conversion of the current lane configuration at the EB on-ramp from one NB through/right lane and a separate right to three separate lanes NB – one through and two right turn lanes.
- Conversion of the current SB right-in/right-out intersections along CO9 to a continuous SB through/right turn lane from south of the CO9/DDR intersection for ½ mile to just south of Lagoon Drive.
- Conversion of the current NB right-in/right-out intersections on CO 9 to a continuous NB through/right turn lane from Hawn Drive/10 Mile Road north.

- Signal coordination along CO 9.

Figure 5-14 shows the minor widening option near the Lusher/DDR intersection only. This option would need to consider several potential impacts to CO9 and adjacent properties. The options would likely require the removal and widening of the SB curb line immediately south of the intersection and would remove several SB channelizing islands at the right-in/right-out locations. The option would also likely require widening CO 9 for about 800 feet from 10 Mile Road to 10 Mile Drive and widening CO 9 between DDR and the EB on-ramp. This may also include adding retaining walls on the east side of the interchange to accommodate the additional lane.

Figure 5-14: CO9/DDR Minor Widening

5.4.3 MAJOR WIDENING

The major widening option includes the minor widening described above plus the following additional capacity improvements at the Lusher/DDR intersection

- Additional EB and WB lanes on the west leg (Lusher Ct) of the CO9/DDR intersection.
- Additional WB through lane on the east leg (DDR) of the intersection.
- Conversion of the east leg of the intersection to a WB approach only with four lanes – two left turn lanes, one through lane and one shared through/right turn lane.
- Realignment of the EB through lane on the east leg of the intersection to a location between the Starbucks and the Kentucky Fried Chicken properties. This alignment allows an additional lane of left turn capacity for WB at CO9 and may relieve some of the operations pressure at 10-Mile and DDR.

Figure 5-15 shows the major widening option near the intersection only. This option would need to consider several potential impacts to CO9 and adjacent properties including those noted above for the minor widening. In addition, it is likely that this option will require ROW along the EB approach and for the realigned west leg through movements. To minimize realignment of DDR, the EB approach will also likely require retaining wall along the north side of DDR. The options will also affect accesses on the west leg. Because of the realignment of the EB through movements at DDR, there is likely to be an additional traffic load on the intersection of DDR and North 10 Mile Road – just east of CO9.

Figure 5-15: CO9/DDR Major Widening

5.4.4 CONTROLLED ACCESS INTERSECTION

The controlled access intersection options consider limited EB and WB movements to/from Lusher/DDR through the intersection with the objective to reduce signal phases at the signalized intersection. Two options were considered to accomplish this objective - redirect EB and WB left turns or redirect EB and WB through movements

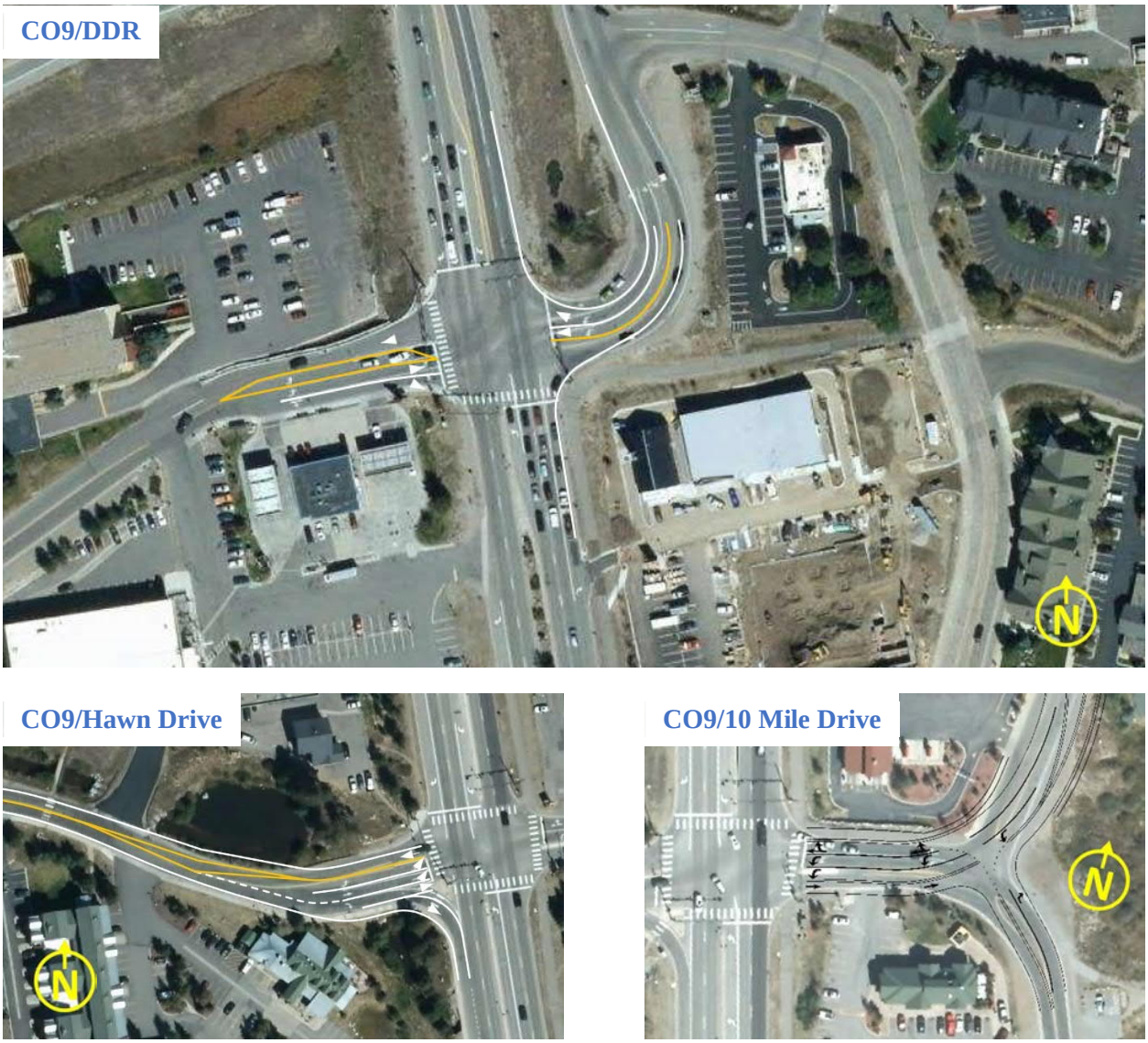
REDIRECTING EB/WB LEFT TURNS

This option, shown in Figure 5-16, redirects left turn movements on Lusher Court and Dillon Dam Road to other facilities on the existing roadway network including 10 Mile Road, Meadow Drive, 10 Mile Drive, and Hawn Drive. This option:

- Realigns DDR and 10 Mile Road to provide continuity to the left turn demand to 10 Mile Road.
- Realigns the through lane on the east leg of the intersection to a location between the Starbucks and the Kentucky Fried Chicken properties.
- Realigns EB 10 Mile Drive at CO 9 to accommodate new reassigned left turn demand.
- Provides an additional EB left turn lane at 10 Mile Drive and CO 9
- Realigns WB Hawn Drive at CO 9 to accommodate new reassigned left turn demand.
- Provides an additional WB left turn lane and storage capacity at Hawn Drive and CO 9

This option would need to consider the additional traffic load on North 10 Mile Road, Meadow Drive, 10 Mile Drive, and Hawn Drive. In addition, the option will likely require ROW for the realigned east leg through movements, along 10 Mile Road near 10 Mile Drive, and the west leg of Hawn Drive.

Figure 5-16: CO9/DDR Eliminate EB/WB Lefts



REDIRECT EB/WB THROUGH MOVEMENTS

This option, shown in Figure 5-17, redirects through movements on Lusher Court and Dillon Dam Road to other facilities on the existing roadway network including 10 Mile Road, Meadow Drive, 10 Mile Drive, Hawn Drive, and a potential for a new frontage road and underpass adjacent to I-70. This option

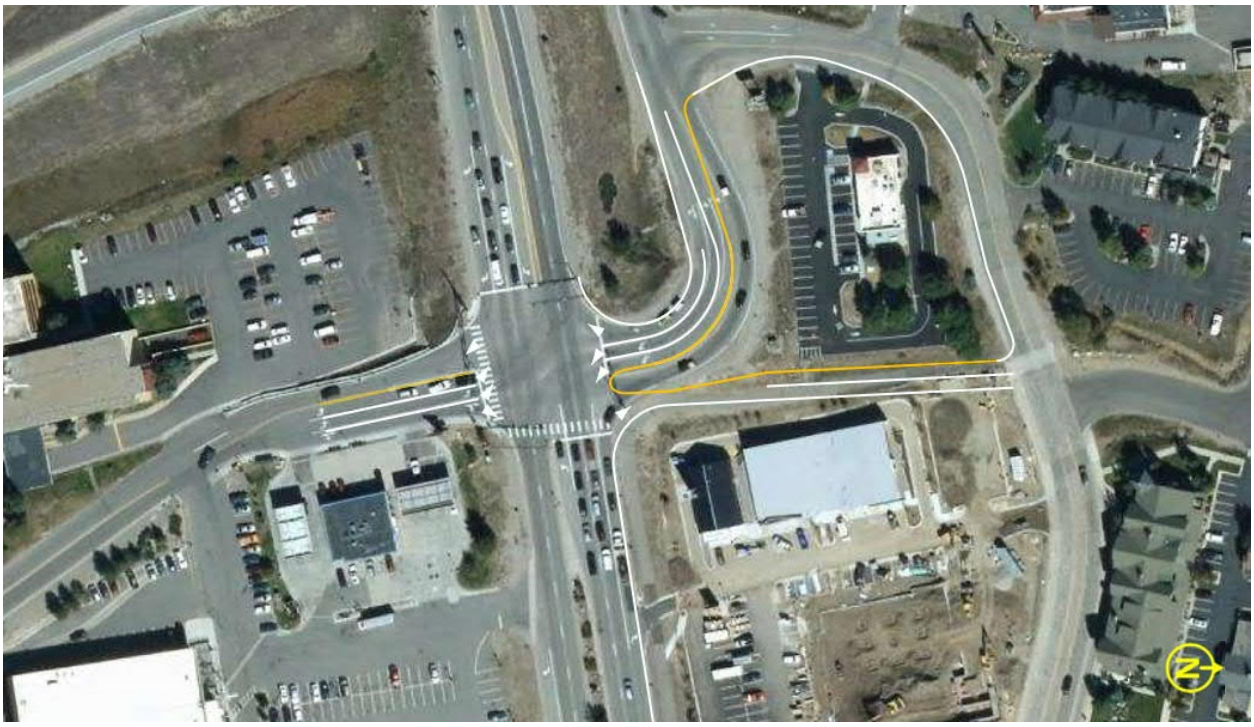
- May provide a potential frontage road underpass of CO9 to accommodate through movements and include a new intersection of DDR and the frontage road.

This option would need to consider the additional traffic load on North 10 Mile Road, Meadow Drive, 10 Mile Drive, Hawn Drive and a frontage road intersection on Lusher Court near the Base Camp development. This option would likely require geometric design changes at 10 Mile

Drive to accommodate through movements to Frisco Station Shopping Center and at the 10 Mile Road/Hawn Drive intersection to accommodate through movements to Basecamp and the Frisco Transit Center.

Any underpass of CO9 near the interchange would need to consider a frontage road connection location to the east and west and may require ROW from one or several businesses.

Figure 5-17: CO9/DDR Eliminate EB/WB Throughs



5.4.5 PARTIAL CONTINUOUS FLOW INTERSECTION (CFI)

The continuous flow intersection is a high capacity intersection that combines phases in the signal cycle. The objective is to provide additional signal timing capacity by combining left and through movements in the intersection. This is done by realigning left turns to cross over signals north and south of the main intersection to move with opposing through movements.

The partial CFI shown in Figure 5-18 includes the conversion of the CO 9 north and south legs only. The east and west legs on DDR and Lusher Court were not considered for two reasons:

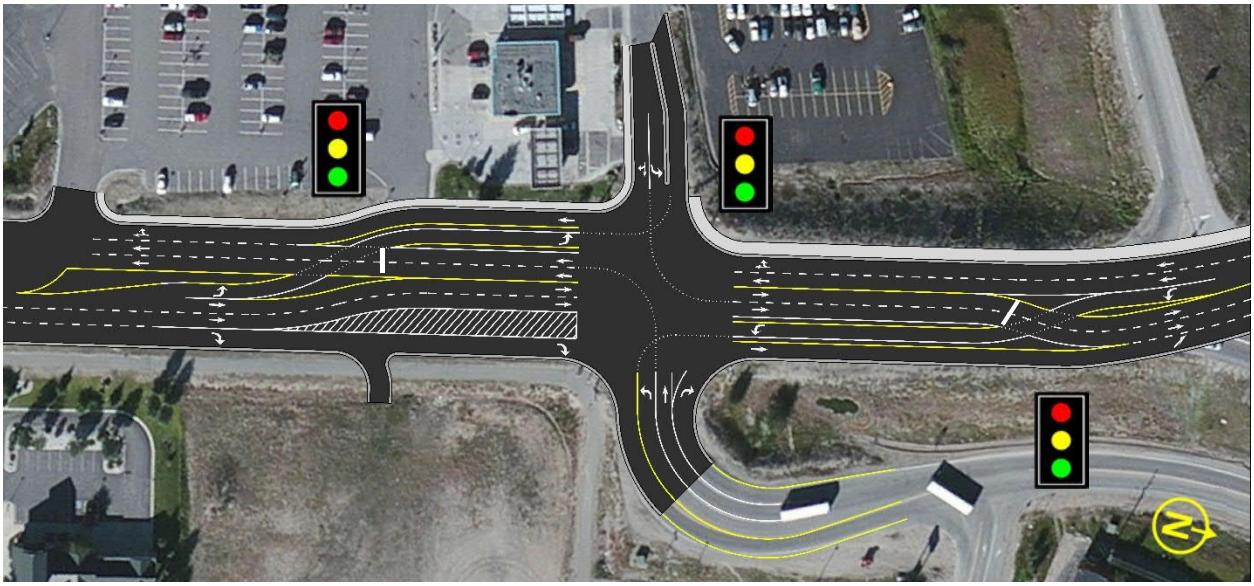
1) widening and realignment of the east and west legs would likely require ROW from businesses on both the north and south sides of DDR and Lusher Court as well as the potential impacts to access, particularly on the west leg.
2) given the objective of the CFI, the focus is on the higher volume movements in the intersection. The higher volumes at the intersection are on the north and south legs.

This option includes

- Although not shown in the figure, the analysis shows that CO 9 would need to have three lanes in each direction (similar to the major widening option) at least between the EB ramps and 10-Mile Drive.
- Adequate spacing to allow for proper development of CFI geometry – includes a major shift of the Exit 203 interchange to the north as an offset interchange such as a SPUI.
- Combines the signal phasing for the left turns and through movements in both NB and SB directions on CO 9.
- Signal coordination along CO 9.

The partial CFI option would need to consider the potential for access control on both the EB and NB approaches as it requires the removal and widening of both the curb line immediately south of the intersection. Because of the larger footprint of this option, it will likely require the EB ramps at I-70 to be realigned to the north to accommodate the approach lanes and crossover for the CFI. This could potentially be accomplished using an offset SPUI. Challenges of CFI's include user comfort and understanding, snow removal operations, and at this location spacing between the CFI lanes north DDR and the interaction of the traffic to the eastbound on ramp.

Figure 5-18: CO9/DDR Continuous Flow Intersection



5.5 CONCEPT OPERATIONS ANALYSIS

5.5.1 I-70

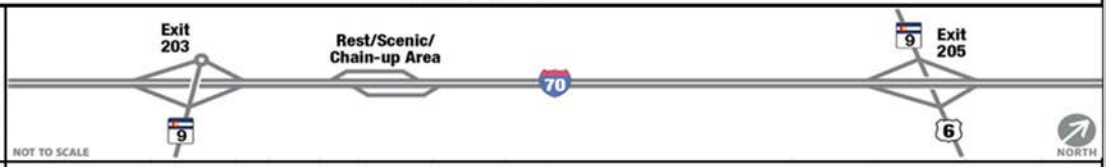
EASTBOUND I-70

Figure 5-19 shows the results of the 2045 build conditions for the eastbound I-70 auxiliary lane. The addition of the eastbound auxiliary lane from Exit 203 to Exit 205 will alleviate much of the congestion on I-70 in this area. LOS D or better is expected to occur. However, the forecast traffic volumes indicate the section of I-70 that is west of Exit 203 will be over capacity and will operate at LOS F, which will act to meter traffic heading east beyond Exit 203.

The conceptual-level assessment of the auxiliary lane drop at Exit 205 shows that the diverge condition is LOS D. Given the complexity of the lane drop at this location, a more detailed operations analysis using advanced microsimulation is required to determine the extent of queuing and merge-diverge activity in this area.

Figure 5-19: Future (2045) Operations Analysis Eastbound I-70 2045 Mainline Option HCS Results

EASTBOUND I-70



Time Period	LOS												
4:00 - 4:15 PM	F	F	C	D	D	C	D	C	D	D	D	C	C
4:15 - 4:30 PM	F	F	D	D	D	C	D	C	D	D	D	D	C
4:30 - 4:45 PM	F	F	D	D	D	C	D	C	D	D	D	D	C
4:45 - 5:00 PM	F	F	D	D	D	C	D	C	D	D	D	D	C
Segment #	1	2	3	4	5	6	7	8	9	10	11	12	13
Segment Type	B	D	B	M	O	D	B	M	B	D	B	M	B

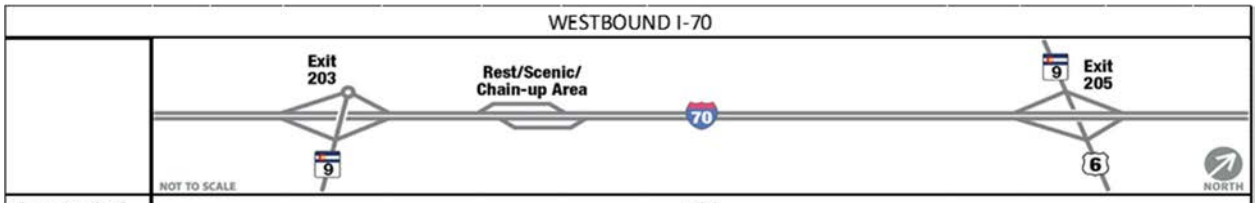
Note: B= Basic Segment, D = Diverge Segment, M = Merge Segment, O = Overlap Segement, and W = Weave Segment.

WESTBOUND I-70

Figure 5-20 shows the results for westbound I-70 for the 2045 Build conditions. Although there are no planned improvements to I-70 in the westbound direction, there are planned improvements at the Exit 203 interchange. These improvements, while not shown in the HCS analysis results, will increase the ability for the Exit 203 westbound off-ramp to process more vehicles than under the No-Action conditions. The capacity improvements at the Exit 203 WB ramp intersection were accounted for in the analysis and are reflected in the HCS analysis. The increase in capacity at the westbound off-ramp is not expected to completely resolve the congestion conditions on westbound I-70 at Exit 203, but there will be some improvements to operations. It is likely that, by 2045, there will need to be additional improvements to either

westbound I-70 or at the Exit 203 interchange or both to provide additional capacity to further improve operations on westbound I-70.

Figure 5-20: Future (2045) Operations Analysis Westbound I-70 2045 Mainline Option HCS Results



Time Period	LOS										
4:00 - 4:15 PM	B	B	A	F	F	B	C	C	C	C	B
4:15 - 4:30 PM	B	B	B	F	F	F	B	C	C	C	B
4:30 - 4:45 PM	B	B	B	F	F	F	F	C	C	C	B
4:45 - 5:00 PM	B	B	B	F	F	F	F	C	C	C	B
Segment #	11	10	9	8	7	6	5	4	3	2	1
Segment Type	B	M	B	W	B	D	B	M	B	D	B

Note: B= Basic Segment, D = Diverge Segment, M = Merge Segment, O = Overlap Segement, and W = Weave Segment.

5.5.2 EXIT 203

GENERAL DISCUSSION

The existing configuration of the EB I-70 on-ramp has two lanes and may be controlled by a ramp meter before merging onto I-70 during heavy congestion. The ramp meter requires all vehicles to stop on a red indication at about 800 feet down the ramp. The ramp meter allows one vehicle from each lane to proceed on a green light after a short duration (typically 6- 10 seconds). After the green indication, the two ramp lanes merge into a single lane before merging onto I-70 auxiliary lane to the scenic overlook/chain-up station.

The EB ramp meter signal was included in all Synchro analyses completed in this study. In general, the ramp meter creates queues that extend to the top of the ramp during existing conditions. This spill back occurs over short periods of time, but remains consistent throughout the PM peak. During the future conditions analyses, it was noted that the ramp meter queue extends into the DDR/Lusher Court intersection for short periods of time during the PM peak. However, this did not appear to cause significant operational issues on northbound CO 9. In most cases, the DDR/Lusher Court intersection operations for northbound CO 9 were poor and acts as a meter to limit traffic reaching the on ramp and the ramp meter location – not the other way around.

Improvements to the DDR/Lusher Court intersection that would improve operations on northbound CO 9 and increase traffic flows to the eastbound on ramp may result in a need to re-evaluate the use of a ramp meter or at least on the operational configuration of the meter detection set up and/or timing parameters.

TWO-LANE ROUNDABOUT

Table 5-1 shows the results of the two-lane roundabout analysis. The overall LOS for the Westbound Ramps/CO 9 roundabout intersection is LOS E and the WB off-ramp approach is LOS F. Despite a LOS F, on this leg the queue length is approximately 450 feet (20 vehicles) compared to no action conditions of 1,739 feet, which would keep vehicles from spilling back onto I-70. At the Eastbound Ramps/CO 9 signalized intersection the LOS is a B overall due to low left turn volumes, but the eastbound queue length is long at 530 feet. This queue length from a free right movement is impacted by the congestion and backups at the CO 9/DDR intersection. This option will improve operations at the WB intersection over current conditions, but without major improvements to CO 9/DDR intersection this option will break down. This option would not require widening the bridge structure.

Table 5-1: Future (2045) Operations Analysis Exit 203 Two-lane Roundabout Intersection

Intersection		Approach Direction	LOS	Delay (sec/veh)	95%ile Queue (ft)
Name	Type				
I-70 Westbound Ramps and CO 9	Roundabout	WB	F *	69	450
		NB	A *	8	80
		SB	C *	17	25
		Overall	E *	49	-
I-70 Eastbound Ramps and CO 9	Signalized	EB	A	2	530
		NB	D	35	505
		SB	A	2	240
		Overall	B	19	-

Note: * Roundabout intersections use unsignalized intersections LOS criteria, which has higher **letter values per delay then signalized intersections. Threshold between LOS D and E is 35 sec/veh** for unsignalized **vs. 55 sec/veh for signalized criteria.**

SIGNALIZED INTERSECTION

Table 5-2 shows the results for the signalized intersection analysis. The overall LOS for the Westbound Ramps/CO 9 signalized intersection is LOS E, but the WB off-ramp queue is 1,917 feet which is worse than existing.. The LOS E at the Westbound Ramps/CO 9 intersection is similar to the two lane roundabout from the previous option, but overall has 10 seconds more delay overall. This option has similar operations at the Eastbound Ramps/CO signalized intersection as the first option. The analysis assumes only one northbound lane on the bridge; however, the laneage at the westbound ramp intersection will most likely require an additional northbound lane on the bridge, since there are nearly 600 vehicles turning left onto I-70, which would require widening of the bridge structure.

Table 5-2: Future (2045) Operations Analysis Exit 203 Signalized Intersection

Intersection		Approach Direction	LOS	Delay (sec/veh)	95%ile Queue (ft)
Name	Type				
I-70 Westbound Ramps and CO 9	Signalized	WB	E	59	1,917
		NB	E	56	338
		SB	E	71	5
		Overall	E	58	-
I-70 Eastbound Ramps and CO 9	Signalized	EB	A	2	654
		NB	C	32	511
		SB	A	1	543
		Overall	B	18	-

DIVERGING DIAMOND INTERCHANGE

Table 5-3 shows the results for the DDI analysis. The analysis assumes one northbound lane and two southbound lanes approaching the signalized EB Ramps intersection, with appropriate turn lane development and storage. The overall LOS for the DDI is LOS B at both intersections, however due to the congestion and backups from the CO 9/DDR intersection the EB off-ramp approach has queue lengths of 803 feet for this free right movement.

Table 5-3: Future (2045) Operations Analysis Exit 203 Diverging Diamond Interchange

Intersection		Approach Direction	LOS	Delay (sec/veh)	95%ile Queue (ft)
Name	Type				
I-70 Westbound Ramps and CO 9	Signalized	WB	B	15	91
		NB	A	6	92
		SB	C	29	17
		Overall	B	12	-
I-70 Eastbound Ramps and CO 9	Signalized	EB	C	24	803
		NB	C	23	388
		SB	C	29	262
		Overall	B	17	-

SINGLE POINT URBAN INTERCHANGE

Table 5-4 shows the results for the single-point urban interchange analysis. The overall LOS for the SPUI is LOS D. The SB approach is LOS E, but is also very low volume from Giberson Road and the Meadow Creek Trailhead. The analysis assumes two northbound lanes and two southbound lanes on a new bridge, with appropriate turn lane development and storage. The SPUI will operate well independent of the CO 9/DDR intersection (as a standalone interchange), however, combined with a potential CFI at CO 9/DDR there will be challenges to develop appropriate turn lane length and sufficient weave areas..

Table 5-4: Future (2045) Operations Analysis Exit 203 Single Point Urban Interchange

Intersection		Approach Direction	LOS	Delay (sec/veh)	95%ile Queue (ft)
Name	Type				
I-70 Westbound/Eastbound Ramps and CO 9	SPUI - Signalized	EB	B	19	6
		WB	D	38	272
		NB	D	43	146
		SB	E	76	17
		Overall	D	39	-

TIGHT URBAN DIAMOND INTERCHANGE

Table 5-5 shows the results for the TUDI analysis. The analysis assumes two northbound lanes and two southbound lanes on a new bridge, with appropriate turn lane development and storage. It also includes the frontage road underpass option as described in Section 5.3.5 and in Figure 5-13. The overall LOS for the TUDI is LOS C. The crossing volumes at the interchange for the WB off ramp and the NB left turn minimizes delays for the WB ramp intersection and reduces queuing compared to the signalized intersection option alone.

Table 5-5: Future (2045) Operations Analysis Exit 203 Tight Urban Diamond Interchange

Intersection		Approach Direction	LOS	Delay (sec/veh)	95%ile Queue (ft)
Name	Type				
I-70 Westbound Ramps and CO 9	Signalized	WB	C	29	466
		NB	C	24	202
		SB	D	46	13
		Overall	C	27	-
I-70 Eastbound Ramps and CO 9	Signalized	EB	D	41	763
		NB	D	38	204
		SB	A	2	105
		Overall	C	28	-

5.5.3 LUSHER COURT/DILLON DAM ROAD

Table 5-6 below is a summary of the CO 9 / DDR intersection concept options operations analysis. The analysis indicates a need to combine or remove signal phases from the intersection timing. Enhanced signal timing/detection, minor, and major widening efforts will not accommodate the 2045 demand. The analysis shows that only access controlled or high capacity intersections that combine or remove signal phases from the intersection timing will provide the

necessary capacity for 2045 demand. Although the partial CFI indicates acceptable operations the configuration has geometric and maintenance challenges along with driver comfort concerns and is not recommended for the CO 9 corridor.

Table 5-6: Future (2045) Operations Analysis CO 9/Dillon Dam Road Intersection Options

CO 9/DDR Intersection Option	Intersection Level of Service	Overall Intersection Delay (sec/veh)
Enhanced Detection	LOS E	76
Minor Widening and Realignment	LOS E	61
Major Widening and Realignment	LOS E	58
Controlled Access Intersection		
• **Eliminate EB/WB Lefts**	LOS D	36
• **Eliminate EB/WB Throughs**	LOS D	40
Partial Continuous Flow Intersection (CFI)	LOS D	48

5.6 REVISED EXIT 203 AND CO 9/DDR CONCEPT

The review of this Draft Feasibility Study produced questions and comments related to the interaction of the Exit 203 interchange options in combination with the CO 9/Dillon Dam Road intersection operations. The analysis demonstrates that the long term 2045 solution needs to include Exit 205 and CO9/DDR intersection in combination not separately. Following the draft study review the project team and CDOT met with local agency PLT members and discussed the options further. The primary comments and questions discussed included:

- The TUDI Option introduced a new frontage road underpass that the other options did not include. Would this new frontage road underpass option be applicable to other Exit 203 options?

- The new frontage road underpass is applicable to all of the Exit 203 interchange options and could provide geometric and operational improvements combined with additional access control at the CO 9/DDR intersection.

- Table 5-7 compares the alternatives and benefits of the new frontage road underpass for each Exit 203 option in addition to access control at CO 9/DDR, discussed in more detail below.

- The new frontage road underpass would be a major investment, but the TUDI option only eliminated through movements through the CO 9/DDR intersection. Is there value in additional access control at CO 9/DDR with the new frontage road underpass?

  - Yes, as the analysis shows additional access control at CO 9/DDR would be beneficial for both the Exit 203 operations and CO 9 in general. The initial assumption and local request to keep this intersection full movement was discussed. It was noted that in any full movement configuration analyzed the queue lengths on the Lusher and DDR approach legs become so long that local traffic would begin to find legal and illegal (through businesses) routes to avoid the intersection. With a new frontage road underpass serving as a bypass closely adjacent to the existing CO 9/DDR intersection it was agreed that the potential for additional access control should be explored with this option.

  - A new frontage road underpass enables additional access control at CO 9/DDR while providing additional capacity to the local network (i.e. the access control would not force all of the CO 9 left turning and through movements to existing local streets). The new frontage road underpass would accommodate the CO 9/DDR through movements across CO 9, and the majority of the left turn movements to and from CO 9. It is feasible to change the CO 9/DDR intersection to a right-in and right-out intersection removing all left turn movements to and from CO 9 and through movements across CO 9. This would allow the removal of the full signal at CO 9/DDR and provide more flexibility to the design options at the eastbound I-70 ramps.

  - There will likely be traffic redistribution across the local network that needs additional analysis from CO 9/DDR down to the CO 9/Hawn Drive intersection. This redistribution will need additional analysis in future project development activities.

- How would the new frontage road underpass connect to local street network and what are the potential impacts?

- The new frontage road alignment would connect on the west side near the existing Lusher Court and Meadow Drive with a new intersection. On the east the new frontage road would connect to DDR. Figure 5-21 shows a conceptual alignment with connections on the west and east side to the local street network. The west connection would require right of way acquisition and changes to access immediately adjacent to the intersection. In this concept the new intersections are shown as roundabouts which provide the best free movement operations during peak and off-peak traffic.

Table 5-7: Exit 203 Comparisons and Benefits of New Frontage Rd Underpass

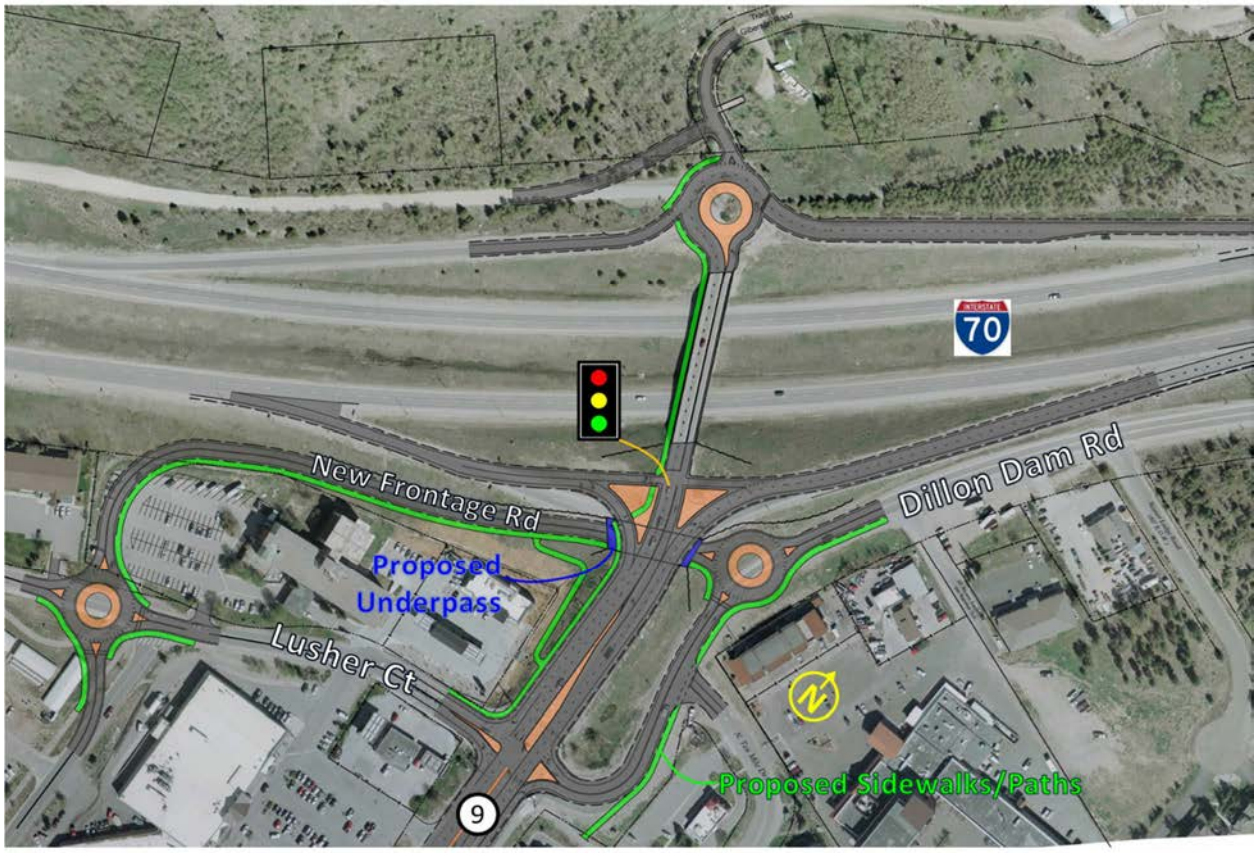
Exit 203 Option	Primary Issue with Option	Works w/ Existing Bridge	Would Frontage Rd Underpass & Additional CO9/DDR Access Control Improve Option?
1. Two Lane Roundabout Option	Proximity to CO 9/DDR impact EB Ramp operations	Yes #	Yes, improves EB Ramp operations
2. Signalized Option	WB Ramps operations fail	Yes #	Only slightly, WB Ramp operations would not improve
3. Diverging Diamond	EB Ramps geometry and operation due to proximity with CO 9/DDR	Yes #	Yes, would allow for appropriate geometry and turn lane length and improve EB Ramp operations
4. SPUI	Turn lane geometry between intersections and overall cost	No	Slight operation improvements, more flexibility in geometry
5. TUDI w/Frontage Rd Underpass	EB Ramps operation due to proximity with CO 9/DDR	No	Frontage Rd previously included, additional access control would improve EB Ramp operations
Note: # The existing bridge could accommodate the traffic lanes, but a widened or separate bridge is necessary to provide pedestrian and bicycle access.			

To better understand the benefits of the new frontage road the consultant team revised and advanced the Exit 203 Option 1, Two Lane Roundabout. This includes adding the new frontage road underpass and expanded the design of the frontage road to include connections to local

roads, additional access control at CO 9/DDR, and developing pedestrian sidewalks and paths. The additional access control at CO 9/DDR includes changing the intersection to right-in/right-out movements to and from CO 9, and an unsignalized northbound left turn lane to Lusher Court. This eliminates left turns from DDR and Lusher Court to CO 9, and the southbound CO 9 left turn to DDR. These movements would be displaced to the new frontage road underpass. This revised option is shown in Figure 5-21.

Initial high level operation analysis was completed to understand the benefits of this revised concept. This analysis showed that the access control at CO 9/DDR reduces the queue lengths at the Eastbound signals. This analysis also shows that the traffic modeling will need to be expanded south along CO 9 and a detailed review of turning movements and redistribution is needed to analyze all benefits and impacts to the local network. The heavy right turn movements from DDR to northbound CO 9 may need some signal control during peak periods.

Figure 5-21: Revised Exit 203 and CO 9/DDR Intersection Concept



This revised concept was presented and discussed with the local agency stakeholders and FHWA. The benefits of this concept including acceptable operations in year 2045, providing more flexibility to the design of the Exit 203 ramp terminals, ability to utilize the existing bridge structure (widening would be required for pedestrian and snow plow operations), potential benefits to transit access by eliminating the need for delay at signals. Transit from I-70 could

access the Frisco Transit Center via right turns through the roundabout and new frontage road. Additionally, items needing additional development and analysis in future project development were noted. There was general agreement that the Exit 203 revised concept should be advanced in a future phase to gain environmental and FHWA approvals.

During future project development activities, the revised Exit 203 Option needs further analysis on:

- Analyze traffic redistribution along CO 9 and the local street network, and complete more detailed traffic operation modeling along CO 9 down to CO 9/Hawn Drive and at the proposed frontage road intersections.
- Advance preliminary design and more detailed operation analysis to confirm the ramp intersection types (roundabouts vs. signals), confirm geometry of roundabout and bridge structure widening.
- Confirm the westbound off-ramp lane configuration (single vs. two lane exit), and confirm storage requirements on off-ramps so queue length and deceleration geometry is adequate.
- Accommodate pedestrian and bicycle connections and movements across CO 9 and along CO 9 across I-70 (widened or separate pedestrian bridge)
- Identify new frontage road typical section including accommodation of pedestrian and bike facilities along new frontage road

5.7 PHASING CONSIDERATIONS

An interim year analyses was completed to better understand the performance of freeway and arterial elements and how elements of the project might be phased to address safety issues in the face of project funding constraints. For this analysis, two interim years, 2025 and 2035, were selected for analysis. The future traffic volumes were developed by using a straight-line forecasting approach between the current and 2045 traffic demand used in the existing conditions and future year analyses.

The options evaluated in this phasing analysis include the EB auxiliary lane, the Exit 203 WB ramp two-lane roundabout, and the WB ramp signalized intersection.

A more detailed analysis of the phasing considerations is available in a separate report entitled Interstate 70 Exit 203 & Eastbound Auxiliary Lane Transportation and Traffic Existing and Future Conditions Report.

5.7.1 EASTBOUND I-70

Eastbound I-70 between Exit 203 and Exit 205 will operate well with the planned addition of the auxiliary lane through 2045. However, the analysis shows that, by 2035, eastbound I-70 will need improvement for the segments ***west of*** Exit 203 and through the interchange. This may include the need to add an additional lane under CO 9 and improve the eastbound off-ramp.

5.7.2 WESTBOUND I-70

Westbound I-70 is expected to benefit from improved capacity for the Exit 203 off-ramp and the intersections along CO 9. The benefits would last up to 2035, but not much longer than that. By 2035, there would be a need for additional improvements to westbound I-70 (e.g. making the ramp a two-lane exit ramp, modifying Exit 203 to a higher capacity interchange).

The two Exit 203 interchange design options considered in this phasing analysis (two-lane roundabout, signalized intersection) are expected to provide acceptable LOS (LOS D or better) for the intersections on CO 9 through at least 2025 and maybe a few years beyond that. By 2035, the Lusher Court/Dillon Dam Road and the I-70 westbound ramps intersections will need additional improvements (e.g. additional lanes on CO 9, including the bridge or restricted movements at Lusher Court, or some type of a grade separation/frontage road underpass).

Overall, making improvements at the Exit 203 westbound off-ramp, such as making the roundabout a two-lane roundabout and adding a long storage lane to the westbound off-ramp (not a second exit lane off I-70) would provide immediate benefit and provide at least 5 years to 10 years (between 2025-2030) before additional improvements would be required.

6 STAKEHOLDER INVOLVEMENT

6.1 CONTEXT SENSITIVE SOLUTIONS (CSS)

The FHWA defines CSS as: a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist. CSS principles include the employment of early, continuous and meaningful involvement of the public and all stakeholders throughout the project development process.

This section documents the CSS process conducted for the I-70 Eastbound Auxiliary Lane and Exit 203 Interchange Feasibility Study.

6.2 PROJECT LEADERSHIP TEAM

As required by the CSS process, CDOT formed a Project Leadership Team (PLT) prior to initiation of the Study. The PLT ensured that the CSS process was followed and that conclusions from the Study were developed in an open, collaborative process.

The PLT was comprised of representatives of key stakeholder agencies and organizations within the project study corridor. The following organizations were represented on the PLT:

- Federal Highway Administration
- CDOT Region 3
    - Roadway
    - Traffic
    - Environmental
- Summit County
- Town of Frisco
- Town of Silverthorne (invited)
- I-70 Mountain Corridor Coalition
- The Consultant Team

6.2.1 PLT MEETING #1

The first PLT meeting was held on August 7, 2018 at the Community Commons in Frisco. Representatives from CDOT Region 3, FHWA, the Town of Frisco, Summit County, and the Consultant Team attended. This was the first PLT meeting so an extensive overview of the project was given including the background and history of the project, a review of the scope and schedule, a discussion about the CSS process, and a conversation regarding key issues and local concerns.

The discussion about concerns covered a variety of areas including trail access and connections, being aware of private holdings, network solutions, aesthetics, noise, water quality and safety. The key topics discussed by the PLT are listed below.

FHWA

- Stay focused on safety and capacity of the I-70 corridor
- Pay attention to the I-70 PEIS
- Lane balance at Exit 205

CDOT ENVIRONMENTAL

- Believe Environmental Overview is the right approach (clarified that this means no analysis) during the Feasibility Study
- Not aware of any significant issues
- Noise issues related to Lake Hill
- Multi-modal access; discussion around latent demand and the current observations of pedestrian traffic across I-70
- Water quality - wetlands, sand in drainages and river- is an item to pay attention to during environmental phases

CDOT ACCESS

- Must consider the redistribution of traffic and how to manage the inflow to the Dillon Dam Road intersection

SUMMIT COUNTY

- The adjacent intersection on SH9 (Summit Boulevard) and Lusher Court/Dillon Dam Road is part of the project; other intersections to the south should be given consideration, but not addressed in the project

- Trails connections and planning will impact the project as access to trailheads are improved (may change demand at Exit 203) and connections made between trails; considering connecting to the Salt Lick Gulch and Meadow Creek trailheads
- It was noted - CDOT ROW and ROW in general around Dillon Dam Road is complex
- The private holdings near the project corridor (Giberson Preserve) maybe challenging to accommodate some options
- Need to consider the progression of bottleneck relief along SH 9 moving towards Exit 203 and how this last piece in the corridor may affect the operations of the corridor

TOWN OF FRISCO

- CSS needs to meet the needs of both corridors, but some elements such as aesthetics may be more critical on SH 9
- View the project as a network solution
- Consider the Frisco and Summit County Trails Plans

6.2.2 PLT MEETING #2

The second PLT meeting was held on November 30, 2018 in the Straight Creek Conference Room at the Mountain Residency (West Tunnels), Frisco. The purpose of the meeting was to reaffirm critical success factors, provide information on the work to date and the draft concepts, and obtain feedback. Fifteen (15) people attended including representatives from CDOT Region 3, the Town of Frisco, Summit County and the Consultant Team. A project update was given as well as a review of the work completed and the project schedule.

Several draft documents were delivered prior to the meeting including the DRAFT Travel Demand Forecasting Approach and the DRAFT Environmental Overview Memo.

The key topics discussed by the PLT are listed below.

CDOT TRAFFIC

- Look at continuous counters to see if Dec 30, 2017 data is a good day to base existing traffic numbers; verify the 30th highest hour volume for I-70.
- Even though SAR shows no safety issue at WB 203 off, this is a high-risk area due to high speed differential with ramp traffic stopped next to through-lane

SUMMIT COUNTY

- There should be equal weight on the EB lane work vs. the 203 Interchange

- Intersection LOS is not capturing side-street difficulties, Critical Success Factor is a "Network" solution, and side-streets are critical to this network, all agreed – recommend using Summit County and Town of Frisco Planning Guidelines
- The operations analysis on I-70 should include the interactions on the I-70 corridor (NOTE: VISSIM will be used for detailed analysis of alternatives, for now the feasibility study will use HCS corridor operations software that provides a high-level interaction analysis between corridor segments).

TOWN OF FRISCO

- Full movement at Lusher Court/DDR is a priority for the Town of Frisco and Summit County.
- Ten-mile road as an alternate route would be a fatal flaw = collector function, local residential area

6.2.3 PLT MEETING #3

The third PLT meeting was held on May 3, 2019 in the Conference Room at the Mountain Residency in Silverthorne. The purpose of the meeting was to provide an update on project funding, evaluate public input from the open house, and discuss strategies for moving forward.

16 people attended in person or joined the meeting by phone. Representatives from CDOT Region 3, the Town of Frisco, the I-70 Mountain Corridor Coalition and the Consultant Team. A project update was given as well as a review of the work completed and the project schedule. During the project update, a review of the critical success factors was covered, an overview of the project funding, a summary of the public meeting and project strategy for the next task order.

The key topics discussed by the PLT are listed below.

PUBLIC MEETING SUMMARY

- There was generally good support from community with good comments regarding the options presented.
- The public wants to see change and improvements to the project corridor with little environmental impact.
- There were concerns on pedestrian access, how to tie-in to 205 (weave), and CO 9/Dillon Dam Road capacity in the future.

PLANNING AND TRAFFIC

- Methodology for forecasting demand was approved in the Travel Demand Forecasting Approach memo.
- The December 2017 volumes used for the forecasting basis equals the 30th hour design volume used to project future capacity. This was a criterion to verify as given by the PLT in November meeting.
- The project team forecasted traffic volumes out to 2045 to be consistent with CDOT planning, but the project scope of work indicates a 20-year forecast horizon will be used – or a planning year of 2040.
- The PLT discussed the planning horizon at length 2040 vs 2045 vs 2050 and agreed to meet with FHWA to make a final determination (NOTE: Project team met with FHWA and agreed to 2045 for analysis and decision-making to be consistent with CDOT planning and potential construction year delivery.)
- Existing conditions and the No Action 2045 analysis shows LOS F for Lusher/ DDR and the team did not pursue Lusher/DDR options that eliminated access or forced improvements on 10-Mile Road. However, the team evaluated phased (2025, 2035) interchange and signal timing improvements on CO 9 that provided improved LOS for Lusher/DDR through 2035.Lusher/DDR intersection can only be improved long-term (beyond the 15 years/2035) if signal phases or approach movements are removed from the intersection. This includes EB/WB through movements or left turn movements.

SUMMIT COUNTY

- Pedestrian access is important to the area and that there is minor foot traffic across the bridge, but more significantly, there is pedestrian crossing activity across I-70. If no room is allowed on the bridge, can a pedestrian bridge be built that is aligned closer to transit center and trailhead? This is likely the destination for the pedestrian traffic - between the trailhead and Base Camp.

TOWN OF FRISCO

- There are options to consider on 10-Mile Road, including removing the curved alignment on DDR by using the space between the KFC and the Starbucks (i.e. a straightened alignment from Lusher across CO 9).

6.3 PUBLIC MEETINGS

A public meeting was held Wednesday, February 20, 2019 from 4:00pm-7:00pm at the Frisco Adventure Park Day Lodge, 621 Recreation Way, Frisco. The meeting was attended by over 30 people.

The meeting was advertised using a press release, a print advertisement, and electronic distribution. The press release included a description of the project, the goals of the project and information for the public to access information about the project on CDOT's website.

During the public meeting a 25-minute presentation was given using Power Point. The Power Point presentation covered the Meeting Purpose, an overview of the PEIS and the CSS process, an outline of the critical success factors as well as descriptions of the completed work.

16 boards were displayed which gave an overview of the project, existing conditions and the proposed outcomes of the feasibility study. Staff from CDOT and the project team were present to answer questions. Comment cards were filled out by attendees. The comments covered an array of topics including: concerns about congestions, pedestrian and bicycle access, possibility for an HOV/Express Lane, removal of the roundabout, the scenic overlook, and freight access. All comments were addressed after the meeting by CDOT and the Project Team.

Specific information that was presented included:

- Welcome and information
- Purpose of the meeting and a project overview
- Description of the Context Sensitive Solutions (CSS) process and where we are in the process
- Environmental overview of biological, historic and recreational resources and potential hazardous materials locations
- Existing traffic operations conditions on I-70, the Exit 203 interchange, and CO 9/Lusher Court/Dillon Dam Road intersection

- I-70 corridor safety assessment
- Traffic forecasting methodology
- I-70 eastbound auxiliary lane concept cross sections
- Exit 203 and CO 9/DDR interchange conceptual options (two-lane roundabout and signalized interchange)
- Project schedule and next steps

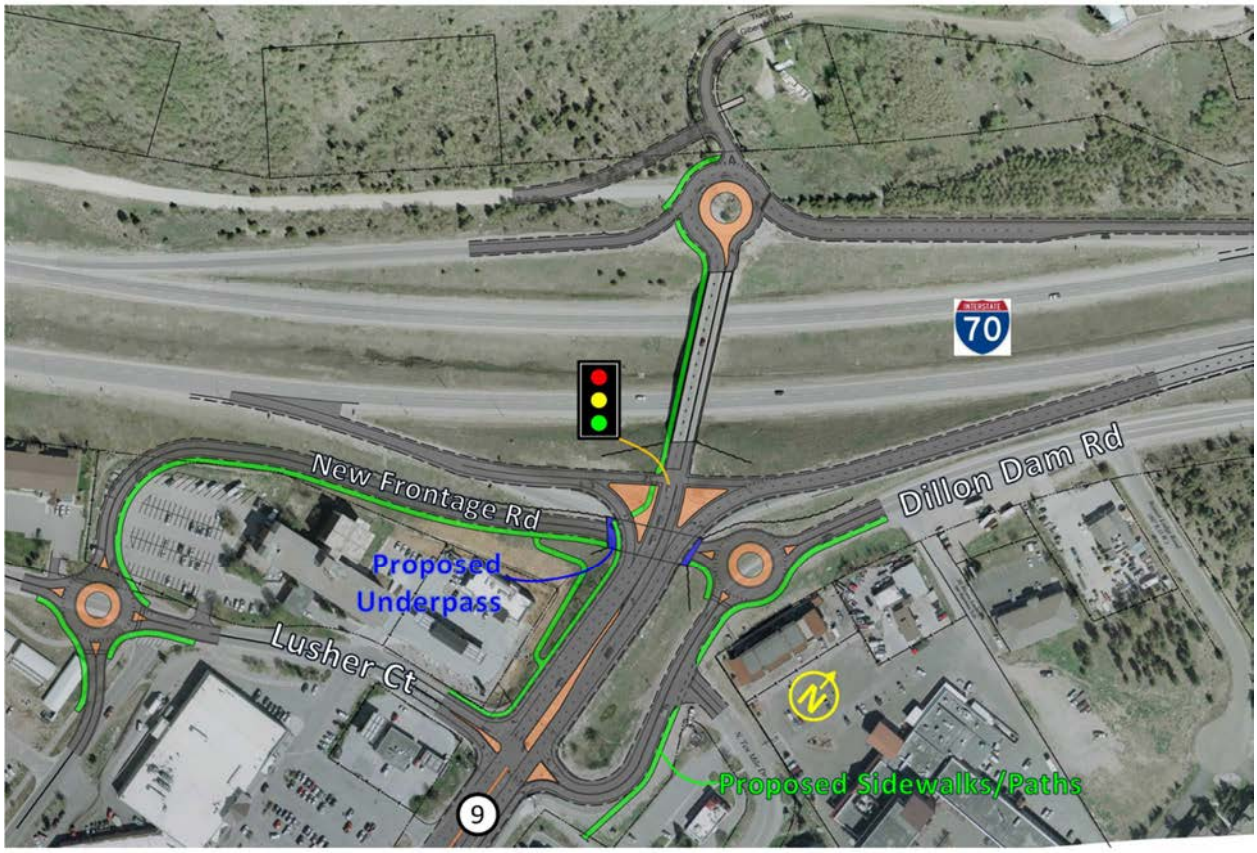
7 CONCLUSION

7.1 OPERATIONS CONSIDERATIONS

The operations of the Exit 203 interchange and CO 9 corridor is dependent upon the relationship between the Exit 203 intersections and the CO 9 /DDR intersection. Several considerations are noted below:

- The CO 9/DDR intersection does not operate better than LOS F in 2045 without access controlled or high capacity intersections, such as a CFI, that combine or remove signal phases from the intersection timing. The tight spacing of the intersections between the EB ramps and the CO 9/DDR intersections create challenging design issues related to turn movement storage and queuing capacity in the SB direction
- Due to the high-volume demand in 2045, and interaction of the CO 9/DDR intersection with the Exit 203 ramp intersections the two-lane roundabout and the signalized intersection options for the Exit 203 intersection do not operate better than LOS E through 2045 without significant changes at CO 9/DDR.
- With a new bridge and I-70 realignment, the SPUI option would help to improve this condition and operate well, at LOS D. This is because the SPUI provides one less signal phase (compared to a standard signalized intersection) and can better process the NB left turns, which gives the WB ramp more green signal time.
- The TUDI option with the frontage road underpass operates well at LOS C overall, but congestion backups from the CO 9/DDR intersection impact queue lengths at the EB ramps. The CO 9/DDR intersection operations are improved with the through movements redirected onto the frontage road, which in turn allows the signalize intersection to work much better.
- Implementing a new frontage road underpass along with access control at CO 9/DDR (reducing access to right-in and right-out from DDR and Lusher Court and a northbound left turn from CO 9 to Lusher Court) greatly improves both traffic operations and provides more flexibility to the geometric design of the Exit 203 ramp intersections. Figure 7-1 shows a Revised Exit 203 Concept with a fully developed frontage road underpass and CO 9/DDR intersection that addresses both geometric and operation issues.

Figure 7-1: Revised Exit 203 and CO 9/DDR Intersection Concept



7.2 RECOMMENDATIONS

The results of the analysis from the feasibility study lead to both short-term and long-term solutions.

7.2.1 SHORT-TERM RECOMMENDATIONS (< 5 YEARS)

Short-term solutions, within the next five years, are necessary to address immediate needs and concerns related to the I-70 corridor. The EB downhill direction of I-70 experiences heavy congestion and safety problems related to the steep grade (>6%) and the slow-moving, heavy vehicles in the outside lane. The WB direction of I-70 regularly experiences congestion and queuing that is caused by the inadequate capacity of the Exit 203 interchange. This issue is significant in that even though the I-70 safety report conducted for the project shows no safety issue at WB 203 off, this is a high-risk area due to high speed differential with ramp traffic stopped next to through-lane. This has the potential for serious consequences.

Short-term improvements are recommended to address these issues.

I-70 EXIT 203

- I-70 EB auxiliary lane through Exit 205
- Safety signing such as VMS and warning signs (speed, curve, grade) and additional guardrail installation

As recommended by the safety study, the auxiliary lane provides additional capacity for the eastbound direction of I-70. In addition, safety signing and guardrail provide layers of awareness of conditions and protection against rollovers, respectively.

- Exit 203 WB ramp storage lane
- Exit 203 WB ramp northbound meter signal into roundabout, a two-lane roundabout or a signalized intersection
- Restripe CO 9 bridge over I-70 to three lanes - two SB and one NB lane (consider separate pedestrian crossing)
- Optimize signal operations along CO 9

These recommendations provide capacity for the interchange through 2035. Additional intersection laneage and storage lanes at the WB ramp intersection remove the I-70 congestion and queuing issues related to the WB ramp intersection.

7.2.2 LONG-TERM RECOMMENDATIONS (>15 YEARS)

Long-term solutions, beyond 2035, are necessary to address future capacity needs related to the I-70 corridor and the CO 9/DDR intersection. The interchange at Exit 203 will continue to see increased vehicle demand beyond 2040 that will lead to failing levels of service even with short-term improvements. Long-term recommendations include higher capacity ramp intersections and ramp improvements combined with significant changes to CO 9/DDR

The CO 9/DDR intersection in its current configuration will begin to fail in 2035 even with improved signal timing on CO 9 and improvements at Exit 203.

I-70 EXIT 203 AND LUSHER COURT/DILLON DAM ROAD

The Revised Exit 203 Interchange and CO 9/DDR Intersection Concept addresses the future capacity needs related to I-70 and CO 9. This includes:

- Higher capacity Exit 203 ramp terminal intersections (multiple lane roundabouts or DDI) and storage length in combination with,
- Implementation of a new frontage road underpass and access control at CO 9/DDR

Several interchange options were evaluated and only the SPUI provided acceptable operations and geometric configurations without significant changes to CO 9/DDR. The SPUI option has high costs and requires realigning I-70 mainline. Multiple options to improve CO 9/DDR were evaluated, and the only options that include eliminating and redirecting movements provided needed capacity. Access control at CO 9/DDR combined with an adjacent new frontage road underpass improves the operations and provides greater flexibility to improve the Exit 203 interchange intersections and ramps.

7.2.3 2045 RECOMMENDATION

The feasibility study suggests that a new frontage road underpass combined with access control at CO 9/DDR intersection along with improved Exit 203 ramp intersections and ramp capacity as shown in Figure 7-1. The access control at CO 9/DDR would restrict through movements that would be accommodated with a frontage road from Dillon Dam Road under CO 9 near the interchange and connect to Lusher Court on the west side of CO 9. These changes at CO 9/DDR provide operational improvements and geometric flexibility to improve Exit 203. This concept is recommended for advancement to future project development and approval activities.