

# STATE OF COLORADO

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**DEPARTMENT OF TRANSPORTATION**  
Region 1 Douglas Mountain Residency  
425 A Corporate Circle  
Golden, CO 80401



**September 20, 2018**

## **Design Review Meeting – I-70 Floyd Hill to Veterans Memorial Tunnels Project # NHPP 0703-446 (21912)**

On July 23<sup>rd</sup> and July 24<sup>th</sup>, 2018, the Colorado Department of Transportation (CDOT) held a Design Review meeting for the I-70 Floyd Hill to Veterans Memorial Tunnels Project. CDOT partnered with the Federal Highway Administration to bring in experts from several agencies, consultants, and specialties to evaluate different engineering solutions for the corridor within the project limits.

Prior to the Design Review meeting, CDOT and the Context Sensitive Solutions Technical Team developed the major elements of a conceptual design to be the Proposed Action for National Environmental Policy Act (NEPA) evaluation. Before carrying the Proposed Action concept forward into the NEPA and preliminary design processes, the project team held the Design Review meeting to identify fatal flaws of the concept, suggest refinements or optimizations, and explore alternative concepts within the project limits.

After review of the Proposed Action concept, a site visit, and group discussions for solutions, the Design Review team concluded the Proposed Action concept did not have a fatal flaw. Suggested design refinements and optimizations from the Design Review team are being taken into consideration as CDOT advances the Proposed Action through preliminary design and NEPA.

Alternative concepts to the Proposed Action were developed due to the risks of geotechnical unknowns when constructing a tunnel. Those alternative concepts will be considered by CDOT for feasibility and merit as CDOT pursues innovative contracting delivery because it is anticipated that bidding teams will identify similar solutions. CDOT will continue to understand the pros and cons of those alternative concepts to be able to have future discussions, but will not advance these concepts into the preliminary design and NEPA processes.

# Meeting Notes



## I-70 Floyd Hill to Veterans Memorial Tunnels

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**Project:** I-70 Floyd Hill to VMT NEPA and 30% Design  
**Meeting:** Design Review Meeting  
**Date:** Monday, July 23, 2018 and Tuesday, July 24, 2018  
**Location:** CDOT CTMC

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### Day 1 – Monday July 23, 2018, 1:00 p.m. to 5:00 p.m.

- 1) **Introductions** – The meeting started with introductions. See sign in sheet for attendees
- 2) **Purpose of the Meeting** – CDOT has developed a conceptual design for the Floyd Hill Project and worked with the Context Sensitive Solutions (CSS) Technical Team over the last year to develop the major elements of the Proposed Action. This concept will be carried forward into the Environmental Assessment (EA) and preliminary design. The purpose of the meeting is to:
  - a) Review the Proposed Action
  - b) Identify fatal flaws or refinements / optimizations
  - c) Explore alternate conceptsCDOT would like to identify and evaluate the above before we begin work on the National Environmental Policy Act (NEPA) impact analyses and preliminary design.
- 3) **Project Overview** – CDOT and Atkins gave an overview of the project from the Programmatic Environmental Impact Statement (PEIS) to present. This included background on how different alternatives and options were evaluated resulting in the Preferred Alternative for the I-70 Mountain Corridor, which includes the Floyd Hill project (PDF of PowerPoint is attached). Key points discussed include:
  - a) PEIS Background
  - b) Speed Study – 55 miles per hour (MPH) design speed
  - c) Concept Development Process
  - d) Alignment and Interchange Options reviewed with the CSS Technical Team.
- 4) **Field Visit:**

The team conducted a field visit. See attached map for locations that the team visited.

### Day 2 – Tuesday July 24, 2018, 8:00 a.m. to 4:30 p.m.

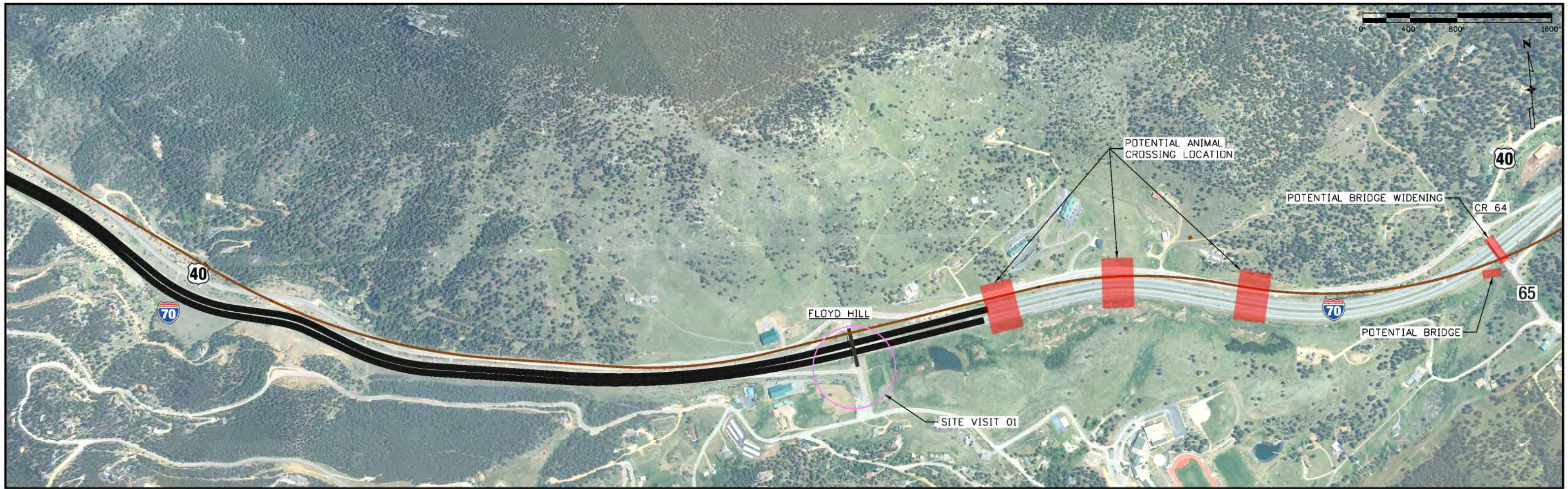
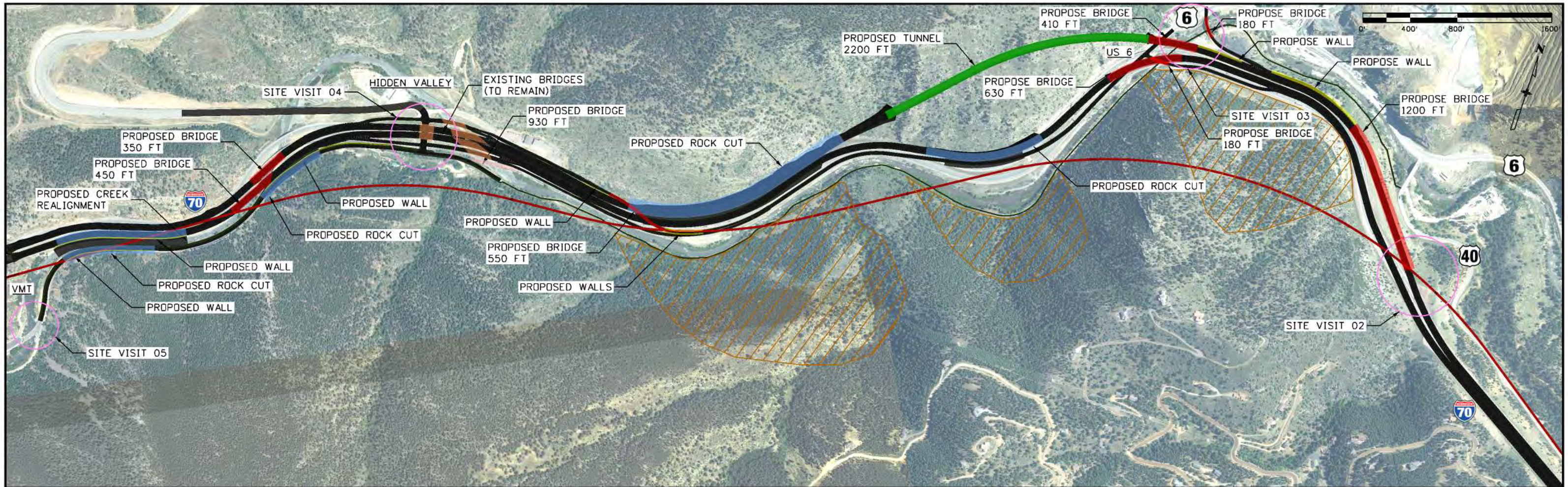
- 5) **8:00 a.m. to 9:00 a.m.** – CDOT and ATKINS gave a brief overview of the Proposed Action to remind everyone on the project elements as well as our current concepts to connect US 6 near Hidden Valley. We also solicited feedback and ideas based on the field visit the previous day.
- 6) **9:00 a.m. to 11:00 a.m.** – The larger group was divided into 4 smaller groups by discipline / specialty. Each group was asked to brainstorm ideas for optimization and refinement. Ideas were to be grouped into the project sections and interchanges. Ideas are listed below:
  - a) **General Items**

- i) Place EB I-70 in a tunnel under the Saddleback development and tie back in closer to the Veterans Memorial Tunnels (VMT).
  - ii) Consider 50 MPH design speed if we can avoid impacts.
  - iii) Optimize for maintenance – Design bridges for 100-year service life. Consider Stainless Steel components.
  - iv) Consider Maintenance of Traffic (MOT) during preliminary design. Evaluate roadway profile for changes in elevation where the new road crosses the median.
  - v) Use three feet of fill on a rigid frame and then pave instead of constructing a bridge to reduce freezing risks.
- b) **Top of Floyd Hill / East Section**
- i) Use roundabout intersections at the Top of Floyd Hill to connect ramps, local roads and US 40 in one intersection. Consider a bypass lane for the westbound (WB) direction through movement.
- c) **Central Section (US 6 to Hidden Valley interchange)**
- i) Make the frontage road one way during peak periods to carry more traffic. Frontage road returns to two-way for non-peak periods.
  - ii) Consider deleting the tunnel and using a stacked section and/or benched sections.
  - iii) Braid I-70 and put eastbound (EB) in the tunnel instead of WB.
    - (1) Consider stacked mainline west of the tunnel
    - (2) This will allow a new US 6 WB on-ramp to be constructed in its current location. It would be a right-hand entrance instead of the current left-hand entrance. This would meet current design standards and allow for a longer auxiliary lane between US 6 and Hidden Valley
    - (3) Consider a split frontage road on either side of WB I-70 (which is now in the canyon, not the tunnel).
    - (4) Keep the frontage road on the south and connect at Hidden Valley interchange similar to the interchange in Mesquite, NV (MP 120 on I-15) or I-70 and Eagle.
  - iv) Look for ways to shorten the WB tunnel or use tighter radii
  - v) Place fill at the bottom of the landslide to act as a buttress. This fill can also be used for traffic.
- d) **West Section (Hidden Valley Interchange to VMT)**
- i) Consider a stacked section to reduce rock cut.
- e) **Interchanges.**
- i) Use a flyover ramp to bring WB US 6 onto WB I-70 near the US 6 / US 40 intersection.
  - ii) Move US 6 WB on ramp flyover west of the Hidden Valley interchange.

- 7) **1:00 p.m. to 3:00 p.m.** – The larger group was divided into 3 smaller groups. Each group was asked to brainstorm ideas to develop alternative concepts. Ideas are listed below:
- a) **Group 1**
    - i) Place fill along the toe of the landslide.
    - ii) Move EB onto the fill raising its elevation
    - iii) Have EB cross the canyon and bench into the top of the cliff above the WB lanes.
    - iv) Shift WB lanes to the west and tie into existing WB lanes in the canyon.
    - v) US 6 WB on Ramp to I-70 could connect to I-70 at its current location, but along the west side of WB I-70
    - vi) Consider splitting directions on the frontage road to provide a slip ramp on WB
    - vii) US 6 to EB I-70 on ramp was eliminated.
    - viii) Consider 50 MPH design speed if we can avoid impacts.
  - b) **Group 2**
    - i) Construct a reversible lane along the Advanced Guideway System (AGS) alignment.
    - ii) Use this lane during peak periods for Trucks, HOV, and Express Lane traffic.
  - c) **Group 3**
    - i) Place WB I-70 on a viaduct outside of the current footprint
    - ii) Continue WB I-70 into the canyon on a structure. Similar to the structured lanes concept in the PEIS or could be stacked lanes.
    - iii) Bench into the first corner in the canyon.
    - iv) Tie back into the existing concept.
- 8) **3:00 p.m. to 4:30 p.m.** – Options a and c were modeling on screen using Bentley's Concept Station software. In addition, we also looked at putting EB into a tunnel as was discussed in the morning session. The following were the results:
- a) Group 1 concept.
    - i) It wasn't possible to place fill along the EB lanes and shift the lanes onto the fill without cutting into the landslide.
    - ii) The idea of placing fill to shift EB will be considered on future options if it has merit.
    - iii) The team will not evaluate this concept further at this time.
  - b) Group 2 concept
    - i) The team did not lay out this concept as the AGS alignment has already been designed. The alignment and how that alignment fits into the proposed design is already known.
    - ii) This option would require several long tunnels and viaducts. This option was considered too expensive to investigate further.
  - c) Group 3 concept.
    - i) This concept has merit and is feasible. It will be considered further.
  - d) Braid I-70 and put EB in the tunnel instead of WB concept.
    - i) This concept has merit and is feasible. It will be considered further.
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9) Conclusion

- a) No fatal flaws were identified for the Proposed Action.
- b) Design refinements and optimizations suggested during the Design Review will be taken into consideration as the preliminary design team advances the Proposed Action. The Design Review identified potential innovation to approach the Proposed Action. It also gave confidence to the validity of the Proposed Action as a potential solution to the complexity of the project.
- c) Alternative concepts developed by the Design Review team will be considered by CDOT for feasibility and merit as CDOT pursues innovative contracting delivery. CDOT anticipates bidding team will identify similar solutions. CDOT will continue to understand the pros and cons to be able to have future discussions but will not advance these concepts into the NEPA process at this time.





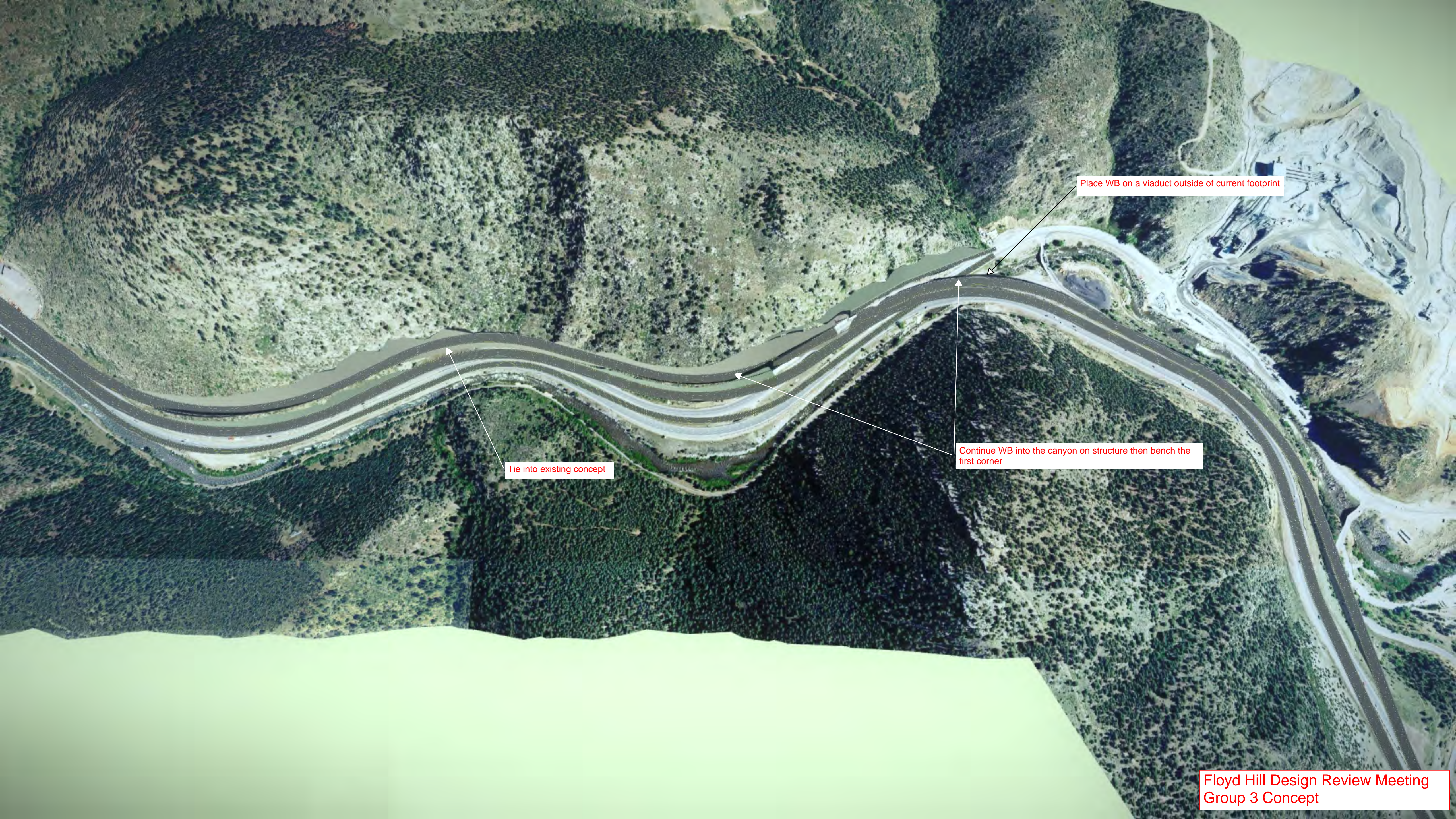
EB crosses the canyon onto a bench

Shift WB on to existing EB lanes and under the new EB bridge.

Place Fill along toe of landslide, Move EB onto the fill

EB alignment shift clips landslide in this area

Opportunity to add new WB I-70 on ramp from US 6 in this area



Tie into existing concept

Continue WB into the canyon on structure then bench the first corner

Place WB on a viaduct outside of current footprint

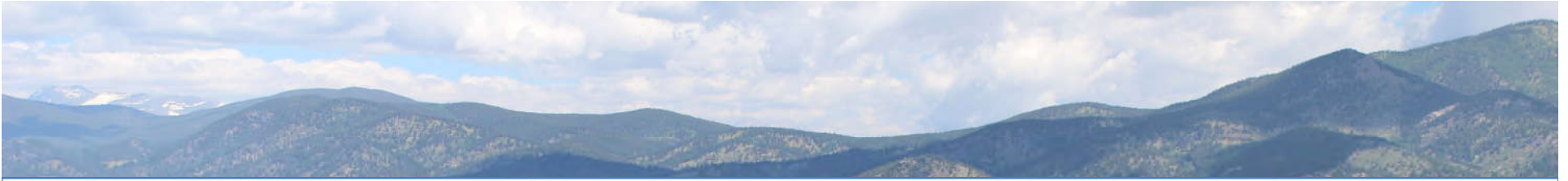


Subject: .....

Comp by: ..... Date: ..... Sheet Number: .....

Check by: ..... Job Number: .....

Name	Company/ Agency
Anthony Pisano	Atkins
TYLER LARSON	ATKINS
Emily Kubovchik	Atkins
Danja Petro	Atkins
MIKE DEMPSEY	ATKINS
Lauren Boyle	CDOT
Andy Pott	CDOT
Amanda Mascarenas	CDOT
JACOB BILLET	CDOT
Mandy Whorton	Peak
Vanessa Henderson	CDOT
KEVIN BROWN	CDOT
Maddy Cieciorka	CDOT
Matt Greer	FHWA
Kelly Galardi	FHWA
JAMAL ELKASSI	FHWA
Ride Andrew	Ych
Khamis Haramy	CFL-FHWA
DENNIS LARGENT	ATKINS
Paul Greco	ATKINS
BARRY SIEL	FHWA
MARK STRAUB	CDOT



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# Floyd Hill Design Review Meeting



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## **Project Background / Overview**



## Floyd Hill Design Review Meeting – Project Background

- CDOT completed the I-70 Mountain Corridor Tier I PEIS and ROD for 144 mi of I-70 in 2011.
- Floyd Hill is one of the specific highway improvement projects Identified in the ROD
  - Add a third WB lane through VMT (6 lane section)
  - Construct a bike path (Greenway) and a Frontage Road from VMT to US 6
- Speed Study 2016 - Floyd Hill Section 55MPH
- 2016 / 2017 - Concept Development Process (CDP) - Developed alignment and interchange alternatives.
- 2017 / 2018 - Evaluated alternatives and design options using our CSS process resulting in a Proposed Action



## Floyd Hill Design Review Meeting - Purpose

- Review the Proposed Action
  - Validate current concept
  - Optimize and refine the current concept
- Brainstorm improvements or better design options before
  - we confirm the elements of the Proposed Action
  - begin NEPA impact analysis
  - and proceed into 30% design



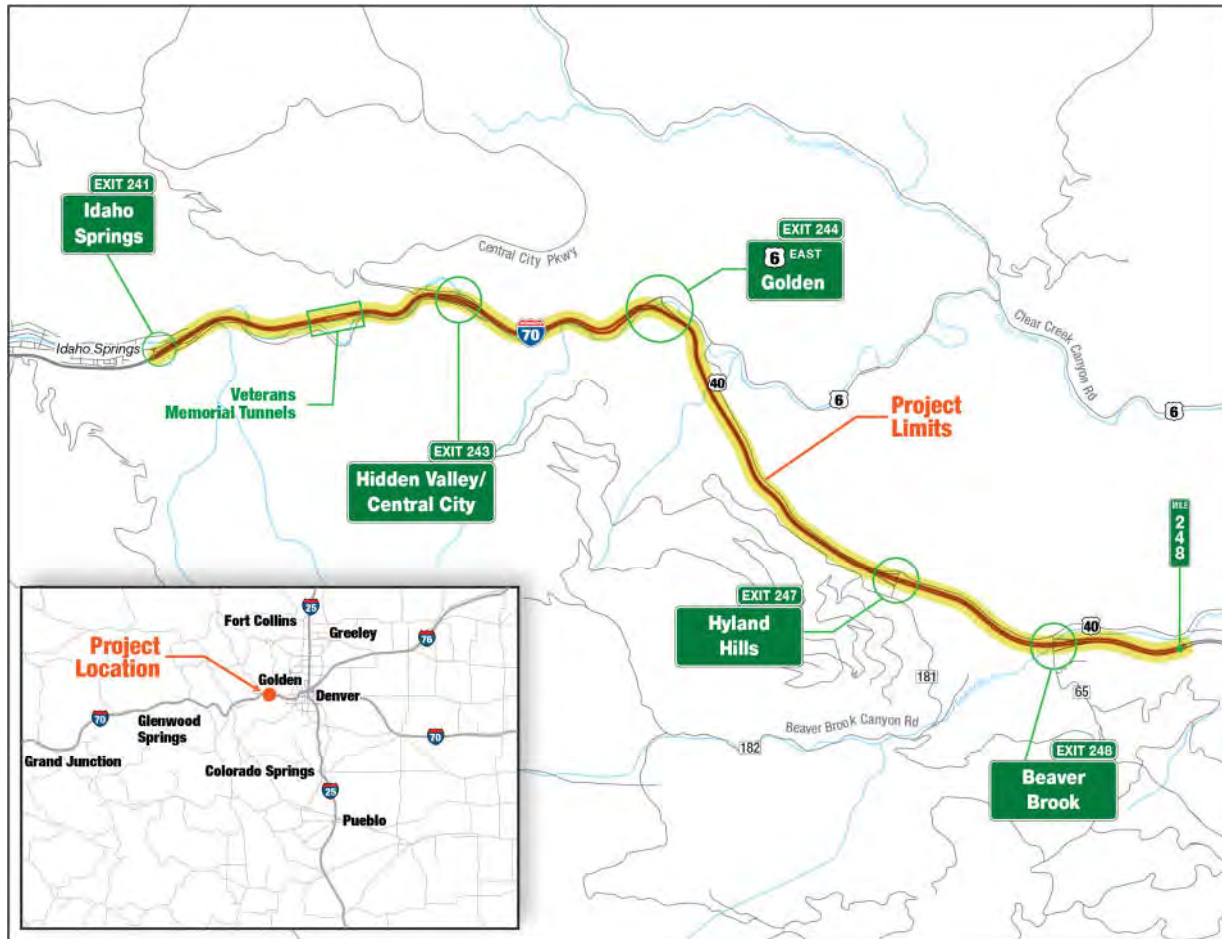
## Scope and Goals

- Improve safety
- Increase design speed to 55 mph
- Add a 3<sup>rd</sup> WB lane
- Improve and balance local and regional mobility needs
- Frontage road between US 6 and Hidden Valley
- Construct the Greenway trail





# Corridor Overview



**Slide 6**

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**PAG1**

Update figure with MP signs, etc.

Pisano, Anthony G, 7/17/2018





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## **Project Evaluation Criteria and Constraints**



# CSS Evaluation Criteria

## CSS and Community Concerns

- Followed the Context Sensitive Solutions (CSS) Process
- Review CSS evaluation criteria (hand out)
- CSS Design and Aesthetic Guidelines
- Key differentiators
  - Improve traffic mobility
  - Minimize impacts to the traveling public (traffic control, closures for blasting)
  - Supports / enhances quality recreation
  - Protects Clear Creek
  - Minimize geologic hazards (landslides and rock fall)
  - Visual quality
  - Adheres to the ROD
  - Accommodates the AGS, Frontage Road and the Greenway Trail



# Project Constraints

## Design Challenges and Considerations

- 55 MPH design speed
  - Limited available footprint
  - Minimum horizontal curve radii (1060 ft)
  - Horizontal sight distance
  - Shoulder widths
- Rockfall mitigation
  - 20 ft wide ditches
- Cold weather/snow (freezing and plowing)
- Accommodates traffic movements



# Project Constraints

## Community Comments – AGS





# Project Constraints

## Design Challenges – Landslides

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**Concepts Considered - CDP**



# Concepts Considered

## Concept Development Process – Tunnel South

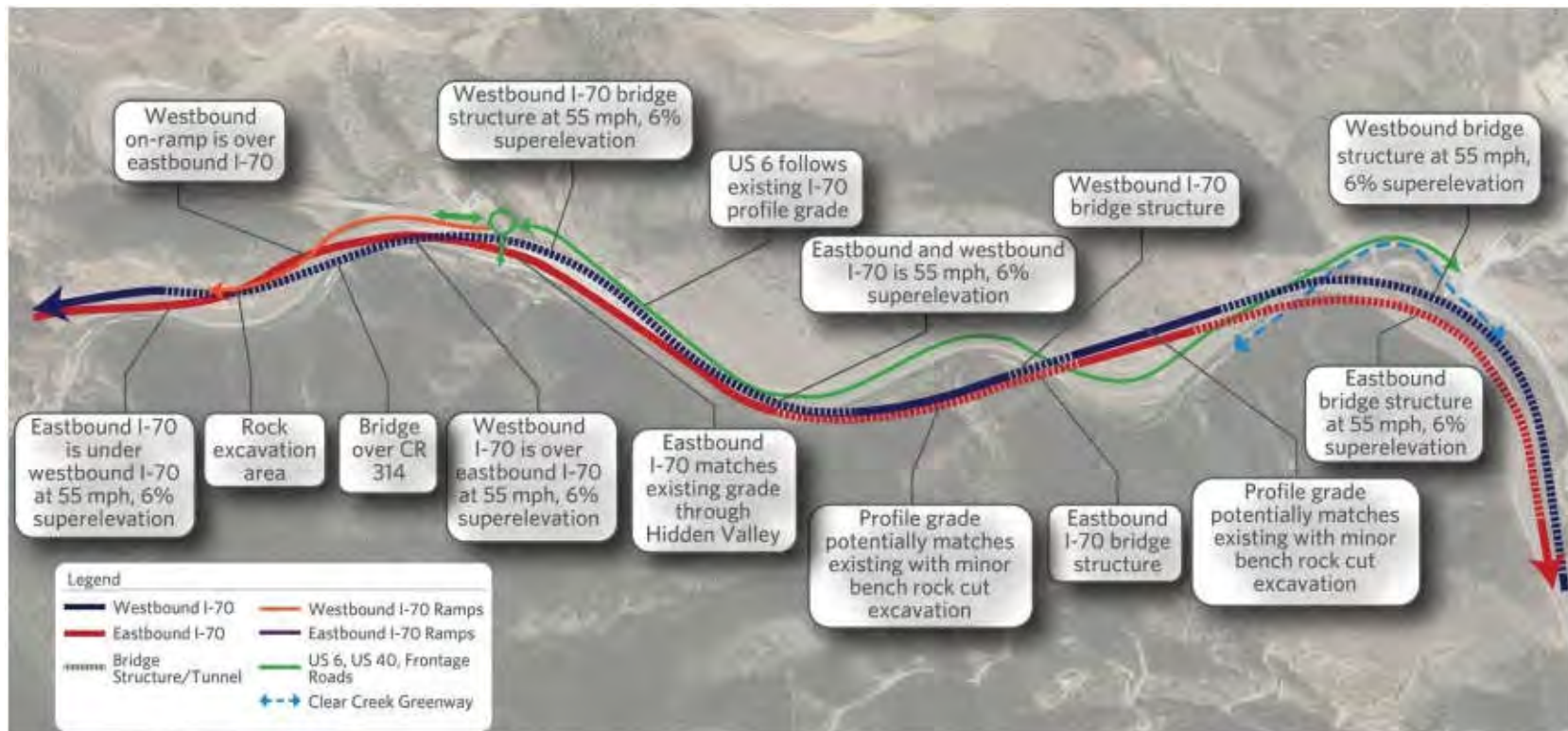
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# Concepts Considered

## Concept Development Process – South

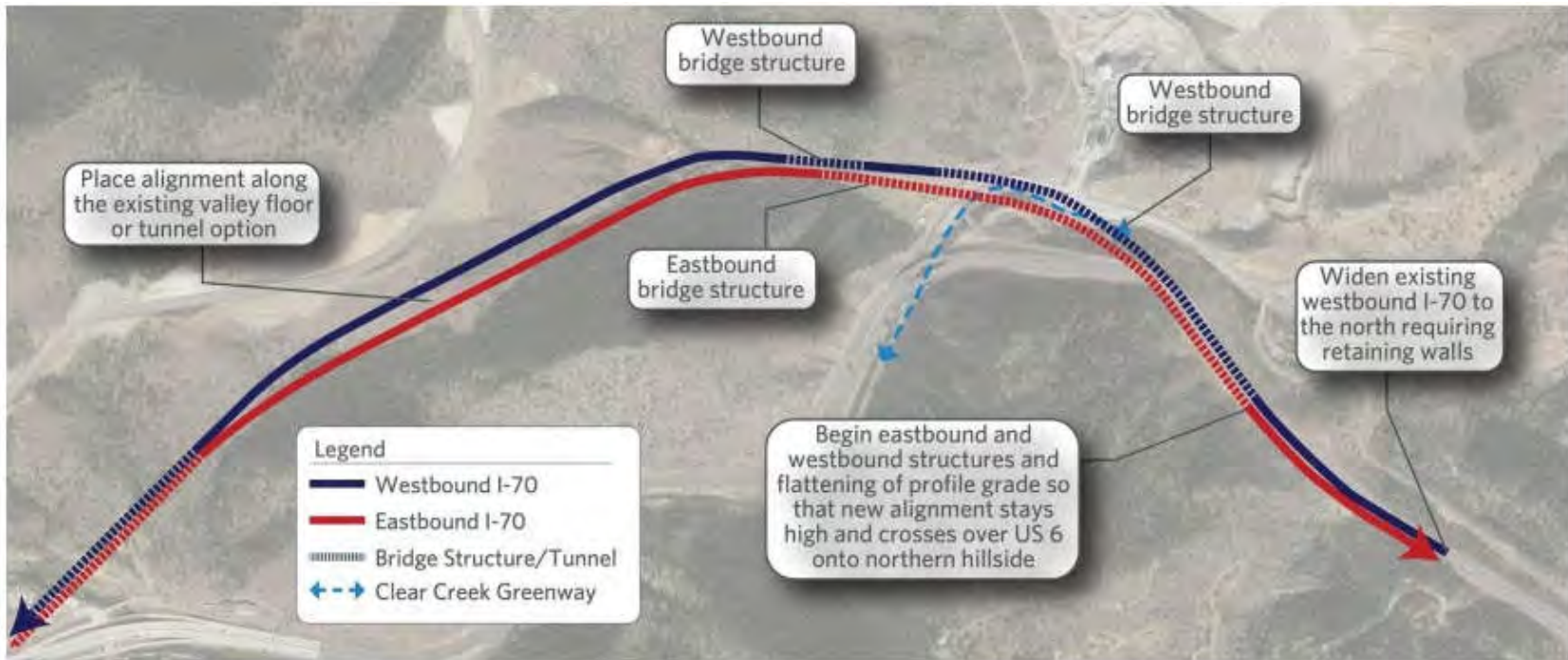






# Concepts Considered

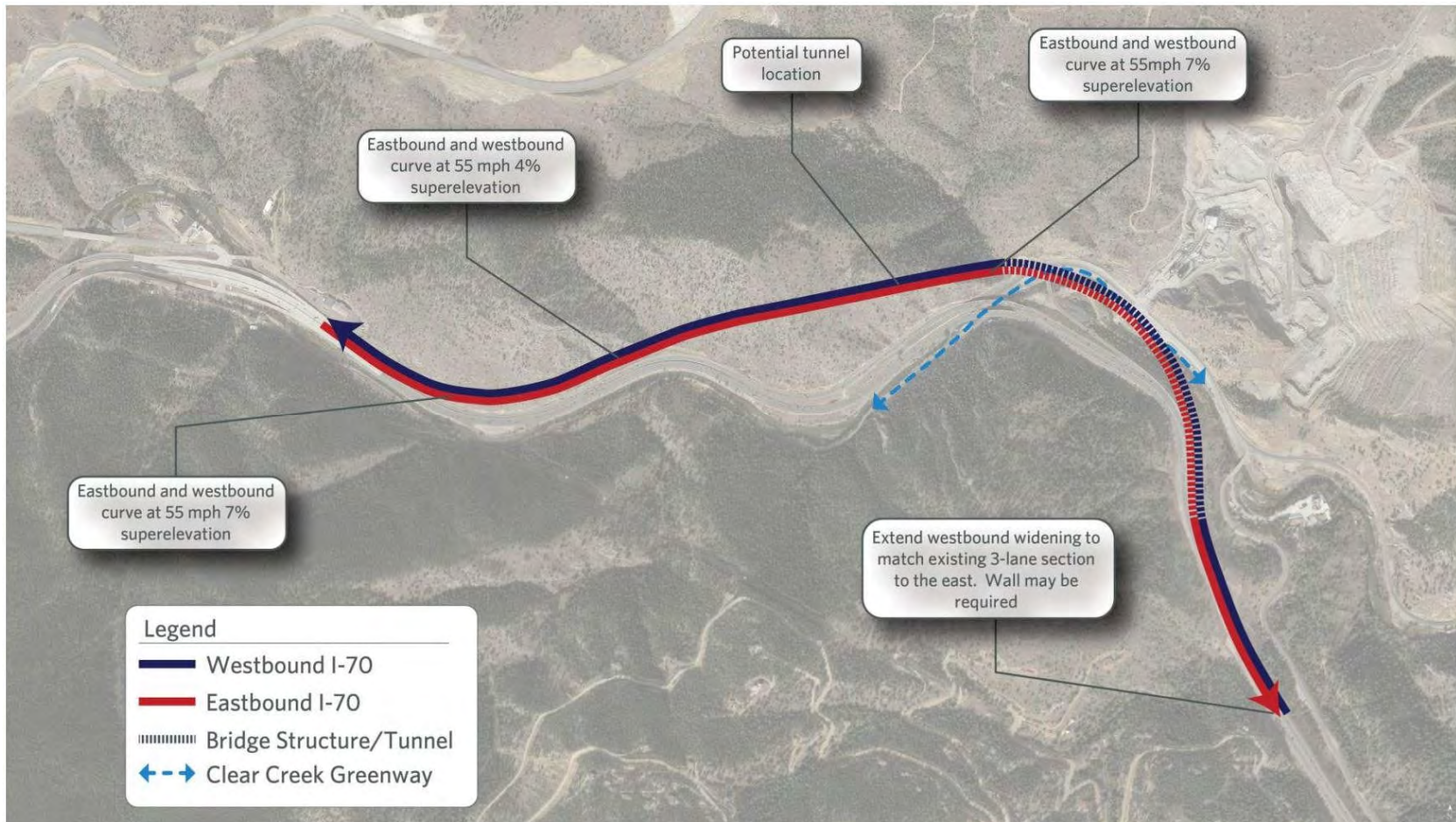
## Concept Development Process – Off Alignment





# Concepts Considered

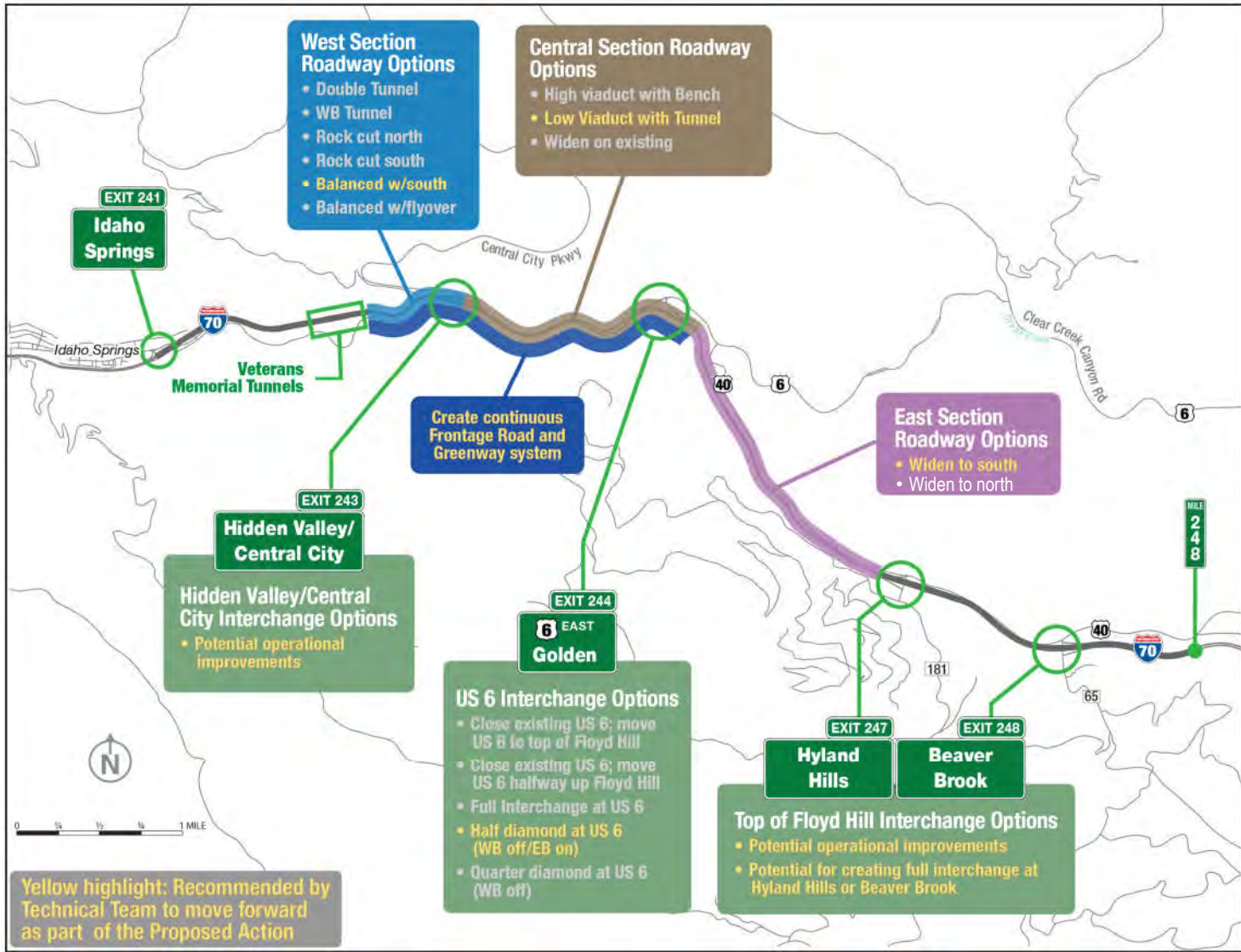
## Concept Development Process – North





# Concepts Considered - CSS

## Roadway Options – Overview



Yellow highlight: Recommended by Technical Team to move forward as part of the Proposed Action

**Slide 17**

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**PAG2**

Is there a more up to date version. Not sure names are correct on West Section

Pisano, Anthony G, 7/17/2018



## East Section

Top of Floyd Hill to US 6

Design options considered:

- Widen along EB lanes within existing footprint
- Widen along the WB lanes on retaining walls



# Concepts Considered - CSS

Floyd Hill – Widen Along Eastbound





# Concepts Considered - CSS

## Floyd Hill – Widen Along Westbound





## Central Section

### US 6 to Hidden Valley Interchange

Design options considered

- High Viaduct with a bench cut
- Low Cut
- Low Bridge into a tunnel

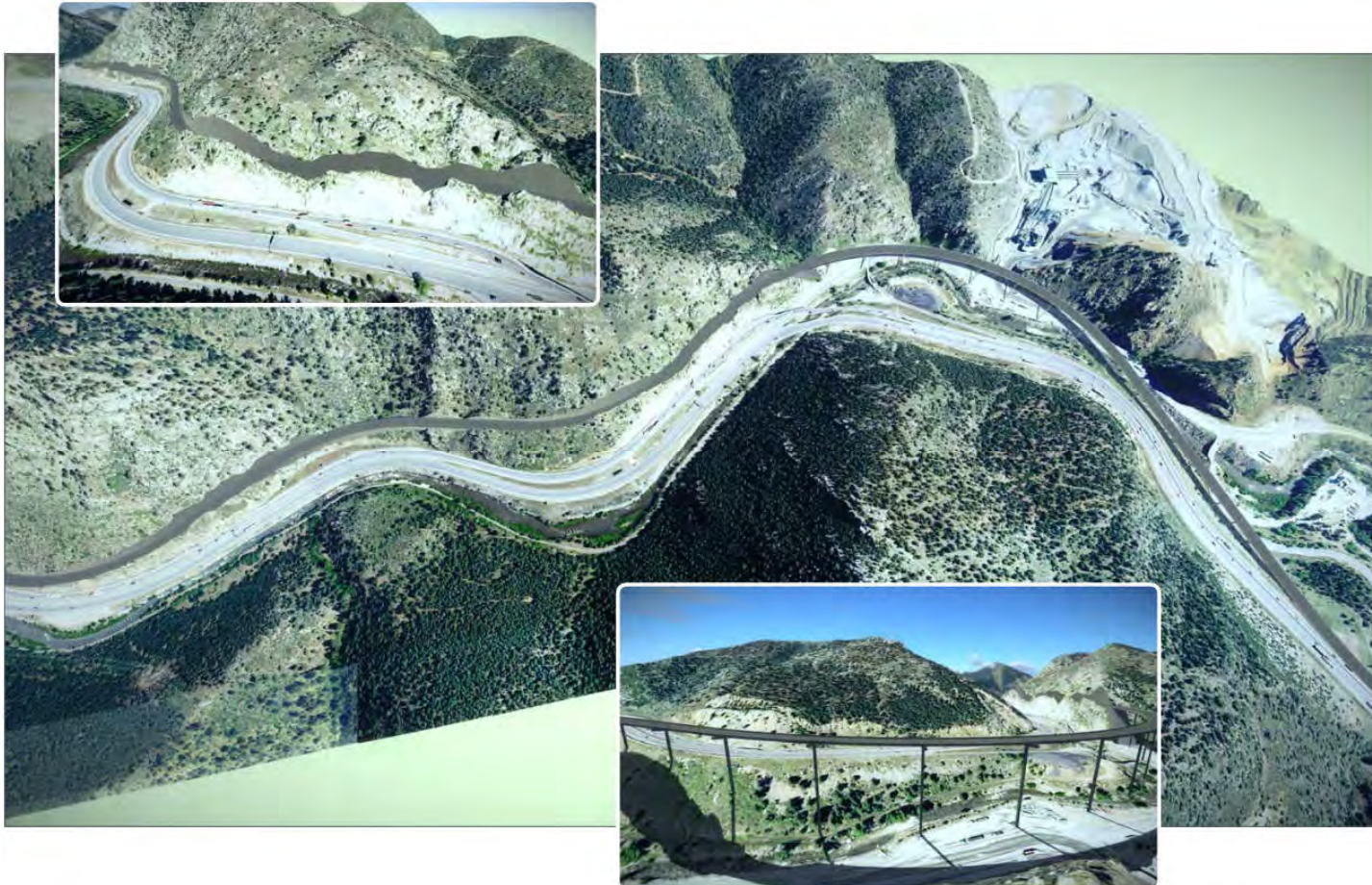
Review options using ConceptStation





# Concepts Considered - CSS

North Alignment – High Bench





# Concepts Considered - CSS

North Alignment – Low Cut





# Concepts Considered - CSS

## North Alignment – Low Tunnel





# Concepts Considered - CSS

## North Alignment – Matrix

ID	Evaluation Questions - How does the option...	Option A: High Viaduct with Bench	Option B: Low Viaduct with Tunnel	Option C: Low Viaduct with Rock Cut
<b>RECOMMENDATIONS</b>				
		<p><b>Not Recommended for further evaluation at this time for the following reasons:</b></p> <ul style="list-style-type: none"> <li>● Viaduct adds maintenance concerns and snow removal</li> <li>● Challenges with emergency access on the viaduct</li> <li>● Adds major elements to the viewshed with rock cuts and viaduct leading to large visual impacts</li> <li>● Constructability concerns with large viaduct, although constructed offline.</li> <li>● Some risk for rock fall problems</li> </ul>	<p><b>Recommended to be evaluated as a part of the Proposed Action. This option provides the following benefits:</b></p> <ul style="list-style-type: none"> <li>● Tunnel reduces snow removal</li> <li>● Minimizes impacts to the viewshed with localized rock cuts and smaller bridges leading to fewer visual impacts</li> <li>● Tunnel limits constructability impacts since it is constructed outside of the existing footprint.</li> <li>● Less risk for rock fall problems</li> </ul>	<p><b>Not Recommended for further evaluation at this time for the following reasons:</b></p> <ul style="list-style-type: none"> <li>● Rock cuts reduce maintenance concerns and snow removal is typical for the corridor.</li> <li>● Emergency access is typical for the corridor</li> <li>● Adds major elements to the viewshed with extensive rock cuts through the entire canyon leading to large visual impacts</li> <li>● Major constructability concerns with extensive blasting adjacent to traffic.</li> <li>● Most risk for rock fall problems</li> </ul>



## West Section

### Hidden Valley Interchange to Veterans Memorial Tunnels

Design options considered

- WB in a tunnel / EB Rock Cut
- North side rock cut
- South side rock cut
- Balanced cut

Review options using ConceptStation



## Concepts Considered - CSS

Hidden Valley to VMT – Tunnel





## Concepts Considered - CSS

Hidden Valley to VMT – North Side Rock Cut





## Concepts Considered - CSS

Hidden Valley to VMT – South Side Rock Cut







# Concepts Considered - CSS

## Hidden Valley to VMT – South Side Rock Cut

WEST SECTION ROADWAY OPTIONS			
Option Ranking			
ID	Evaluation Questions - How does the option...	Option A: WB tunnel / EB Rock Cut	Option B: Balanced Rock Cut with South Frontage Road
<b>RECOMMENDATIONS</b>			
		<p>Not Recommended for further evaluation at this time for the following reasons:</p> <ul style="list-style-type: none"> <li>• Adds major impacts to the viewshed with rock cuts and tunnel portals resulting in substantial visual impacts</li> <li>• Constructability concerns with extensive blasting along I-70.</li> <li>• Infrastructure investment of a tunnel at this location is not reasonable</li> <li>• Would remove known archeological site</li> <li>• May require some trucks to use alternate routes</li> </ul>	<p>Recommended to be evaluated as a part of the Proposed Action. This option provides the following benefits:</p> <ul style="list-style-type: none"> <li>• Much of the construction can be done outside of traffic limiting construction impacts to the I-70 traveling public.</li> <li>• Moving the alignment south minimizes rock cuts and visual impacts</li> <li>• Reasonable infrastructure investment</li> <li>• Does not require trucks to use alternate routes</li> </ul>



# US 6 Interchange

## Existing Conditions

- Review US 6 interchange - Google Earth
- $\frac{3}{4}$  Interchange
- Left side ramps



# US 6 Interchange

## Access Options

- Move all traffic to the top of Floyd Hill
- Construct a new interchange part way up the hill. Review Options in ConceptStation
- New interchange at the bottom of Floyd Hill - ConceptStation
- Half Diamond
- All options include a frontage road north of the creek and Greenway south of the creek



# Concepts Considered - CSS

## US 6 Access Options

ID	Evaluation Questions - How does the option...	Option A: Close existing US 6; move US 6 to top of Floyd Hill	Option B: Close existing US 6; move US 6 halfway up Floyd Hill	Option C: Full Interchange at US 6	Option D: Half diamond at US 6 (WB off/EB on)	Option E: Quarter diamond at US 6 (WB off)
<b>RECOMMENDATIONS</b>						
<p><b>Technical Team Conclusions / Recommendations</b></p>	<p><i>Not Recommended for further evaluation at this time for the following reasons:</i></p> <ul style="list-style-type: none"> <li>Increases truck and gaming traffic on US 40 conflicting with neighborhood and bicycle traffic and high school athletics</li> <li>Not consistent with Clear Creek County Master Plan</li> </ul> <p>However, will evaluate the potential need for a full diamond interchange at the top of Floyd Hill (Beaver Brook) as a part of the proposed action.</p>	<p><i>Not Recommended for further evaluation at this time for the following reasons:</i></p> <ul style="list-style-type: none"> <li>Substantial visual, environmental, and geologic impacts</li> <li>Not consistent with Clear Creek County Master Plan</li> <li>Requires significant infrastructure</li> <li>Potential conflicts with the AGS</li> </ul>	<p><i>Not Recommended for further evaluation at this time for the following reasons:</i></p> <ul style="list-style-type: none"> <li>Substantial visual, environmental, and geologic impacts               <ul style="list-style-type: none"> <li>Substantial impacts to the traveling public during construction</li> </ul> </li> <li>Requires significant infrastructure</li> </ul>	<p><i>Recommended to be evaluated as a part of the Proposed Action. This option provides the following benefits:</i></p> <ul style="list-style-type: none"> <li>Minimizes visual, environmental and geologic hazards.</li> <li>Balances Access at the US 6 interchange with maintaining area at bottom of Floyd Hill for recreational uses</li> <li>Reduces truck and gaming traffic at the top of Floyd Hill</li> </ul>	<p><i>Not Recommended for further evaluation at this time for the following reasons:</i></p> <ul style="list-style-type: none"> <li>Similar to Option D but eliminates the EB on ramp at US 6.</li> <li>Increases truck and gaming traffic on US 40 conflicting with neighborhood and bicycle traffic and high school athletics</li> </ul>	



## US 6 Interchange

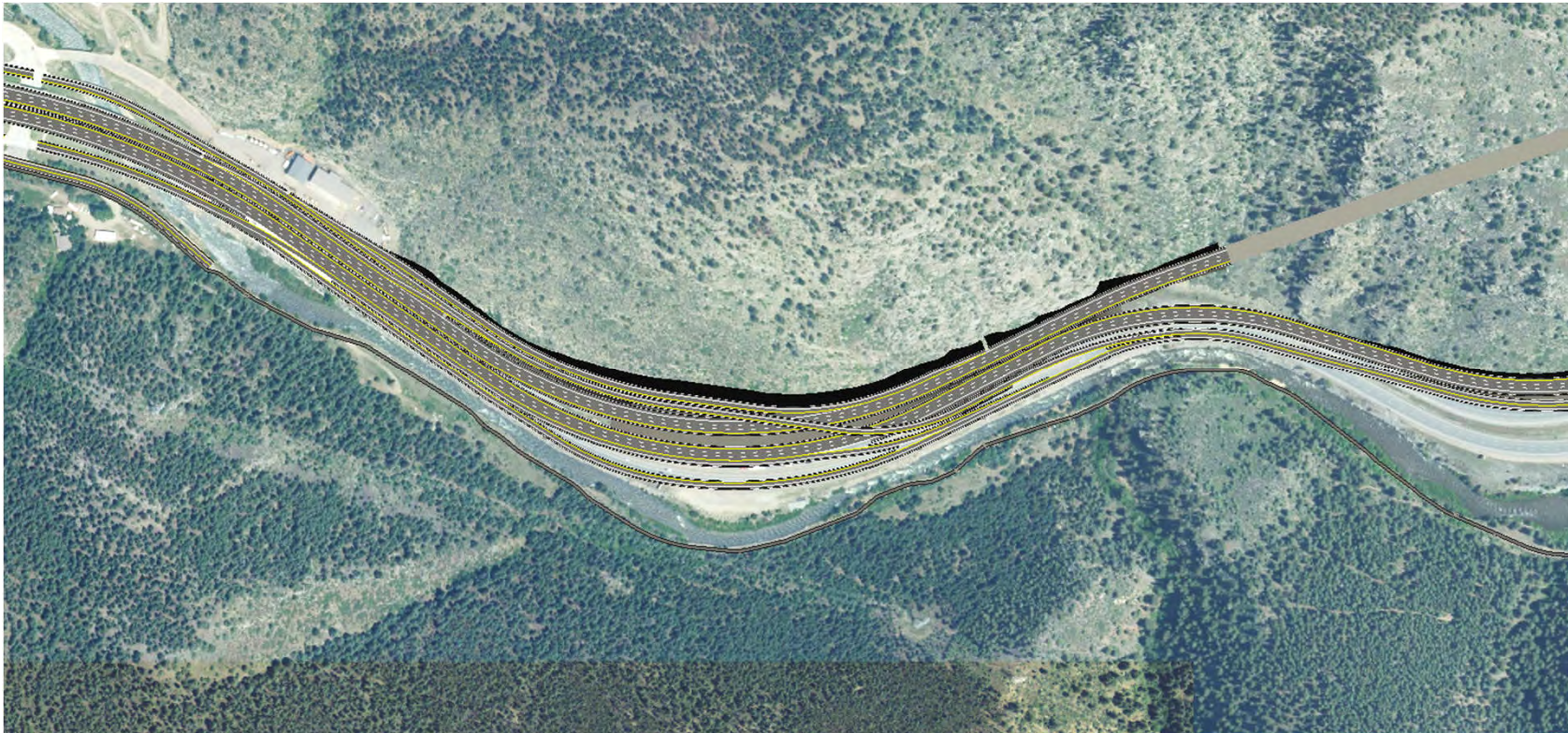
### Frontage Road Connection Options at Hidden Valley Interchange

- Review 4 Direct connect ramp options - Roll Plots
- Review impacts of routing US 6 traffic through Hidden Valley Interchange.



# Concepts Considered - CSS

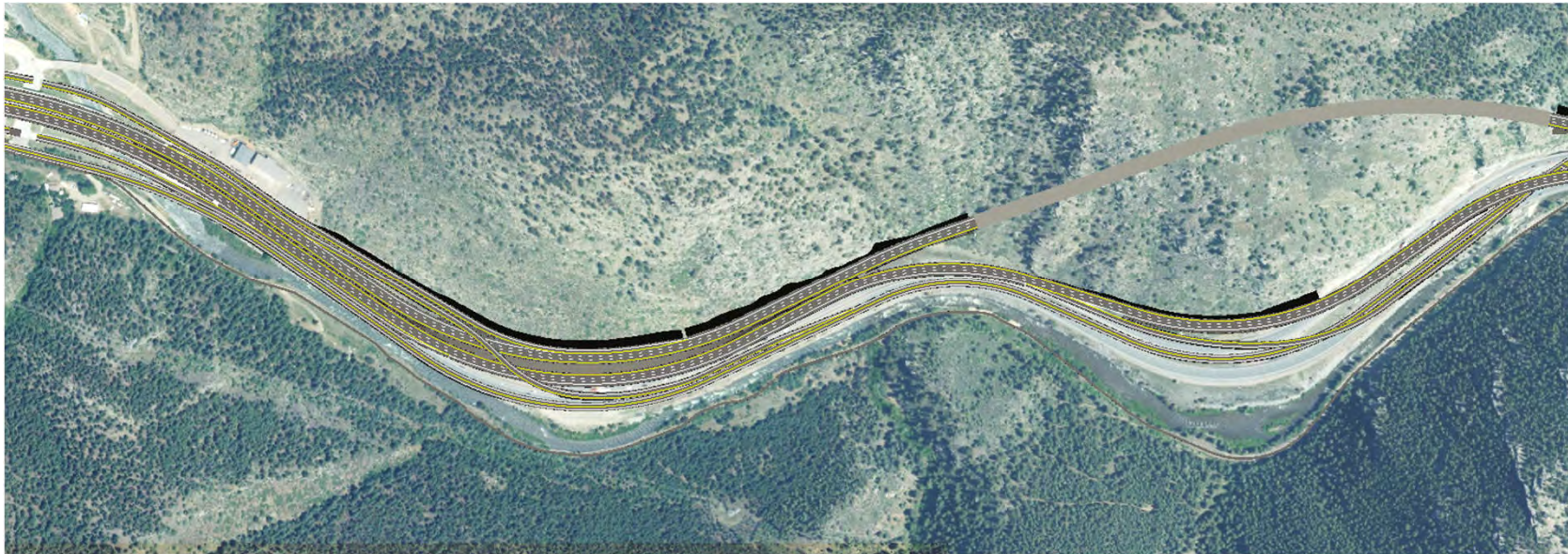
US 6 Full Interchange – Braided Ramps





# Concepts Considered - CSS

## US 6 Full Interchange – Connector Ramps





# Concepts Considered - CSS

US 6 Full Interchange – Double Flyover







# Concepts Considered - CSS

US 6 Full Interchange – Slip Ramps





## Recap and Questions

- 3 alignment design options
  - East Section
  - Central Section
  - West Section
- US 6 Access Options
  - Move Access to top of hill
  - Move access part way up the hill
  - Reconstruct interchange at the bottom of the hill
  - Half diamond with frontage Road connection



## Field Visit