

ALTERNATIVES DEVELOPMENT AND EVALUATION
TECHNICAL MEMORANDUM



April 2014



**EB I-70 Peak Period
Shoulder Lane**
CATEGORICAL EXCLUSION



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Acronyms and Abbreviations

AGS	Advanced Guideway System
ATM	Active Traffic Management
CCC	Clear Creek County
CDOT	Colorado Department of Transportation
CSP	Colorado State Patrol
CSS	Context Sensitive Solutions
FHWA	Federal Highway Administration
LOMR	Letter of Map Revision
MUTCD	Manual of Uniform Traffic Control Devices
PEIS	Programmatic Environmental Impact Statement
ROD	Record of Decision

Section 1. Description of the Proposed Action

1.1 How was the Proposed Action Developed?

The Proposed Action was derived from the I-70 PEIS Preferred Alternative Minimum Program. It is an *expanded use of the existing transportation infrastructure*. This category of Non-Infrastructure Components is included in the Preferred Alternative Minimum Program. It is specifically described in various reports, including the *Efficient Use of Highway Capacity* (FHWA, 2010) and the *I-70 Mountain Corridor Phase II Feasibility Study: Evaluation and Screening of Operational Alternatives* (CDOT, 2011a).

An extensive stakeholder process was initiated in April 2013 to develop the details of the Proposed Action. This process is described in more detail in Appendix B of the Categorical Exclusions

1.2 What is the Proposed Action?

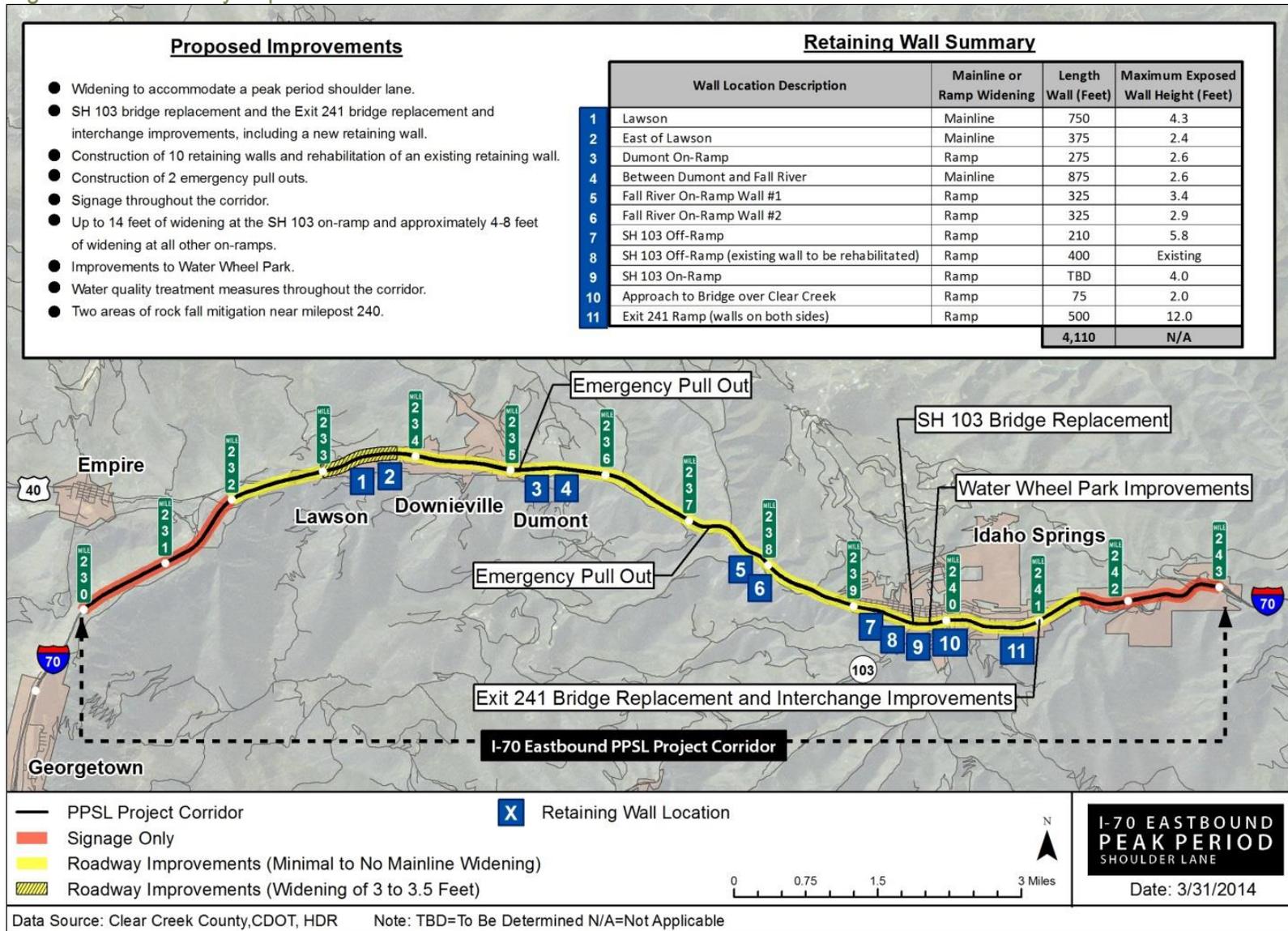
The purpose of the I-70 PPSL project is to provide short-term eastbound operational improvements to relieve traffic congestion during periods when traffic volumes are highest. This segment is the most congested stretch of the entire I-70 Mountain Corridor. During both the summer and winter peak season, traffic volumes are highest on weekends when recreational travelers comprise more than 90 percent of traffic. In 2010, drivers experienced speeds of less than 20 miles per hour for 35 percent of the time on Sundays, which have the highest volume. Some motorists divert to the frontage road along I-70, which affects its ability to function as a local access county road.

The Proposed Action would add a peak period shoulder lane between the US 40/I-70 interchange and east Idaho Springs. This managed lane would be used during peak periods, defined as Saturdays, Sundays, and holidays, improving travel times and operations. The project extends from milepost (MP) 230 to MP 243, with improvements proposed as follows:

- MP 230 to MP 232—signage improvements only. Signage would notify motorists of the status of the managed lane, entrance and exit points, and cost.
- MP 232 to MP 242—roadway improvements, including up to 3.5 feet of widening in select areas to accommodate the managed lane, up to 14 feet of widening at the SH 103 on-ramp, and 4 feet to 8 feet of widening at all other on-ramps in the corridor; replacement of the existing SH 103 bridge; bridge replacement and interchange improvements at Exit 241; improvements to Water Wheel Park; signage; rock fall mitigation in 2 locations; and construction of 11 retaining walls.
- MP 242 to MP 243: signage improvements only.

Figure 1 provides the location of these improvements.

Figure 1. Roadway Improvements



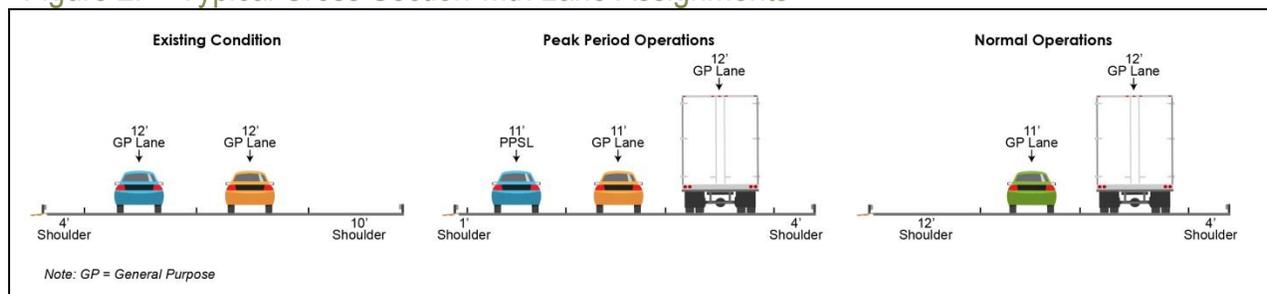
The managed lane, which would be tolled, is subject to the following limitations:

- The toll facility shall operate in time periods between 11:00 a.m. and 8:00 p.m.
- The toll facility shall operate on Saturdays and Sundays from December through March and July through September.
- The toll facility shall operate on holidays throughout the year.
- When necessary, the toll facility shall be allowed to operate during emergency closures of the general purpose lanes.
- The toll facility's operations are weather-dependent.
- The toll facility shall not operate in excess of 20 percent of the annual days per year, including holidays (73 days) or 7.5 percent of the annual hourly time.
- The toll facility shall cease operation by 2035 unless modified by a different project that may or may not be a part of the corridor's long-term solution.

The Proposed Action utilizes the center (left) lane. The existing and proposed typical section is illustrated in Figure 2 and includes:

- A 12-foot wide inside shoulder that also serves as an 11-foot managed lane with a 1-foot shoulder during peak times.
- A center lane that is 11 feet wide.
- An outside (right) lane that is a 12-foot-wide general purpose lane.
- A minimum 4-foot-wide outside (right) shoulder.

Figure 2. Typical Cross Section with Lane Assignments



Source: HDR

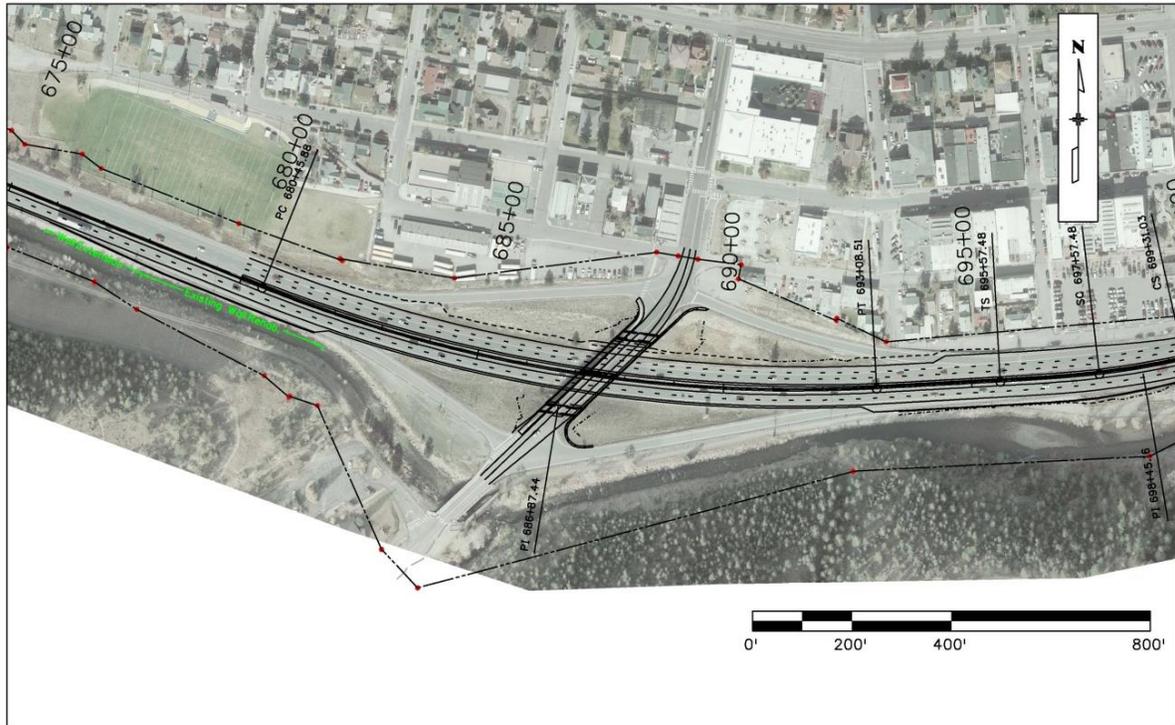
The Proposed Action includes replacement of the bridge that carries SH 103 over I-70, as shown on Figure 3. The bridge would be widened (from 38 feet to 59 feet) to include a center auxiliary lane to accommodate future vehicle storage for left turn movements onto both the eastbound and westbound on-ramps onto I-70, wider shoulders and a wider sidewalk. Other improvements at this location include:

- Shifting of the interstate horizontally to provide for both of the new bridge piers. The eastbound lanes are shifting slightly south and the westbound lanes are shifted slightly north just in the vicinity of the bridge.

- Minor interchange improvements to align the on and off-ramps with the horizontal shift of I-70.
- Pedestrian improvements to build a new 10 foot walk on the west side of the new bridge. This is a substantial improvement to the existing 4 foot walks on both sides of the bridge.
- Shoulder widths will change from two feet on each side to two feet on the west side and a four foot shoulder on the east side.

The cross sections of SH 103 are shown on Figure 4.

Figure 3. SH 103 Plan View of Improvements



Source: HDR

Figure 4. Cross Sections of SH 103



Source: HDR

The Proposed Action includes replacement of the bridge at Exit 241 and interchange improvements at this location (see Figure 5). These improvements include:

- Interchange improvements that consist of two new roundabouts, one on each side of I-70.
- Lengthening of acceleration and deceleration lanes.
- Pedestrian and bicycle improvements to include a 10-foot walk on the west side of the bridge.

Figure 5. Exit 241 Bridge Replacement and Interchange Improvements



Source: HDR

The Proposed Action includes improvements to the Water Wheel Park and the Greenway Trail in the vicinity of the park (see Figure 6). Improvements include:

- Grading of the Water Wheel Park and the Greenway Trail to lower the areas most utilized by pedestrians in order to improve the user experience by reducing noise from vehicles on I-70 and screening the views of the interstate.
- Redesigning of the hardscape plaza area to improve accessibility down to Clear Creek, fishing access, and views of the Charlie Taylor Water Wheel.
- Installation of interpretive and retaining walls that showcase the unique habitat of Clear Creek and the history of mining in Clear Creek County. These may be used by school groups, tour groups, or recreational users of the Greenway Trail to better understand the history and natural environment of Idaho Springs and Clear Creek County.
- Making landscaped areas consistent with native vegetation in the area. Low plantings and grasses will be used so as not to obscure views of the Charlie Taylor Water Wheel from I-70 motorists. Existing riparian trees, vegetation and wetland habitat will be preserved and restored.

Figure 6. Plan View of Improvements for the Water Wheel Park



Source: THK Associates

The Proposed Action includes two emergency pull outs located adjacent to the on-ramp at the Dumont interchange and on a flat area just past MP 237. Figure 7 shows the location of these pull outs. These are proposed to be in addition to six off-ramp locations also available for emergency use.

Figure 7. Emergency Pull Out at Dumont and Just East of MP 237



Source: HDR

The Proposed Action is an interim improvement. As traffic volumes increase over time, other transportation improvements are intended to be constructed to meet the 2050 Purpose and Need as defined in the *I-70 Mountain Corridor PEIS* (CDOT, 2011b). CDOT will monitor its travel time reliability, use, and safety and crash data annually. The Proposed Action will be reassessed in 2020.

Signage is needed to make sure the I-70 users are aware of the safe use of the new infrastructure. Signs will be placed in the median cantilevered over the managed lane and on the sides of the road. The signage plan is context sensitive, using the minimum size signs necessary. New overhead signs are proposed in 19 locations (of which 9 will be Active Traffic Management (ATM) signs, which means they will be blank most of the time). New ground mounted right side sign installations and median sign installations are proposed as necessary for compliance with FHWA sign guidance. Existing speed limit signs will be removed and replaced with Variable Speed Limit (VSL) signs. Appendix A includes a listing of all of the planned signs.

The Proposed Action includes two general purpose lanes which will remain open for free to all travelers. The PPSL will be tolled using transponders or license plate tolling. The PPSL will be subject to variable or dynamic pricing, which means different price levels can be triggered by traffic flow thresholds using real time traffic detection equipment. Pricing is planned to achieve the desire lane use in order to keep the lane operating at a speed of 45 miles per hour.

The Proposed Action includes an assumption of enforcement focused on traffic violations such as speeding, driving too fast for the conditions, vehicles crossing the separation treatment (solid white stripe) when the PPSL is in operation and vehicles driving on the shoulder when the PPSL is closed. Multiple toll points will be installed along the project corridor. Closed circuit television surveillance and recording can be used to review the frequency of violations (such as monitoring vehicles illegally crossing the solid white line) and to determine specific areas for enforcement [Concept of Operations for I-70 Peak Period Shoulder Lanes (Apex and HDR, 2014)].

Two areas of rock fall mitigation are needed to accommodate the Proposed Action. The western location would be approximately 375 feet long and 55 feet high, and the eastern location 500 feet long and 50 feet high. Locations of these areas are shown on Figure 8.

Figure 8. Rock Fall Mitigation Locations



Source: HDR



Rock fall mitigation site at mile marker 240



Rock fall mitigation site at mile marker 240.4

Section 2. What Alternatives were Considered?

2.1 PEIS Flex Lanes

The I-70 Mountain Corridor PEIS evaluated an alternative called a flex lane. It is very similar to the peak period shoulder lane included as a part of the Proposed Action. The flex lane was eliminated, as described in the *I-70 Mountain Corridor PEIS Alternatives Development and Screening Report* (CDOT, 2011c) because of poor safety as a result of inconsistent lane balance for sections of the highway on either side of the flex lane section. The four foot shoulder included as a part of the flex lane did not meet AASHTO design standards and was incompatible with CDOT's Incident Management Plan which requires sufficient shoulder width to operate emergency vehicles. The four foot wide shoulder does not allow broken down vehicles to get out of the flow of traffic.

The Proposed Action differs from the flex lane in the following ways:

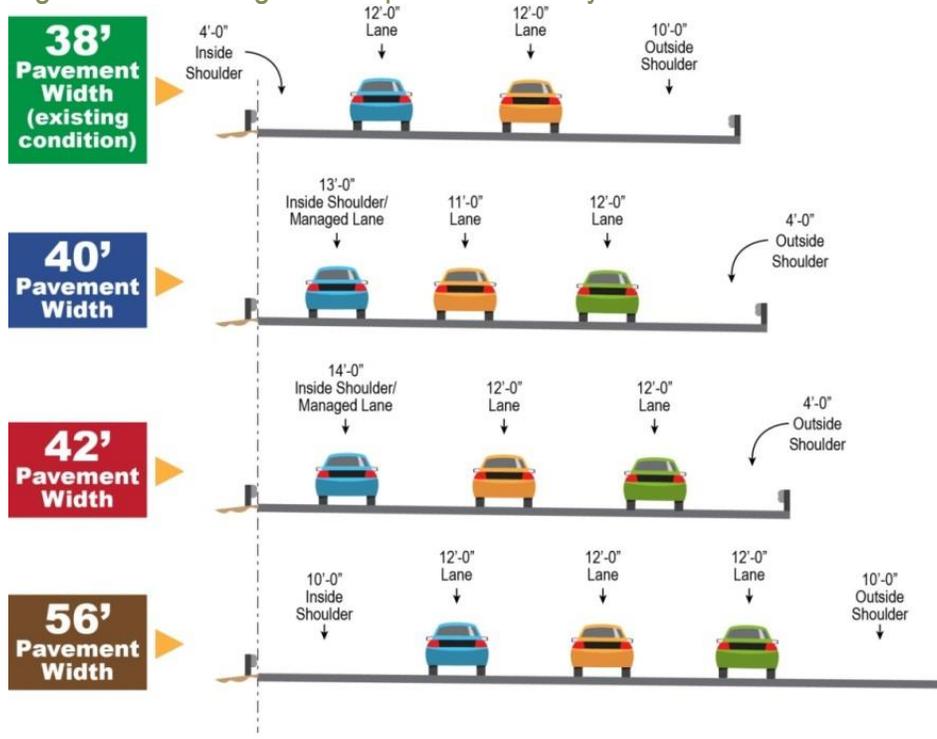
- It is tolled. This allows for CDOT to actively manage the lane in emergency situations, such as in case of a broken down vehicle or if emergency vehicles need to use the tolled lane.
- It is subject to Active Traffic Management. This substantially reduces concerns about safety because it will be monitored by closed circuit television cameras and traffic controlled through variable speed limit signs and lane use signs.
- It is an interim improvement, intended to be removed and replaced by a longer term improvement.
- It connects logical termini from a major interchange ramp on the western end to a three lane section on the eastern end, so the issue of lane imbalance is not a concern.
- It is considered a safe operation. New safety analysis that has been done since the PEIS of

similar applications in Minneapolis, Northern Virginia, California, The Netherlands, Germany and Great Britain indicate that similar applications can experience a reduction in crash rate.

2.2 Roadway Width

The existing width of I-70 through the study area varies from less than 37 feet to just less than 40 feet. In general, it is comprised of a 4-foot-wide inside shoulder, two 12-foot-wide travel lanes, and a 10-foot-wide outside shoulder. Driver expectations and comfort levels are a concern for the I-70 corridor because of the large number of recreational travelers who do not drive the road on a regular basis, as well as out-of-state truck drivers. Some of the other PPSL-type projects that were analyzed for comparison were in urban settings, which are primarily traveled by commuters with a high level of familiarity with the road configuration. (See Figure 9 for an illustration of existing and proposed roadway widths.)

Figure 9. Existing and Proposed Roadway Widths



Source: HDR

Option 1: 40-Foot or Greater Width Option

- A 40-foot pavement width option = 13-foot inside shoulder/PPSL, 11-foot travel lane, 12-foot travel lane, 4-foot outside shoulder. Eleven retaining walls would be constructed, with a maximum wall height of 4 feet. Because the 11-foot-wide lane is less than the standard 12-foot width, it is inconsistent with driver expectations and could result in additional safety concerns.
- A 42-foot pavement width option = 14-foot inside shoulder/PPSL, two 12-foot travel lanes, 4-foot outside shoulder. This option would require an additional nine retaining walls (20 total), with a maximum wall height of 8.9 feet. The travel lanes would be the standard 12 feet in width during both peak and off-peak periods.

- A 56-foot pavement width option = 10-foot inside shoulder, three 12-foot travel lanes, 10-foot outside shoulder. This option is not consistent with an interim project like the PPSL and would result in more impacts. Therefore, it was not considered further.

Option 2: Hybrid Width Option (Preferred Option)

Following further analysis and extensive stakeholder involvement, it was determined that no widening would be needed throughout most of the corridor, prompting the development of a hybrid approach. Rather than treating the 13-mile-long PPSL corridor as a homogeneous road, the corridor was analyzed in detail to determine where widening and the addition of new retaining walls and emergency pull outs would be needed. It was determined that:

- No widening is needed between MP 230 and MP 232.
- Minimal to no mainline widening would be required between MP 232 and MP 241, with the exception of the cross-hatched area between MP 233 and MP 234 shown on Figure 1. In this area, a widening of the roadway by 3 feet to 3.5 feet would be needed.

The hybrid width option is the preferred option because it requires less infrastructure and is, therefore, less costly. It is also more likely to meet the desired schedule, is easier to maintain, and is more consistent with an interim project. Although the 40-foot model was identified as better for meeting AASHTO design standards, it was determined that the hybrid model will not negatively impact safety or mobility. The hybrid model also better protects environmental resources by reducing new infrastructure, avoiding encroachment into Clear Creek, reducing the number of retaining walls, and minimizing visual impacts. The hybrid model also better adheres to the Context Sensitive Solutions (CSS) process with clear preference by Clear Creek County (CCC) stakeholders. See Appendix B for the evaluation matrices used for all alternatives.

2.3 Left Side versus Right Side

The project could be constructed with the PPSL on either the left side or the right side. The existing roadway configuration is shown on Figure 10.

Option 1: PPSL on the Left Side (Preferred Option)

The potential of head-on collisions during off-peak times is reduced if the shoulder is on the left during normal operations. If the PPSL is on the left side, trucks would travel in the right lane, which is desirable because trucks have additional need for the right lane in order to exit for the Port-of-Entry and the eastbound chain-up areas during the winter. If the PPSL is on the right side, trucks would travel in the center lane, and general traffic would have to pass trucks on the right in the PPSL. Fewer signs would be required for the left side option, because the signs required for the express lane beginning at the Twin Tunnels could be consolidated with PPSL signs. For the left side, the configurations of the general purpose lanes remain consistent during off-peak and on peak hours, enhancing driver comfort. In addition, this design is more consistent with similar operations in the Denver metro area, potentially reducing confusion for some drivers. Traffic flow in the PPSL would be smoothest if it is located on the left side, away from the acceleration and deceleration lanes, and from slower-moving trucks and cars.

Figure 10. Existing Roadway Configuration



Source: Apex Design

Option 2: PPSL on the Right Side

More potential conflict points are created if the PPSL is on the right side. At exits, faster-moving traffic in the right PPSL lane would encounter slower vehicles accelerating onto or decelerating off of the highway. An advantage to this option is that the right shoulder would be available to vehicles experiencing a breakdown or accident. Drivers typically expect to pull to the right in case of an emergency. The Colorado State Patrol (CSP) recognizes that currently there are limited desirable areas for pulling over vehicles for enforcement of traffic laws. CSP troopers attempt to account for driver reaction time, and will deploy lights accordingly to pull drivers over in acceptable areas. It is noted that this is difficult to do given the wide range of driver behaviors. Troopers would use pull outs for enforcement but would not pull vehicles over to the left for enforcement. It is known that drivers should pull over to the right for emergency vehicles and so utilizing the left lane (even in off-peak conditions) would likely not happen. More signage would be required for the PPSL on the right side (25 signs rather than 11 signs required for the left side option). Table 1 presents the pros and cons of a left-side PPSL versus a right-side PPSL.

Table 1. Left-Side versus Right-Side PPSL

	Pros	Cons
LEFT	<ul style="list-style-type: none"> Managed lane clearly defined. Consistent operations peak and off peak. Reduces signing by 50%. Ability to add rumble strip between general purpose and managed lanes. 12' lane is on the far right used by trucks. 	<ul style="list-style-type: none"> Shoulder is wider on the left during off peak periods (unconventional). Deceleration lanes will be reduced. Ice and snow removal issues (100% of the time). Striping at the Twin Tunnels will not match PPSL project for express lane.
RIGHT	<ul style="list-style-type: none"> Breakdown lane is on the right side of the roadway. PPSL lane would be a continuous add lane at US 40 interchange. 	<ul style="list-style-type: none"> Increases signing by up to 50%. Managed lane is not clearly defined. Peak and off peak operations differ. 12' lane is in the middle, meaning cars will need to pass trucks on the right. Trucks have to weave right to reach port-of-entry. No opportunity for rumble strip. Inattentive drivers may end up on the managed lane.

After extensive stakeholder involvement, including separate meetings with emergency responders and the Colorado Motor Carriers, the conclusion of this analysis is that the left side is preferred for the PPSL. Emergency responders preferred this option because of the reduced potential for head-on collisions during off-peak hours and increased driver comfort. Truck operators preferred this option because it keeps truck travel closest to the right side of the road, keeping general traffic from passing trucks on the right and making it easier for trucks to exit to the Port-of-Entry and for chaining up. Impacts to safety and visual resources would be less than the right side option, and traffic operations would be most improved by placing the PPSL on the left side of the roadway.

2.4 Widen to Creek or Median

In the four areas of the PPSL corridor where the pavement would be widened, there is the option to widen either towards Clear Creek or towards the median. Each of the four areas was evaluated individually, with conclusions of this evaluation shown below.

Option 1: Widen to the Creek

Widening to the creek would require clearing of trees and other riparian vegetation in some segments, resulting in visual impacts and degrading the recreational experience on the creek. The number and size of retaining walls that would be required for creek-side widening were considered with respect to their impact to the bed and bank of Clear Creek, their cost to build and maintain, and their visual impacts to users of both the creek and I-70. The safety concerns related to retaining walls capped with guard rails which block emergency responder access to the creek was also a consideration in certain areas. Widening toward Clear Creek was chosen in the following locations:

- At Lawson and east of Lawson: This option was chosen because there is no available median
- Dumont On-Ramp and East of Dumont: This option was chosen to reduce roadway runoff on the slope, to encourage vegetation growth and preserve the grade-separated median.
- Fall River On-Ramp: This option was chosen to reduce roadway runoff, encourage vegetation growth on the slope and maintain the width of the grade-separated, vegetated median. A retaining wall is needed and would be needed even if the widening would occur to the median.

Option 2: Widen to the Median

Widening to the median would reduce the potential for encroachment into the creek. This option would require a guard rail in the median, but not a retaining wall between the highway and the creek, thereby maintaining wildlife permeability and easier access to the north side of Clear Creek from I-70. Visual impacts would be minimized, but are of concern to stakeholders, which is the primary reason the *CSS Engineering Design Criteria* (CDOT, 2011d) specify that the existing median width should be maintained. In some areas the median provides a grade separation between eastbound and westbound lanes, enhancing safety. The cost of widening to the median is generally much lower than widening to the creek. Widening toward the median is recommended in two locations:

- Downieville and East of Downieville: This option was chosen in these two locations primarily to protect mature riparian vegetation along Clear Creek. The riparian vegetation serves an important role supporting the aquatic environment and the recreational experience. Since the maximum width of shift into the median is six feet, there is still a substantial green median (16 to 20 feet) that will remain.

Since widening to the median is not consistent with the *I-70 Mountain Corridor Design Criteria and Aesthetic Guidance*, the two locations where this is proposed to be done were subject to a *Median Shift Design Criteria Exception Request*. This evaluation was presented to the Technical Team at three different times in September and October 2013 and then provided to the Project Leadership Team for their concurrence (CDOT, 2013).

2.5 Acceleration and Deceleration Lanes

Option A: Build to AASHTO standards

This option consists of meeting the AASHTO standard acceleration and deceleration lengths for interchange ramps within the PPSL. The interchange ramps currently existing along the PPSL corridor do not meet current AASHTO standards for acceleration and deceleration distances. Upgrading the on-ramps and off-ramps to meet the current standards would provide the maximum safety benefit. Longer ramps would provide increased opportunities for merging and diverging traffic.

Option B: Match Existing (Preferred Option)

Option B includes matching the existing acceleration and deceleration lengths for interchange ramps within the PPSL. The existing lengths do not meet current design standards. Safety may be decreased at the on-ramps and off-ramps. However, no new infrastructure would be required for this option, and visual impacts to recreational and historic resources would not occur. Costs would be lower. Retaining walls would not be constructed and additional encroachment into Clear Creek would not occur.

Option B was identified as the preferred option. It requires less new infrastructure and is less costly to construct and to maintain. The likelihood of meeting the preferred schedule is greater with this option. Although Option A was identified as providing the maximum safety benefit, Option B was determined to not compromise safety when compared to existing conditions, and is consistent with an interim project such as the PPSL. This option better protects environmental resources by constructing less infrastructure (including retaining walls), avoiding encroachment into Clear Creek, and reducing visual impacts. This option was clearly preferred by CCC stakeholders participating in the CSS process.

2.6 SH 103 Options

Because the width of the bridge at SH 103 (35 feet from pier to pier) is not enough to accommodate the PPSL, options were evaluated for improving this interchange, which is the entrance to the center of the town of Idaho Springs. Construction at the SH 103 interchange would be scheduled for April through June to minimize traffic impacts. Three options were developed and evaluated: modifying the existing bridge, constructing a new clear span bridge, and constructing a new two-span bridge.

Option 1: Retrofit Existing Four-Span Bridge

Retrofitting the existing four-span bridge would require removal of one pier of the three piers to accommodate the PPSL. In order to obtain adequate vertical clearance, I-70 would have to be lowered. Lowering the elevation of I-70 would create a sump condition that may allow water to pond on I-70 which is a safety concern. The profile of SH 103 could not be altered or widened to improve pedestrian mobility across the bridge. Significant impacts to traffic would occur on both I-70 and SH 103 during the modification of the existing bridge, which would require 8 weeks to 10 weeks if SH 103 was closed, or 6 to 9 months if a phased approach was used. The retrofits to the bridge would result in a temporary appearance that would not be aesthetically pleasing. Increased risks during construction would occur when working with an existing structure. This option would not provide flexibility for AGS and the ultimate preferred alternative for the I-70 Mountain Corridor.

Option 2: Construct New Clear Span Bridge

Options 2 would provide the opportunity to widen sidewalks alongside SH 103 and a wider shoulder for increased safety. This option would require the full closure of SH 103 and increase construction time to 9 to 12 months. The clear span type of bridge cannot be widened in the future. The clear span bridge would raise the elevation of SH 103 by 1 foot more than the two-span bridge, resulting in more impacts to the ramps and the bridge over the creek. Aesthetically, this could be a signature structure. This option costs five times more than retrofitting the existing bridge.

Option 3: Construct New Two-Span Bridge (Preferred Option)

Like Option 2, this new bridge would be designed to current design and safety standards. Option 3 could be constructed in two phases, leaving one lane of SH 103 open during bridge construction, which would require 6 months to 9 months of construction time. (Full closure of SH 103 would lower construction time to about 8 weeks to 10 weeks.) The design of the interchange would allow for improved pedestrian movements and safety, improved shoulders for motorist safety, and an added turning lane that would facilitate future development, including access to the Advanced Guideway System (AGS). This design would blend well visually with the other bridges in the I-70 Mountain Corridor. Although the new two-span bridge would initially cost more than retrofitting the existing bridge, lower maintenance costs would mean that the new construction would be more cost-effective over the full life cycle.

The new two-span bridge is the preferred option because it allows for flexibility in the cross section of I-70 in the future, minimizes changes to the SH 103 profile, enables wider shoulders and sidewalk to improve safety and pedestrian movement, and allows for an auxiliary lane to improve traffic movement. It will be designed to current standards and provides better aesthetics and shorter construction phasing.

2.7 Exit 241 Bridge Replacement and Interchange Improvements

Options that were developed in this location include:

- Lowering I-70 to allow for sufficient height under the existing bridge. Appendix C includes more information about this option.
- Building a roundabout with a direct westbound ramp (see Figure 11).
- Building a roundabout with a hook westbound ramp (see Figure 12).
- Building a Tee intersection (see Figure 13).

Figure 11. Roundabout with a Direct Westbound Ramp



Source: HDR

Figure 12. Roundabout with a Hook Westbound Ramp



Source: HDR

Figure 13. Tee Intersection



Source: HDR

Pros and cons for these options are presented in Table 2:

Table 2. Pros and Cons for Exit 241 Improvement Options

Options	Pros	Cons
Lower I-70		<ul style="list-style-type: none"> ▪ Construction costs are twice the amount to replace the bridge. ▪ Restricts future options. ▪ Drainage issues.
Roundabout with Direct WB Ramp	<ul style="list-style-type: none"> ▪ Efficient operation under high and low flows. ▪ Separates the highest flow movements, has the highest capacity in either EB or WB directions. ▪ Best intersection and ramp safety. ▪ Best operations—lowest emissions and lowest energy consumption. ▪ Opportunity for entryway treatment. 	<ul style="list-style-type: none"> ▪ Requires a 600' long wall (max ht. 15') along the creek. ▪ Ramp traffic will merge with bridge traffic at crest of curve. ▪ “Over the shoulder” sight distance may be unsafe. ▪ Tie-ins to adjacent businesses both horizontally and vertically are quite challenging. ▪ Funding opportunities may be limited.
Roundabout with Hook WB Ramp	<ul style="list-style-type: none"> ▪ Efficient operation under moderate and low flows. ▪ Best intersection safety. ▪ Ramp meter can help control flows and prevent queues on the freeway. ▪ Very good operations—low emissions and low energy consumption. ▪ Opportunity for entryway treatment. 	<ul style="list-style-type: none"> ▪ Heavy movements potentially conflict with each other, cutting capacity. Westbound exit ramp spillback can be mitigated with a meter (signal) on the EB approach to the roundabout if traffic volumes unexpectedly increase (i.e., PPSL project fails or is eliminated).
Tee Intersection	<ul style="list-style-type: none"> ▪ Signalized, the intersection timing can be actuated to accommodate prevalent demand. ▪ Intersection will meet current design standards and probably have a typical safety record. ▪ Actuated/adaptive signal timing can control flow and prevent queues on the freeway. 	<ul style="list-style-type: none"> ▪ Unsignalized, the intersection will operate at LOS B, but NB Left Turns experience noticeable delay (LOS D at peak times). ▪ A signal will likely be required in the future. ▪ Unsignalized, the NB movements will quickly queue back on to the freeway. ▪ Typical emissions and energy consumption. ▪ No opportunity for entryway treatment. ▪ No stakeholder support.

A summary is presented in Table 3.

Table 3. Exit 241 Interchange Northern Intersection Configuration Considerations

	Roundabout with Direct WB Ramp	Roundabout with Hook WB Ramp	Tee Intersection
Normal Weekday Operations (80%)	Best—Roundabouts operate far more efficiently than other intersections under moderate and low flows.	Best—Roundabouts operate far more efficiently than other intersections under moderate and low flows.	Good—Unsignalized, the intersection will operate at LOS B, but NB Left Turns experience noticeable delay.
Normal Peak Period Operations (with PPSL) (15%)	Best—Roundabouts operate more efficiently than other intersections under moderately high flows.	Very Good—Roundabouts operate more efficiently than other intersections under moderately high flows. However, heavy movements conflict with each other, cutting capacity.	Good—Unsignalized, the intersection will operate at LOS B, but NB Left Turns have LOS D.
Incident Level Traffic Operations (5%)	Very Good—This configuration separates the highest flow movements, has the highest capacity for traffic movements in either EB or WB directions.	Adequate (with meter)—Heavy movements conflict with each other, cutting capacity. WB Exit ramp spillback can be mitigated with a meter (signal) on the EB approach to the roundabout.	Poor (Unsignalized), Good (Signalized)—Unsignalized, the NB movements will quickly queue back on to the freeway. Signalized, the intersection timing can be actuated to accommodate prevalent demand.
Intersection Safety	Best—Roundabouts unquestioningly have the best (5:1 to 9:1 better crash records) safety performance.	Best—Roundabouts unquestioningly have the best (5:1 to 9:1 better crash records) safety performance.	Adequate—This will meet current design standards and probably have a typical safety record.
Exit Ramp Safety	Good to TBD—Ultimately the safety will depend on design parameters. The roundabout will have the smallest likelihood of queues spilling onto the freeway.	Good (with meter)—A meter on the EB approach can control flow and prevent queues on the freeway.	Good (signalized)—Actuated/adaptive signal timing can control flow and prevent queues on the freeway.
Environmental	Best—Best operations will translate to lowest emissions and lowest energy consumption.	Very Good—Very good operations will translate to low emissions and low energy consumption.	Adequate—Adequate operations will translate to typical emissions and energy consumption.
Aesthetics	Best—Entryway treatment possible.	Best—Entryway treatment possible.	Adequate

The recommendation from these analyses is to proceed with a roundabout with a hook westbound ramp because:

- It does not create a potentially unsafe sight distance problem.
- It does not need a large wall along the creek.
- It does not create any problems with access to adjacent businesses.

Figure 14 presents the conceptual plan for the new bridge and new interchange.

Figure 14. Bridge and Interchange Conceptual Plan



Source: HDR

Two meetings were held with residents and stakeholders, which included business owners whose businesses are accessed from Exit 241. Input from this group was primarily focused on business impacts during construction and an interchange design that is easy to navigate. This group agreed with the roundabout option with a hook westbound ramp.

2.8 I-70 Alignment Shift

I-70 in the vicinity of SH 103 needs to be shifted horizontally to allow for bridge piers needed for the SH 103 bridge replacement. Two options were analyzed: a shift to the north and a shift to the south.

North Option

Shifting the alignment of I-70 to the north would result in substantial and costly impacts to drainage, utilities, and parking in the city of Idaho Springs. Increased construction and less parking could result in a loss of visitors to the city. It also likely impacts historic properties protected by the National Historic Preservation Act and Section 4(f) of the DOT Act. Moving to the north would reduce the potential for construction to encroach upon Clear Creek, and fewer walls would result in fewer visual impacts. This option would not impact the Bikeway or Water Wheel Park.

South Option (Preferred Option)

Shifting to the south would not impact the historic Water Wheel but would result in minor impacts to Water Wheel Park. This option would provide opportunities to improve Water Wheel Park, which could increase usage of the park and engage I-70 travelers with community amenities and history. The south option would improve pedestrian mobility and the connectivity and aesthetics of the Bikeway and the Water Wheel Park. Construction in Clear Creek associated with the South Option would result in minor revisions to the floodplain in a non-inhabited area, and a

Letter of Map Revision (LOMR) would be filed with Clear Creek County floodplain administrators following construction.

Shifting the I-70 alignment to the south is the preferred option because it eliminates impact to the city's parking, drainage, and utilities along the north side of I-70. While shifting to the south does have some minor impacts to Water Wheel Park, it provides opportunities for improvements not only to the park but to the multi-use trail along the creek. Additionally, the stakeholders requested that this shift accommodate additional maximum width (~6 feet to 8 feet) to allow for the possibility of a future westbound PPSL. Appendix A contains the final signage plan.

2.9 Signage

Signage would be used to direct drivers safely to the PPSL when in use. Stakeholders expressed a strong desire to minimize the number of signs in the PPSL corridor, and especially to minimize additional lighted signs in a relatively dark part of the I-70 Mountain Corridor. The PPSL would be in use for a small percentage of overall hours, and residents and users of the corridor would prefer not to have large flashing signs present when the lane is not in use. This presents a clear trade-off between safety and the aesthetic effect to viewsheds and the character of the area. CDOT would use the minimum number of signs needed to meet FHWA safety requirements. Use of overhead variable message signs would minimize the visual impact of signage in the PPSL corridor and assist with Active Traffic Management (ATM).

To increase peak capacity and smooth traffic flows in the PPSL, CDOT would use ATM. Techniques of ATM include variable speed limits, variable tolls, ramp metering, and use of variable message signs to control access to the shoulder lane during peak periods. ATM could also be used to close the PPSL to the public in case of an accident so that emergency response vehicles could use the lane. ATM would be used during non-peak periods to educate the driving public about the PPSL, and to increase the amount of information available to the driver at all times. Stakeholders, including emergency response personnel, agreed that the use of ATM would enhance safety in the PPSL corridor.

2.10 Access to Managed Lane

Three options were developed and analyzed for access into and egress from the PPSL managed lane.

Single-Point Access Option (Preferred Option)

Drivers would be able to enter the PPSL at US 40 and exit only at the end, near the Twin Tunnels. Because this option has the fewest number of merge points, this is the safest option and requires the least amount of signage.

Intermediate Access Option

Drivers could begin to access the PPSL at US 40, but if they missed this entrance, there would be a second entrance at an intermediate point, perhaps after Dumont, or at the west end of Idaho Springs, near Colorado Boulevard. Additional merge points would result in more conflicts between vehicles and the need for more signage.

Continuous Access Option

In this option, drivers could enter and exit the PPSL at any point along its length. This option would require additional facilities for enforcement and tolling. This option would have the most merge points and the highest potential for vehicle accidents and was not analyzed further.

The single point access is the preferred option because it has fewer conflict points, enhancing safety. It also requires fewer signs and, therefore, results in fewer visual impacts and lower construction and maintenance costs. The intermediate access option does not appear to be an enhancement to mobility or safety.

2.11 Free Lane versus Tolloed Lane

The analysis of whether the new PPSL should be tolled versus free to all users considered the following issues:

- Compliance with the CDOT January 2013 Policy Directive on Managed Lanes which directs consideration of managed lanes for all congested corridors because they provide for a less congested, more reliable travel options over time.
- Compatibility with the recently constructed Twin Tunnels project, which plans to toll the new eastbound lane during peak periods.
- Ability of the PPSL lane to improve conditions for emergency responders.
- The likelihood that a new third general purpose lane would be filled up immediately with vehicles from suppressed travel demand. These vehicles are currently likely using I-70 on “shoulder” times to avoid the times of highest congestion.
- The potential for revenue to be used for maintenance needs.

The Proposed Action will be tolled to all users. This option is compatible with the January 2013 Policy Directive, compatible with the Twin Tunnels project, provides an improved condition for emergency responders since managing the lane can be used to clear a lane for their use, allows CDOT to manage the lane to provide a less congested, more reliable travel choice and produces some revenue to be used for maintenance purposes. Since auto occupancy is currently much higher during peak periods than typical, more urban situations where auto occupancy is typically just over one person, providing a free trip for a high-occupancy vehicle was not chosen for implementation.

Section 3. How does the Proposed Action Relate to the I-70 Mountain Corridor PEIS?

The improvements are consistent with the I-70 Mountain Corridor Programmatic Environmental Impact Statement (PEIS), Record of Decision (ROD), I-70 Mountain Corridor Context Sensitive Solutions process, and other commitments of the PEIS. The Proposed Action fits within the definition of “expanded use of existing transportation infrastructure in and adjacent to the corridor” as an element of the Preferred Alternative Minimum Program.

Section 4. References

Apex and HDR. 2014. Concept of Operations for I-70 Peak Period Shoulder Lanes. January 2014.

CDOT. 2011a. I-70 Mountain Corridor Phase II Feasibility Study: Evaluation and Screening of Operational Alternatives. February 2011.

—. 2011b. I-70 Mountain Corridor Programmatic Environmental Impact Statement. March 2011.

—. 2011c. I-70 Mountain Corridor PEIS Alternatives Development and Screening Report. March 2011.

—. 2011d. CSS Engineering Design Criteria. March 2011.

—. 2013. Median Shift Design Criteria Exception Request. November 2013. FHWA. 2010. Efficient Use of Highway Capacity. November 2010.



Appendix A. Proposed Sign Locations

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I-70 Peak Period Shoulder Lane Preliminary Proposed Overhead Sign Locations February 17, 2014

P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
1		Proposed Toll/Express Lane Entrance 2 Miles	MP 229.7	Median	175+00		24 inch diameter Cantilever	Yes	LEFT Plaque - 6' X 2'-6" Sign - 14' X 13'-6"	
	1	Existing MP Marker	230	Right	178+64		Post	Yes		
	2	Existing Adopt a highway		Right	183+57		Post	No		
2		Proposed VTMS	MP 230.5	Median	202+00		24 inch diameter Cantilever	Yes	17'-6" X 10'	Co-locate CCTV Camera. Camera installed on separate 50' pole behind sign.
	3	Existing MP Marker	230.5	Right	206+13		Post	Yes		
	4	Existing Emergency for Authorized Vehicles only	230.5	Median	206+23		Post			
3		Proposed Toll/Express Lane Entrance 1 Mile	MP 230.7	Median	217+20		24 inch diameter Cantilever	Yes	LEFT Plaque - 6' X 2'-6" Sign - 14' X 13'-6"	
3A		Potential reduced speed ahead sign		Median				Yes	4' X 4'	
4		Potential reduced speed ahead sign		Right				Yes	4' X 4'	
	5	Existing MP Marker	231	Right	203+42		Post			
5		Proposed Toll/Express Lane Entrance 1/2 Mile	MP 231.25	Median	245+00		24 inch diameter Cantilever	Yes	LEFT Plaque - 6' X 2'-6" Sign - 14' X 13'-6"	Co-locate Variable Speed Limit Sign
5A		Proposed VSL	MP 231.25	Median	245+00		Mount on 1/2 mile post		4'X5'	Co-located with 1/2 Mile Express Lane Sign, double post speed limit to reduce speed in advance of PPSL
6		Proposed VSL	MP 231.25	Right	245+00		W6x15 Steel Post - 7' to bottom of sign		4'X5'	
	6	Existing Exit 232 US 40 WEST Empire Granby 1 Mile		Right	242+10		Double Post		EXIT 232 11' X 2' Sign 11' X 11'	
	7	Existing Bridge Structure Number Sign					Mounted on Structure		12"X36"	
	8	Existing MP Marker	231.5	Right	257+04		Post			
	9	Existing Exit 232 Ski Areas Winter Park Sol Vista Next Right		Right	257+04		Double Post		EXIT 232 10' X 2' Sign 15' X 11'	
7		Proposed Toll/Express Lane Entrance	MP 231.75	Median	270+00		24 inch diameter Cantilever	Yes	LEFT Plaque - 6' X 2'-6" Sign - 14' X 11'-6"	
7A		Proposed E 470 logo sign		Median	270+00			Required by e470	2'-6" x 3'-6"	Will combine with Toll entrance sign if possible
7B		Proposed Surcharge		Median	270+00			Required by e470	4' x 5'-6"	Will combine with Toll entrance sign if possible
	10	Existing Exit 232 Rocky Mtn Nat'l Park Next Right		Right	267+32		Double Post		EXIT 232 11' X 2' Sign 11' X 7'	
	11	Existing Exit 232 US 40 West Empire Granby Next Right Exit 15 MPH Emergency Call Box		Right	274+37		Double Post		EXIT 232 11'X2' Emergency Call Box 2'-6"X2' Sign 13'X11'	

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I-70 Peak Period Shoulder Lane

Preliminary Proposed Overhead Sign Locations

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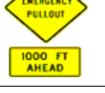
P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
	12	Existing Bridge Structure Number Sign		Median			Mounted on Structure		1'X3'	
	13	Existing Fuel, Food, Lodging, camping arrow		Right			Post			
	14	Existing MP Marker	232	Right			Post			
	15	Existing Ramp 15 (advisory speed)		Right			Double Post		5'X6'	
	16	Existing Exit 232 (arrow)		Right gore	288+57		Double Post		9'X5'	
	17	Existing Exit 233 Lawson 3/4 Mile Weigh Station use Exit 234		Right	291+49		Double Post		10'X10'	
	18	Existing Ramp Merge		Right			Post			
	19	Existing State Law Move Accidents from Traffic		Right			Post			
	20	Existing Trucks Do not exit here weight station is at exit 234		Right			Double Post			
	21	Existing Keep right except to pass		Right			Post			
	22	Existing I-70 East (route marker)		Right			Post			
	23, 24	Existing All Trucks Must use right lane		Median and Right			Double Post			
	25	Existing VMS		Median						
	25A	Existing VMS sign structure number		Median			Mounted on sign structure			
	26	Existing MP Marker	232.55	Median			Post		1'X3'	Verify sign location 232.4 appears to be after MP 232.55 per google map or sign is not showing per .kmz file.
	27	Existing Emergency for Authorized Vehicles only		Median			Post			
	28	Existing Exit 233 Lawson No trucks over 8000 GVW Local Deliveries only Emergency call box (arrow)		Right			Double Post			
	29	Existing Prepass Follow in-cab signals		Right			Double Post		6'X3'	
8		Proposed VSL	MP 232.55	Right	311+10		W6x15 Steel Post - 7' to bottom of sign		4'X5'	
9B		Proposed E 470 logo sign	232.4	Median	320+20			Required by e470	2'-6" x 3'-6"	

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Preliminary Proposed Overhead Sign Locations

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P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
9A		Proposed Surcharge	232.4	Median	320+20			Required by e470	4' X 5'-6"	
9		Proposed VTMS	MP 232.4	Median	320+20		24 inch diameter Cantilever	Yes	17'-6" X 10'	
10		Proposed Express Lane Sign	MP 232.9	Median	328+20		24 inch diameter Cantilever	Yes	13' X 9'-6"	
	30	Existing Exit 233		Right Gore Point			Double Post		9'X5'	
	31	Existing MP Marker	233	Right			Post			
	32	Existing Adopt a highway		Right			Post			
	33	Existing Traveler information Exit 234 (restaurants)		Right			Double Post			Traveler information signs
	34	Existing Exit 234 Weigh Station 3/4 Mile		Right			Double Post			
	35	Existing all trucks commercial vehicles next right		Right			Double Post			
	36	Existing Exit 234 Downville Dumont Next Right		Right			Single Pole Truss structure		EXIT 234 10'X2' Sign 12'X7'	
	37	Existing MP Marker	233.5	Right			Post			
	38	Existing Exit 234 Weigh Station Next Right (VMS Insert)		Right	369+92		Double Post		EXIT 234 10'X2' Sign 10'X6'	
11		Proposed ATM Sign	MP 233.65	Median	370+00		24 inch diameter Cantilever	No	5' x 5'	
	39	Existing Exit 234		Right Gore Point	386+62		Double Post		9'X5'	
	40	Existing MP Marker	234	Right	389+25		Post			
	41	Existing All Trucks Must use right lane		Right	394+80		Double Post		6'X4'	
	42	Existing Structure Number Sign		Median			Mounted on Structure		1'X3'	
	43	Exsitign Ramp Merge (warning sign)		Right Gore Point	407+07		Post			
	44	Existing MP Marker	234.5	Right	415+41		Post			
12		Proposed ATM Sign	MP 234.55	Median	419+00		24 inch diameter Cantilever	No	14'-6"x8'-6"	
13		Proposed VSL	MP 234.95	Right	41900		W6x15 Steel Post - 7" to bottom of sign		4' X 5'	To replace existing 65 MPH sign at Sta 430
14		Proposed Emergency pullout ahead		Right					Sign 4'X4' Supplimental plaque 4'X2'	

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Preliminary Proposed Overhead Sign Locations

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P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
15		Emergency Pullout		Right					Sign 4'X4'	
	45	Existing Speed Limit Sign		Right	430+82		Post	Yes		Just in front of 235 (will eliminate from Existing and will replace with VSL)
	46	Existing Adopt a highway		Right			Post			May combine with MP Marker
	47	Existing MP Marker	235	Right	441+52		Post			May combine with Adopt a Highway sign
	48	Existing Bridge Structure Number Sign		Median			Mounted on Structure			
	49	Existing Ramp Merge (warning sign)		Right	446+89		Post			
	50	Existing I-70 East (route marker)		Right	457+53		Post			
	51	Existing MP Marker	235.5	Right	467+62		Post			
15		Proposed ATM Sign	MP 235.5	Median	468+20		24 inch diameter Cantilever	No	14'-6" X 8'-6"	Will combine with Proposed VSL speed limit sign
16		Proposed VSL	MP 235.5	Right	468+20		W6x15 Steel Post - 7' to bottom of sign		4' X 5'	To replace existing 65 MPH sign at Sta 470+50
	52	Existing Speed Limit Sign		Right	470+31		Double Post			Will remove and replace with VSL speed limit sign
	53	Existing MP Marker	236	Right			Post			
17		Proposed ATM Sign	MP 236.1	Median	495+30		24 inch diameter Cantilever	No	14'-6" X 8'-6"	
	54	Existing MP Marker	236	Right	493+75		Post			
	55	Existing MP Marker	236.54	Right	520+09		Post			
	56A	Existing Sign Structure ID		Right			Mounted on sign structure			
	56	Existing VMS		Right			Monotube cantilever			
18		Proposed Emergency pullout ahead		Right					Sign 4'X4' Supplemental plaque 4'X2'	
19		Emergency Pullout		Right					Sign 4'X4'	
	57	Existing Exit 238 Fall River Road 1 Mile		Right	524+65		Double Post		Exit 10'X2' Sign 12'X7'	
	58	Existing Adopt a highway		Right	537+67		Post			
	59	Existing curve warning ahead advisory speed plaque (60MPH)		Right	541+30		Post			

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Preliminary Proposed Overhead Sign Locations

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P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
	60	Existing curve warning ahead advisory speed plaque (60MPH)		Median	541+89		Post			
	61	Existing MP Marker	237	Right	546+64		Post			
20		Proposed ATM Sign	MP 237.1	Median	548+80		24 inch diameter Cantilever	No	5'x5'	
	62	Existing Collapsible sign		Right			Double Post			
	63	Existing Collapsible sign		Median			Double Post			
	64	Existing Chevron		Right	550+99		Post			
	65	Existing Chevron		Right	552+80		Post			
	66	Existing Chevron		Right	554+88		Post			
	67	Existing Chevron		Right	557+06		Post			
	68	Existing Exit 238 St Marys Alice Next Right		Right	560+21		Double Post		EXIT 235 10'X2' Sign 10'X7'	
	69	Existing Exit 238 Fall River Road (Emergency Call Box Arrow)		Right	570+46		Double Post		Exit 238 10'X2' Sign 10'X7'	
	70,71	Existing curve warning ahead advisory speed plaque (60MPH)		Median and Right	571+88		Post			
	72	Existing MP Marker	237.5	Right	573+23		Post			
	73	Existing Exit 238		Right Gore Point	578+90		Double Post		7'X5'	
	74	Existing Bridge Structure Number Sign		Right			Post			
	75	Existing Ramp Merge (warning sign)		Right	586+39		Post			
	76	Existing Museum Visitor Center Next Right		Right	595+04		Double Post		10'X9'	
	77	Existing MP Marker	238	Right			Post			
21		Proposed ATM Sign	MP 238.1	Median	602+00		24 inch diameter Cantilever	No	14'-6" X 8'-6"	Co-locate CCTV Camera. Camera installed on separate 50' pole behind sign.
	78	Existing Idaho Springs Next 3 Exits		Right	602+48		Double Post		12'X5'	
	79	Existing Truckers Engine Brake Mufflers Required		Right	607+76		Double Post			
	80	Existing Exit 239 I-70 East Idaho Springs 1/2 Mile		Right	611+58		Double Post		Exit 239 10'X2' Sign 14'X9'	

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Preliminary Proposed Overhead Sign Locations

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P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
	81	Existing Speed Limit Sign		Right	618+80		Double Post			Will remove and replace with VSL speed limit sign
	82	Existing Speed Limit Sign		Median	621+00		Double Post			Will remove and replace with VSL speed limit sign
22		Proposed VSL	MP 238.35	Median	619+50		W6x15 Steel Post - 7' to bottom of sign		4' X 5'	Speed Limit change - Double post speed limit to replace existing 60 mph signs near Sta 619+80
23		Proposed VSL	MP 238.35	Right	619+50		W6x15 Steel Post - 7' to bottom of sign		4' X 5'	Speed Limit change - Double post speed limit to replace existing 60 mph signs near Sta 619+80
	83	Existing MP Marker	238.5	Right	626.44		post			
	84	Existing Food, Phone, Gas, Lodging, Camping (arrow)		Right	627+26		Post			
	85	Existing Exit 239 I-70 East Idaho Springs arrow		Right	635+41		Pole and truss		Exit 239 10'X2' Sign 16'X7'	Existing Truss OH sign
	85A	Existing Sign Structure ID		Right			Mounted on sign structure		1'X3'	
	86	Existing Exit 239		Right Gore Point	639+62		Double Post		9'X5'	Sign was hit by vehicle, not currently repaired (one pole still standing)
	87	Existing Adopt a highway		Right Gore Point	640+03		Post			
	88	Existing Bikes Prohibited		Right	640+50		Post			
	89	Existing Traveler Information Dial 511		Right	641+22		Post		3'X4'	
24		Proposed ATM Sign	MP 239	Median	653+30		24 inch diameter Cantilever	No	5'x5'	
	90	Existing Idaho Spgs City Limit Elev 7540 ft		Right	650+30		Double Post			
	91	Existing MP Marker	239	Right	653+12		Post			
	92	Existing Exit 240 Mt Evans 1/2 Mile		Right	653+51		Double Post		Exit 10'X2' Sign 12'X9'	
25		Proposed VSL	MP 239.5	Right	654+20		W6x15 Steel Post - 7' to bottom of sign		4' X 5'	To replace Existing 60 mph sign at Sta 656+00
	93	Existing Speed Limit Sign		Right	656+65		Double Post			Will remove and replace with VSL speed limit sign collocated with ATM sign
	94	Existing Traveler Information Food Exit 204		Right	661+90		Dual Post			
	95	Existing State Law Move Accidents from Traffic		Right	667+89		Dual Post			
	96	Existing Exit 240 Nat'l Forest Information Next Right		Right	669+69		Post and truss			Existing Truss structure
	97	Existing Exit 240 Mt Evans		Right	677+93		Post and truss			Existing Truss structure

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Preliminary Proposed Overhead Sign Locations

February 17, 2014

P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
	98	Existing MP Marker	239.5	Right	679+37		Post			
	99	Existing Exit 240		Right Gore Point	683+53		Double Post			
	100	Existing Slippery when wet (warning sign)		Right	685+49		Post			
	101	Existing State Law move over or slow down for stopped emergency and maintenance vehicles		Right			Double Post			
	102	Existing Structure Number Sign		Right			Mounted on Structure			
	103	Existing Ramp Merge (warning sign)		Right	689+96		Post			
	104	Existing No Parking		Right			Post			
	105	Existing No Parking		Right			Post			
	106	Existing Structure Number Sign		Right	701+85		Post			
	107	Existing MP Marker		Right	705+03		Post			
26		Proposed ATM Sign	MP 240.05	Median	707+30		24 inch diameter Cantilever	No	14'-6" X 8'-6"	
27		Proposed VSL	MP 240.05	Right	708+00		W6x15 Steel Post - 7' to bottom of sign		4' X 5'	To replace existing 60 mph at Sta 713+00
	108	Existing Speed Limit Sign		Right	713+00					Will remove will replace with VSL sign
	109	Existing Chain law enforced when flashing \$500 to \$1,000 fines		Right			Double Post			
	110	Existing Exit 241A Idaho Spgs 1/2 Mile		Right	744+92		Double Post			
	111	Existing Chain Station 3/4 Mile		Right			Double Post			
	112	Existing Traveler information sign gas food exit 241A		Right	755+67		Double Post			
	113	Existing Clearance Warning Sign		Right	756+06		Post			Eliminate sign will increase bridge clearance will also need to eliminate WB signs
	114	Existing Clearance Warning Sign		Median	756+37		Post			Eliminate sign will increase bridge clearance will also need to eliminate WB signs
	115	Existing MP Marker	241	Right	756+65		Post			
	116	Existing Adopt a highway		Right	756+62		Post			
28		Proposed ATM Sign	MP 241.1	Median	758+80		24 inch diameter Cantilever	No	5'x5'	

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Preliminary Proposed Overhead Sign Locations

February 17, 2014

P. No.	E. No.	Sign/Device	Mile Post	Side	Station Number	Picture	Mount	MUTCD Required Sign	Sign Dimensions (Feet)	Comments
	117	Existing Exit 241A Idaho Spgs (arrow)		Right	763+69		Dual Post			
	118	Existing Exit 15 MPH (advisory speed)		Right	769+04		Dual Post			
	119	Existing Exit 241A (arrow)		Right Gore Point	771+76		Dual Post			
29		Proposed Toll/Express Lane Entrance	MP 241.4	Median	780+00		24 inch diameter Cantilever	Yes	Left Plaque - 6' X 2'-6" Sign -14' X 11'-6"	
	120	Existing MP Marker	241.5	Right	783+35		Post			
	121	Existing JCT US6 2 1/2 MILES		Right			Double Post			
	122	Existing Clear Creek		Right	786+36		Post			
	123	Existing Structure number sign		Right	786+10		Post			
	124	Existing Chain Station		Right			Double Post			
30		Proposed VTMS	MP 241.7	Median	792+70		24 inch diameter Cantilever	Yes	17'-6" X 10'	
30A		Proposed VSL	MP 241.8	Median	792+70		Co-located with VTMS sign - mounted on cantilever		4' X 5'	Speed Limit change - Double post speed limit to replace existing 55 mph signs near Sta 800+00
31		Proposed VSL	MP 241.8	Right	792+70		W6x15 Steel Post - 7' to bottom of sign		4' X 5'	Speed Limit change - Double post speed limit to replace existing 55 mph signs near Sta 800+00
	125	Existing Traveler information sign Attraction exit 243		Right	793+33		Double Post			
	126	Existing Exit 243 Hidden Valley Central City 1 Mile	242	Right			Double Post			
	127	Existing Speed Limit Sign	242	Right			Post			Will remove and replace with VSL speed limit sign
	128	Existing Structure Number Sign	242	Right			Post			
	129	Existing Speed Limit Sign	242	Median			Post			Will remove and replace with VSL speed limit sign
	130	Existing Express Lane Left Lane Fees Waived Until 2015	242	Median			Double Post			Will remove once open and toll signs have been installed
	131	Existing MP Marker	242	Right	808+00		post			
32		Proposed Express Lane Sign	MP 242	Median	808+00		24 inch diameter Cantilever	Yes	7'-6" X 6'-6"	
33		Proposed Express Lane Restriction Ends 1/2 Mile		Median					4'-6" X 5'-6"	
34		Proposed Express Lane Restriction Ends		Median					4'-6" X 5'-6"	



Appendix B. Evaluation Matrices

Fair	Better	Best
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Left Side Versus Right Side

ID	Criteria	Options Ranking	
		Left-Side	Right-Side
Evaluation Criteria			
1	Addresses safety during PPSL operations	<ul style="list-style-type: none"> •Standard ML striping with solid white line •GP lanes are consistent on peak and off peak •Allows for traditional rumble strips 	<ul style="list-style-type: none"> •Unconventional ML striping with dashed line. •GP lanes shift between on peak and off peak operations
2	Maintains safety during non-peak times	<ul style="list-style-type: none"> •Left-side breakdown lane (non-standard) 	<ul style="list-style-type: none"> • Right-side breakdown lane (standard)
3	Improves mobility during peak times	<ul style="list-style-type: none"> • Increases weaving to/from the express lane •Enhances travel time •Commercial vehicles may operate in right lane 	<ul style="list-style-type: none"> •Decreases weaving to/from the express lane •Commercial vehicles must operate in middle lane
4	Minimizes the effort required to maintain the option	<ul style="list-style-type: none"> •Reduces signing and structures •Creates snow removal/ sediment control challenges •Conventional striping patterns 	<ul style="list-style-type: none"> •Increases signing and structures •Unconventional striping patterns
5	Enables the project team to achieve the goal of opening PPSL by July 2015	<ul style="list-style-type: none"> •Not a differentiator 	
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	<ul style="list-style-type: none"> •Configuration consistent with CDOT similar projects on North I-25, US-36 	<ul style="list-style-type: none"> •Increases signing infrastructure more than left-side option •Configuration not consistent with CDOT similar projects
7	Allows for a process to engage and communicate with all the local, regional and national users of the I-70 Mountain Corridor	<ul style="list-style-type: none"> •Not a differentiator 	
8	Creates opportunities to "correct past damage"	<ul style="list-style-type: none"> •Not a differentiator 	
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, and interstate commerce.	<ul style="list-style-type: none"> • Not a differentiator 	
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	<ul style="list-style-type: none"> • Not a differentiator 	
11	Protects or creates unique features for the area as a gateway	<ul style="list-style-type: none"> •Creates an opportunity to replace the 103 bridge 	<ul style="list-style-type: none"> •Opportunity to maintain the 103 bridge
12	Protects wildlife needs	<ul style="list-style-type: none"> • Not a differentiator 	
13	Protects Clear Creek	<ul style="list-style-type: none"> • Not a differentiator 	
14	Protects the defining historical elements of Clear Creek County	<ul style="list-style-type: none"> •Less signs impacting historic viewshed 	<ul style="list-style-type: none"> •More signs impacting historic viewshed
15	Meets CDOT's and industry standards	<ul style="list-style-type: none"> • Not a differentiator 	
16	Achieves the mountain mineral belt aesthetic guidelines	<ul style="list-style-type: none"> •Not a differentiator 	
17	Meets the I-70 Mountain Corridor design criteria	<ul style="list-style-type: none"> •Not a differentiator 	
18	Preserves opportunities for the AGS and the ultimate preferred alternative	<ul style="list-style-type: none"> •Not a differentiator 	
19	Adaptable for future changes/projects	<ul style="list-style-type: none"> • Less infrastructure removal (signage) 	<ul style="list-style-type: none"> • Additional infrastructure removal (signage)

Fair	Better	Best
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Left Side Versus Right Side

ID	Criteria	Options Ranking	
		Left-Side	Right-Side
Issue Specific Criteria			
1	Meets driver expectations/roadway environment/precedence set for express lanes in the state	<ul style="list-style-type: none"> •Standard ML striping with solid white line • Breakdown lane on non-traditional left side •GP lanes are in the same configuration (on peak versus off peak) •Consistent with US 36 and North I-25 managed lane corridors 	<ul style="list-style-type: none"> •Unconventional ML striping with dashed line. • Breakdown lane on traditional right side • Possible fewer emergency pullouts required •Not consistent with North I-25 and US 36 managed lane corridors •GP lanes are in different configurations (on peak versus off peak)
2	Minimizing signing types and locations throughout the corridor	•Requires less signing	•Requires more signing
3	Maintains fluid ramp access and standard ramp geometry on and off-ramps accesses and ramp geometry.	• Not a differentiator	

Fair	Better	Best
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Roadway Width

ID	Criteria	Options Ranking	
		Hybrid Width	40' or greater width
Evaluation Criteria			
1	Addresses safety during PPSL operations	•Narrower, less width for driver error	•Wider shoulder widths consistently
2	Maintains safety during non-peak times	•Narrower, less width for driver error	•Wider shoulder widths consistently
3	Improves mobility during peak times	•Narrower section causes generally slower speeds	•Wider section allows for generally faster speeds
4	Minimizes the effort required to maintain the option	•Less infrastructure, less maintenance	•Additional infrastructure, additional maintenance
5	Enables the project team to achieve the goal of opening PPSL by 1-Jul-15	•Narrower cross section could require less effort for NEPA, design, and construction.	•Wider cross section could require additional effort for NEPA, design, and construction.
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	•Less infrastructure is more consistent with an interim definition for the project.	•More infrastructure would be required (widening of all I-70 bridges, increase in wall areas)
7	Allows for a process to engage and communicate with all the local, regions and national users of the I-70 Mountain Corridor	•Not a differentiator	
8	Creates opportunities to "correct past damage"	• Fewer Opportunities	• More Opportunities
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, interstate commerce and also limits disproportionate effects to the community.	•Not a differentiator	
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	•Not a differentiator	
11	Protects or creates unique features for the area as a gateway	• Fewer Opportunities	• More Opportunities
12	Protects wildlife needs	•Less barrier effect impeding highway permeability	•More barrier effect impeding highway

Fair	Better	Best
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Roadway Width

ID	Criteria	Options Ranking	
		Hybrid Width	40' or greater width
			permeability
13	Protects Clear Creek	<ul style="list-style-type: none"> •Less potential for encroachment into creek •Less visual impact for walls •More space for WQ features to be added 	<ul style="list-style-type: none"> •More potential for creek encroachment •More visual impact from walls •Less space for WQ features to be added
14	Protects the defining historical elements of Clear Creek County	<ul style="list-style-type: none"> •Less infrastructure, less visual impact 	<ul style="list-style-type: none"> •More infrastructure, more visual impact, more potential encroachment into historic properties
15	Meets CDOT's and industry standards	<ul style="list-style-type: none"> •Rarely meets minimum standards 	<ul style="list-style-type: none"> • More frequently meets minimum standards
16	Achieves the mountain mineral belt aesthetic guidelines	<ul style="list-style-type: none"> • Less opportunities 	<ul style="list-style-type: none"> • More opportunities
17	Meets the I-70 Mountain Corridor design criteria		<ul style="list-style-type: none"> •Not a differentiator
18	Preserves opportunities for the AGS and the ultimate preferred alternative		<ul style="list-style-type: none"> •Not a differentiator
19	Adaptable for future changes/projects		<ul style="list-style-type: none"> •Not a differentiator
Issue Specific Criteria			
1	Clear Creek County Preference	<ul style="list-style-type: none"> • Meets preference 	<ul style="list-style-type: none"> • Less preferred
2	Impacts to compounding safety risk factors	<ul style="list-style-type: none"> • More safety risk factors 	<ul style="list-style-type: none"> • Fewer safety risk factors
3	Meets definition of a PPSL project	<ul style="list-style-type: none"> • Optimizes existing infrastructure 	<ul style="list-style-type: none"> • Increased infrastructure improvements
4			
Identification of Preferred Option: Summary		<p>The Hybrid Width provides less infrastructure which is less costly, easier to meet the schedule and maintain, and is more consistent with an interim project. Although the 40 ft model was identified as better for meeting design standards, it was determined that the hybrid model will not negatively impact safety or mobility. The hybrid model also better protects environmental resources due to less infrastructure, encroachment, walls, and visual impacts. The hybrid model also better adheres to the CSS process with clear preference by CCC stakeholders. The analysis accounted for, but was not limited to, safety, widening requirements for mainline, and infrastructure needs.</p>	

Fair	Better	Best
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Acceleration and Deceleration Lanes

ID	Criteria	Options Ranking	
		AASHTO Standard Acceleration and Deceleration Length for Interchange Ramps	Match Existing Acceleration and Deceleration Lengths for Interchange Ramps
Evaluation Criteria			
1	Addresses safety during PPSL operations	•Provides maximum safety benefit and meets current design standards	•Does not meet current standards and may decrease safety at acceleration and deceleration lanes
2	Maintains safety during non-peak times	•Provides maximum safety benefit and meets design standards	•Does not meet current standards and may decrease safety at acceleration and deceleration lanes
3	Improves mobility during peak times	•Longer ramps provide increased opportunities for merging and diverging increasing mobility	•Shorter ramps decrease opportunities for merging and diverging
4	Minimizes the effort required to maintain the option	•Not a differentiator	
5	Enables the project team to achieve the goal of opening PPSL by 1-Jul-15	•Increased Infrastructure increasing construction efforts and Project schedule.	•Less Infrastructure decreasing construction efforts and Project schedule.
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	•Additional Infrastructure investments provide less value for Project life cycle, function, and purpose.	•Maximizes use of existing infrastructure and provides best value for Project life cycle, function, and purpose
7	Allows for a process to engage and communicate with all the local, regional and national users of the I-70 Mountain Corridor	•Not a differentiator	
8	Creates opportunities to "correct past damage"	•Not a differentiator	
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, interstate commerce and also limits disproportionate effects to the community.	•Not a differentiator	
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	•Not a differentiator	
11	Protects or creates unique features for the area as a gateway	• Not a differentiator	
12	Protects wildlife needs	•Increased barrier effect	•Less barrier effect impeding highway permeability

Fair	Better	Best
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Acceleration and Deceleration Lanes

ID	Criteria	Options Ranking	
		AASHTO Standard Acceleration and Deceleration Length for Interchange Ramps	Match Existing Acceleration and Deceleration Lengths for Interchange Ramps
		impeding highway permeability	
13	Protects Clear Creek	<ul style="list-style-type: none"> •More potential for encroachment into creek •More visual impact for walls •Less space for WQ features to be added 	<ul style="list-style-type: none"> •Less potential for encroachment into creek •Less visual impact for walls •More space for WQ features to be added
14	Protects the defining historical elements of Clear Creek County	<ul style="list-style-type: none"> •More infrastructure, more visual impact, more potential encroachment into historic properties 	<ul style="list-style-type: none"> •Less infrastructure, less visual impact
15	Meets CDOT's and industry standards	•Meets design Standards	• Does not meet design standards
16	Achieves the mountain mineral belt aesthetic guidelines		•Not a differentiator
17	Meets the I-70 Mountain Corridor design criteria		•Not a differentiator
18	Preserves opportunities for the AGS and the ultimate preferred alternative		•Not a differentiator
19	Adaptable for future changes/projects		•Not a differentiator
Issue Specific Criteria			
1	Clear Creek County Preference	• Less Preferred	• More Preferred
2	Impacts to compounding safety risk factors	• Less safety risk factors	• More safety risk factors
3	Meets definition of a PPSL project	• Increased infrastructure Improvements	• Optimizes existing infrastructure
4			
Identification of Preferred Option: Summary			The "Match Existing" option was identified as the preferred option. It provides less infrastructure which is less costly, easier to meet the schedule and to maintain, and is more consistent with an interim project. Although the AASHTO standard option was identified as providing the maximum safety benefit, the "Match Existing" option was determined to not compromise safety when compared to existing. This option protects environmental resources better due to less infrastructure, encroachment, walls, and visual impacts. It also adheres better to the CSS process with clear preference by CCC stakeholders. The

Fair	Better	Best
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Acceleration and Deceleration Lanes

ID	Criteria	Options Ranking	
		AASHTO Standard Acceleration and Deceleration Length for Interchange Ramps	Match Existing Acceleration and Deceleration Lengths for Interchange Ramps
			analysis accounted for, but was not limited to, safety, widening requirements, and design standards.

Fair	Better	Best
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Widening Median vs. Creek

ID	Criteria	Options Ranking	
		Widen to Creek	Widen to Median
Evaluation Criteria			
1	Addresses safety during PPSL operations	•Not a differentiator	
2	Maintains safety during non-peak times	•Not a differentiator	
3	Improves mobility during peak times	•Not a differentiator	
4	Minimizes the effort required to maintain the option	•More difficult to maintain taller walls along creek	•Easier to maintain shorter walls and access from roadway.
5	Enables the project team to achieve the goal of opening PPSL by 1-Jul-15	•More wall area to design & build increases schedule	•Less wall area to design & build reduces schedule
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	•More wall area has more impacts, is more expensive, and requires more maintenance	•Less wall area has less impacts, is less expensive, and requires less maintenance
7	Allows for a process to engage and communicate with all the local, regional and national users of the I-70 Mountain Corridor	•Not a differentiator	
8	Creates opportunities to "correct past damage"	•Not a differentiator	
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, interstate commerce and also limits disproportionate effects to the community.	• More impacts to riparian vegetation affects river recreational experience	• More impacts to the median vegetation
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	•Not a differentiator	
11	Protects or creates unique features for the area as a gateway	•Not a differentiator	
12	Protects wildlife needs	•More barrier effect impeding highway permeability	•Less barrier effect impeding highway permeability
13	Protects Clear Creek	<ul style="list-style-type: none"> •More potential for creek encroachment •More visual impact from walls and tree removal •Less space for WQ features to be added • Degrades recreational experience 	<ul style="list-style-type: none"> •Less potential for encroachment into creek •Less visual impact for walls and tree removal •More space for WQ features to be added
14	Protects the defining historical elements of Clear Creek County	•More infrastructure, more visual impact	•Less infrastructure, less visual impact
15	Meets CDOT's and industry standards	•Not a differentiator	

Fair	Better	Best
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Widening Median vs. Creek

ID	Criteria	Options Ranking	
		Widen to Creek	Widen to Median
16	Achieves the mountain mineral belt aesthetic guidelines	• More impacts to riparian vegetation	• Minimizes the area of walls
17	Meets the I-70 Mountain Corridor design criteria	• Meets the corridor design criteria by not decreasing median width	• Narrows the median
18	Preserves opportunities for the AGS and the ultimate preferred alternative	•Not a differentiator	
19	Adaptable for future changes/projects	• More infrastructure to remove in future	• Less infrastructure to remove in future
Issue Specific Criteria			
1	Impacts to creek users	• More visual impacts to creek users	• No visual impacts to creek users
2	Allows access to the north side of the creek from I-70.	Requires a retaining wall with guard rail that impedes access.	Requires a guard rail but no wall, providing easier access.
Identification of Preferred Option: Summary		<p>Lawson & East of Lawson: Widen to Creek due to no available median.</p> <p>Dumont On-Ramp, East of Dumont:Widen to Creek to reduce rdwy runoff on slope and encourage vegetation growth & maintain median width.</p> <p>Fall River On-Ramp: Widen to Creek to reduce rdwy runoff on slope and encourage vegetation growth & maintain median width, widening to median still requires creek-side retaining wall.</p>	<p>At & East of Downieville: Walls eliminated by shifting into median providing less riparian impacts.</p>

Fair	Better	Best
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I-70 Widening North or South

ID	Criteria	Options Ranking	
		Shift to North	Shift to South
Evaluation Criteria			
1	Addresses safety during PPSL operations	•Not a differentiator	
2	Maintains safety during non-peak times	•Not a differentiator	
3	Improves mobility during peak times	•Not a differentiator	
4	Minimizes the effort required to maintain the option		• Requires maintenance of park improvements.
5	Enables the project team to achieve the goal of opening PPSL by 1-Jul-15	•Not a differentiator	
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	• Requires significant and costly impacts to drainage, utilities, and City parking.	• Minor impacts to the park. • Creates opportunities for park improvements.
7	Allows for a process to engage and communicate with all the local, regional and national users of the I-70 Mountain Corridor	• By impacting drainage, utilities, and City parking, users along the I-70 corridor will be less likely to visit due to increased construction and reduced parking.	• Park improvements will engage I-70 travelers with community amenities and history
8	Creates opportunities to "correct past damage"	• Increases impacts to the City	• Provides opportunity for park improvements which may increase usage of the facility.
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, interstate commerce and also limits disproportionate effects to the community.	• Increases impacts to the City	• Provides opportunity for park improvements which may increase usage of the facility.
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	•Not a differentiator	
11	Protects or creates unique features for the area as a gateway	• Increases impacts to the City parking	• Provides opportunity for park improvements which may increase usage of the facility.
12	Protects wildlife needs	•Not a differentiator	
13	Protects Clear Creek	•Less potential for encroachment into creek	

Fair	Better	Best
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I-70 Widening North or South

ID	Criteria	Options Ranking	
		Shift to North	Shift to South
		<ul style="list-style-type: none"> • Less visual impact for walls 	<ul style="list-style-type: none"> • More potential for creek encroachment • More visual impact from walls • Positively impacts recreational experience
14	Protects the defining historical elements of Clear Creek County	<ul style="list-style-type: none"> • No impacts to historical elements 	<ul style="list-style-type: none"> • Park enhancements may lead to a greater awareness and more frequent visits to the water wheel
15	Meets CDOT's and industry standards	<ul style="list-style-type: none"> • Not a differentiator 	
16	Achieves the mountain mineral belt aesthetic guidelines	<ul style="list-style-type: none"> • No opportunity for park improvements 	<ul style="list-style-type: none"> • Provides opportunity for park improvements
17	Meets the I-70 Mountain Corridor design criteria	<ul style="list-style-type: none"> • Not a differentiator 	
18	Preserves opportunities for the AGS and the ultimate preferred alternative	<ul style="list-style-type: none"> • Not a differentiator 	
19	Adaptable for future changes/projects	<ul style="list-style-type: none"> • Not a differentiator 	
Issue Specific Criteria			
1	Appropriate Cost/Benefit	<ul style="list-style-type: none"> • More costs associated with utility and drainage impacts 	<ul style="list-style-type: none"> • Less costs and more benefits associated with Park improvements.
2	How well does the solution support pedestrian movement?	<ul style="list-style-type: none"> • Does not impact pedestrian movements 	<ul style="list-style-type: none"> • Improves pedestrian movements
3	How does the solution affect the Bikeway and Water Wheel Park?	<ul style="list-style-type: none"> • Does not impact Bikeway or Park 	<ul style="list-style-type: none"> • Greatly improves Bikeway and Park (connectivity, aesthetically)
4	How does the solution affect emergency services?	<ul style="list-style-type: none"> • Not a differentiator 	
5	How does the CDOT parking lot (currently in use by Kramer) integrate with the activities of the interchange?	<ul style="list-style-type: none"> • Not a differentiator 	
6	How is access to Idaho Springs and Mt. Evans affected during construction and in the long term?	<ul style="list-style-type: none"> • Not a differentiator 	
Identification of Preferred Option: Summary		Shifting the I-70 alignment to the south eliminates impact to the City's parking, drainage and utilities along the north side of I-70. While shifting to the south does have some minor impacts to Water Wheel Park, it provides opportunities for	

Fair	Better	Best
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I-70 Widening North or South

ID	Criteria	Options Ranking	
		Shift to North	Shift to South
		improvements not only to the park but to the multi-use trail along the creek. Additionally, the stakeholders requested that this shift accommodate additional maximum width (~6' to 8') to allow for the possibility of a future WB PPSL.	

Fair	Better	Best
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SH 103 Bridge

ID	Criteria	Options Ranking		
		Reuse Existing	Clear Span	Two Span
Evaluation Criteria				
1	Addresses safety during PPSL operations	● Not a differentiator		
2	Maintains safety during non-peak times	● Not a differentiator		
3	Improves mobility during peak times	● This option is limited to the existing conditions.	● Improves mobility on SH 103	● Improves mobility on SH 103
4	Minimizes the effort required to maintain the option	● This type of major retrofit would require additional effort to maintain in comparison to a new structure.	● These type of structures can be designed and detailed to provide durability and low maintenance.	● This more traditional type of bridge would provide a very durable structure with minimal maintenance.
5	Enables the project team to achieve the goal of opening PPSL by 1-Jul-15	● Not a differentiator		
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	● A retrofit of even this magnitude may still provide some initial investment savings. However, life cycle cost analysis will illustrate that it is not a best value. This option also limits the pedestrian and vehicle functions to the existing conditions.	● This option is very expensive and typically warranted when traditional alternatives are not feasible.	● This option is cost effective and provides the best value when considering the life cycle cost. This option provides the most flexibility for the future.
7	Allows for a process to engage and communicate with all the local, regional and national users of the I-70 Mountain Corridor	● Not a differentiator		
8	Creates opportunities to "correct past damage"	● Not a differentiator		
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, and interstate commerce.	● Limited to existing conditions	● Provides opportunities for aesthetic and mobility enhancements	● Provides opportunities for aesthetic and mobility enhancements
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	● Not a differentiator		

Fair	Better	Best
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SH 103 Bridge

ID	Criteria	Options Ranking		
		Reuse Existing	Clear Span	Two Span
Evaluation Criteria				
11	Protects or creates unique features for the area as a gateway	<ul style="list-style-type: none"> This option will appear as a temporary retrofit bridge. 	<ul style="list-style-type: none"> This option could be a signature structure. 	<ul style="list-style-type: none"> This option would meet the corridor guidelines and match well with the rest of this corridor.
12	Protects wildlife needs		<ul style="list-style-type: none"> Not a differentiator 	
13	Protects Clear Creek		<ul style="list-style-type: none"> Not a differentiator 	
14	Protects the defining historical elements of Clear Creek County		<ul style="list-style-type: none"> Not a differentiator 	
15	Meets CDOT's and industry standards	<ul style="list-style-type: none"> This option would require some variances, since it is a retrofit with an older structure. 	<ul style="list-style-type: none"> This option would meet CDOT and industry standards. 	<ul style="list-style-type: none"> This option would meet CDOT and industry standards.
16	Achieves the mountain mineral belt aesthetic guidelines	<ul style="list-style-type: none"> This option is limited to the existing conditions. 	<ul style="list-style-type: none"> This option would meet the aesthetic guidelines. 	<ul style="list-style-type: none"> This option would meet the aesthetic guidelines.
17	Meets the I-70 Mountain Corridor design criteria	<ul style="list-style-type: none"> This option is limited to the existing conditions. 	<ul style="list-style-type: none"> This option would meet the design criteria. 	<ul style="list-style-type: none"> This option would meet the design criteria.
18	Preserves opportunities for the AGS and the ultimate preferred alternative	<ul style="list-style-type: none"> This option is limited to the existing conditions. 	<ul style="list-style-type: none"> This option provides flexibility for AGS and the ultimate preferred alternative. 	<ul style="list-style-type: none"> This option provides flexibility for AGS and the ultimate preferred alternative.
19	Adaptable for future changes/projects	<ul style="list-style-type: none"> This option is limited to the existing conditions. 	<ul style="list-style-type: none"> This option provides flexibility for future changes. 	<ul style="list-style-type: none"> This option provides flexibility for future changes.
Issue Specific Criteria				
1	How well does the solution support pedestrian movement?	<ul style="list-style-type: none"> This option maintains the existing pedestrian conditions and does not provide enhancement opportunity. 	<ul style="list-style-type: none"> This option provides the opportunity to have a wider sidewalk for pedestrian movements and also a wider roadway shoulder for safety. 	<ul style="list-style-type: none"> This option provides the opportunity to have a wider sidewalk for pedestrian movements and also a wider roadway shoulder for safety.
2	Provide flexibility for the construction/traffic phasing	<ul style="list-style-type: none"> This option is limited to the existing two lane bridge width, which would restrict the bridge to one lane during construction. Significant impacts to SH 103 and I-70 traffic 	<ul style="list-style-type: none"> This option would require a full closure of SH103. The closure period would depend on if the structure was built on-site or if it was built off-line and moved into place. 	<ul style="list-style-type: none"> This option provides the flexibility of two lane phasing during construction. Accelerated bridge technology provides opportunity to reduce traffic impacts.
3	Minimizes the construction schedule	<ul style="list-style-type: none"> The construction time frame for this option with a full closure would be approximately 2 months and with a phased approach the construction time frame would be in the 6 to 9 month range. A retrofit structure has a higher risk of impacts to schedule, construction and traffic phasing. 	<ul style="list-style-type: none"> The construction time frame for this option is on the order of two times more than traditional bridge construction. 	<ul style="list-style-type: none"> The construction time frame for this option with a full closure would be approximately 2 months and with a phased approach the construction time frame would be in the 6 to 9 month range.

Fair	Better	Best
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SH 103 Bridge

ID	Criteria	Options Ranking		
		Reuse Existing	Clear Span	Two Span
<i>Evaluation Criteria</i>				
	Identification of Preferred Option: Summary			The two span bridge allows for flexibility in the cross section of I-70 in the future, minimizes changes to SH 103 profile, enables wider shoulders and sidewalk to improve safety and pedestrian movement and allows for an auxiliary lane to improve traffic movement. It is designed to current standards provides better aesthetics and shorter construction phasing.

Fair	Better	Best
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Advanced Traffic Management			
ID	Criteria	Options Ranking	
		ATM - YES	ATM -NO
Evaluation Criteria			
1	Addresses safety during PPSL operations	Provides additional driver information, provides for emergency response vehicles	Provides less driver information
2	Maintains safety during non-peak times	Could provide information about lane use during non peak.	Provides less driver information
3	Improves mobility during peak times	Not a differentiator	
4	Minimizes the effort required to maintain the option	More infrastructure to maintain	Less infrastructure to maintain
5	Enables the project team to achieve the goal of opening PPSL by 1-July-15	Software development and implementation impacts	No software development and implementation impacts
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	Anticipated to provide a positive return on investment.	No additional return on investment.
7	Allows for a process to engage and communicate with all the local, regional and national users of the I-70 Mountain Corridor	Increased driver information	Decreased driver information
8	Creates opportunities to "correct past damage"	Increased infrastructure	Less infrastructure
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, and interstate commerce.	Increased infrastructure	Less infrastructure
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	Not a differentiator	
11	Protects or creates unique features for the area as a gateway	May impact viewshed	No impact
12	Protects wildlife needs	Increased infrastructure	Less infrastructure
13	Protects Clear Creek	Not a differentiator	
14	Protects the defining historical elements of Clear Creek County	More infrastructure (signs)	Less infrastructure (signs)
15	Meets CDOT's and industry standards	Industry trends toward dynamic managed shoulders	Not the trend
16	Achieves the mountain mineral belt aesthetic guidelines	Not a differentiator	

Fair	Better	Best
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Advanced Traffic Management		
ID	Criteria	Options Ranking
		ATM - YES
Evaluation Criteria		
17	Meets the I-70 Mountain Corridor design criteria	Not a differentiator
18	Preserves opportunities for the AGS and the ultimate preferred alternative	Not a differentiator
19	Adaptable for future changes/projects	Increased adaptability
Issue Specific Criteria		
1	Efficiency and consolidation (including old signs)	Not a differentiator
2	Preserves emergency response capabilities	Provides ability to control managed lane
Identification of Preferred Option: Summary		The recommendation is to incorporate ATM because it preserves the ability for emergency response.

Fair	Better	Best
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MANAGED LANE ACCESS

ID	Criteria	Options Ranking	
		SINGLE	INTERMEDIATE
Evaluation Criteria			
1	Addresses safety during PPSL operations	Per David Hatton safer	
2	Maintains safety during non-peak times	Not a differentiator	
3	Improves mobility during peak times	Not a differentiator	
4	Minimizes the effort required to maintain the option	Less infrastructure to maintain	More infrastructure to maintain
5	Enables the project team to achieve the goal of opening PPSL by 1-Jul-15	Not a differentiator	
6	Creates infrastructure investments that are reasonable to construct and provide the best value for their life cycle, function, and purpose.	Not a differentiator	
7	Allows for a process to engage and communicate with all the local, regional and national users of the I-70 Mountain Corridor	Not a differentiator	
8	Creates opportunities to "correct past damage"	Not a differentiator	
9	Provides access and protects opportunities for enhancements to tourist destinations, community facilities, and interstate commerce.	Less access points	More access points
10	Incorporates sustainability by using locally available materials and environmentally-friendly processes	Not a differentiator	
11	Protects or creates unique features for the area as a gateway	Not a differentiator	
12	Protects wildlife needs	Less infrastructure (signs)	More infrastructure (signs)
13	Protects Clear Creek	Not a differentiator	
14	Protects the defining historical elements of Clear Creek County	Less infrastructure (signs)	More infrastructure (signs)
15	Meets CDOT's and industry standards	Not a differentiator	
16	Achieves the mountain mineral belt aesthetic guidelines	Not a differentiator	

Fair	Better	Best
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MANAGED LANE ACCESS

ID	Criteria	Options Ranking	
		SINGLE	INTERMEDIATE
<i>Evaluation Criteria</i>			
17	Meets the I-70 Mountain Corridor design criteria	Not a differentiator	
18	Preserves opportunities for the AGS and the ultimate preferred alternative	Not a differentiator	
19	Adaptable for future changes/projects	Less infrastructure (signs)	More infrastructure (signs)
<i>Issue Specific Criteria</i>			
1	How does it affect signage?	Less infrastructure (signs)	More infrastructure (signs)
Identification of Preferred Option: Summary		The single point of entry is the preferred alternative, it has less infrastructure impacts and a reduction of conflict points, enhancing safety. The intermediate option does not appear to be an enhancement to mobility or safety.	



Appendix C.
DRAFT White Paper:
East Idaho Springs Interchange Bridge (Structure F-14-Y)
(as of November 26, 2013)

I-70 Eastbound Peak Period Shoulder Lane

DRAFT - White Paper

East Idaho Springs Interchange Bridge (Structure F-14-Y)

November 26, 2013



Purpose of White Paper:

This paper is intended to discuss alternatives for providing adequate vertical clearance for the widened, three-lane I-70 cross section under the bridge carrying the eastbound I-70 ramp movements at the East Idaho Springs interchange over I-70. Benefits and drawbacks to lowering I-70 at this location or replacing the bridge will be presented.

Project History/Purpose

The Colorado Department of Transportation (CDOT) is in the process of developing a creative solution to maximize the use of existing highway infrastructure for the I-70 Mountain Corridor. The purpose of the PPSL project is to provide interim, eastbound operational improvements to relieve traffic congestion during peak periods when eastbound traffic volumes are highest. The operational improvements are intended to be implemented within a short time frame, without substantial construction outside of the existing I-70 highway footprint and in advance of longer-term major improvements of the I-70 Mountain Corridor.

Existing East Idaho Springs Interchange Bridge (Structure F-14-Y)

The existing bridge over I-70 is comprised of four spans supported by concrete girders and crosses at a skew of approximately 60 degrees. The existing parabolic superstructure has a vertical clearance at the edge of eastbound I-70 travel way of 15'-1", which is less than the 16'-6" required for new structures. The existing vertical clearance is greatly reduced beyond the limits of the existing lane lines, which is the case for the PPSL lane configuration. Built in 1957, the bridge has a sufficiency rating of 34.5, and the structure inspection report references numerous issues such as shear cracking in the superstructure.

Two options were investigated:

1. Lower existing eastbound I-70 to maintain the existing 15'-1" vertical clearance.
2. Replace the existing structure with a new structure that meets current design standards.

Option 1: Lower I-70

The first option investigated lowering eastbound I-70. Currently, the eastbound I-70 typical section is a two lane section with shoulders. The PPSL will utilize the existing pavement width to provide a three lane configuration, which reduces the shoulder widths to accommodate the additional lane. The new edge of the outside lanes will have reduced vertical clearances due the existing parabolic superstructure. Existing eastbound I-70, at the bridge, would need to be lowered by approximately two feet to maintain the existing 15'-1" of vertical clearance.

Profile grade adjustments – The 2'-0" profile grade adjustment to I-70, just match the existing 15'-1" of vertical clearance, would require modifications of approximately 1600 LF of eastbound I-70. The construction phasing would be quite challenging to lower I-70 considering the tight corridor restraints in this area. The roadway width between the existing bridge piers only provides enough width for one lane at a time to be reworked in the vicinity of the bridge. The option to provide the desired vertical clearance of 16'-6" is not considered feasible, since it would require EB I-70 to be lowered an additional 1'-6". In lowering I-70, the foundation for the existing bridge piers would likely not have enough cover, and it would create a sump drainage condition that has safety implications with the potential for ponding water on mainline I-70.

Drainage - The existing eastbound I-70 profile at the crossing has a gradual 0.20% grade to the east. The existing conditions are adequate for drainage, but are somewhat close to the minimum parameters from a drainage perspective. The lowering of I-70 further complicates these existing conditions creating a challenging situation in which additional drainage features would need to be incorporated. There will be more associated risk of drainage issues in this area in comparison to the existing conditions. The drainage features would be designed to handle the runoff conditions, but this mountain area can experience harsh conditions with ice and snow that complicate the function of the drainage features and may require additional maintenance during adverse conditions.

Costs – The cost to lower eastbound I-70 to match the existing vertical clearance of 15'-1" is approximately \$1,100,000. This cost includes the pavement, subgrade, guardrail, drainage improvements, and construction phasing. It is also important to keep in mind that this is only for eastbound I-70 and any future westbound I-70 improvements would have the same substandard vertical clearance with roadway adjustments being required at a similar cost of around \$1,100,000. Since I-70 would be lowered, the replacement or rehabilitation of the existing bridge could be done as a future project, however with such a low sufficiency rating this would probably be more of a near future need and is why it should be taken into consideration with the cost comparison to lower I-70. The above costs to lower both directions of I-70 and are around \$2,200,000 and do not include any structure rehabilitation or replacement costs, which would add an additional cost of around \$2,000,000.

Option 2: New Interchange Bridge

Replacing the existing structure with a new bridge allows for the opportunity to replace an aging structure, provide greater flexibility for future corridor needs, meet current standards and not modify the existing I-70 profile grade. Pier placement and structure layout would incorporate features to provide opportunities for future interchange enhancements.

Width – Wider shoulders and a sidewalk on the interchange bridge will improve safety.

Structure – The new bridge would be designed to current geometry, loading, and safety standards.

Aesthetics – The new structure will be designed to the corridor standards providing an improved appearance.

Costs – The cost of the new structure is estimated at \$2,800,000. The design team recommends moving forward with a new interchange bridge as the most desirable alternative. The existing structure is nearing the end of its service life and will likely require substantial rehabilitation or even replacement in the very near future. It is very likely with a structure of this condition and age that a benefit cost analysis would yield a replacement structure as the preferred alternative.

Summary

Option #1 – Lower I-70: Total cost ~\$2.2M to lower both EB and WB. Additional \$2M to rehab bridge
Cumulative Total ~\$4.2M

Option #2 – Replace Bridge: Total cost ~\$2.8M

As shown, based on cost alone, it is not cost-effective to lower the existing I-70 profile to accommodate an existing structure with a sufficiency rating of 34.5. Another key factor for consideration is that the chosen alternative affects the flexibility of westbound I-70. If the existing bridge is left in place, and for example a westbound PPSL or additional general purpose lane is initiated, westbound I-70 would have to be lowered like eastbound and also have the same substandard vertical clearance. A replacement structure would meet the current design standards and provide both eastbound and westbound I-70 with opportunity rather than restrictions for the future.