I-70 Mountain Corridor CSS

Partnerships Powered by Context

Tunnel Visioning

A Design Workshop for the Twin Tunnels

Prepared for

DOT

DEPARTMENT OF TRANSPORTATION

March 2011

Tunnel Visioning

A Design Workshop for the Twin Tunnels

Executive Summary

During the week of February 21st, 2011 a team of stakeholders and technical experts met to discuss the mobility issues at the Twin Tunnels just east of Idaho Springs on the I-70 Mountain Corridor. On Day One of the workshop the group developed and agreed upon Critical Success Factors to measure ideas and concepts proposed to improve near-term mobility at the Twin Tunnels.

On Days 2 – 4 of the workshop, the technical experts worked to develop and refine the improvement concepts, with a report out on the 5th and final day. Stakeholders reassembled with the Technical Team to discuss and, ultimately, to approve a recommended Concept Package.

The technical team's recommendation includes the following elements:

Concept Package 2 – Widen Eastbound Tunnel and Fix the 45 mph Curve Eastbound
Preliminary Cost Estimate $55 Million

- Construct a detour on old US 40/ CR 314
- Widen eastbound tunnel to 3 lanes
- Use shoulder for third lane during peak period prior to construction of additional lane, as a temporary measure
- Flatten the 45 mph curve just east of the tunnels with a 55 mph design
- Add an eastbound lane from Idaho Springs to Floyd Hill
- Restore the frontage road, restore and enhance the trail and trailhead

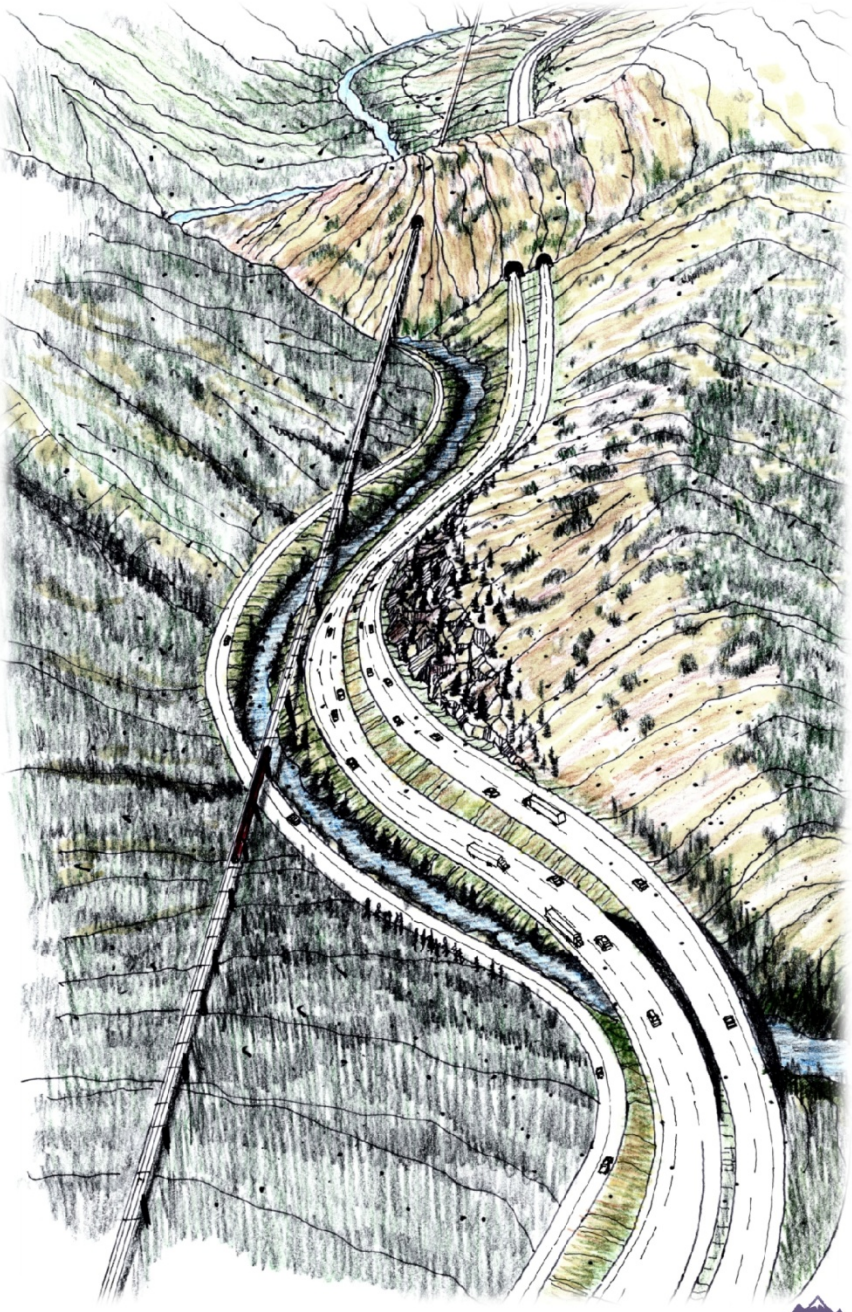
In addition to the elements outlined in Concept Package 2, it is recommended that future studies consider the following variations:

- Eliminate 45 mph curve reconstruction
- Don't build the 3rd lane, but implement hard shoulder running
- Don't build the 3rd lane or reconstruct 45 mph curve
- Reconstruct all the curves to 55 mph design
- Reconstruct all the curves to 65 mph design
- Add a westbound cross-over area to accommodate peak period westbound traffic with a reversible lane

The Concept Package is recommended because it best meets the desired outcome of "**develop improvements that address near term and current mobility needs"** set by the group during the

initial meeting. Specifically, this Concept Package was preferred by the Technical Team because: it addresses the most immediate mobility issues; it improves the tightest curve, a location of many accidents; the pre-design, design, and construction can be accomplished in 4 to 5 years; it is consistent with the PEIS Preferred Alternative; and it constructs permanent elements of the PEIS Preferred Alternative while being cost competitive with temporary plans, such as the Zipper Lane plan.

While the group discussed all of the Concept Packages, much of the discussion focused on the impacts, benefits and variations of the Concept Package 2. At the conclusion of the discussion, the entire group was supportive of moving forward with the steps necessary to see Concept Package 2, with appropriate variations, implemented.



ARTIST'S RENDERING
AT-GRADE WIDENING OF I-70
EAST OF THE TWIN TUNNELS

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Introduction

The Tunnel Visioning Design Workshop is the result of state and local interest in the I-70 Mountain Corridor and a desire for improvements to the existing weekend congestion.

This interest has manifested itself in regular calls to CDOT on Monday mornings from frustrated travelers who were delayed over the weekends; the belief that many Front Range residents opt out of visiting the mountains for recreational activities due to the long slow drives both into and out of the mountains; and most recently, the State Legislature passing a bill directing CDOT to investigate a reversible lane option which might offer immediate relief for the Sunday afternoon eastbound trip.

A focal point of the congestion and delay has long been the Twin Tunnel area. Located at mile Marker 242, just east of Idaho Springs, the Twin Tunnels encourage drivers to slow down as they approach the seemingly narrow tunnels. These slowing vehicles create a queue stretching back, sometimes, for 4 and 5 miles.

The first study, the Reversible Lane Study, sometimes referred to as the Zipper Lanes, found the delays, congestion and resulting crashes focused around the Twin Tunnels and represented a pinch point for the proposed Zipper Lane. The results of the Zipper Lane work can be found in the Phase II Study. One thing that became clear was regardless of what improvement is implemented, the Twin Tunnels need to be addressed.

This was the genesis to the Tunnel Visioning effort.

Discussing how to study the Twin Tunnel area in a quick and effective way led to this innovative approach. Bring together technical experts in the areas of tunneling, roadway design, geotechnical engineering, traffic operations, and transit design for 1 week. Create a forum for the technical experts to interact with the corridor stakeholders to understand the issues and the context. Sequester the technical experts together to develop, design, analyze, and refine ideas into concepts that address the immediate problems.

This approach was executed during the week of February 21, 2011 through February 25, 2011 and the process, participants, and the results are detailed in this report.

Process

As a project on the I-70 Mountain Corridor, CDOT committed to use the 6-Step process outlined in the CSS Guidance. The 6-Step process was developed with all of the corridor stakeholders and is fully detailed on the CSS web site (www.i70mtncorridorcss.com) .These steps are intended to provide a clear and repeatable process that is fair and understandable. The order of the steps is as important as the activities within each step.

The agenda for each day of the workshop paralleled the 6-Step process, with day 1, February 21st completing Steps 1 through 4.

In order to Define the Desired Outcomes and Actions the Large Stakeholder Group discussed the issues surrounding the area. These issues included the Twin Tunnels proximity to Clear Creek, the tunnels standing as a historic landmark, the land over the tunnels is a land bridge for wildlife movement, and the Frontage Road just south of I-70.

The group then reviewed the I-70 Mountain Corridor Programmatic EIS and the Consensus Recommendation for their direction on the preferred alternative in the area of the Twin Tunnels.

This allowed the group to agree that the desired outcome for the workshop was to **"develop improvements that address near term and current mobility needs".**

With agreement on the desired outcome and review of the 6-Step process, the group endorsed the process.

The structure of this workshop required a time-focused effort on each of the steps. The group completed steps 1 through 4 during the Monday session.

The agendas for each day are shown below.

The 6 Step Process

Step 1: Define Desired Outcomes and Actions
Using the CSS Guidance and other relevant materials, this step establishes the project goals and actions. It also defines the terms to be used and decisions to be made.

Step 2: Endorse the Process
This step establishes participants, roles, and responsibilities for each team. The process is endorsed by discussing, possibly modifying, and then finalizing with all teams the desired outcomes and actions to be taken.

Step 3: Establish Criteria
This step establishes criteria, which provides the basis for making decisions consistent with the desired outcomes and project goals. The criteria measure support for the Core Values for the I-70 Mountain Corridor.

Step 4: Develop Alternatives or Options
The Project Staff works with the Project Leadership Team, stakeholders, and the public to identify alternatives or options relevant to the desired outcomes, project-specific vision, and goals.

Step 5: Evaluate, Select, and Refine Alternative or Option
The process of analyzing and evaluating alternatives applies the criteria to the alternatives or options in a way that facilitates decision making. This may be a one-step or multi-step process depending on the complexity of the alternatives and the decision.

Step 6: Finalize Documentation and Evaluate Process
Documentation should be continuous throughout the process. Final documentation will include each of the previous steps, final recommendations, and the process evaluation.

6-Step Process	Tunnel Visioning Agendas
Monday 2/21– Large Stakeholder Group *1.Define Desired Outcomes and Actions* *2.Endorse the Process* *3.Establish Criteria* *4.Develop Alternatives*	Morning: Share History and Discuss Concerns Afternoon: Brainstorm Critical Measures of Success and Short Term Solutions
Tuesday 2/22– Technical Experts *5.Evaluate, Select, and Refine Alternatives*	Morning: Functional Analysis of Ideas Afternoon: Screen Ideas and Create Viable Concepts

Wednesday 2/23– Technical Experts *5.Evaluate, Select, and Refine Alternatives*	Morning: Technical Evaluation of Concepts Afternoon: Peer Review of Alternatives
Thursday 2/24 – Technical Experts *5.Evaluate, Select, and Refine Alternatives*	Morning: More Technical Evaluation of Concepts Afternoon: Packaging the Concepts
Friday 2/25 – Large Stakeholder Group *6.Finalize Documentation and Evaluate Process*	Morning: Report-out of Technical Findings Gain Stakeholder Endorsement Determine Next Steps

Critical Success Factors

Monday afternoon was spent, first, establishing the criteria which would be used for analyzing the concepts and then brainstorming all of the solutions for the area. For this workshop the criteria were named the Critical Success Factors.

The Critical Success Factors, shown below, were developed by breaking into groups and discussing the issues that needed to be considered in evaluating any ideas or concepts. The groups were then asked to identify the 10 most important issues or the Critical Success Factors for the concepts.

These Critical Success Factors were presented to the group and all agreed that these represented the most important issues that needed to be evaluated for each concept in order to reach the desired outcome for the workshop.

Critical Success Factor	Measurement	Considerations
Improve Mobility	Best Better Good	Speed, Volume, # of People
Compatibility with Existing Plans	All Many Some	
Timing of Implementation	Years to operation	Date of opening to full operations
Cost	2011 Dollars	Cost to build will be in $$. Changes in operations and maintenance costs will be discussed
Level of Environmental Change	High Medium Low	Based on the relative impacts to the environmental resources (water, air, wildlife, visual, historic)
Level of Economic Benefit	High Medium Low	Recreational opportunities, impact to local businesses, access to resorts, local access
Flexibility of Design and Long Term Usability	High Medium Low	Provides for operational options and compatibility with the PEIS Preferred Alternative

Community Stakeholder Acceptance	High Medium Low	Local, Regional and State
Attractive solution to gain funding and political support	High Medium Low	
Safety	High Medium Low	Address existing deficiencies, reduce congestion, reduce demand, meets driver expectation
Construction Disruption	High Medium Low	Duration, Repetition, Interruption, Frequency

After the Critical Success Factors were discussed the group brainstormed all of the ideas they had for the Technical Team to review. No ideas were critiqued or eliminated.

Ideas

The ideas, shown below, were categorized into Build Concepts and Variations; Operational Concepts; Enhancements; and Funding Elements.

Build Concepts and Variations
1. New Long Tunnel
a)Realign 3 WB lanes into a new tunnel from west of Hidden Valley to the west end, north of the existing tunnel
b) New tunnel with 3 lanes EB and WB tunnels
2. Realign EB lanes south of the existing tunnel
a) Viaduct/structure south of existing tunnel
b) Take it to Floyd Hill
c) Tie it in tight
d) Build it across the creek on structure
3. Flatten curves west of Hidden Valley Interchange
a) New WB tunnel between Hidden Valley and Twin Tunnels for flatter curves
b) Realign EB and WB lanes on elevated viaduct or walled structure from Hidden Valley to Twin Tunnels
4. Reversible lane
a) Zipper Lane
5. Old US 40 Improvements
a) Use EB shoulder as a lane, take around the tunnel at game check, and have it return to I-70 at Hidden Valley
b) Use CR 314 as construction detour during reconstruction of EB tunnel
6. Open cut the highway EB and WB to accommodate 3 lanes in each direction
7. Reconstruct existing bores
a) Widen EB and WB tunnels to 3 lanes
b) Lower WB bore
c) Make one large bore that accommodates 3 lanes EB and WB
d) Widen EB bore
e) Widen 1 bore for reversible lane

Build Concepts and Variations
8. Third bore
a) Use 1 bore for AGS
b) New bore for EB (3lanes)
c) Third bore at a new elevation south of existing EB bore
d) Construct express lane bore
e) Build third bore on top of existing use for AGS in the long term
f) Build third bore and use one of the existing tunnels for transit or reversible lane
g) Build third bore north of the existing Twin Tunnels
Operational Concepts – ideas that might improve mobility w/out building
1. Tickets for National Forest (limit access)
2. Add bus service
3. Add ATMS
a) Control speed
b) Manage access
4. Restrict truck use in tunnels by time
5. Traffic metering in the whole corridor
6. Create incentives for off-peak travel
Enhancements – ideas that could improve on several or all build concepts
1. Flare and light tunnel portals, ATMS
2. Enhance County Road 314 for improved emergency response access
3. Improve trails
Funding Elements – ideas to gain funding to build the improvements
1. Congestion pricing
2. Toll the corridor to pay for improvements
3. Create incentives for off-peak travel
4. Privatize funding
5. Legislative changes to generate funding
6. Create a tolling authority

Armed with the context, the criteria, and the stakeholder's ideas, the Technical Team spent the next 3 days working to combine ideas into concepts, design the concepts to a level of confidence that the concept could be built to industry standards, CDOT standards and the I-70 Mountain Corridor standards.

The Analysis

One of the first activities of the Technical Team was to screen all of the ideas and determine if any were outside the scope of their charge, which ideas were duplicates or had duplications in them, and which ideas might improve all build concepts. The table below tracks each of the ideas and its ultimate use.

Ideas and Variations	Where it Went	Comments
1) New Long Tunnel		
a) Realign 3 WB lanes into a new tunnel from west of Hidden Valley to the west end, north of the existing tunnel	Not included in a concept package	1400 ft tunnel Less than 1000 from existing tunnel Capital, maintenance and operation costs high
b) New tunnel with 3 lanes EB and WB tunnels	Not included in a concept package	1400 ft tunnel WB 1000 ft tunnel EB Less than 1000 from existing tunnel Capital, maintenance and operation costs high
2) Realign EB lanes south of the existing tunnel		
a) Viaduct/structure south of existing tunnel	CP6	
b) Take it to Floyd Hill	Not included in a concept package	Would be an extension of 2a at increased cost
c) Tie it in tight	CP5	
d) Build it across the creek on structure	Not included in a concept package	Achieves same results as 2a and 2c at higher cost
3) Flatten curves west of Hidden Valley Interchange		
a) New WB tunnel between Hidden Valley and Twin Tunnels for flatter curves	Not included in a concept package	Capital, maintenance and operation costs high Other alignment options achieved same objective with lower costs (see 3b)
b) Realign EB and WB lanes on elevated viaduct or walled structure from Hidden Valley to Twin Tunnels	CP1, CP2, CP3, CP4, CP5, CP7	Expanded to two options: Realign with structure Realign with rock cuts
4) Reversible lane		
a) Zipper lane	Not included in a concept package	See previous study
5) Old US 40 Improvements		
a) Use EB shoulder as a lane, take around the tunnel at game check, and have it return to I-70 at Hidden Valley	Not included in a concept package	Safety and operational concerns Restricts use of the frontage road Requires limited speeds
b) Use CR 314 as construction detour during reconstruction of EB tunnel	CP 1, CP2, CP3, CP4	
6) Open cut the highway EB and WB to accommodate 3 lanes in each direction	Not included in a concept package	High cost Environmental impacts Would require closure of interstate during construction
7) Reconstruct existing bores		
a) Widen EB and WB tunnels to 3 lanes	CP1, CP3	
b) Lower WB bore	Not included in a concept package	Does not address mobility
c) Make one large bore that accommodates 3 lanes EB and WB	Not included in a concept package	High cost Would require closure of interstate during construction Widening each bore accomplishes the same mobility
d) Widen EB bore	CP2,CP4	

Ideas and Variations	Where it Went	Comments
e) Widen 1 bore for reversible lane	Not included in a concept package	Reversible lane through tunnel was not considered in lieu of additional lane EB
8) Third bore		
a) Use 1 bore for AGS	Not included in a concept package	Not applicable to current mobility
b) New bore for EB (3lanes)	Not included in a concept package	Expanding existing bore to three lanes more cost effective
c) Third bore at a new elevation south of existing EB bore	CP7	
d) Construct express lane bore	Not included in a concept package	Expanding existing bore to three lanes more cost effective
e) Build third bore on top of existing use for AGS in the long term	Not included in a concept package	Expanding existing bore to three lanes more cost effective
f) Build third bore and use one of the existing tunnels for transit or reversible lane	Not included in a concept package	Expanding existing bore to three lanes more cost effective
g) Build third bore north of the existing Twin Tunnel	Not included in a concept package	Expanding existing bore to three lanes more cost effective
Operational Concepts		
1. Tickets for National Forest (limit access)	Not considered in this process	
2. Add bus service	Not considered in this process	
3. Add ATMS		Considered as part of 7e Currently being studied
4. Control speed		
5. Manage access		
6. Restrict truck use in tunnels by time	Not considered in this process	
7. Traffic metering in the whole corridor	Not considered in this process	
8. Create incentives for off-peak travel	Not considered in this process	
Enhancements		
1. Flare and light tunnel portals, ATMS		Could be included in all concept packages that include tunnel improvements
2. Enhance CR 314 for improved emergency response access		Could be combined with all concept packages
3. Improve trails		Could be combined with all concept packages
Funding Elements		
1. Congestion pricing	Not in the scope of this process	
2. Toll the corridor to pay for improvements	Not in the scope of this process	
3. Create incentives for off-peak travel	Not in the scope of this process	
4. Privatize funding	Not in the scope of this process	
5. Legislative changes to generate funding	Not in the scope of this process	
6. Create a tolling authority	Not in the scope of this process	

The Technical Team started with 48 ideas and sorted them into 4 types; Ideas, Variations on Ideas, Operational Concepts, Enhancements and Funding Elements.

The Technical Team agreed that the Funding Elements were not theirs to address and that Enhancements would be added to Concepts as appropriate. The group also agreed that Operational Concepts had been proposed and implemented on this corridor with results that had not satisfactorily addressed the problems; therefore they were not included in the analysis.

This directed the focus on the 8 ideas and their variations. The Technical Team disassembled the 8 ideas and their variation into 16 Concept Elements. After review elements I and K were eliminated because they were duplicative. Further, Element N was never used. Listed below are the Concept Elements that were looked at with preliminary lay outs, discussed in the individual Concept Element reports, and cost estimated. The Concept Element reports and the detailed quantities and cost estimates are included in the Appendices of this report.

Concept Elements

CONCEPT ELEMENT A -- Widen Existing EB and WB Tunnels

CONCEPT ELEMENT B -- Widen Existing EB Tunnel

CONCEPT ELEMENT C -- Construct new 3rd Tunnel

CONCEPT ELEMENT D -- Realign 3 EB lanes with 65 mph design

CONCEPT ELEMENT E -- Realign 3 EB lanes with 55 mph design

CONCEPT ELEMENT F -- Flatten EB and WB curves to 65mph

CONCEPT ELEMENT G -- Flatten EB and WB curves to 55mph

CONCEPT ELEMENT H -- Flatten EB 45 mph curve to 55 mph

CONCEPT ELEMENT J -- Hidden Valley to Floyd Hill widen to 3 EB lanes

CONCEPT ELEMENT L -- Add 3rd EB lane from Idaho Springs to Twin Tunnels

CONCEPT ELEMENT M -- Improve shoulder to provide 3 EB lanes for peak period

CONCEPT ELEMENT O -- Old US 40/CR 314 used for detour EB during construction

CONCEPT ELEMENT P -- Restore/enhance frontage road, trail and trailhead

The analysis of these Concept Elements provided the team with the design information to reassemble them into Concept Packages that would meet the Critical Success Factors.

The following 7 Concept Packages were built from the Concept Elements, they were evaluated against the Critical Success Factors and preliminary cost estimates were assembled. The following pages present each of the Concept Packages.

Concept Package 1 -- Widen Both Tunnels/ 55mph Design

Construct a detour on US40 and CR 314.

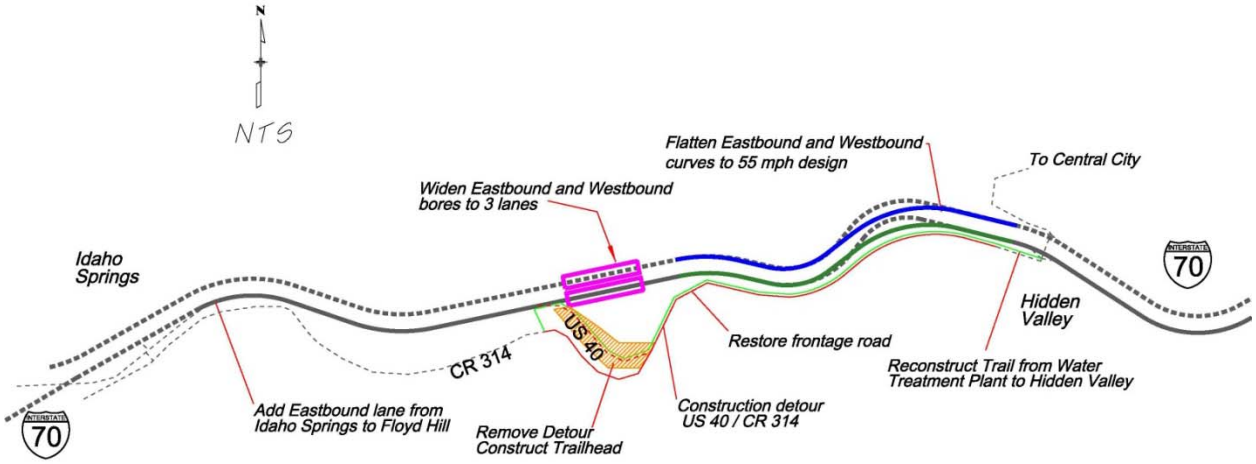
Then widen the eastbound and westbound tunnels to accommodate 3 lanes in each direction with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

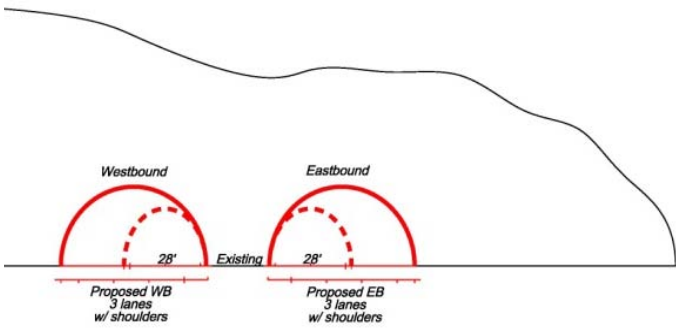
The eastbound and westbound curves east of the Twin Tunnels would be redesigned with curves meeting a 55 mph design speed.

A third lane would be added for eastbound travel from the Idaho Springs easternmost interchange to the bottom of Floyd Hill, connecting with the existing third lane.

At the conclusion of using the Frontage Road as a detour, it would be restored and enhancements to the trail and trailhead would be made.

This Concept Package include Concept Elements A, G, J, L, M, O, and P





Concept Package 2 -- Widen EB Tunnel/Fix 45 mph Curve EB

Construct a detour on US40 and CR 314.

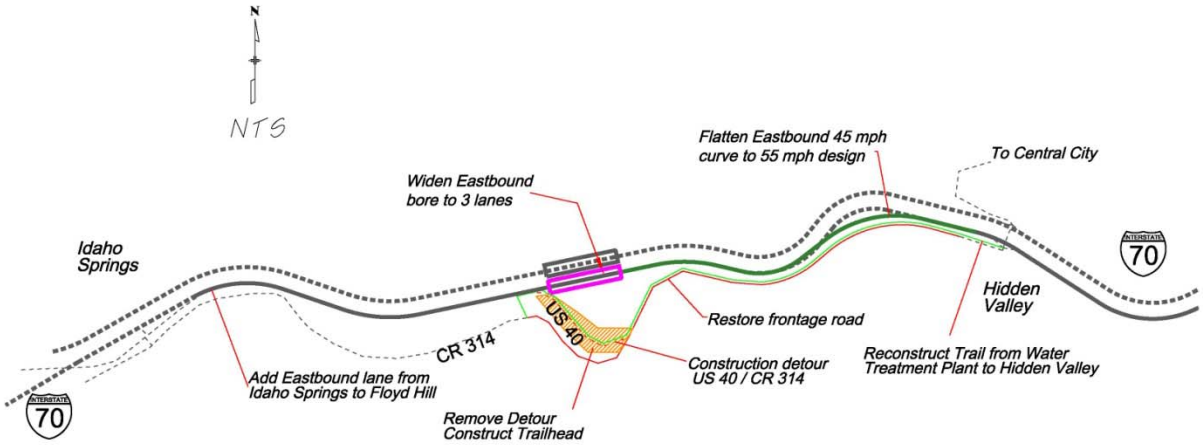
Then widen the eastbound tunnel to accommodate 3 eastbound lanes with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

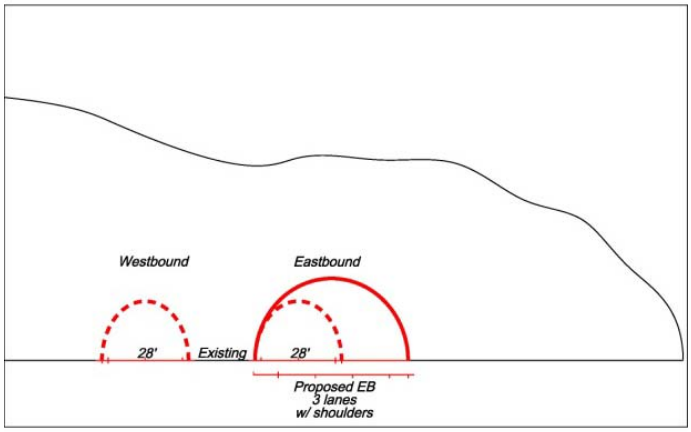
The single eastbound curve, now posted for 45 mph, would be redesigned with a curve meeting a 55 mph design speed.

A third lane would be added for eastbound travel from the Idaho Springs easternmost interchange to the bottom of Floyd Hill, connecting with the existing third lane.

At the conclusion of using the Frontage Road as a detour, it would be restored and enhancements to the trail and trailhead would be made.

This Concept Package include Concept Elements B, H, J, L, M, O, and P





Concept Package 3 -- Widen Both Tunnels/ 65mph Design

Construct a detour on US40 and CR 314.

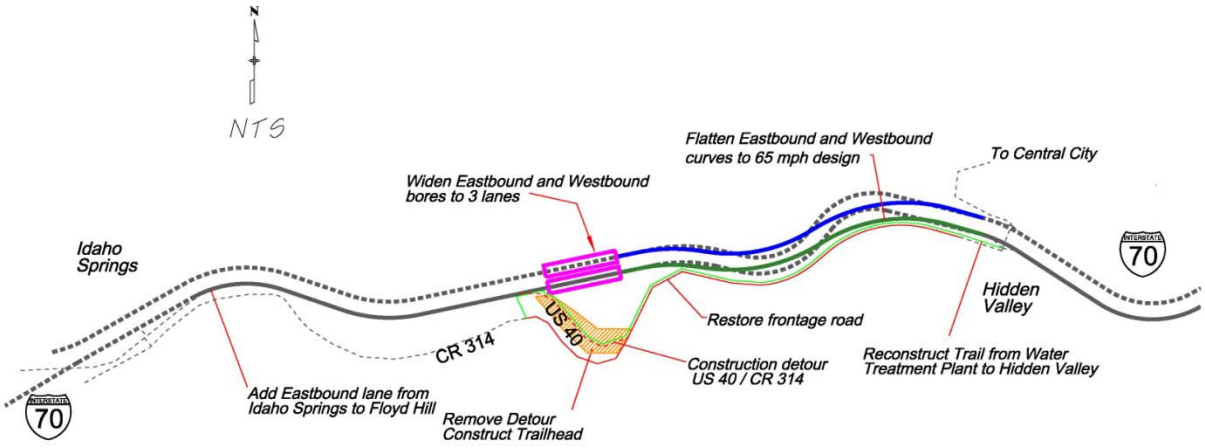
Then widen the eastbound and westbound tunnels to accommodate 3 lanes in each direction with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

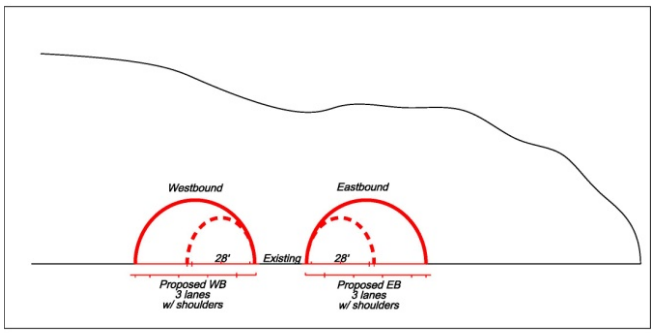
The eastbound and westbound curves east of the Twin Tunnels would be redesigned with curves meeting a 65 mph design speed. (The westbound curve must be redesigned to fit in the eastbound curve).

A third lane would be added for eastbound travel from the Idaho Springs easternmost interchange to the bottom of Floyd Hill, connecting with the existing third lane.

At the conclusion of using the Frontage Road as a detour, it would be restored and enhancements to the trail and trailhead would be made.

This Concept Package include Concept Elements A, F, J, L, M, O, and P





Concept Package 4 -- Widen EB Tunnel/ 65 mph Design

Construct a detour on US40 and CR 314.

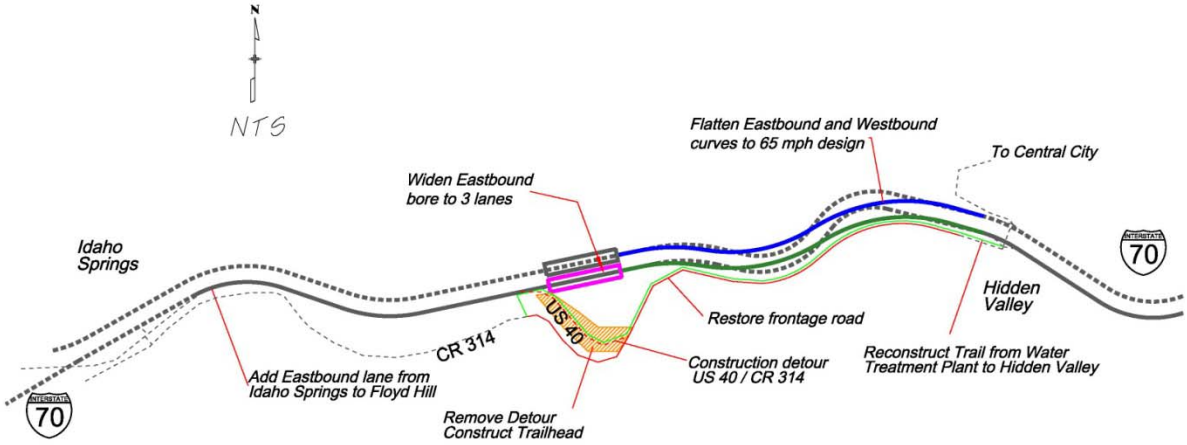
Then widen the eastbound tunnel to accommodate 3 eastbound lanes with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

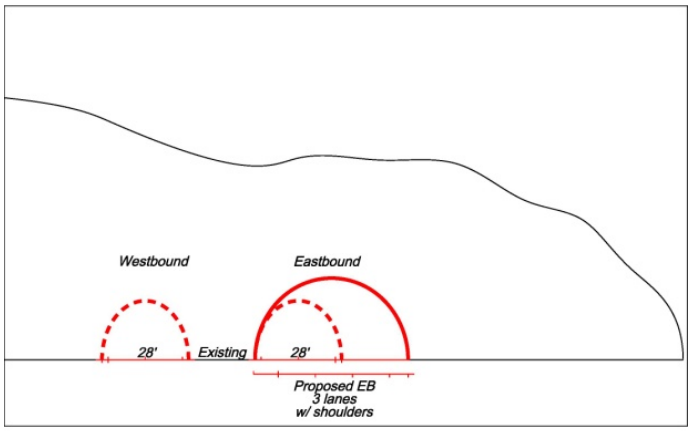
The eastbound and westbound curves east of the Twin Tunnels would be redesigned with curves meeting a 65 mph design speed. (The westbound curve must be redesigned to fit in the eastbound curve).

A third lane would be added for eastbound travel from the Idaho Springs easternmost interchange to the bottom of Floyd Hill, connecting with the existing third lane.

At the conclusion of using the Frontage Road as a detour, it would be restored and enhancements to the trail and trailhead would be made.

This Concept Package include Concept Elements B, F, J, L, M, O, and P





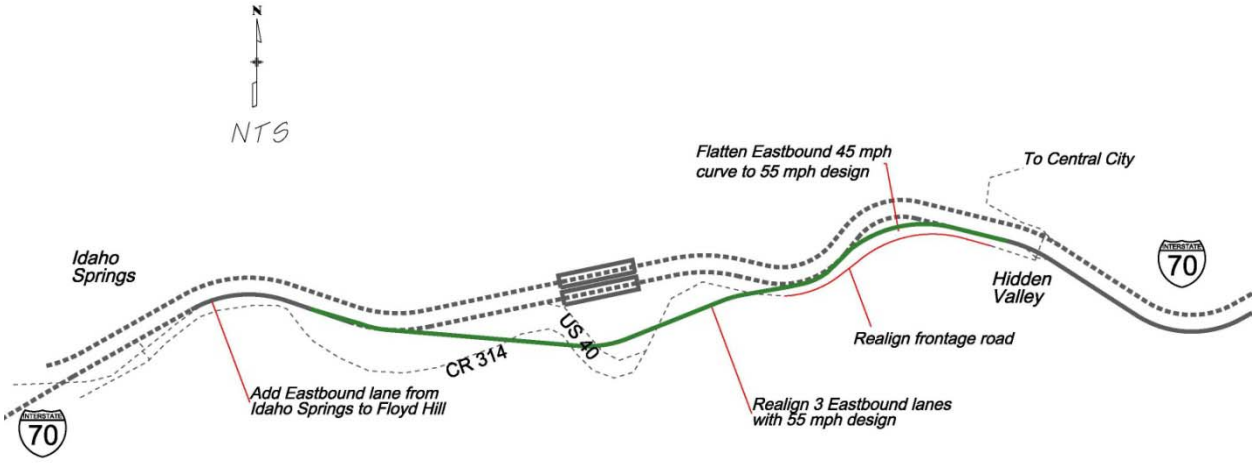
Concept Package 5 -- 55mph EB Tunnel Bypass

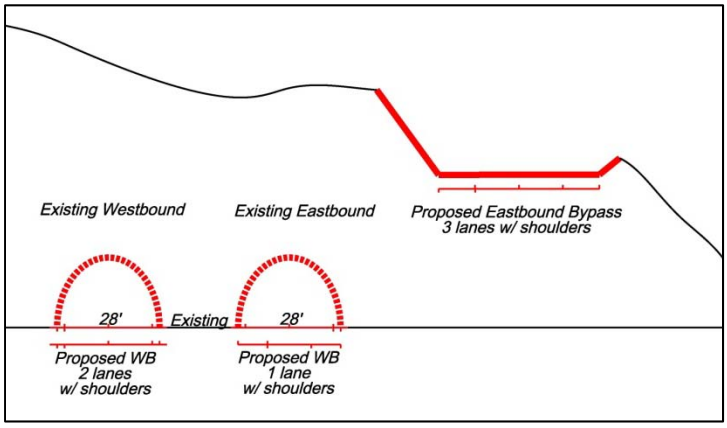
Construct eastbound lanes on a viaduct positioned south of the existing I-70 thus bypassing the eastbound tunnel. The viaduct would be from mile marker 241.8 to 242.7. This short viaduct would be designed for 55 mph and would accommodate 3 eastbound lanes. Included is redesign of the 45 mph curve to accommodate a 55 mph design.

Westbound lanes would remain in their current location. Westbound lanes could use the existing eastbound tunnel.

The addition of a third eastbound lane from Idaho Springs easternmost interchange to the new viaduct and then continuing to Floyd Hill connecting with the existing 3 lane section.

This Concept Package includes Concept Elements E , J, and L





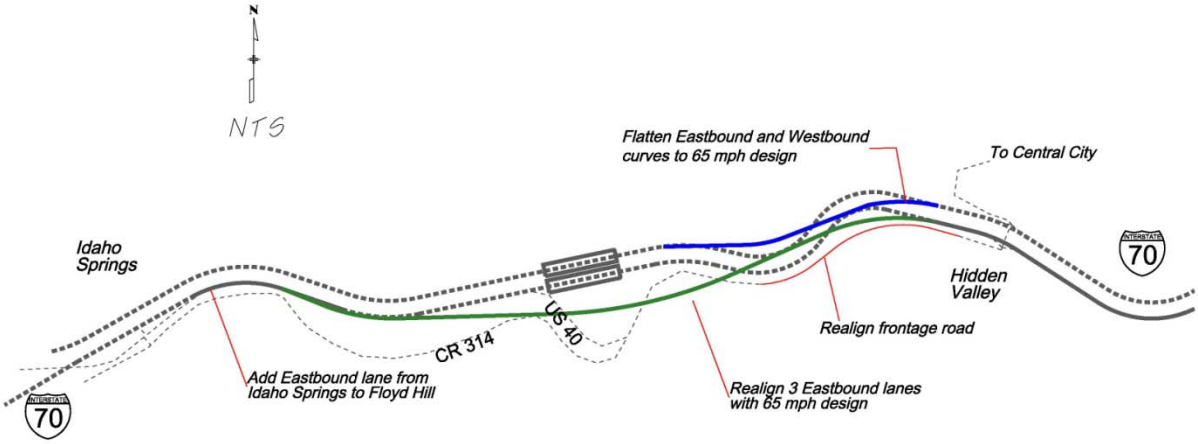
Concept Package 6 -- 65mph EB Tunnel Bypass

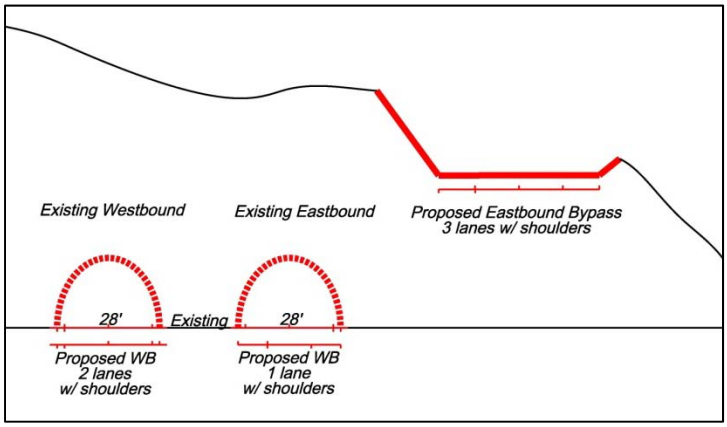
Construct eastbound lanes on a viaduct positioned south of the existing I-70 thus bypassing the eastbound tunnel. The viaduct would be from mile marker 241.8 to Hidden Valley. This long viaduct would be designed for 65 mph, includes flatten of both the EB and WB curves, and would accommodate 3 eastbound lanes.

Westbound lanes would be improved to 65 mph as well. Westbound lanes could use the existing eastbound tunnel.

The addition of a third eastbound lane from Idaho Springs easternmost interchange to the new viaduct and then continuing to Floyd Hill connecting with the existing 3 lane section.

This Concept Package includes Concept Elements D, J, and L





Concept Package 7 -- New EB Tunnel/ Fix 45mph Curve EB

Construct a third tunnel for the eastbound lanes. This tunnel would accommodate 3 lanes with improved shoulders. This would require the realignment of the eastbound lanes. Clear Creek would be realigned to the south to make room for the eastbound lanes.

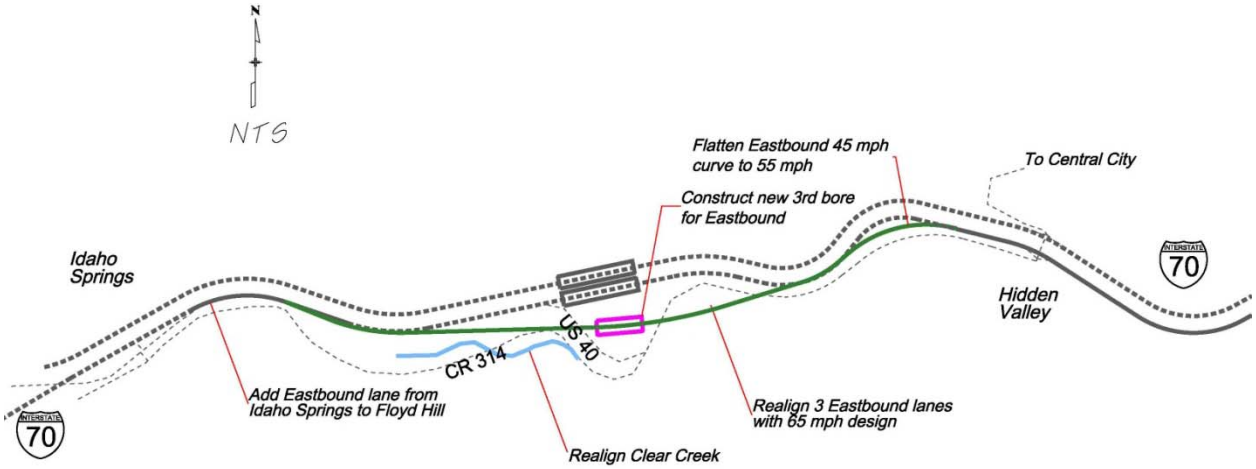
Westbound lanes would remain in their existing location. Further, the existing eastbound tunnel could be used for an additional westbound lane.

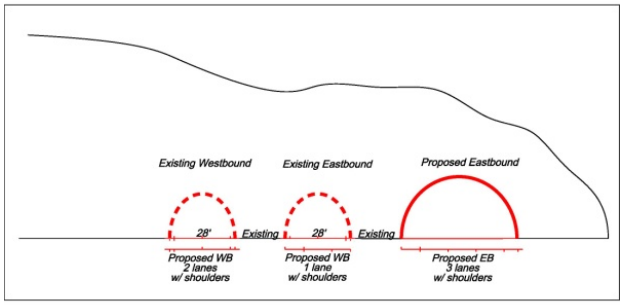
The single eastbound curve, now posted for 45 mph, would be redesigned with a curve meeting a 55 mph design speed.

A third lane would be added for eastbound travel from the Idaho Springs easternmost interchange to the bottom of Floyd Hill, connecting with the existing third lane.

This Concept Package is the design analyzed in the PEIS as the Preferred Alternative in this location.

This Concept Package includes Concept Elements C, H, J, and L.





The following table shows the evaluation of each of the Concept Packages based on the Critical Success Factors developed on the 1st day of the workshop with the Large Stakeholder group.

Concept Packages		Critical Success Factors										
		Improve Mobility	Compatibility with existing plans	Timing of Implementation in years	Cost	Level of Environmental Change	Level of Economic Benefit	Flexibility of design and long term usability	Community Stakeholder acceptance*	Attractive solution to gain funding and political support	Safety Enhancements	Construction Disruption
1	Widen both tunnels - 55 mph design	Best	Many	5-6	Capital: $100 M O&M: Moderate increase	Med	High	Med	High	High	High	Med
2	Widen EB Tunnel- fix 45 mph curve EB	Better	Many	4-5	Capital: $55 M O&M: Moderate increase	Med	High	Med	Med	High	Med	Med
3	Widen both tunnels – 65 mph design	Best	Many	6-7	Capital: $105 M O&M: Moderate increase	Med	High	High	High	High	High	Med
4	Widen EB tunnel – 65 mph design	Better	Many	5-6	Capital: $80 M O&M: Moderate increase	Med	High	High	Med	High	High	Med
5	55 mph EB tunnel bypass	Better	Many	6-7	Capital: $66 M O&M: Increase due to structures	Med	Med	Med	Low to Med	Med	Med	Low
6	65 mph EB tunnel bypass	Better	Many	6-7	Capital: $85 M O&M: Increase due to structures	Med	Med	High	Med	Med	High	Low
7	New EB tunnel – fix 45 mph curve	Better	Some	6-7	Capital: $80 M O&M: Increased due new tunnel	Med to High	Med	Med	Med	Med	Med	Low

Further, the costs for each Concept Package were assembled by Concept Element. The following table shows the cost analysis.

Concept Packages				CP1	CP2	CP3	CP4	CP5	CP6	CP7
Concept Elements		**Costs** (In $ Millions)		Widen both tunnels/ 55 mph design	Widen EB tunnel/ fix 45 mph curve	Widen both tunnels. 65 mph	Widen EB tunnel/ 65 mph design	55 mph EB Tunnel Bypass	65 mph EB Tunnel Bypass	New EB Tunnel / fix 45 mph curve
A	Widen EB & WB Tunnels	$50.0		$50		$50				
B	Widen EB Tunnel	$25.0			$25		$25			
C	Construct 3rd Tunnel	$57.0								$57
D	Realign EB w/ 65 mph	$80.0							$80	
E	Realign EB w/ 55 mph	$58.8						$58.8		
F	Flatten EB & WB to 65mph	$40.6				$40.6	$40.6		Note 1	
G	Flatten EB & WB to 55mph	$35.8		$35.8						
H	Flatten EB 45 mph	$14.6			$14.6			Note 1		14.6
J	3rd lane – Hidden Valley to Floyd Hill	$3.8		$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8
L	3rd lane – Idaho Springs to Twin Tunnels	$3.4		$3.4	$3.4	$3.4	$3.4	$3.4		$3.4
M	Improve should to use as 3rd lane during peak period			Optional Feature for CP1, CP2, CP3 and CP4. Cost not included						
O	US40 for detour	$2.4		$2.4	$2.4	$2.4	$2.4			
P	Restore Frontage Road, trails and trailheads	$4.6		$4.6	$4.6	$4.6	$4.6			
	Totals			$100	$53.8	$104.8	$79.8	$66	$83.8	$78.8*
	Preliminary Cost Estimates			**$100 M**	**$55 M**	**$105 M**	**$80 M**	**$66 M**	**$85 M**	**$80 M**
	COSTS PRESENTED ON FRIDAY 2/25/2011			**$100**	**$55**	**$105**	**$80**	**$65**	**$85**	**$75**

Note 1: Cost for flattening curves included in the realignment costs
*** CP7 cost estimate revised based on final reviews**

The detailed quantities and costs associated with this summary are found in the Appendices of this report.

The Results

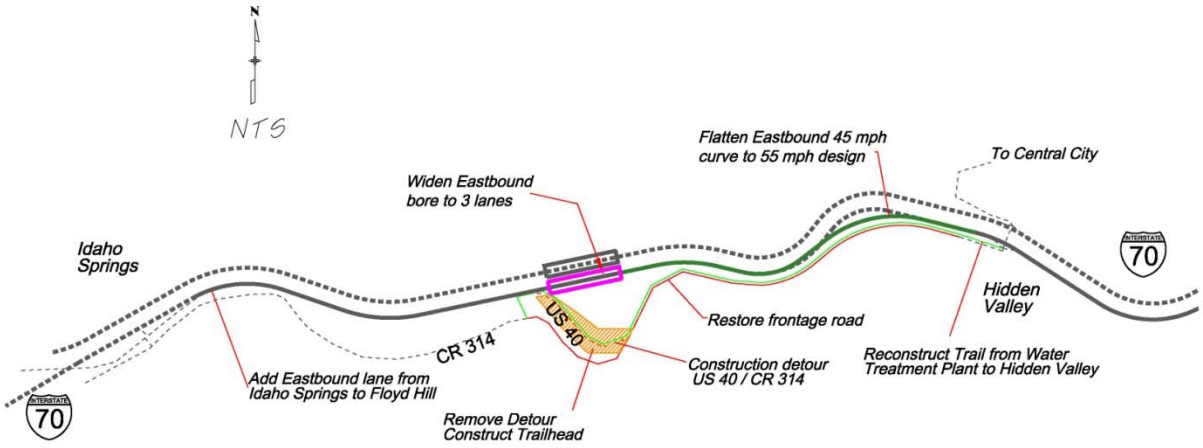
The Technical Team agreed, unanimously, that their recommendation would be Concept Package 2 with variations that should be considered during the environmental documentation.

The Recommendation
Concept Package 2 -- Widen EB Tunnel/Fix 45 mph Curve EB
Preliminary Cost $55 Million

- Construct a detour on old US 40/ CR 314
- Widen eastbound tunnel to 3 lanes
- Use shoulder for third lane during peak period prior to construction of additional lane, as a temporary measure
- Flatten the 45 mph curve just east of the tunnels with a 55 mph design
- Add an eastbound lane from Idaho Springs to Floyd Hill
- Restore the frontage road, restore and enhance the trail and trailhead

In addition to the elements outlined in Concept Package 2, it is recommended that future studies consider the following variations:

- Eliminate 45 mph curve reconstruction
- Don't build the 3rd lane, but implement hard shoulder running
- Don't build the 3rd lane or reconstruct 45 mph curve
- Reconstruct all the curves to 55 mph design
- Reconstruct all the curves to 65 mph design
- Add a westbound cross-over area to accommodate peak period westbound traffic with a reversible lane



Critical Success Factors	Concept Package 2 Widen EB Tunnel and fix the 45 mph curve eastbound	
Improve Mobility	Better	Adding the EB lane addresses the most immediate problem and improves the mobility.
Compatibility with Existing Plans	Many	All recent plans support adding eastbound lanes.
Timing of Implementation	4 -5 years	It is assumed this package would require 18 months of Environmental Clearance, 1 year of design and 1 year of construction.
Cost	Capital: $55 M O&M: Moderate increase	The capitol costs are estimated at $55 Million. The Operations and Maintenance Costs would increase slightly because of wider pavement to plow and maintain.
Level of Environmental Change	Medium	This package maintains the wildlife land bridge, would not change the configuration of the tunnels only widen them, have little impact on Clear Creek, and the Frontage Road and trails would be restored after the detour was no longer needed.
Level of Economic Benefit	High	This would address the most immediate problem of weekend eastbound delays on I-70. This could encourage drivers to make more trips to the mountains and stop along their trip home without the fear of additional congestion and delays.
Flexibility of Design and Long Term Usability	Medium	This package is completely consistent with the PEIS Preferred Alternative and does not preclude any of the other elements of the Preferred Alternative. There would be no 'throw away' elements unless the speed limit for I-70 is ultimately set at 65 mph.
Community Stakeholder Acceptance	Medium	Because of the immediate improvement of the most congested time, it was felt stakeholders would support this package. However, this package does not make all of the improvements and therefore, more construction would be needed on this stretch of I-70.
Attractive Solution to Gain Funding and Political Support	High	This package constructs permanent elements of the Preferred Alternative while being cost competitive with the Zipper Lane plan.
Safety Enhancements	Medium	This package eliminates the current low speed curve that results in accidents. This package meets all design standards and would result in a constant posted speed of 50 mph.
Construction Disruption	Medium	This package will take at least 1 year to construct. However, the US40 detour allows the tunnel widening to be completed in 2 months and then I-70 would be re-opened to traffic. More construction on I-70 will be needed to complete the PEIS Preferred Alternative.

On the final day of the workshop the Technical Team presented the 7 Concept Packages to the Large Stakeholder Group along with their recommendations. The entire group discussed the options, the impacts, the benefits and the variations for 2 hours. At the end of the 2 hours the

entire group was supportive of moving forward with the steps necessary to see Concept Package 2 with appropriate variations implemented.

Participants

The Tunnel Visioning Workshop could not have been a success without the participation of the stakeholders. They spent their Monday and Friday with the Technical Team making sure everyone understood the others ideas, concerns, goals and limitations. This was a tour-de-force and every participant should be proud of their contribution to the I-70 Mountain Corridor's legacy.

Shown below are the corridor stakeholders who participated and the technical experts who made up the Technical Team.

Corridor Stakeholders

Name	Company
Ken Katt	BRT Advocate
Don Krueger	Clear Creek Co. Sherriff
Tony DeVito	CDOT
Wendy Wallach	CDOT
Angie Drumn	CDOT
Darren Stavish	CDOT
Belinda Arbogast	CDOT
Pam Hutton	CDOT
Stacey Stegman	CDOT
Tim Mauck	Clear Creek Co. Commissioner
Kevin O'Malley	Clear Creek Co. Commissioner

Name	Company
Art Ballah	CMCA
Jeff Leib	Denver Post
Sarah Karjala	DRCOG
Randy Jensen	FHWA
Cindy Condon	Idaho Springs
Bill Macy	Idaho Springs
Mary Jane Loevlie	Idaho Springs
Jack Morgan	Idaho Springs Mayor
Will Kearns	Jefferson Co.
Ace King	Transit Research
Brendan McGuire	Vail Resorts

Technical Team

Name	Company
Barry Gondron	AECOM
Ian Gee	Atkins Global

Name	Company
Jim Allen	Beam, Longest & Neff LLC

Name	Company
Gary Brierley	Brierley Associates
Ty Ortiz	CDOT – Region 1
Mike Salamon	CDOT – Region 1
Chuck Attardo	CDOT - Region 1
Bernie Guevara	CDOT – Region 1
Russel Cox	CDOT – Region 1
Mike DeLong	CDOT – Region 1
Bill Scheuerman	CDOT – Region 1
Saeed Sobhi	CDOT – Region 1
Peter Kozinski	CDOT – Region 3
Mary Jo Vobejda	CH2M HILL
Chris Angleman	CH2M HILL
Andrea Garcia	CH2M HILL
Kelly Ronat	CH2M HILL
Loretta LaRiviere	CH2M HILL

Name	Company
Candice Hein	CH2M HILL
Tim Maloney	Edward Kraemer & Sons, Inc.
Dave Hattan	Felsburg Holt & Ullevig
Melinda Urban	FHWA
Chung Tran	FHWA
Tony O'Donnell	Kiewit Infrastructure Comp
Tony Stirbys	Parsons
Pat Noyes	Pat Noyes & Associates
Allan Brown	PBS & J
Bernie Dull	Solutions Engineering & Facilitating, Inc.
Kevin Shanks	THK & Associates
Rick Andrew	Yeh & Associates

Next Steps

The group discussed the next steps to be taken. After the material generated over the week has been assembled, reviewed and finalized, it will be posted at http://i70mtncorridorcss.com/.

A presentation to the Transportation Commission will be made regarding the results of the workshop with its benefits and costs.

With approval of the Transportation Commission the next steps would include initiation of a Tier 2 Environmental Document, developing a funding plan, and determining a design and construction method.

Concept Element A
Widen Existing EB & WB Tunnels

Description

Eastbound and Westbound Tunnel Widening

This element comprises the widening of the existing I-70 EB and I-70 WB tunnel bores. This element includes the enlargement of two existing, operational twin lane highway tunnels into two three lane tunnels. The widened tunnels will provide for three 12' lanes, and 8' & 4' shoulder and 2.5' low level walkway. The refurbishment would provide for a maintained height of 16' 9" at the 'fog strip'.

Associated with this concept element would be:

- Flatten curves EB & WB with 55 or 65 mph design from Twin Tunnels to Hidden Valley Add I-70 EB lanes to Floyd Hill
- Add I-70 EB lanes from east Idaho Springs to Twin Tunnels
- Construction detour on old US 40/CR 314
- Restore frontage road, trail and trailhead

Preliminary Cost Estimate: $50,000,000

(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Widen EB and WB bores to 3 lanes

- Construction costs are estimated with reference
- The pricing index is Q1 2011.
- A contingency at 30% is applied as bottom line to measured construction costs.
- Pre-construction design costs are allowed as 10% to allow for development of the scheme from concept through to a 'reference design' with in-principle approvals, suitable for subsequent design-and-construction or CMGC.
- Construction engineering: supervision & management costs, are allowed as 20% (conservative).
- Costs do not include land acquisition, legal fees or compensation entitlement.
- The cost estimate assumes no *extraordinary* environmental mitigation.
- Benefits which accrue (reduction in delays) from 24/7 working schedule to shorten construction program not expressly considered.

Operations and Maintenance Costs

This element includes the enlargement of two existing, operational twin lane highway tunnels into two three lane tunnels. There will be a small commensurate increase in some operations & maintenance cost e.g. additional lighting, washdown of walls & tunnel crown, however the new facility will comprise more space that will facilitate safer use (less accidents) and more operational flexibility (addition of shoulders). The new facility should not require any additional new mechanical ventilation equipment.

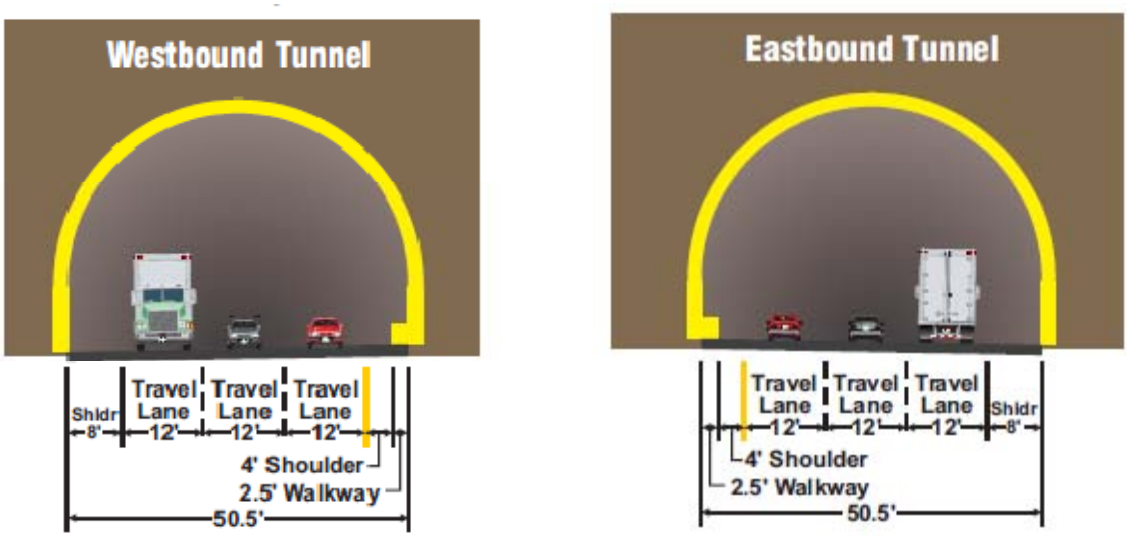
The full definition of operational and maintenance costs are outside the scope of this study.

Timing of Implementation

Widen EB and WB bores to 3 lanes would take approxiamtely4 years

Sketches

Typical section as identified from the I-70 PEIS. Actual crown height would be reduced based on final design requirements.



Discussion

- EB Tunnel enlargement scope will require advance installation of construction detour on the old US 40/ CR 314 route. Existing linar demolition, tunnel enlargement and portal upgrade activities are envisioned on a 24/7 working schedule with a mid April start for a period of two months, follow on final lining and tunnel fit out will proceed on a 6 day schedule until November 15th.
- The east bound tunnel will be widened to the south – preserving a 27’ wall to wall separation of future tubes pillar for rock mass stability.
- The west bound tunnel will be widened likely to the north although widening to the center pillar may be viable. If tunnel is widened to the north, additional rock excavation resulting in a taller rock cut, will be required.
- Newly widened east bound bore can be used to run west and east bound traffic during construction of the west bound bore.
- The tunnels will have no requirement for mechanical ventilation equipment, consistent with best practice & NFPA requirements.
- The tunnels will be fitted with luminares LED’s, a twin bank of lighting will be provided.
- The existing tunnel drainage will be removed and replaced with new drainage system to allow for tunnel maintenance (washdown etc).
- Infiltrate & washdown water will be put through a process treatment prior to discharge (costed by ‘highways team’ group #1). Drainage design to MS4 requirements.
- The widened tunnels will have an enhanced portal protection against falling rock.

- The eastbound tunnel widening will take place with full access from both east & west sides of the existing tunnel.
- All spoil will be reused – spoil disposal options will be developed in future design, options will include disposal to local quarry (re-crushing).
- Access to the Scott Lancaster cycle bridge should be maintained through construction.
- Staging sites will be established (i) to the north side of the existing I-70 opposite the quarry/ rafting premises, (ii) proximate to the east portal of the east bound tube, accessed via the existing highway 40 & (iii) portal worksite on west side of tunnel.
- Construction traffic supplying the site (working from the east side of the eastbound tunnel) will need to use the US 40/CR 314 diversion, and will therefore share this route with diverted traffic.
- It is assumed that no blasting restrictions will apply: however, noise attenuation may be necessary at the tunnel portals during bulk rock excavation.
- Construction duration for each bore will be in the order of 3-6 months.

A primary support (fall protection) typically FRSC/ mesh will be applied on an observational support basis in conjunction with passive rock dowels as necessary for revealed geology.
A final lining (design objective: plain, unreinforced, concrete), could be applied as sprayed applied with poly fibres (anti-spalling measure). Typically the lining will be 12” to 18” thickness.
The shotcrete to tunnel springing line will be wooden float finished, and painted to provide suitable lighting reflectance.

The anticipated construction sequence will be to remove the existing lining in incremental transverse ‘strips’, which will continue from portal throughout the tunnel. Subject to constructor preference this demolition may occur from each end of the tunnel.
Behind the activity of removal of the existing final lining, excavation support will be installed.
The final lining (spray applied) will be completed in a ‘continuous staged operation unobstructed by existing lining removal or additional rock excavation.
The portals will provide a canopy to enhance the aesthetics of the approach to the tunnels portal to assist conditioning driver behavior; and to provide enhanced safety provision against falling rock debris on the highway.

Concept Element B
Widen Existing EB Tunnel

Description

Eastbound Tunnel Widening

This element comprises the widening of the existing I-70 EB tunnel bore from two lanes, to a new three lane facility. The new tunnel will provide for three 12' lanes, and 8' & 4' shoulder and 2.5' low level walkway. The refurbishment would provide for a maintained height of 16' 9" clearance at the 'fog stripe'.

Associated with this concept element would be:

- Flatten curves EB & WB with55 or 65 mph design from Twin Tunnels to Hidden Valley
- Add I-70 EB lanes to Floyd Hill
- Add I-70 EB lanes from east Idaho Springs to Twin Tunnels
- Construction detour on old US 40/CR 314
- Restore frontage road, trail and trailhead

Preliminary Cost Estimate: $25,000,000

(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

- The pricing index is Q1 2011.
- A contingency at 30% is applied as bottom line to measured construction costs.
- Pre-construction design costs are allowed as 10% to allow for development of the scheme from concept through to a 'reference design' with in-principle approvals, suitable for subsequent design-and-construction or CMGC.
- Construction engineering: supervision & management costs, are allowed as 20%.
- Costs do not include land acquisition, legal fees or compensation entitlement.
- The cost estimate assumes no extraordinary environmental mitigation.
- Benefits which accrue (reduction in delays) from 24/7 working schedule to shorten construction program not expressly considered.

Operations and Maintenance Costs

This element includes the enlargement of an existing, operational twin lane highway tunnel into a three-lane tunnel. There will be a small commensurate increase in some operations & maintenance cost e.g. additional lighting, washdown of walls & tunnel crown, however the new facility will comprise more space that will facilitate safer use (less accidents) and more operational flexibility (addition of shoulders available for snow storage). The new facility should not require any additional new mechanical ventilation equipment.

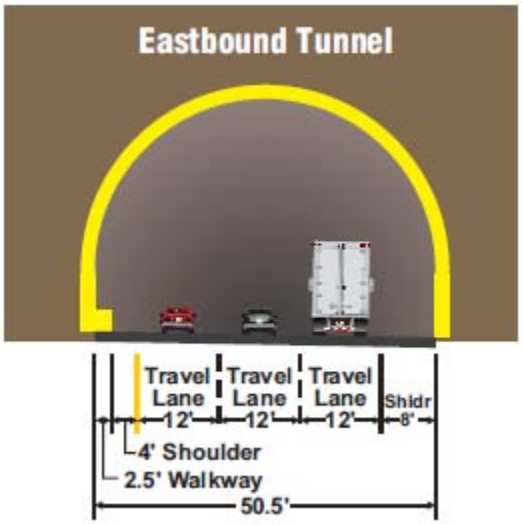
The full definition of operational and maintenance costs are outside the scope of this study.

Timing of Implementation

The implementation of this concept is linked with the requirement of a diversionary highway route which is described elsewhere.

It is assumed that a detour (lasting a season) would be established along an improved US40/CR314 route to facilitate construction. From April 15th all eastbound flow will be accommodated in the diversionary route for a period of two months. For periods of peak demand (Sunday afternoons) following this two month window, a single lane would be made available through the eastbound tunnel (which is in the process of being widened).

Sketches



Discussion

- EB Tunnel enlargement scope will require advance installation of construction detour on the old US 40/ CR 314 route. Existing liner demolition, tunnel enlargement and portal upgrade activities are envisioned on a 24/7 working schedule with a mid April start for a period of two months, follow on final lining and tunnel fit out will proceed on a 6 day schedule until November 15th.
- The east bound tunnel will be widened to the south – preserving a 27’ wall to wall separation of future tubes pillar for rock mass stability.
- The tunnel will have no requirement for mechanical ventilation equipment, consistent with best practice & NFPA requirements.
- The tunnels will be fitted with luminares LED’s, a twin bank of lighting will be provided.
- The existing tunnel drainage will be removed and replaced with new drainage system to allow for tunnel maintenance (washdown etc).
- Infiltrate & washdown water will be put through a process treatment prior to discharge. Drainage design to MS4 requirements.
- The widened tunnel will have an enhanced portal protection against falling rock.
- The eastbound tunnel widening will be constructed with full access from both east & west sides of the existing tunnel.
- All spoil will be reused – spoil disposal options will be developed in future design, options will include disposal to local quarry (re-crushing).
- Access to the Scott Lancaster cycle bridge should be maintained through construction.

- Staging sites could be established (i) to the north side of the existing I-70 opposite the quarry/ rafting premises, (ii) proximate to the east portal of the east bound tube, accessed via the existing highway 40 & (iii) portal worksite on west side of tunnel.
- Construction traffic supplying the site (working from the east side of the eastbound tunnel) will need to use the US 40/ CR 314 diversion, and will therefore share this route with diverted traffic.
- It is assumed that no blasting restrictions will apply: however, noise attenuation may be necessary at the tunnel portals during bulk rock excavation.
- Construction duration for each bore will be in the order of 3-6 months.

A primary support (fall protection) typically FRSC/ mesh will be applied on an observational support basis in conjunction with passive rock dowels as necessary for revealed geology.
A final lining (design objective: plain, unreinforced, concrete), could be applied as sprayed applied with poly fibres (anti-spalling measure). Typically the lining will be 12” to 18” thickness. The shotcrete to tunnel springing line will be wooden float finished, and painted to provide suitable lighting reflectance.

The anticipated construction sequence will be to remove the existing lining in incremental transverse ‘strips’, which will continue from portal throughout the tunnel. Subject to constructor preference this demolition may occur from each end of the tunnel.
Behind the activity of removal of the existing final lining, excavation support will be installed. The final lining (spray applied) will be completed in a ‘continuous staged operation unobstructed by existing lining removal or additional rock excavation. It is assumed that blasting will occur at night during complete road closure. Condition assessment of the WB bore will be required prior to release of traffic.
The portals will provide a canopy to enhance the aesthetics of the approach to the tunnels portal to assist conditioning driver behavior; and to provide enhanced safety provision against falling rock debris on the highway.

The existing highway pavement will be reconstructed to a full new section of ABC and asphalt.

Concept Element C
Construct New 3rd Tunnel

Description

Construct 3rd bore for I-70 EB south of the existing Twin Tunnels

This alternative is the development of a new 3-lane bore to carry eastbound traffic and flattening the curves from the Twin Tunnels to Hidden Valley. The proposed tunnel will be located approximately 30 feet to the south of the existing tunnels. The new tunnel will provide for three 12' lanes, and 8' & 4' shoulders and a 2.5' low level walkway. The tunnel will then continue eastbound on a viaduct to approximate milepost 242.7. The realignment of the roadway from milepost 242.7 to the Hidden Valley Interchange would be addressed in another element.

Associated with this concept element would be:

-Realign Clear Creek
-Flatten curves I-70EB & I-70WB with 65mph design from Twin Tunnels to milepost 242.7
-Flatten I-70 EB curve east of 242.7 to 55 mph
-Add I-70 EB lanes to Floyd Hill
-Add I-70 EB lanes from east Idaho Springs to Twin Tunnels

Preliminary Cost Estimate: $57,000,000

(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Cost estimates are developed allowing for the following:

- The pricing index is Q1 2011.
- A contingency at 30% is applied as bottom line to measured construction costs.
- Pre-construction design costs are allowed as 10% to allow for development of the scheme from concept through to a 'reference design' with in-principle approvals, suitable for subsequent design-and-construction or CMGC.
- Construction engineering: supervision & management costs, are allowed as 20% (conservative).
- The cost estimate assumes no extraordinary environmental mitigation.
- Benefits which accrue (reduction in delays) from 24/7 working to shorten construction program not expressly considered.

Operations and Maintenance Costs

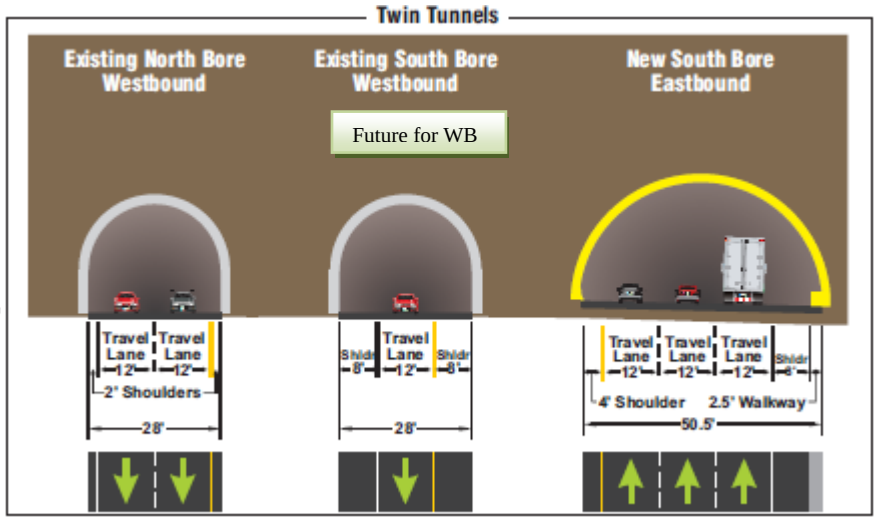
This element includes the construction of a new third bore to carry 3-lanes of traffic eastbound. There will be a small increase in some operations & maintenance cost e.g. additional lighting, washdown of walls & tunnel crown, however the new facility will comprise more space that will facilitate safer use (less accidents) and more operational flexibility (addition of shoulders). The new facility should not require any additional new mechanical ventilation equipment. The viaduct will require additional costs up to 50% more.

The full definition of operational and maintenance costs are outside the scope of this study.

Timing of Implementation

4 years. (Includes environmental documentation, ROW, design and construction)

Sketches



Discussion

Alternative requires realigning Clear Creek to accommodate new roadway platform to the west of the tunnels. Clear Creek had been realigned from natural alignment on previous Interstate projects. Realignment would require acquisition of ROW (Water treatment plant and Aggregate Industries) and include restoration of creek, mitigation and enhancements. Trail enhancements and relocation of Scott Lancaster Bridge would be required.

Two crossings of Clear Creek on the east side of the existing tunnels is likely due to the need for a bridge to span the creek and frontage road from the east portal of the new bore. The alignment of the bridge would meet 65 mph design speed. The bridge will be a multi-span structure (viaduct segmental) to the tie in with I-70. Straddle bents will minimize impacts to the frontage with only moderate increase in cost.

Include: issues, variations, cost spreadsheet, assumptions, advantages, concerns, value-added opportunities

- The east bound tunnel will be constructed to the south with a 30' wall to wall separation of future tubes pillar for rock mass stability.
- The tunnel will have no requirement for mechanical ventilation equipment, consistent with best practice & NFPA requirements.
- The tunnels will be fitted with luminares LED's, a twin bank of lighting will be provided.
- The new drainage system to allow for tunnel maintenance (washdown etc).

- Infiltrate & washdown water will be put through a process treatment prior to discharge (costed by ‘highways team’ group #1). Drainage design to MS4 requirements.
- The widened tunnel will have an enhanced portal protection against falling rock.
- It is assumed that a single cross passage midway will be provided for egress from incident tunnel to a place of relative safety.
- The eastbound tunnel widening will take place with full access from both east & west sides of the existing tunnel.
- All spoil will be reused – spoil disposal options will be developed in future design, options will include disposal to local quarry (re-crushing).
- Scott Lancaster Bridge would need to be relocated.
- Construction sites could be established (i) to the north side of the existing I-70 opposite the quarry/ rafting premises, (ii) proximate to the east portal of the east bound tube, accessed via the existing highway 40 & (iii) portal worksite on west side of tunnel.
- Construction traffic supplying the site (working from the east side of the eastbound tunnel) will need to use the US 40/ CR 314 road.
- It is assumed that no blasting restrictions will apply: however, noise attenuation may be necessary at the tunnel portals during bulk rock excavation.
- Construction duration for each bore will be in the order of 3-6 months and 18 months for the viaduct.

A primary support (fall protection) typically FRSC/mesh will be applied on an observational support basis in conjunction with passive rock dowels as necessary for revealed geology.
A final lining (design objective: plain, unreinforced, concrete), could be applied as sprayed applied with poly fibres (anti-spalling measure). Typically the lining will be 12” to 18” thickness. The shotcrete to tunnel springing line will be wooden float finished, and painted to provide suitable lighting reflectance.

Concept Element D
Realign 3 EB Lanes with 65 mph Design

Description
Eastbound I-70 would be widened to three lanes starting at the East Idaho Springs interchange on-ramp. The widening would follow the existing alignment to approximately MP 241.8 where it would veer to the south and cross Clear Creek. It would rise at a 5% grade and cross the Twin Tunnels ridge with a 30-foot cut. The alignment would then shift to the northeast and cross to the south side of Clear Creek and cut into the south hillside with a cut up to 60 feet tall. It would cross over the existing westbound I-70 alignment at a height sufficient that westbound traffic could remain as now. It would curve to the east with a 65-mph curve and rejoin eastbound I-70 at the west abutment of the Hidden Valley interchange bridge.

Preliminary Cost Estimate: $80,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
Increased cost for maintenance and snowplowing due to additional lane and multiple bridge structures.

Timing of Implementation
Preconstruction (design, environmental, ROW): 3 years for preconstruction
Construction: 2 years

Sketches
Line drawings, diagrams, available cross sections, renderings

Discussion
- The bridge over Clear Creek would need to be widened by 12-feet to assure a 56-foot cross section.

Pros	Cons
65 mph design speed	Impact sewer plant, gravel pit with structure
Flatten curves east of the tunnel	Impact high tension power lines
Off-line construction, minimal traffic impact	Reconstruct frontage road at the east end, would increase grades
Can maintain frontage road	Complex environmental issues
Can maintain trail and avoid 4F property of proposed trailhead	5% grades – doesn't meet desirable design standard
Can tie to south option of Idaho Springs ASA	Cuts are up to 60 feet through landslide area
Can accommodate wildlife crossings with viaducts	
New alignment could accommodate AGS	

Concept Element E
Realign 3 EB Lanes with 55 mph Design

Description
Eastbound I-70 would be widened to three lanes to the south starting at the East Idaho Springs interchange on-ramp. The widening would follow the existing alignment to approximately MP 241.8 where it would veer to the south and cross Clear Creek. It would rise at a 5% grade and cross the "Twin Tunnels" ridge with a 80-foot cut. The alignment would then shift to the northeast and cross to the south side of Clear Creek and cut into the south hillside with a cut up to 80 feet tall. It would return to existing I-70 at the 50-mph curve (MP 242.7). This curve and the 45-mph curve to the east would be improved to 55 mph design speed. Replacing the 45-mph curve would involve a new bridge over Clear Creek.

Preliminary Cost Estimate: $59,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
Increased cost for maintenance and snowplowing due to additional lane and multiple bridge structures.

Timing of Implementation
Preconstruction (design, environmental, ROW): 3 years
Construction: 2 years

Sketches
Line drawings, diagrams, available cross sections, renderings

Discussion
- The bridge over Clear Creek would need to be widened by 12-feet to assure a 56-foot cross section.

Pros	Cons
Lower cost (than 65 mph design)	More curves
Less impact on the frontage road	Lower speed
Minimum impacts to Hidden Valley interchange	80' cut on the south side east of tunnel through landslide area – closer to toe than 65 mph variation
Primarily off-line construction, minimal traffic impact	80' cut through "Twin Tunnels" ridge
Address existing 45 mph curve east of tunnel	5% grade – doesn't meet desirable design standard
Can maintain frontage road	Impact sewer plant, gravel pit with structure
Can maintain trail and avoid 4F property of proposed trailhead	Impact high tension power lines
Can tie to south option of Idaho Springs ASA	Complex environmental issues

Concept Element F
Flatten EB & WB Curves to 65 mph

Description
Realign I-70 EB and I-70 WB horizontally and vertically from the west portal of the twin tunnels to the Hidden Valley Interchange. Final section will include 3 travel lanes with full shoulders for both directions. A varied height median barrier wall will separate the directions with EB lower in elevation than WB. New twin bridges over Clear Creek will be constructed immediately west of Hidden Valley Interchange.

- Design speed is 65 MPH
- Emax=6%.
- Max Grade =3%.

Preliminary Cost Estimate: $41,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
The increase of pavement (lanes and shoulders), drainage structures, addition of median barrier wall, and addition of cantilevered barrier wall (EB) will increase the maintenance cost within the limits of the element. The introduction of wider shoulders will better accommodate snow removal.

Timing of Implementation
Preconstruction (design, environmental, ROW): 3 years
Construction: 2 years

Sketches
Line drawings, diagrams, available cross sections, renderings

Discussion
The alignment cuts into the vertical rock face approximately 2,000 ft east of the tunnels. This rock excavation is welcomed by CDOT maintenance who encounters recurring rock cleanup due to inadequate existing vertical slope.

Although this proposes to construct 3 full WB lanes, it is not recommended to utilize all 3 lanes until 3 WB lanes can be constructed from Hidden Valley to the top of Floyd Hill or 3 WB lanes can be constructed from the Twin Tunnels to US 40/Empire Exit. Additionally, the use of 3 lanes would necessitate the widening of the WB tunnel to accommodate 3 lanes.

Although this proposes to construct 3 full EB lanes, it is not recommended to utilize all 3 lanes until 3 EB lanes can be constructed from Hidden Valley to the bottom of Floyd Hill or 3 EB lanes can be constructed from the Twin Tunnels to US 40/Empire Exit. Additionally, the use of 3 lanes would necessitate the widening of the EB tunnel to accommodate 3 lanes.

Old US 40/CR 314 will require partial realignment, paralleling I-70, for approximately 1,500 ft. It is anticipated the realignment could require some ROW acquisition.

Realigning the roadway could increase safety within the 2 mile section due to the larger radius and full shoulders. Additional safety measures would include widening the twin tunnels to match the full section of the realigned roadway.

Tying into the existing Hidden Valley Interchange presents several challenges due to elevation differences and close proximity of CR 314. Overall impacts to the interchange are extremely high and potentially prohibitive for the element.

Concept Element G
Flatten EB & WB Curves to 55 mph

Description

Realign I-70 EB and I-70 WB horizontally and vertically from the west portal of the Twin Tunnels to the Hidden Valley Interchange. Final section will include 3 travel lanes with full shoulders for both directions. A varied height median barrier wall will separate the directions with EB lower in elevation than WB. New twin bridges over Clear Creek will be constructed immediately west of Hidden Valley Interchange.

- Design speed is 55 MPH
- Emax=6%.
- Max Grade =3%.

Preliminary Cost Estimate: $36,000,000

(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs

The increase of pavement (lanes and shoulders), drainage structures, addition of median barrier wall, and addition of cantilevered barrier wall (EB) will increase the maintenance cost within the limits of the element. The introduction of wider shoulders will better accommodate snow removal.

Timing of Implementation

Preconstruction (Design, environmental, ROW): 3 years
Construction: 2 years

Sketches

Line drawings, diagrams, available cross sections, renderings

Discussion

The alignment cuts into the vertical rock face approximately 2,000 ft east of the tunnels. This rock excavation is welcomed by CDOT maintenance who encounters recurring rock cleanup due to inadequate existing vertical slope.

Although this proposes to construct 3 full WB lanes, it is not recommended to utilize all 3 lanes until 3 WB lanes can be constructed from Hidden Valley to the top of Floyd Hill or 3 WB lanes can be constructed from the Twin Tunnels to US 40/Empire Exit. Additionally, the use of 3 lanes would necessitate the widening of the I-70 WB tunnel to accommodate 3 lanes.

Although this proposes to construct 3 full EB lanes, it is not recommended to utilize all 3 lanes until 3 EB lanes can be constructed from Hidden Valley to the bottom of Floyd Hill or 3 EB lanes can be constructed from the Twin Tunnels to US 40/Empire Exit. Additionally, the use of 3 lanes would necessitate the widening of the EB tunnel to accommodate 3 lanes.

Old US 40/CR 314 will require partial realignment, paralleling I-70, for approximately 1,000 ft.

Realigning the roadway could increase safety within the 2 mile section due to the larger radius and full shoulders. Additional safety measures would include widening the Twin Tunnels to match the full section of the realigned roadway.

Tying into the existing Hidden Valley Interchange presents several challenges due to elevation differences and close proximity of old US 40/CR 314.

Concept Element H
Flatten EB 45 mph Curve to 55 mph

Description
Widen existing I-70 EB mainline to 3 lanes with minimum desirable shoulders from the east portal of the Twin Tunnels to Hidden Valley. The widening would maintain existing geometry and design speed, except for the curve over Clear Creek west of Hidden Valley interchange. The south edge of I-70 EB would be held constant; all widening would occur to the median. The roadway would be 3-12' lanes with 4' inside and 8' outside shoulders. Most of this widening is relatively easy to obtain by widening into the median, but the bridge over Clear Creek just west of Hidden Valley must be replaced to obtain the necessary width and to obtain a 55 mph design speed.

Preliminary Cost Estimate: $15,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
The existing 36' I-70 EB mainline would be widened to 48,' so there is more pavement to be maintained. Plowing 3 lanes and wider shoulders will require multiple passes with snowplows. Existing Type 3 guardrail on the south side would be preserved, so ongoing maintenance of aging guardrail would be required. New Type 7 barrier will be installed in the median, which would act as a barrier to snow removal.

Timing of Implementation
Preconstruction: (Design, environmental, ROW): 2 years
Construction: 1 year

Sketches
Line drawings, diagrams, available cross sections, renderings

Discussion
Include: issues, variations, cost spreadsheet, assumptions, advantages, concerns, value-added opportunities

Requires design criteria variance because of reduction in median width
Difficult to maintain ramp configuration with frontage road to Hidden Valley
Potential extensive rock cuts and increase in cost
Potential closing of Hidden Valley EB off-ramp
Potential relocation of frontage road
The cost of the rock cut is not included in the cost estimate

Concept Element J
Hidden Valley to Floyd Hill Widen to 3 EB Lanes

Description
Widen existing I-70 EB mainline to 3 lanes with minimum desirable shoulders from Hidden Valley interchange to the base of Floyd Hill. The widening would maintain existing geometry and design speed. The south edge of I-70 EB would be held constant; all widening would occur to the median. The section would be 3 twelve foot lanes with four foot left and eight foot right shoulders.

Preliminary Cost Estimate: $4,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
The existing 36' I-70 EB mainline would be widened to 48,' so there is much more pavement to be maintained. Plowing 3 lanes and wider shoulders will require multiple passes with snowplows. Existing Type 3 guardrail on the south side would be preserved, so ongoing maintenance of aging guardrail would be required. New Type 7 barrier will be installed in the median, which would act as a barrier to snow removal.

Timing of Implementation
Preconstruction: (Design, Environmental, ROW): 8 months
Construction: 6 months

Sketches
Line drawings, diagrams, available cross sections, renderings

Discussion
Include: issues, variations, cost spreadsheet, assumptions, advantages, concerns, value-added opportunities

Concept Element L
Add 3rd I-70 EB Lane from Idaho Springs to Twin Tunnels

Description
This concept would add the third through lane to EB I-70 from East Idaho Springs to the Twin Tunnels. This improvement would also include widening the inside and outside shoulder to 10' wide. This would allow full-time three-lane operations for EB I-70 traffic. Also included is the widening of the bridge over Clear Creek

The third lane would begin with the East Idaho Springs interchange (Exit 241) EB on-ramp and tie into the widened EB Twin Tunnel.

Preliminary Cost Estimate: $3,400,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
Increased cost for maintenance and snowplowing due to additional lane.

Timing of Implementation
Preconstruction (design, environmental, ROW): 2 years
Construction: 6 months

Sketches

Discussion

Pros	Cons
Adds third lane eastbound	Third lane ends at Twin Tunnels creating bottleneck
Can be constructed quickly	

Concept Element M
Idaho Springs to the Twin Tunnels
Improve Shoulder to Provide 3 EB Lanes for Peak Period

Concept Element M is a combination of Concept Elements I, K and M. The total cost for Concept Element M is approximately $6 Million. This includes $4.2 Million for Operational Improvements described below and $1.8 Million for pavement improvements detailed in the Preliminary Cost Estimates (Found on the CD at the end of the Tunnel Visioning report).

Description

This concept allows Hard Shoulder Running (HSR) to provide a third, temporary lane for through traffic on I-70 EB. HSR typically utilizes the outside shoulder as a travel lane to increase the capacity of a congested corridor during specified periods. Existing EB I-70 would be restriped to narrow the inside (to two feet wide) and outside (to one foot wide) shoulders in order to provide room for three lanes. The center lane would be twelve feet wide while the inside (left/through) lane would be 11 feet wide. The outside lane would also be 11 feet wide and would serve as the shoulder when it is not being used for HSR.

The HSR would begin with the East Idaho Springs interchange (Exit 241) EB on-ramp. When the HSR is operating, on-ramp traffic would stay in the HSR (outside shoulder) lane instead of merging with through traffic.

Preliminary Cost Estimate:

ITS Operational Improvements: $2,000,000 (Cost from Zipper Lane Study)

Operations and Maintenance Costs

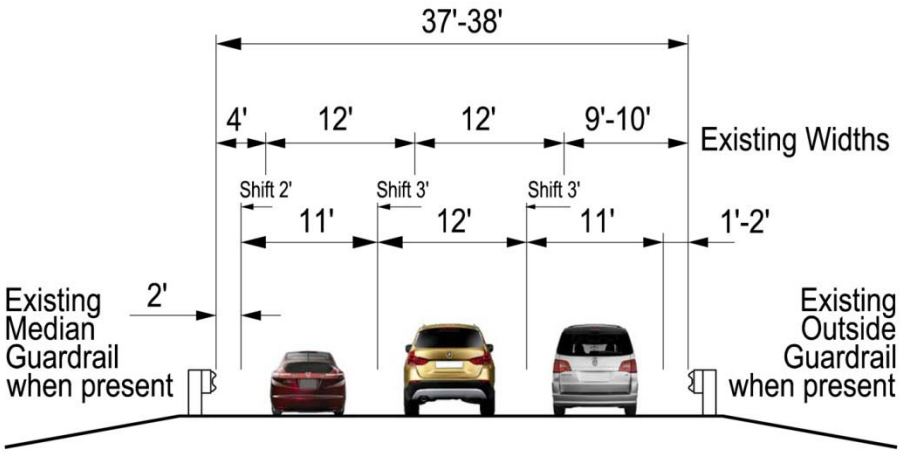
Minor additional workload for Colorado Transportation Management Center to program and initiate HSR operations during peak hours.

Timing of Implementation

Preconstruction (design, environmental): 7 months
Construction: 6 months

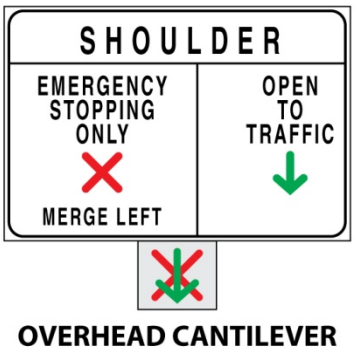
Sketches

Eastbound I-70 Typical Section – Hard Shoulder Running

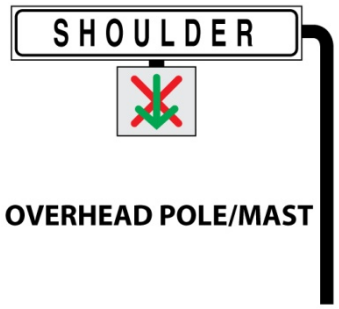

37'-38'
4'
12'
12'
9'-10'
Existing Widths
Shift 2'
Shift 3'
Shift 3'
11'
12'
11'
1'-2'
2'
Existing
Median
Guardrail
when present
Existing
Outside
Guardrail
when present

Typical HSR Lane Control Signals

Type 1



Type 2



Discussion

To implement the HSR, the striping of lanes would be changed (see cross section) from this from the east Idaho Springs on-ramp to Floyd Hill. During peak periods for EB traffic (typically summer and winter Saturday and Sunday afternoons), lane use control signs would change from red X to a green arrow (see figure). Traffic would be able to use the right shoulder as a through lane.

This segment provides no opportunities for an emergency pullout which could be used during HSR operations.

Costs include:

- One shoulder "portable" VMS – located east of East Idaho Springs interchange to notify I-70 of upcoming HSR condition
- One Lane Use Control Signal – Type 1 - located at the East Idaho Springs EB on-ramp
- One shoulder "portable" VMS at the East Idaho Springs EB on-ramp
- One Lane Use Control Signals – Type 2 – to reinforce HSR message
- One new variable message sign (VMS) west of Twin Tunnel to inform I-70 traffic of bypass or detour that uses old US 40/CR 314 alignment, and
- One new Closed Circuit Television (CCTV) – on curve just east of Idaho Springs on-ramp..

Pros	**Cons**
Adds third lane eastbound	Narrow through lanes
Can be constructed quickly	Very limited shoulders
Low cost	Impacts emergency response time/route
Accommodates hard shoulder running for eastbound	
Shoulder construction only	

Concept Element M
Twin Tunnels to Hidden Valley
Improve Shoulder to Provide 3 EB Lanes for Peak Period

Description
This concept allows Hard Shoulder Running (HSR) to provide a third, temporary lane for through traffic on I-70 EB. HSR typically utilizes the outside shoulder as a travel lane to increase the capacity of a congested corridor during specified periods. Existing EB I-70 would be restriped to narrow the inside (to two feet wide) and outside (to one foot wide) shoulders in order to provide room for three lanes. The center lane would be 12 feet wide while the inside (left/through) lane would be 11 feet. The outside lane would also be 11 feet wide and would serve as the shoulder when it is not being used for HSR.

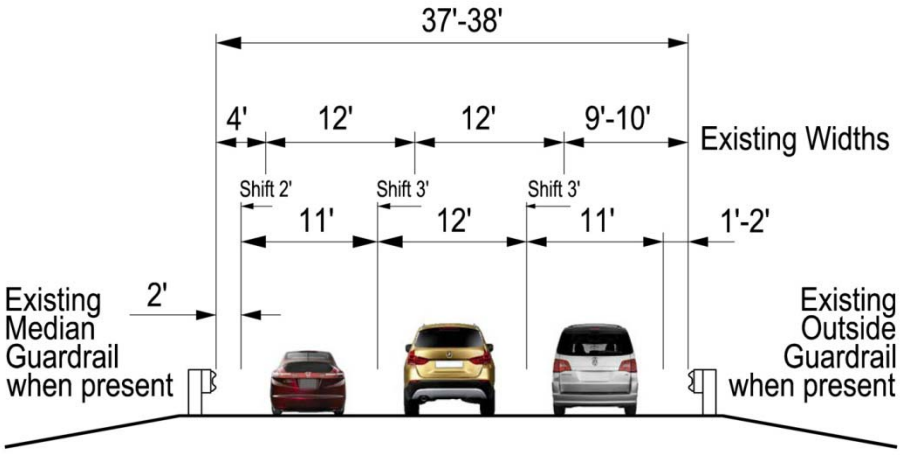
Preliminary Cost Estimate:
ITS Operational Improvements: $220,000 (Cost from Zipper Lane Study)

Operations and Maintenance Costs
Minor additional workload for Colorado Transportation Management Center to program and initiate HSR operations during peak hours.

Timing of Implementation
Preconstruction (design, environmental: 7 months
Construction: 6 months

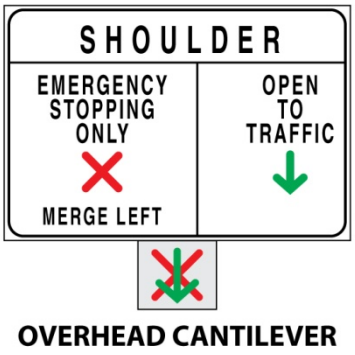
Sketches

Eastbound I-70 Typical Section – Hard Shoulder Running

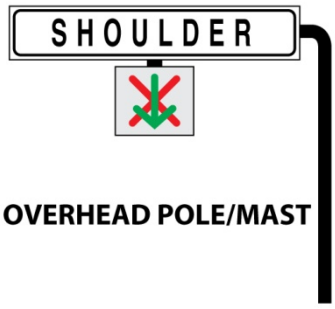


Typical HSR Lane Control Signals

Type 1



Type 2



Discussion

To implement the HSR, the striping of lanes would be changed (see cross section) from this from the east Idaho Springs on-ramp to Floyd Hill. During peak periods for EB traffic (typically summer and winter Saturday and Sunday afternoons), lane use control signs would change from red X to a green arrow (see figure). Traffic would be able to use the right shoulder as a through lane.

This segment provides no opportunities for an emergency pullout which could be used during HSR operations.

Costs include

- one Lane Use Control Signal – Type 2 - to reinforce the HSR message
- one new Closed Circuit Television (CCTV) – east of Twin Tunnel

Pros	**Cons**
Adds third lane eastbound	Narrow through lanes
Can be constructed quickly	Very limited shoulders
Low cost	Impacts emergency response route
Accommodates hard shoulder running for eastbound	
Shoulder construction only	

Concept Element M
Hidden Valley to Floyd Hill
Improve Shoulder to Provide 3 EB Lanes for Peak Period

Description
This concept allows Hard Shoulder Running (HSR) to provide a third, temporary lane for through traffic on I-70 eastbound. HSR typically utilizes the outside shoulder as a travel lane to increase the capacity of a congested corridor during specified periods. Existing EB I-70 would be restriped to narrow the inside (to two feet wide) and outside (to one foot wide) shoulders in order to provide room for three lanes. The center lane would be 12 feet wide while the inside (left/through) lane would be 11 feet. The outside lane would also be 11 feet wide and would serve as the shoulder when it is not being used for HSR.

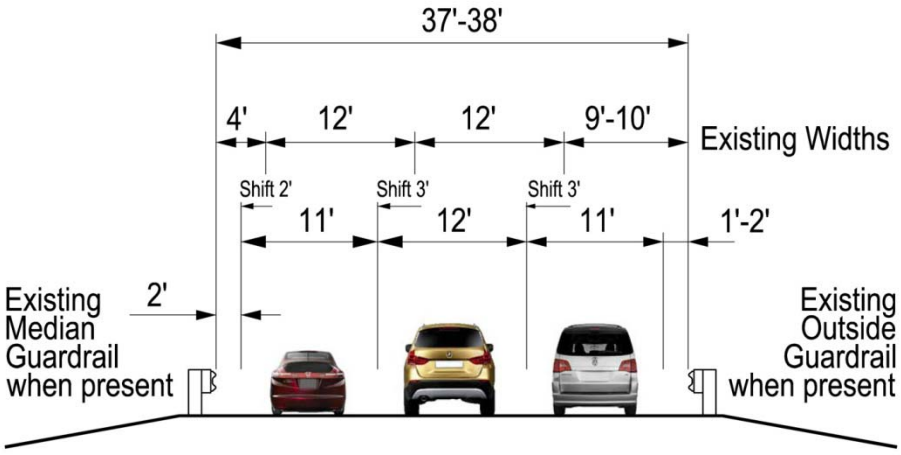
Preliminary Cost Estimate
ITS Operational Improvements: $2,000,000

Operations and Maintenance Costs
Minor additional workload for Colorado Transportation Management Center to program and initiate HSR operations during peak hours.

Timing of Implementation
Preconstruction: (Design, environmental): 3 months
Construction: 6 months

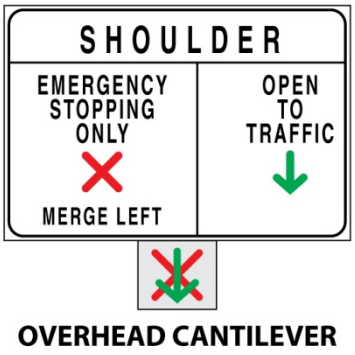
Sketches

Eastbound I-70 Typical Section – Hard Shoulder Running

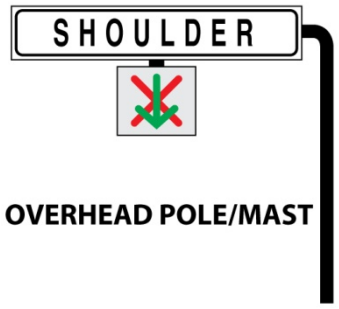


Typical HSR Lane Control Signals

Type 1



Type 2



Discussion

To implement the HSR, the striping of lanes would be changed (see cross section) from this from the east Idaho Springs on-ramp to Floyd Hill. During peak periods for EB traffic (typically summer and winter Saturday and Sunday afternoons), lane use control signs would change from red X to a green arrow (see figure). Traffic would be able to use the right shoulder as a through lane.

This segment provides no opportunities for an emergency pullout which could be used during HSR operations.

Costs include

- One Lane Use Control Signal – Type 1 – at the Hidden Valley EB on-ramp
- Two Lane Use Control Signals – Type 2 – to reinforce HSR message,
- Upgrade an existing variable message sign (VMS) at MP 234.45 to a full color/full matrix LED sign,
- One “side of the road” “portable” VMS at the Hidden Valley EB on-ramp, and
- One new Closed Circuit Television (CCTV) west of Floyd Hill.

Pros	**Cons**
Adds third lane eastbound	Narrow through lanes
Can be constructed quickly	Very limited shoulders
Low cost	Impacts emergency response route/time
Accommodates hard shoulder running for eastbound	
Shoulder construction only	

(Not Used)
Concept Element N
Old US 40/CR 314 Used for Single EB Lane During Peak Period

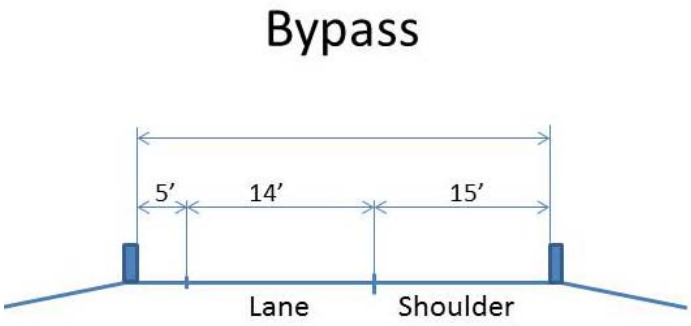
Description
This concept would use the old US 40/CR 314 roadway as a third lane to provide a continuous bypass around the current EB Twin Tunnel bottleneck. This allows the concept of Hard Shoulder Running (HSR) to be utilized between the East Idaho Springs on-ramp and the base of Floyd Hill.

Preliminary Cost Estimate: $3,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
Minor additional workload for CTMC to program VMS signs to notify traffic of bypass/HSR operations during peak hours. Gates or cones would be used to close off US40/CR 314 to the west. Cones on I-70 would need to be placed to close the Hidden Valley EB off-ramp.

Timing of Implementation
Preconstruction: 3 months
Construction: 3 months

Sketches



Discussion
During peak periods for EB traffic (typically summer and winter Saturday and Sunday afternoons), the bypass would be used to provide three lane continuity (in conjunction with HSR) from East Idaho Springs to Floyd Hill. The HSR would diverge from the existing I-70 alignment just west of the Twin Tunnel (game check exit). It would rejoin I-70 main line near the EB off-ramp at Hidden Valley interchange. During operations, traffic destined to the EB off-ramp at Hidden Valley would need to use the bypass as the off-ramp would be closed.

ITS costs include:

- One shoulder "portable" VMS – located at east end of bypass near Hidden Valley to notify traffic on continuation of HSR condition

- One Lane Use Control Signal – Type 1 - located at the bypass on-ramp at Hidden Valley.

Pros	**Cons**
Adds third lane eastbound around current two-lane Twin Tunnel	US 40/CR 314 is closed during peak hour operations
Can be constructed quickly	Sharp, lower speed curves
Low cost	Driver Expectancy - EB off-ramp at Hidden Valley is closed during operations, although movement is possible by using bypass
Accommodates hard shoulder running for eastbound	
Off-line construction	

Concept Element O
Twin Tunnels to Hidden Valley
Old US 40/CR 314 Used for Detour During Construction

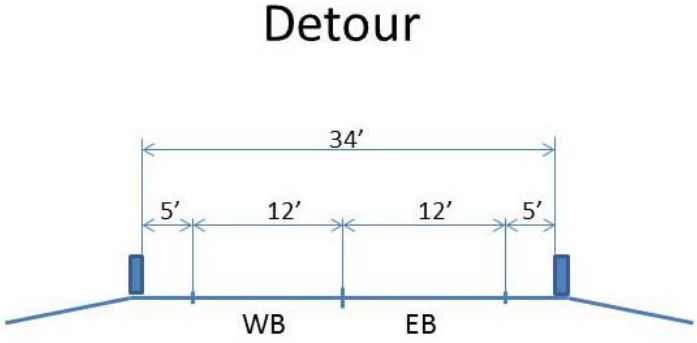
Description
This concept would use the old US 40/CR 314 roadway as a two lane detour that bypasses the EB Twin Tunnel while it is being reconstructed/widened to three lanes. It could also be used when the WB Twin Tunnel is being reconstructed/widened to three lanes.

Preliminary Cost Estimate: $3,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
Minor additional workload for CTMC to program VMS signs to notify traffic of detour during construction operations during off-peak periods and weekdays during the peak season.

Timing of Implementation
Preconstruction: 3 months
Construction: 3 months

Sketches



Discussion

During construction activities for reconstructing/widening the I-70 EB Twin Tunnel, both through lanes on I-70 EB would be directed to use the two lane detour. It would begin just west of the Twin Tunnel (game check exit) and rejoin I-70 main line near the EB off-ramp at Hidden Valley interchange.

ITS costs include:

- one shoulder "portable" VMS – located at east end of bypass near Hidden Valley to notify traffic on continuation of HSR condition
- one Lane Use Control Signal – Type 1 - located at the bypass on-ramp at Hidden Valley.

Pros	Cons
Provide two lane detour for Twin Tunnel construction	US 40/CR 314 is closed during peak hour operations
Can be constructed quickly	Sharp, lower speed curves
Low cost	
Off-line construction	

Concept Element P
Restore/Enhance Frontage Road, Trail and Trailhead

Description
Improving old US 40/CR 314 from water treatment plant to game check station/Clear Creek Bridge
Remove detour road from I-70 to Clear Creek Bridge
Install new Clear Creek Greenway Trailhead
Install Clear Creek Greenway Trail from Idaho Springs Water Treatment Facility to Hidden Valley Interchange

Preliminary Cost Estimate: $5,000,000
(Preliminary Cost Estimates can be found on the CD at the end of the Tunnel Visioning report).

Operations and Maintenance Costs
Operation and maintenance by Clear Creek County.

- Maintain trail and trailhead including:
- Landscape maintenance
- Snow removal
- Restroom facilities
- Trash and debris removal
- Security

Timing of Implementation
Preconstruction: Design considered being second phase of detour project
Construction: 1 to 1 ½ years after closure of detour road

Sketches
Line drawings, diagrams, available cross sections, renderings

Discussion
Consistent with Clear Creek Greenway Plan
Assumes:
Greenway trail will be closed during detour activity (safety reason)
Assuming use of 11’ lanes on old US 40/CR 314 rebuild

Concept Element P

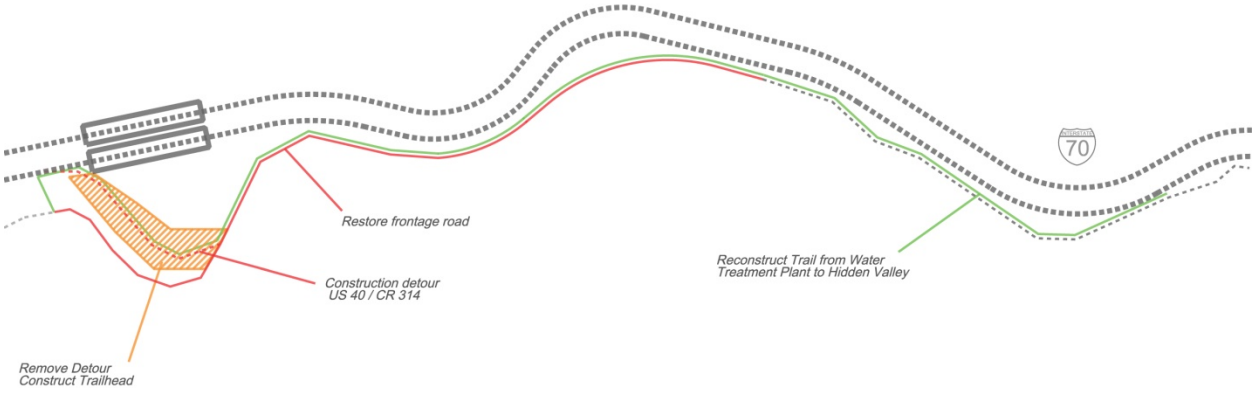


Table 1. I 70 Twin Tunnels Visioning

Tunnel Studies - Preliminary Tunneling Cost

New Third Bore Tunnel East bound bore (Tunnel Only)

Item	Unit	Quantity	Item Cost	Cost	
Rock excavation	cu yds	39000	$300	$11,700,000	
Unclassified excavation	cu yds	1000	$25	$25,000	
Embankment	cu yds	10000	$10	$100,000	
Spiling	lin ft	750	$25	$18,750	
Rock reinforcement (8' length)	lin ft	11200	$10	$112,000	
Shotcrete (shotcrete, mesh, drainage)	cu yds	2400	$800	$1,920,000	
Final Lining (troweled finish)	cu yds	1100	$800	$880,000	
Portal stabilization	lump sum	2	$25,000	$50,000	
Portals	lump sum	2	$500,000	$1,000,000	
Lighting	lump sum	1	$1,000,000	$1,000,000	
Utilities	lump sum	1	$100,000	$100,000	
Roadway (ABC, asphalt & striping)	sq ft	35000	$13	$455,000	
Retaining walls	sq ft	5000	$80	$400,000	
Stream restoration	mile	0.2	$2,000,000	$400,000	
ROW	lump sum	1	$3,000,000	$3,000,000	
Traffic Control	lump sum	1	$400,000	$400,000	
				$21,160,750	**Subtotal**
Contingency		30%		$6,348,225	
				$27,508,975	**Subtotal**
Preconstruction cost	NOT USED	10%		$2,750,898	
CE cost		20%		$5,501,795	
				$35,761,668	**EB Total**

New Third Bore Tunnel East bound bore with viaduct -- Concept Element C

Item	Unit	Quantity	Item Cost	Cost	
Rock excavation	cu yds	39000	$300	$11,700,000	
Unclassified excavation	cu yds	1000	$25	$25,000	
Embankment	cu yds	10000	$10	$100,000	
Spiling	lin ft	750	$25	$18,750	
Rock reinforcement (8' length)	lin ft	11200	$10	$112,000	
Shotcrete (shotcrete, mesh, drainage)	cu yds	2400	$800	$1,920,000	
Final Lining (troweled finish)	cu yds	1100	$800	$880,000	
Portal stabilization	lump sum	2	$25,000	$50,000	
Portals	lump sum	2	$500,000	$1,000,000	
Elevated Bridge Structure (Viaduct)	Sq Ft	82000	$140	$11,480,000	
Park Enhancement	Sq Ft	166000	$3	$498,000	
Lighting	lump sum	1	$1,000,000	$1,000,000	
Utilities	lump sum	1	$100,000	$100,000	
Roadway (ABC, asphalt & striping)	sq ft	100000	$13	$1,300,000	
Retaining walls	sq ft	5000	$80	$400,000	
Stream restoration	mile	0.2	$2,000,000	$400,000	
ROW	lump sum	1	$3,000,000	$3,000,000	
Relocation for Agg Industries	lump sum	1	$1,000,000	$1,000,000	
Traffic Control	lump sum	1	$500,000	$500,000	
				$33,983,750	**Subtotal**
Contingency		30%		$10,195,125	
				$44,178,875	**Subtotal**
Preconstruction cost		10%		$4,417,888	
CE cost		20%		$8,835,775	
				$57,432,538	**EB Total**

Widen Twin Tunnel East bound bore - Concept Element B

Full closure, detour using old US 40 alignment

Item	Unit	Quantity	Item Cost	Cost	
Demolition (Steel sets 4' o.c.; 18" concrete)	cu yds	2000	$500	$1,000,000	
Rock excavation	cu yds	23000	$320	$7,360,000	
Unclassified excavation	cu yds	1000	$25	$25,000	
Spiling	lin ft	750	$25	$18,750	
Rock reinforcement (8' length)	lin ft	11200	$10	$112,000	
Shotcrete (shotcrete, mesh, drainage)	cu yds	2400	$800	$1,920,000	
Final Lining (troweled finish)	cu yds	1100	$800	$880,000	
Portal stabilization	lump sum	2	$25,000	$50,000	
Portals	lump sum	2	$500,000	$1,000,000	
Lighting	lump sum	1	$1,000,000	$1,000,000	
Utilities	lump sum	1	$100,000	$100,000	
Roadway (ABC, asphalt & striping)	sq ft	35000	$13	$455,000	
Retaining walls	sq ft	3000	$80	$240,000	
				$14,160,750	**Subtotal**
Contingency		30%		$4,248,225	
				$18,408,975	**Subtotal**
Preconstruction cost		10%		$1,840,898	
CE cost		20%		$3,681,795	
				$23,931,668	**EB Total**

Rounded to $25M
for Preliminary Estimates

Widen Twin Tunnel EB & WB bound bore - Concept Element A

Full closure, detour using new widened EB bore

Item	Unit	Quantity	Item Cost	Cost	
Demolition (Steel sets 4' o.c.; 18" concrete)	cu yds	2100	$500	$1,050,000	
Rock excavation	cu yds	25000	$320	$8,000,000	
Unclassified excavation	cu yds	10000	$25	$250,000	
Spiling	lin ft	750	$25	$18,750	
Rock reinforcement (8' length)	lin ft	11200	$5	$56,000	
Shotcrete (shotcrete, mesh, drainage)	cu yds	2600	$800	$2,080,000	
Final Lining (troweled finish)	cu yds	1200	$800	$960,000	
Portal stabilization	lump sum	2	$25,000	$50,000	
Portals	lump sum	2	$500,000	$1,000,000	
Lighting	lump sum	1	$1,000,000	$1,000,000	
Utilities	lump sum	1	$100,000	$100,000	
Roadway (ABC, asphalt & striping)	sq ft	37000	$13	$481,000	
Retaining walls	sq ft	1000	$80	$80,000	
				$15,125,750	**Subtotal**
Contingency		30%		$4,537,725	
				$19,663,475	**Subtotal**
Preconstruction cost		10%		$1,966,348	
CE cost		20%		$3,932,695	
				$25,562,518	**WB Total**
EB & WB Bore Combined		**Rounded to $50M for Preliminary Estimates**		**$49,494,185**	
Assumes one mobilization	0				

NOT USED

EB & WB Bore Combined				**$50,494,185**	
Assumes second mobilization	$1,000,000				

Hidden Valley Tunnel - WB Long bore

(TUNNEL COSTS ONLY -- Eliminated, costs too high with no increase in benefit)

Alternatives	Total Length (feet)	Minimum Cost per Foot ($1000)	Maximum Cost per Foot ($1000)	Minimum Total Cost ($1000)	Maximum Total Cost ($1000)	Average Total Cost ($1000)
3 Lane - Single Bore	3450	25	35	86250	120750	103500

$120,000,000 tunnel boring only

Hidden Valley Tunnel - East

(TUNNEL COSTS ONLY -- Eliminated, costs too high with no increase in benefit)

Alternatives	Total Length (feet)	Minimum Cost per Foot ($1000)	Maximum Cost per Foot ($1000)	Minimum Total Cost ($1000)	Maximum Total Cost ($1000)	Average Total Cost ($1000)
3 Lane - Single Bore	1500	20	30	30000	45000	37500

$45,000,000 tunnel boring only

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT D
Twin Tunnels Study - Preliminary/Conceptual Estimate - REALIGN 3 EB LANES WITH 65MPH DESIGN

Prepared By:

Date Prepared:

Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
	Elevated Viaduct - Bridge Structure	sf	$125.00	280,000.00	$35,000,000.00	5,000 lf x 56' bridge spanning entire alignment
	Rock Excavation - Mt. Cuts	CY	$20.00	150,000.00	$3,000,000.00	
	Walls as Req'd	LS	$1.00	2,000,000.00	$2,000,000.00	
	West Approach to Viaduct on EB lanes :					
	Clearing and Grubbing	LS	$10,000.00	1.00	$10,000.00	
	Removal of Asphalt Mat (Planing)	SY	$3.00	1,000.00	$3,000.00	Includes tie-ins at west end, adjacent milling for grade match
	Removal of Guardrail Type 3	LF	$2.00	1,200.00	$2,400.00	1200 lf EB
	Reset Guardrail Type 3	LF	$7.00	1,200.00	$8,400.00	
	Unclassified Excavation	CY	$5.00	3,000.00	$15,000.00	EB : 1800 x 20' - figure 2' rework
	Aggregate Base Course (Class 6)	Ton	$16.00	1,400.00	$22,400.00	EB : 1800 x 20' - figure 2' rework
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$70.00	2,800.00	$196,000.00	
	Widen I-70 EB over Clear Ck	SF	$250.00	3,000.00	$750,000.00	Need to widen from 44' to 56' for I-70 EB over Clr Creek just east of Exit 241
	Add future crossover for WB use ?	LF		0.00	$0.00	Not anticipated to be used
		CY				
	Civil Subtotal				$41,007,200.00	
	ITS Subtotal				$1,100,000.00	
					$42,107,200.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$42,107,200.00		**(A)**
Contingencies		30.0%	$12,632,160.00		**(B)**
Removals		0.0%	$0.00		**(C)**
Drainage		1.0%	$421,072.00		**(D)**
Signing		1.0%	$421,072.00		**(E)**
Construction Signing & Traffic Control		5.0%	$2,105,360.00		**(F)**
Electrical			$500,000.00		
Erosion Control, SWMP		3.0%	$1,263,216.00		
Mobilization		5.0%	$2,105,360.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$61,555,440.00		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$12,311,088.00		**(J)**
Final Design		10.0%	$6,155,544.00		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$80,022,072.00**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT E
Twin Tunnels Study - Preliminary/Conceptual Estimate - REALIGN 3 EB LANES WITH 55MPH DESIGN

Prepared By:

Date Prepared:

Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
	Elevated Viaduct - Bridge Structure	sf	$130.00	156,800.00	$20,384,000.00	2,800 lf x 56' bridge spanning entire alignment
	Rock Excavation - Mt. Cuts	CY	$20.00	150,000.00	$3,000,000.00	
	Walls as Req'd	LS	$0.00	0.00	$0.00	
	Roadway Widening	SY	$75.00	10,000.00	$0.00	
	West Approach to Viaduct on EB lanes :					
	Clearing and Grubbing	LS	$10,000.00	1.00	$10,000.00	
	Removal of Asphalt Mat (Planing)	SY	$3.00	1,000.00	$3,000.00	Includes tie-ins at west end, adjacent milling for grade match
	Removal of Guardrail Type 3	LF	$2.00	1,200.00	$2,400.00	1200 lf EB
	Reset Guardrail Type 3	LF	$7.00	1,200.00	$8,400.00	
	Unclassified Excavation	CY	$5.00	3,000.00	$15,000.00	EB : 1800 x 20' - figure 2' rework
	Aggregate Base Course (Class 6)	Ton	$16.00	1,400.00	$22,400.00	EB : 1800 x 20' - figure 2' rework
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$70.00	2,800.00	$196,000.00	
	Add future crossover for WB use of EB tunnel?	LF		0.00		Not anticipated at this time
				0.00		
	Flatten Curves east of Viaduct	LS	$1.00	5,705,000.00	$5,705,000.00	In other pricing element - see details in that breakdown
				0.00		Includes new EB bridge over Clr Crk
	Widen I-70 EB over Clear Ck (West side)	SF	$250.00	3,000.00	$750,000.00	Need to widen from 44' to 56' for I-70 EB over Clr Creek just east
				0.00		Exit 241
				0.00		
				0.00		
				0.00		
				0.00		
	Civil Subtotal				$23,641,200.00	
	ITS Subtotal				$1,100,000.00	
					$31,196,200.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$31,196,200.00		**(A)**
Contingencies		30.0%	$9,358,860.00		**(B)**
Removals		0.0%	$0.00		**(C)**
Drainage		0.0%	$0.00		**(D)**
Signing		0.5%	$155,981.00		**(E)**
Construction Signing & Traffic Control		5.0%	$1,559,810.00		**(F)**
Electrical			$500,000.00		
Erosion Control, SWMP		3.0%	$935,886.00		
Mobilization		5.0%	$1,559,810.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$45,266,547.00		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$9,053,309.40		**(J)**
Final Design		10.0%	$4,526,654.70		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$58,846,511.10**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT F
Twin Tunnels Study - Preliminary/Conceptual Estimate - FLATTEN EB AND WB CURVES to 65mph

Prepared By:

Date Prepared:

Item		Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
EB Bridge over Clear Creek -	sf	$150.00	24,000.00	$3,600,000.00	400 x 56' over clear creek
WB Bridge over Clear Creek -	sf	$150.00	24,000.00	$3,600,000.00	400 x 56' over clear creek
Existing Bridge Demo	EA	$100,000.00	2.00	$200,000.00	
Pavement removal	sy	$3.00	55,000.00	$165,000.00	4400 lf x 56' x 2 ea
Aggregate Base Course (Class 6)	Ton	$16.00	18,000.00	$288,000.00	
Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$70.00	36,000.00	$2,520,000.00	Complete new pavement sections
EB - Walls at Clear Creek	sf	$70.00	16,000.00	$1,120,000.00	
Median - Grade separation wall	lf	$120.00	4,400.00	$528,000.00	Increased unit price to reflect larger grade separation (6')
Roadway Widening, Inc'l base, asphalt	sy	$75.00	0.00	$0.00	N/A - pavement rem/replace in total
Frontage Rd - Re-align	sy	$75.00	4,000.00	$300,000.00	1500lf x 24' wide
Guardrail - Remove, Replace	lf	$8.00	7,000.00	$56,000.00	
Tie-in to Hidden Valley Interchange	LS	$3,000,000.00	1.00	$3,000,000.00	
Roadway alignment - uncl exc	cy	$10.00	60,000.00	$600,000.00	
EB & WB Rock Excavation, Rock Cuts	CY	$15.00	200,000.00	$3,000,000.00	
Walls needed for EB, WB alignment	LS	$500,000.00	1.00	$0.00	N/A - in rock cuts
Frontage Rd, Rock Cuts	CY	$20.00	20,000.00	$400,000.00	
Walls needed for Frontage Rd	LS	$0.00	1.00	$0.00	N/A - in rock cuts
Civil Subtotal				**$19,377,000.00**	
ITS Subtotal				$1,100,000.00	
				$20,477,000.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$20,477,000.00		**(A)**
Contingencies		30.0%	$6,143,100.00		**(B)**
Removals		0.0%	$0.00		**(C)**
Drainage		4.0%	$819,080.00		**(D)**
Signing		1.0%	$204,770.00		**(E)**
Construction Signing, Traffic Control & Striping		7.5%	$1,535,775.00		**(F)**
Electrical			$400,000.00		
Erosion Control, SWMP		3.0%	$614,310.00		
Mobilization		5.0%	$1,023,850.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$31,217,885.00		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$6,243,577.00		**(J)**
Final Design		10.0%	$3,121,788.50		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$40,583,250.50**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT G
Twin Tunnels Study - Preliminary/Conceptual Estimate - FLATTEN EB AND WB CURVES to 55mph

Prepared By:

Date Prepared:

Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
	EB Bridge over Clear Creek -	sf	$150.00	24,000.00	$3,600,000.00	400 x 56' over clear creek
	WB Bridge over Clear Creek -	sf	$150.00	24,000.00	$3,600,000.00	400 x 56' over clear creek
	Existing Bridge Demo	EA	$100,000.00	2.00	$200,000.00	
	Pavement removal	sy	$3.00	55,000.00	$165,000.00	4400 lf x 56' x 2 ea
	Aggregate Base Course (Class 6)	Ton	$16.00	18,000.00	$288,000.00	
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$70.00	36,000.00	$2,520,000.00	Complete new pavement sections
	EB - Walls at Clear Creek	sf	$70.00	16,000.00	$1,120,000.00	
	Median - Grade separation wall	lf	$110.00	3,900.00	$429,000.00	Increased unit price to reflect larger grade separation (6')
	Roadway Widening, Inc'l base, asphalt	sy	$75.00	0.00	$0.00	N/A - replacing all of pavement
	Frontage Rd - Re-align	sy	$75.00	2,700.00	$202,500.00	1000lf x 24' wide
	Guardrail - Remove, Replace	lf	$8.00	7,000.00	$56,000.00	
	Tie-in to Hidden Valley Interchange	LS	$1,500,000.00	1.00	$1,500,000.00	Reduced difficulty of tie-in to intersection (vs. 65mph design)
	Roadway alignment - uncl exc	cy	$10.00	60,000.00	$600,000.00	
	EB & WB Rock Excavation, Rock Cuts	CY	$20.00	120,000.00	$2,400,000.00	
	Walls needed for EB, WB alignment	LS	$0.00	1.00	$0.00	N/A
	Frontage Rd, Rock Cuts	CY	$20.00	12,000.00	$240,000.00	
	Walls needed for Frontage Rd	LS	$0.00	1.00	$0.00	Not needed
	Civil Subtotal				**$16,920,500.00**	
	ITS Subtotal				$1,100,000.00	
					$18,020,500.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$18,020,500.00		**(A)**
Contingencies		30.0%	$5,406,150.00		**(B)**
Removals		0.0%	$0.00		**(C)**
Drainage		4.0%	$720,820.00		**(D)**
Signing		1.0%	$180,205.00		**(E)**
Construction Signing, Traffic Control & Striping		7.5%	$1,351,537.50		**(F)**
Electrical			$400,000.00		
Erosion Control, SWMP		3.0%	$540,615.00		
Mobilization		5.0%	$901,025.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$27,520,852.50		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$5,504,170.50		**(J)**
Final Design		10.0%	$2,752,085.25		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$35,777,108.25**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT H

Twin Tunnels Study - Preliminary/Conceptual Estimate - FLATTEN EB 45mph CURVE TO 55mph

Prepared By:

Date Prepared:

Item		Unit Cost	Original Full Implementation Quantity	Original Full Implementation Extended Cost	Notes
EB Bridge over Clear Creek -	sf	$150.00	24,000.00	$3,600,000.00	400 x 56' over clear creek
WB Bridge over Clear Creek -	sf	$150.00	0.00	$0.00	Not impacting WB
Existing Bridge Demo	EA	$100,000.00	1.00	$100,000.00	
Pavement removal	sy	$4.00	9,000.00	$36,000.00	1450 lf x 56'
Aggregate Base Course (Class 6)	Ton	$16.00	3,000.00	$48,000.00	1450' x 52' wide
Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$70.00	6,000.00	$420,000.00	Complete new pavement sections
EB - Walls at Clear Creek	sf	$70.00	0.00	$0.00	Only widening to median
Median - Grade separation wall	lf	$130.00	2,600.00	$338,000.00	Increased unit price to reflect larger grade separation (8')
Roadway Widening, Inc'l base, asphalt	sy	$75.00	3,500.00	$262,500.00	Widening 12'x 2600'
Frontage Rd - Re-align	sy	$75.00	2,700.00	$202,500.00	1000lf x 24' wide
Guardrail - Remove, Replace	lf	$8.00	1,000.00	$8,000.00	
Tie-in to Hidden Valley Interchange	LS	$1,500,000.00	0.00	$0.00	Plan for now is to close EB off ramp - exit at 241
Roadway alignment - uncl exc, Embankment	cy	$15.00	30,000.00	$450,000.00	Fills next to exist HV off ramp wall, etc.
EB & WB Rock Excavation, Rock Cuts	CY	$20.00	0.00	$0.00	
Walls needed for EB, WB alignment	LS	$0.00	0.00	$0.00	No walls needed assuming EB off ramp closed
Frontage Rd, Rock Cuts	CY	$20.00	12,000.00	$240,000.00	
Walls needed for Frontage Rd	LS	$0.00	1.00	$0.00	Not needed
Civil Subtotal				**$5,705,000.00**	
ITS Subtotal				$1,100,000.00	
				$6,805,000.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$6,805,000.00		**(A)**
Contingencies		30.0%	$2,041,500.00		**(B)**
Removals		2.0%	$136,100.00		**(C)**
Drainage		7.5%	$510,375.00		**(D)**
Signing		2.0%	$136,100.00		**(E)**
Construction Signing, Traffic Control & Striping		10.0%	$680,500.00		**(F)**
Electrical		6.0%	$408,300.00		
Erosion Control, SWMP		3.0%	$204,150.00		
Mobilization		5.0%	$340,250.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$11,262,275.00		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$2,252,455.00		**(J)**
Final Design		10.0%	$1,126,227.50		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$14,640,957.50**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT J
Twin Tunnels Study - Preliminary/Conceptual Estimate - HIDDEN VALLEY TO FLOYD HILL
WIDEN TO 3 EB LANES

Prepared By:

Date Prepared:

Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
	Clearing and Grubbing	LS	$30,000.00	1.00	$30,000.00	
	Removal of Asphalt Mat (Planing)	SY	$3.00	0.00	$0.00	Currently being constructed under Region 1 contract (was 17,600sy)
	Removal of Guardrail Type 3	LF	$2.00	8,800.00	$17,600.00	Two lengths of Guardrail - complete length of median - both sides
	Reset Guardrail Type 3	LF	$7.00	500.00	$3,500.00	Assume some qty of reset on outside shoulder of EB
	Unclassified Excavation	CY	$7.50	15,000.00	$112,500.00	Assume re-work of 3' of mat'l through 30' median for 4400 lf
	Rock Excavation, Rock Cuts	CY	$10.00		$0.00	No need for Rock exc at this time - not moving to north
	Embankment Material (CIP)	CY	$10.00	0.00	$0.00	In Uncl Exc
	Aggregate Base Course (Class 6)	Ton	$16.00	4,000.00	$64,000.00	
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$75.00	0.00	$0.00	Mill / Overlay Section (was 3,000 tn - being done next year)
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$70.00	6,000.00	$420,000.00	New Pavement Section
	Retaining Wall (Type to be Determined)	SF	$70.00		$0.00	Not needed along creek at this time
	Roadway Luminaires, Pole, Foundation, Wiring	EA	$50,000.00	1.00	$50,000.00	
	Overhead Sign re-set	LS	$10,000.00	1.00	$10,000.00	
	CE Barrier in Median - for Grade Separation	LF	$100.00	4,400.00	$440,000.00	New barrier throughout median to Floyd Hill
					$0.00	
	Civil Subtotal				$1,147,600.00	
	ITS Subtotal				$700,000.00	
					$1,847,600.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$1,847,600.00		**(A)**
Contingencies		30.0%	$554,280.00		**(B)**
Removals - Misc		2.0%	$36,952.00		**(C)**
Drainage		5.0%	$92,380.00		**(D)**
Signing - Rem/Replace in Median & Striping		5.0%	$92,380.00		**(E)**
Construction Signing & Traffic Control		7.5%	$138,570.00		**(F)**
Electrical			$0.00	N/A	
Erosion Control, SWMP		5.0%	$92,380.00		
Mobilization		5.0%	$92,380.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$2,946,922.00		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$589,384.40		**(J)**
Final Design		10.0%	$294,692.20		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$3,830,998.60**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT L
Twin Tunnels Study - Preliminary/Conceptual Estimate - ADD 3RD EB LANE FROM IDAHO SPRINGS EAST TO TUNNEL

Prepared By:

Date Prepared:

Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
	Clearing and Grubbing	LS	$20,000.00	1.00	$20,000.00	
	Removal of Asphalt Mat (Planing)	SY	$3.00	2,500.00	$7,500.00	Includes tie-ins at west end, adjacent milling for grade match
	Removal of Guardrail Type 3	LF	$2.00	2,400.00	$4,800.00	1200 lf both EB & WB
	Reset Guardrail Type 3	LF	$7.00	2,400.00	$16,800.00	
	Unclassified Excavation	CY	$5.00	11,500.00	$57,500.00	EB : 3300x20', WB 4200x20' - figure 2' rework
	Aggregate Base Course (Class 6)	Ton	$16.00	6,000.00	$96,000.00	EB : 3300x20', WB 4200x20'
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$70.00	12,000.00	$840,000.00	
					$0.00	
	Widen I-70 EB over Clear Ck	SF	$220.00	3,000.00	$660,000.00	Need to widen from 44' to 56'
					$0.00	
					$0.00	
	Civil Subtotal				$1,702,600.00	
	ITS Subtotal				$0.00	
					$1,702,600.00	

		% Range	% Used	Cost		
	Project Construction Bid Items	Project Dependent	**N / A**	$1,702,600.00		**(A)**
	Contingencies		30.0%	$510,780.00		**(B)**
	Removals - Misc		2.0%	$34,052.00		**(C)**
	Drainage		5.0%	$85,130.00		**(D)**
	Signing - Rem/Replace in Median & Striping		5.0%	$85,130.00		**(E)**
	Construction Signing & Traffic Control		5.0%	$85,130.00		**(F)**
	Electrical					
	Erosion Control, SWMP		3.0%	$51,078.00		
	Mobilization		5.0%	$85,130.00		**(G)**
	Total of Construction Bid Items	(A+B+C+D+E+F+G)		$2,639,030.00		**(H)**
	Engineering and Other Capital Costs					
	Construction Engineering - CDOT		20.0%	$527,806.00		**(J)**
	Final Design		10.0%	$263,903.00		**(K)**
	Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
	TOTAL PROJECT COST (H + J + K + L + M + N)			**$3,430,739.00**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT M
Twin Tunnels Study - Preliminary/Conceptual Estimate - IMPROVE SHOULDER TO PROVIDE 3 EB LANES FOR PEAK PERIOD
(cost from Hidden Valley to Floyd Hill ONLY)

Prepared By:

Date Prepared:

Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
	Clearing and Grubbing	LS	$10,000.00	1.00	$10,000.00	
	Removal of Asphalt Mat (Planing)	SY	$3.00	0.00	$0.00	4,400 lf @ 36' width - mill for 3" overlay (17,600 sy)
	Removal of Guardrail Type 3	LF	$2.00	4,400.00	$8,800.00	One length of guardrail - EB
	Reset Guardrail Type 3	LF	$7.00	500.00	$3,500.00	Assume some qty of reset on outside shoulder of EB
	Unclassified Excavation	CY	$10.00	1,500.00	$15,000.00	Assume re-work of 3' of mat'l through 30' median for 4400 lf
	Rock Excavation, Rock Cuts	CY	$10.00		$0.00	No need for Rock exc at this time - not moving to north
	Embankment Material (CIP)	CY	$10.00	0.00	$0.00	In Uncl Exc
	Aggregate Base Course (Class 6)	Ton	$16.00	750.00	$12,000.00	
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$75.00	0.00	$0.00	Mill / Overlay Section (was 3,000 tn - being done next year)
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$75.00	1,500.00	$112,500.00	New Pavement Section
	Retaining Wall (Type to be Determined)	SF	$70.00		$0.00	Not needed along creek at this time
	Roadway Luminaires, Pole, Foundation, Wiring	EA	$50,000.00	0.00	$0.00	
	Overhead Sign re-set	LS	$10,000.00	0.00	$0.00	
	CE Barrier in Median - for Grade Separation	LF	$100.00	0.00	$0.00	Not needed with only 4' widening on EB
					$0.00	
	Civil Subtotal				$161,800.00	
	ITS Subtotal				$700,000.00	
					$861,800.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$861,800.00		**(A)**
Contingencies		30.0%	$258,540.00		**(B)**
Removals - Misc		2.0%	$17,236.00		**(C)**
Drainage		5.0%	$43,090.00		**(D)**
Signing - Rem/Replace in Median & Striping		5.0%	$43,090.00		**(E)**
Construction Signing & Traffic Control		7.5%	$64,635.00		**(F)**
Electrical			$0.00	N/A	
Erosion Control, SWMP		5.0%	$43,090.00		
Mobilization		5.0%	$43,090.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$1,374,571.00		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$274,914.20		**(J)**
Final Design		10.0%	$137,457.10		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
COSTS FROM ZIPPER LANE STUDY FOR OPERATIONAL IMPROVEMENTS NEEDED			$4,220,000.00		
TOTAL PROJECT COST (H + J + K + L + M + N)			**$6,006,942.30**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT N AND CONCEPT ELEMENT O
Twin Tunnels Study - Preliminary/Conceptual Estimate - OLD US-40 IMPROVEMENTS

Prepared By:

Date Prepared:

Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
	Clearing and Grubbing	LS	$20,000.00	1.00	$20,000.00	
	Removal of Asphalt Mat (Planing)	SY	$3.00	12,500.00	$37,500.00	Mill / Overlay Section - 2" - includes bridge deck
	Guardrail Type 3	LF	$10.00	2,000.00	$20,000.00	Assume some rework or new install of guardrail
	Unclassified Excavation	CY	$10.00	5,200.00	$52,000.00	Assume widening req'd for 10' x 4600' (x 3' depth)
	Rock Excavation, Rock Cuts	LS	$75,000.00	1.00	$75,000.00	Clean up edge of "peninsula"
	Embankment Material (CIP)	CY	$10.00	0.00	$0.00	In Uncl Exc
	Aggregate Base Course (Class 6)	Ton	$16.00	3,500.00	$56,000.00	Widening of shoulder - 10'
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$75.00	1,500.00	$112,500.00	Mill / Overlay Section - 2"
	Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??	Ton	$75.00	2,600.00	$195,000.00	10' of new 9" asphalt for widening
	Retaining Wall (Type to be Determined)	SF	$40.00	4,000.00	$160,000.00	Some wall work for widening req'd
	Roadway lighting	EA	$50,000.00	1.00	$50,000.00	Assume new lighting to upgrade existing ?
					$0.00	
	Bridge Deck Repairs	LS	$225,000.00	1.00	$225,000.00	Assume deck repairs, rem/replace barrier ? - Load rating needs to be verified - assume exist can handle HS20 loading for detour
	Trail Restoration	LS	$0.00	1.00	$0.00	See separate pricing
					$0.00	
	Civil Subtotal				$1,003,000.00	
	ITS Subtotal		$1.00	0.00	$0.00	
					$1,003,000.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$1,003,000.00		**(A)**
Contingencies		30.0%	$300,900.00		**(B)**
ITS for Detour			$300,000.00		
Removals - Misc		2.0%	$20,060.00		**(C)**
Drainage		5.0%	$50,150.00		**(D)**
Signing & Striping		5.0%	$50,150.00		**(E)**
Construction Signing & Traffic Control		7.5%	$75,225.00		**(F)**
Electrical		0.0%	$0.00	See roadway lighting above	
Erosion Control, SWMP		3.0%	$30,090.00		
Mobilization		5.0%	$50,150.00		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$1,879,725.00		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$375,945.00		**(J)**
Final Design		10.0%	$187,972.50		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+ K+L+M+N)**	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$2,443,642.50**		

Project Number : IM 070-XXXXX **Project Name:I-70 Twin Tunnels Study**

CONCEPT ELEMENT P
Twin Tunnels Study - Preliminary/Conceptual Estimate - RESTORE/ENHANCE FRONTAGE ROAD, TRAIL AND TRAILHEAD

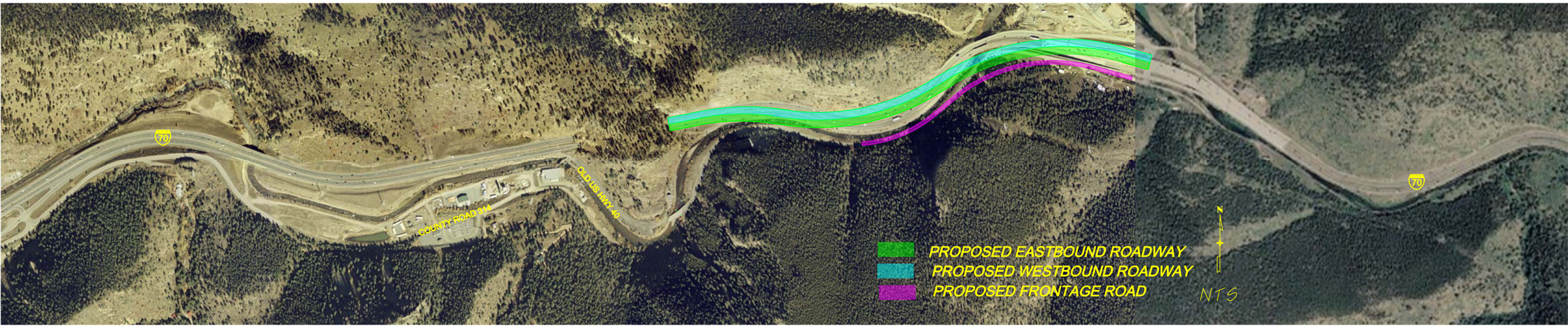
Prepared By:

Date Prepared:

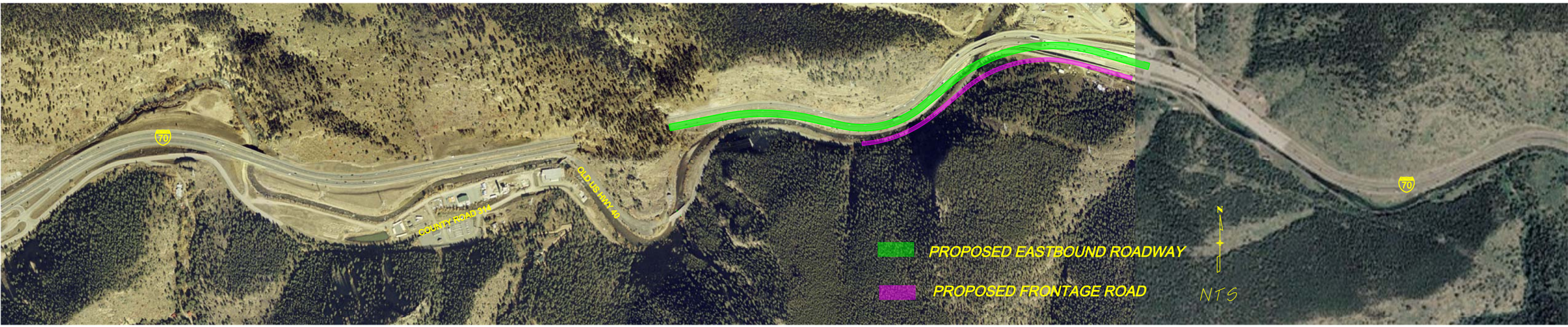
Item			Unit Cost	Original Full Implementation Quantity	Extended Cost	Notes
Clearing and Grubbing		LS	$15,000.00	1.00	$15,000.00	
Removal of Asphalt Mat (Planing)		SY	$3.00	4,200.00	$12,600.00	Remove 1250 lf of Old US 40
Type 3 Guardrail		LF	$10.00	2,000.00	$20,000.00	Assume some rework or new install of guardrail
Unclassified Excavation		CY	$10.00	2,000.00	$20,000.00	Widening for 2300'
Rock cut at West side of new trail		LS	$20,000.00	1.00	$20,000.00	
Embankment Material (CIP)		CY	$10.00	0.00	$0.00	In Uncl Exc
Aggregate Base Course (Class 6)		Ton	$16.00	2,500.00	$40,000.00	New trail - 28' x 2300'
Hot Mix Asphalt (Grading SX)(75)(PG 58-28)??		Ton	$75.00	3,600.00	$270,000.00	New trail - 28' x 2300'
Retaining Walls (Type to be Determined)		SF	$40.00	30,000.00	$1,200,000.00	Use MSE wall if possible
Park Restoration		SF	$2.80	166,000.00	$464,800.00	
Asphalt Lot		SY	$75.00	275.00	$20,625.00	
Concrete Trail to Hidden Valley		SF	$4.00	113,400.00	$453,600.00	
					$0.00	
Civil Subtotal					$2,536,625.00	
ITS Subtotal			$1.00	0.00	$0.00	
					$2,536,625.00	

	% Range	% Used	Cost		
Project Construction Bid Items	Project Dependent	**N / A**	$2,536,625.00		**(A)**
Contingencies		30.0%	$760,987.50		**(B)**
Removals - Misc		0.0%	$0.00	In Above	**(C)**
Drainage		1.0%	$25,366.25		**(D)**
Signing & Striping		1.0%	$25,366.25		**(E)**
Construction Signing & Traffic Control		1.0%	$25,366.25		**(F)**
Electrical				N/A	
Erosion Control, SWMP		3.0%	$76,098.75		
Mobilization		5.0%	$126,831.25		**(G)**
Total of Construction Bid Items	(A+B+C+D+E+F+G)		$3,576,641.25		**(H)**
Engineering and Other Capital Costs					
Construction Engineering - CDOT		20.0%	$715,328.25		**(J)**
Final Design	10% of (**H**)	10.0%	$357,664.13		**(K)**
Inflation to 20XX (5% per year)	0% of (**H+J+K+L+M+N**)	0.0%	$0.00		**(O)**
TOTAL PROJECT COST (H + J + K + L + M + N)			**$4,649,633.63**		

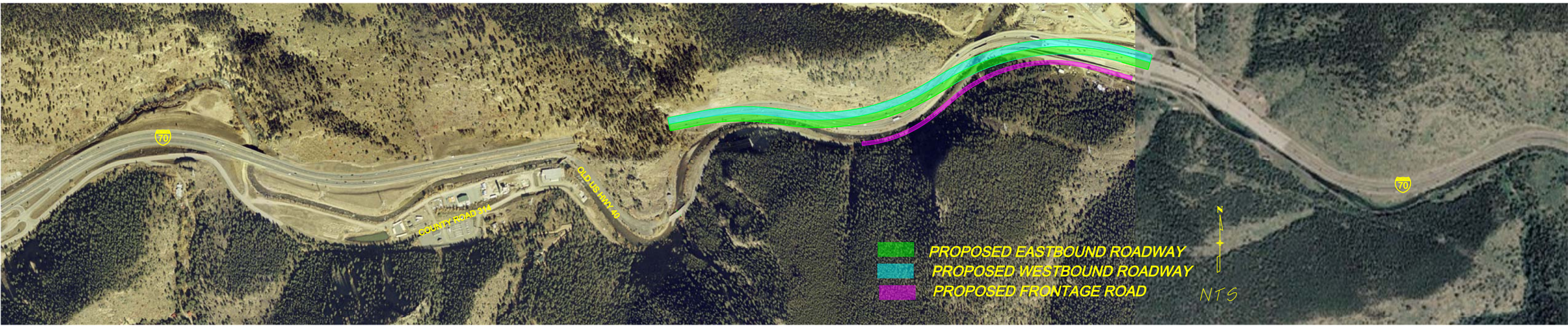
Concept Package 1 - Widen Both Tunnels/ 55 mph Design



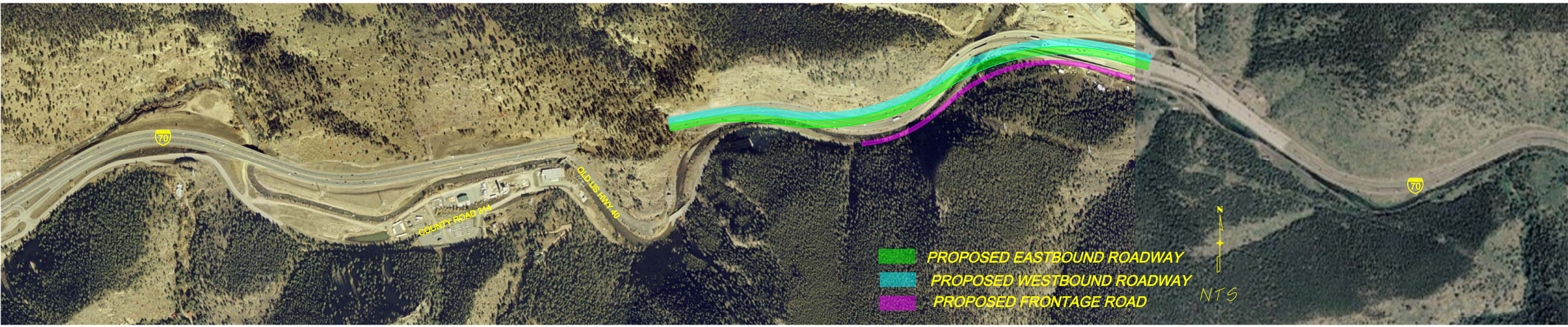
Concept Package 2 - Widen EB Tunnel/Fix 45 mph Curve EB



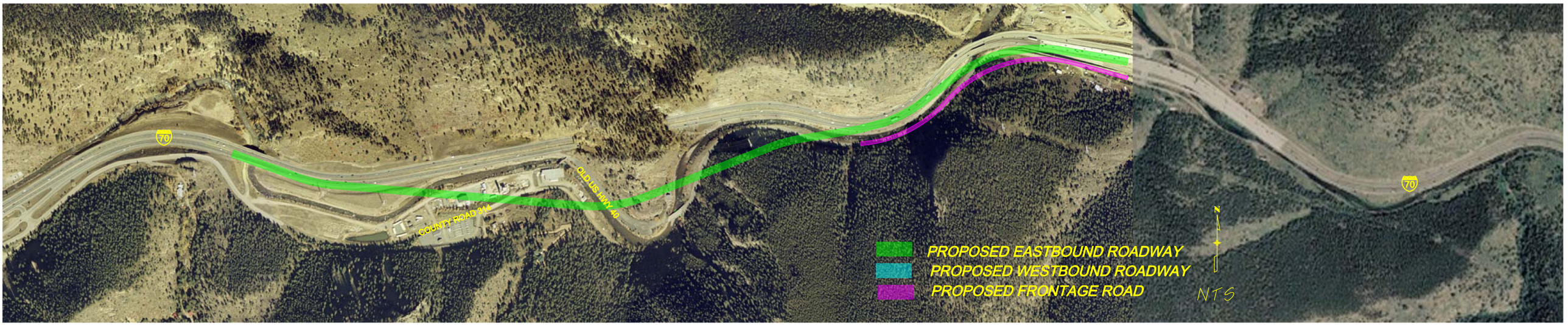
Concept Package 3 - Widen Both Tunnels/ 65 mph Design



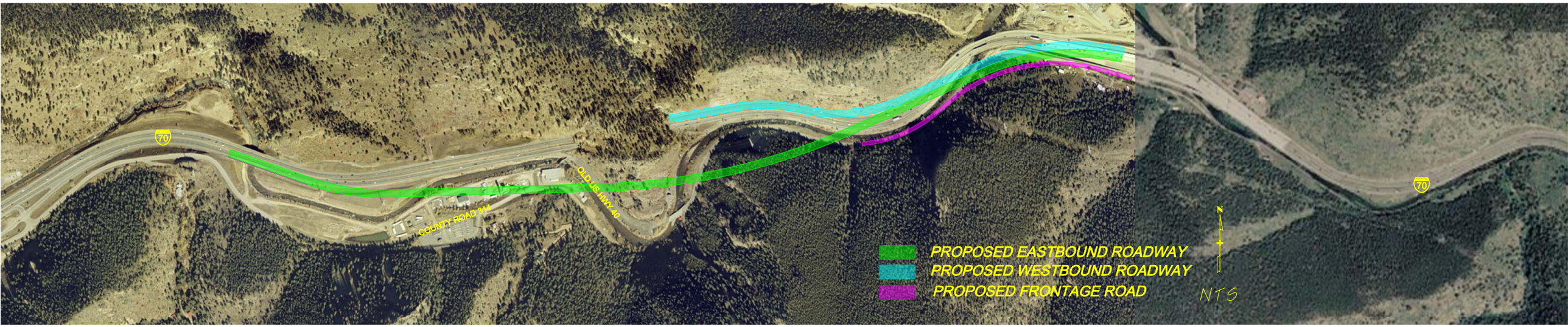
Concept Package 4 - Widen EB Tunnel/ 65 mph Design



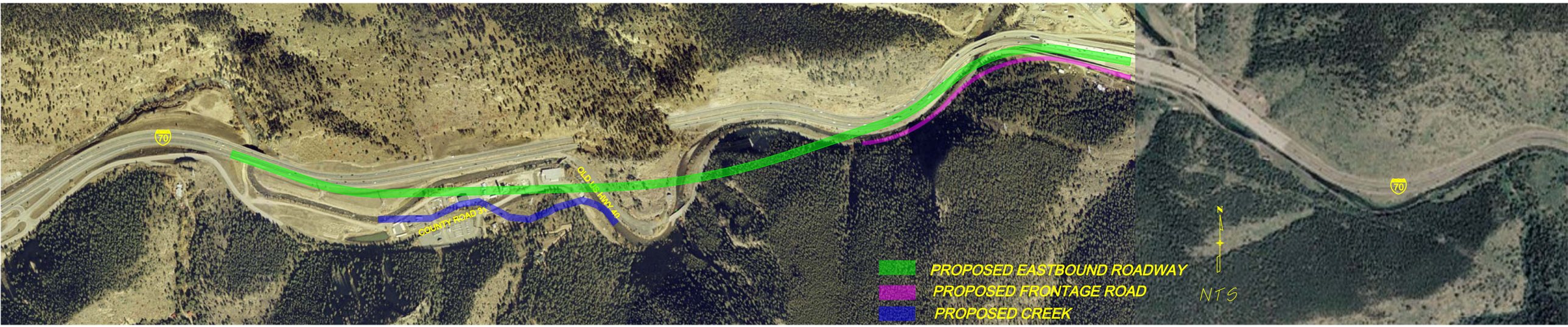
Concept Package 5 - 55 mph EB Tunnel Bypass



Concept Package 6 - 65 mph EB Tunnel Bypass



Concept Package 7 - New EB Tunnel/ Fix 45 mph Curve EB



Tunnel Visioning

A Design workshop for the Twin Tunnels

Held February 21 through 25, 2011

Supported through attendance by 53
Corridor Stakeholders


TUNNEL


TRUCKERS
SHARP CURVES
2000 FT

I-70 Mountain Corridor CSS

Partnerships Powered by Context

I-70 Mountain Corridor CSS

Partnerships Powered by Context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The Process we used

Monday 2/21	Morning: Share History and Discuss Concerns Afternoon: Brainstorm Critical Measures of Success and Short Term Solutions
Tuesday 2/22	Morning: Functional Analysis of Ideas Afternoon: Screen Ideas and Create Viable Concepts
Wednesday 2/23	Morning: Technical Evaluation of Concepts Afternoon: Peer Review of Alternatives
Thursday 2/24	Morning: More Technical Evaluation of Concepts Afternoon: Packaging the Concepts
Friday 2/25	Morning: Conclusion and Report-out of Technical Findings Afternoon: Prepare Overall Recommendations and Determine Next Steps

Goal for Tunnel Visioning

Develop improvements that address near term and current mobility needs

CRITICAL SUCCESS FACTORS

or

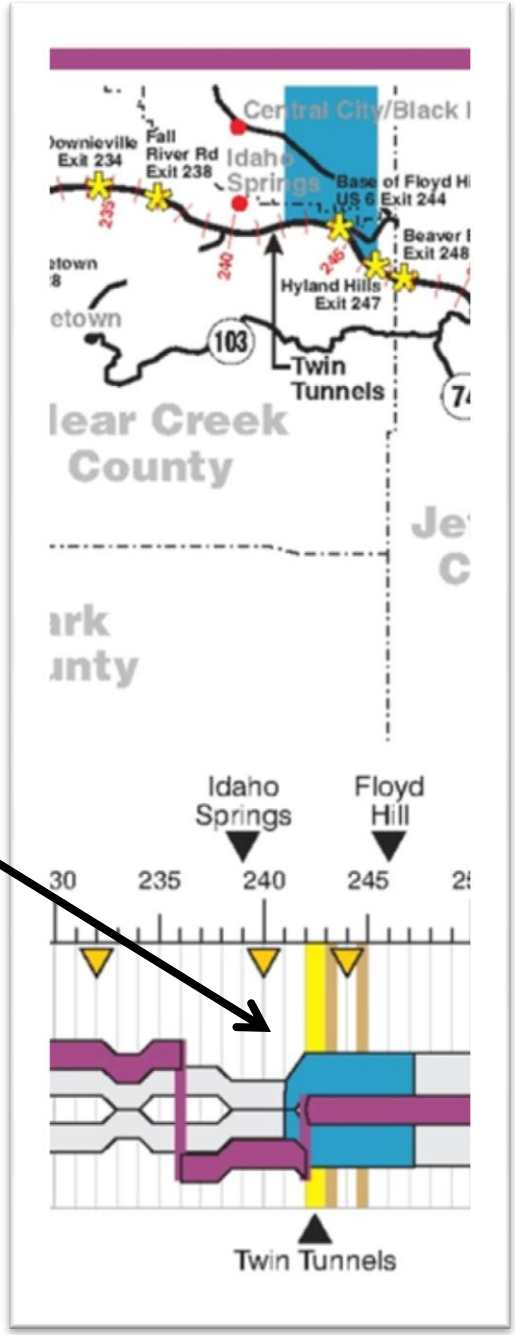
Evaluation Criteria

Improve Mobility
Compatibility with existing plans
Timing of Implementation
Capitol Cost
Level of Environmental Change
Level of Economic Benefit
Flexibility of design and long term usability
Community Stakeholder acceptance
Attractive solution to gain funding and political support
Safety
Construction Disruption

The Preferred Alternative

as defined in the PEIS

3 lanes from Idaho Springs to Floyd Hill



Technical Team started with elements

A -- Widen Existing EB and WB Tunnels

B -- Widen Existing EB Tunnel

C -- Construct new 3rd Tunnel

D -- Realign 3 EB lanes with 65 mph design

E -- Realign 3 EB lanes with 55 mph design

F -- Flatten EB and WB curves to 65mph

G -- Flatten EB and WB curves to 55mph

H -- Flatten EB 45 mph curve to 55 mph

J -- Hidden Valley to Floyd Hill widen to 3 EB lanes

L -- Add 3rd EB lane from Idaho Springs to Twin Tunnels

M -- Improve shoulder to provide 3 EB lanes for peak period

O -- Old US 40/CR 314 used for detour EB during construction

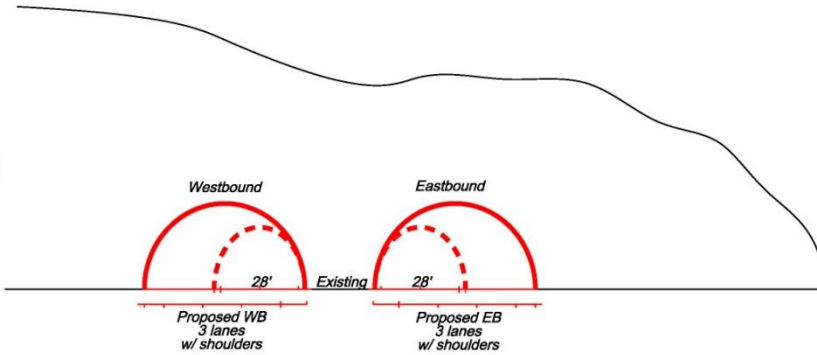
P -- Restore/enhance frontage road, trail and trailhead

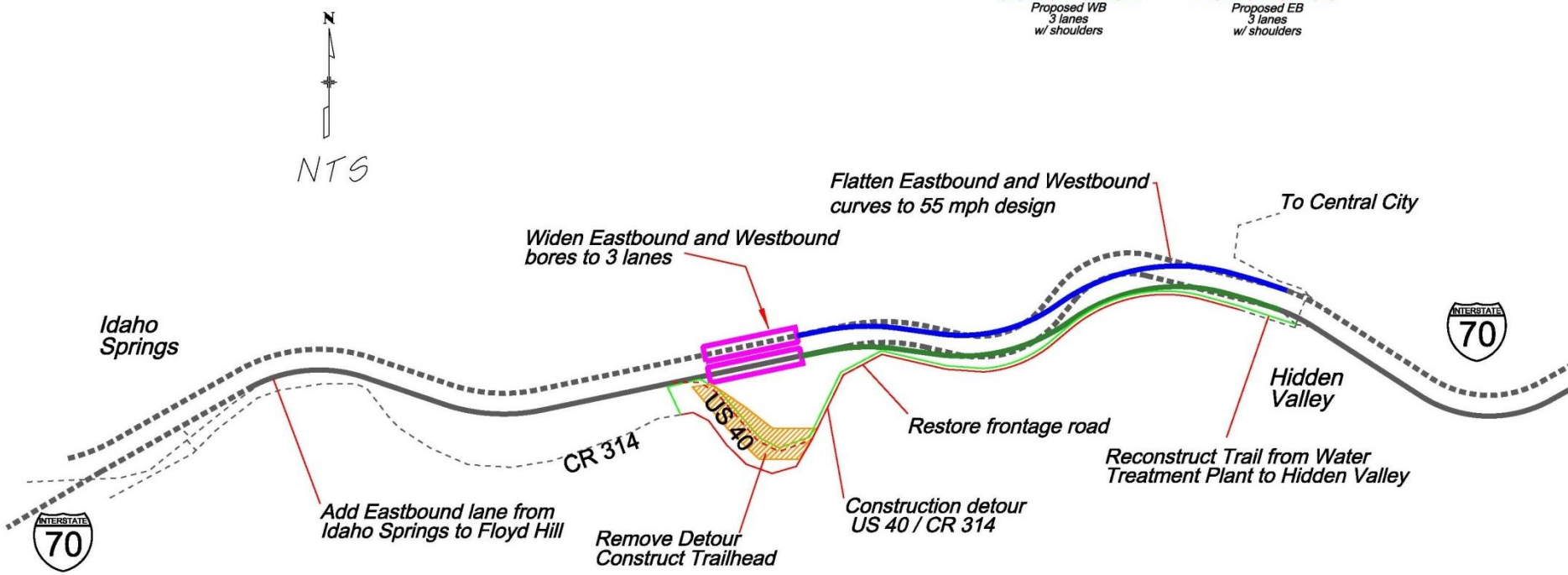
Building Packages

	CP1	CP2	CP3	CP4	CP5	CP6	CP7
Widen EB & WB Tunnels	x		x				
Widen EB Tunnel		x		x			
Construct 3rd Lane							x
Realign EB w/ 65 mph						x	
Realign EB w/55 mph					x		
Flatten EB & WB to 65 mph			x	x			
Flatten EB & WB to 55 mph	x						
Flatten EB 45 mph curve		x					x
3rd Lane – HV to FH	x	x	x	x	x	x	x
3rd Lane – IS to HV	x	x	x	x	x	x	x
Improve shoulders	**Optional CP1, CP2, CP3 and CP4**						
US40 for detour	x	x	x	x			
Restore FR, trail, trailhead	x	x	x	x			

Concept Package 1

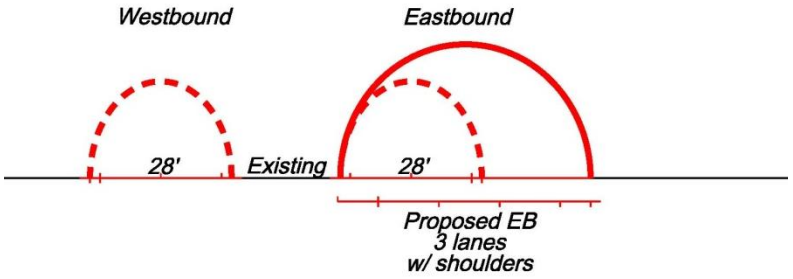
- **Construct a detour on US40 and CR 314.**
- **Widen the EB and WB Tunnels**
- **Flatten EB and WB curves to 55 mph**
- **Add 3rd lane from Idaho Springs to Floyd Hill**
- **Restore/ Enhance Frontage Road, trail and trailhead**

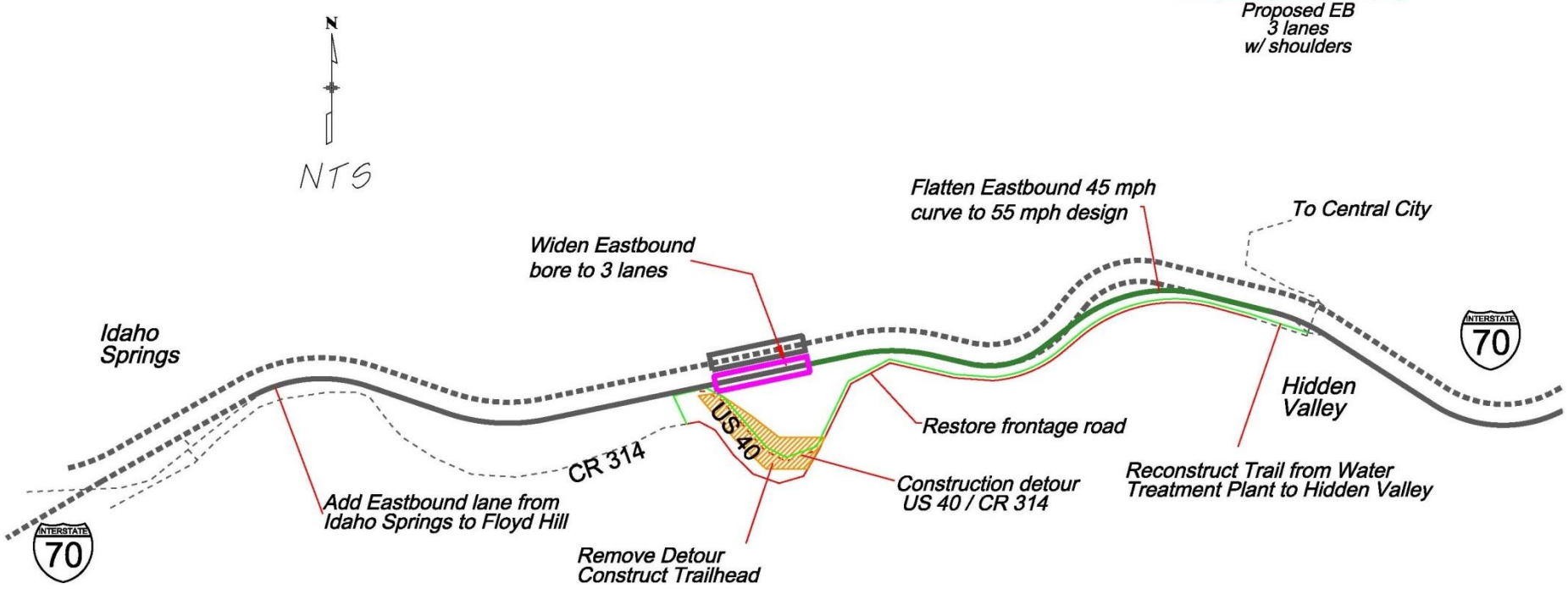




Concept Package 2

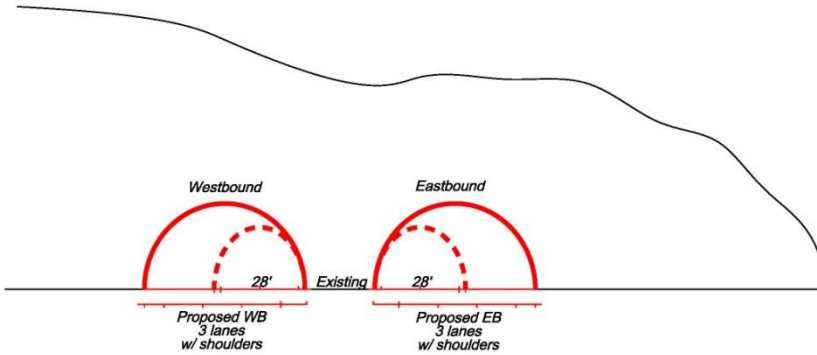
- **Construct a detour on US40 and CR 314.**
- **Widen the EB Tunnel**
- **Flatten the 45 mph curve to 55 mph design**
- **A 3rd EB lane from the Idaho Springs of Floyd Hill,**
- **Restore/ Enhance the Frontage Road the trail and trailhead**

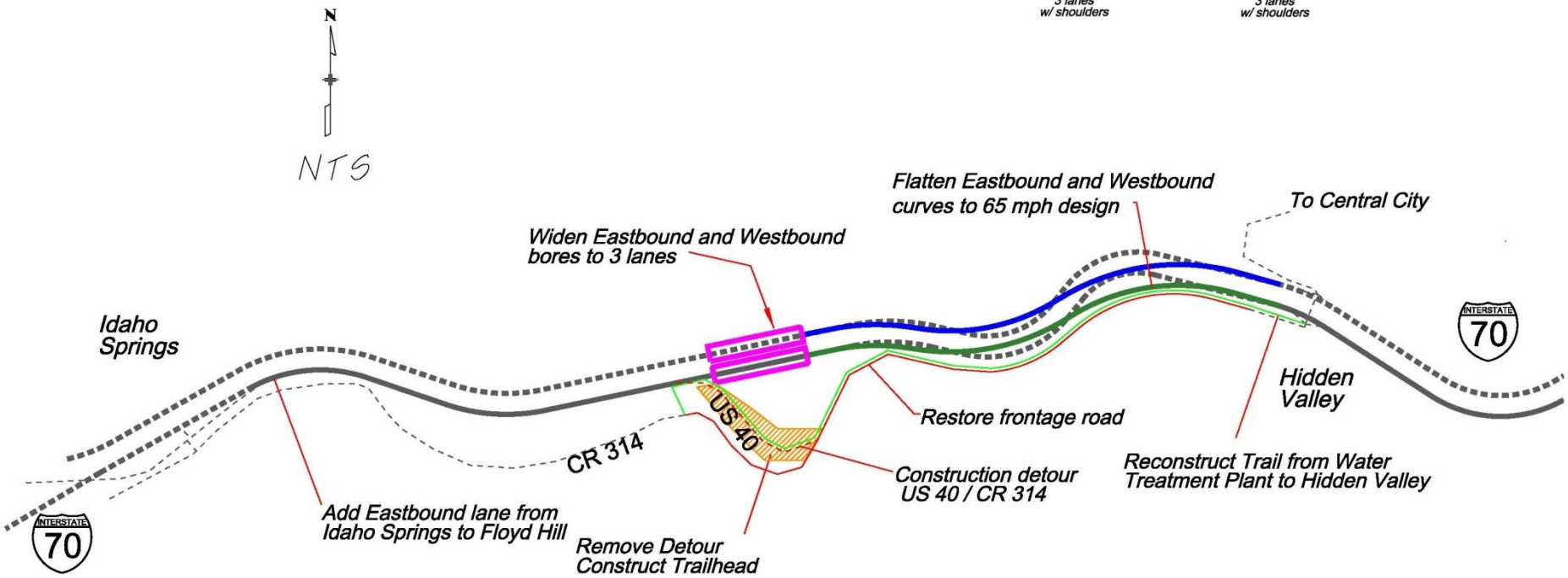




Concept Package 3

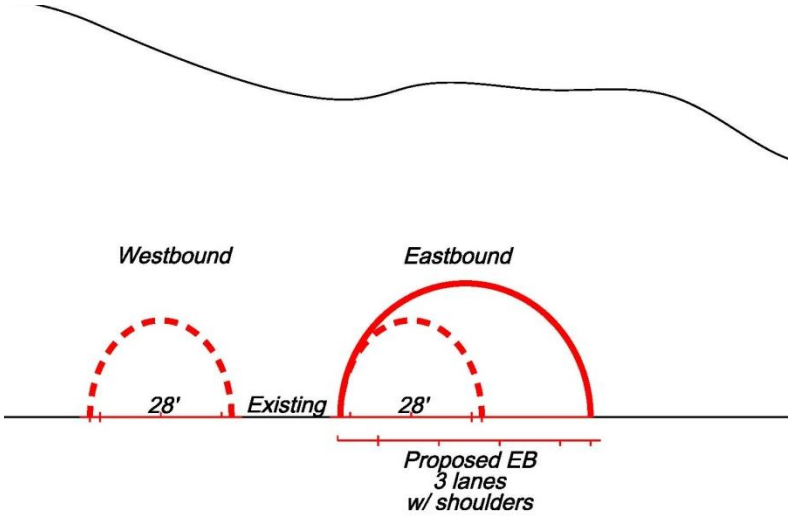
- **Construct a detour on US40 and CR 314**
- **Widen the EB and WB Tunnels**
- **Flatten the EB and WB curves to 65 mph**
- **Add a 3rd lane from Idaho Springs to Floyd Hill**
- **Restore/ Enhance the Frontage Road, trail and trailhead**

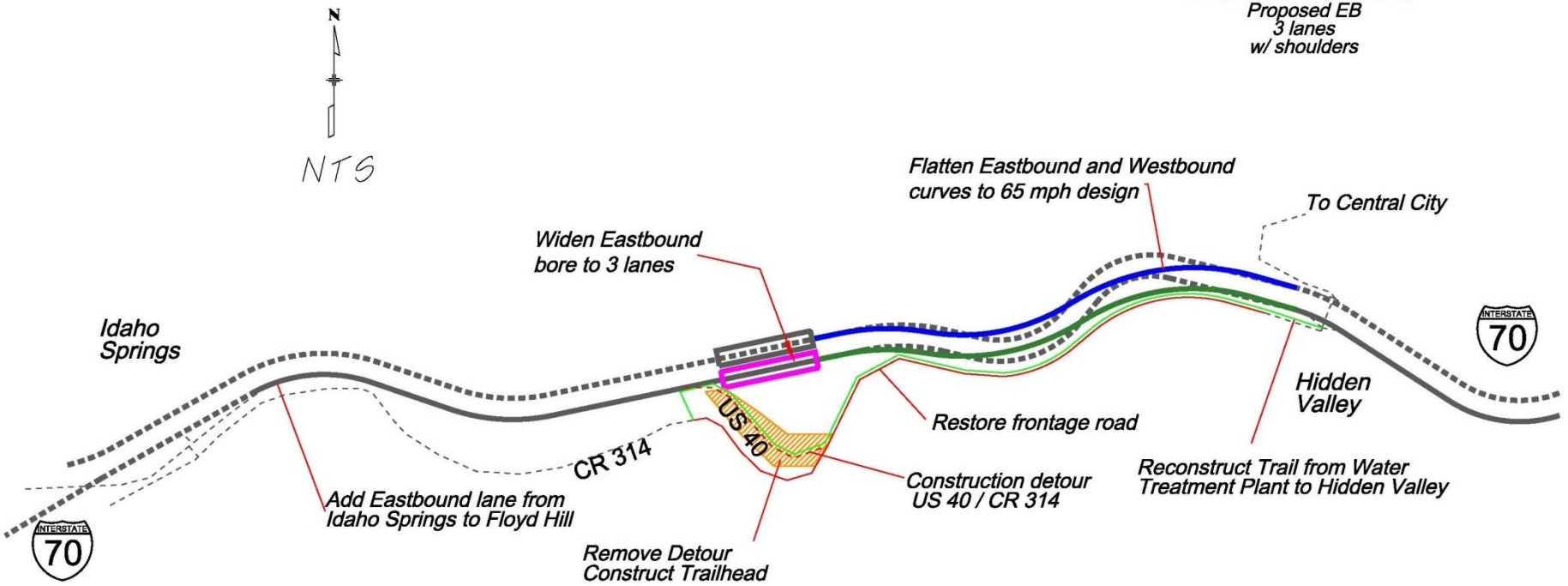




Concept Package 4

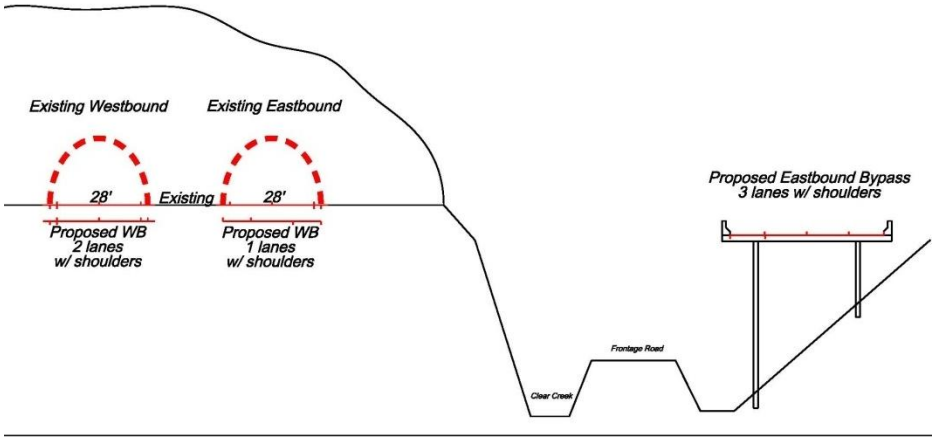
- **Construct a detour on US40 and CR314**
- **Widen the EB tunnel**
- **Flatten the EB and WB curves to 65 mph**
- **Add a 3rd lane from Idaho Springs to Floyd Hill**
- **Restore/ Enhance the Frontage Road, trail and trailhead**

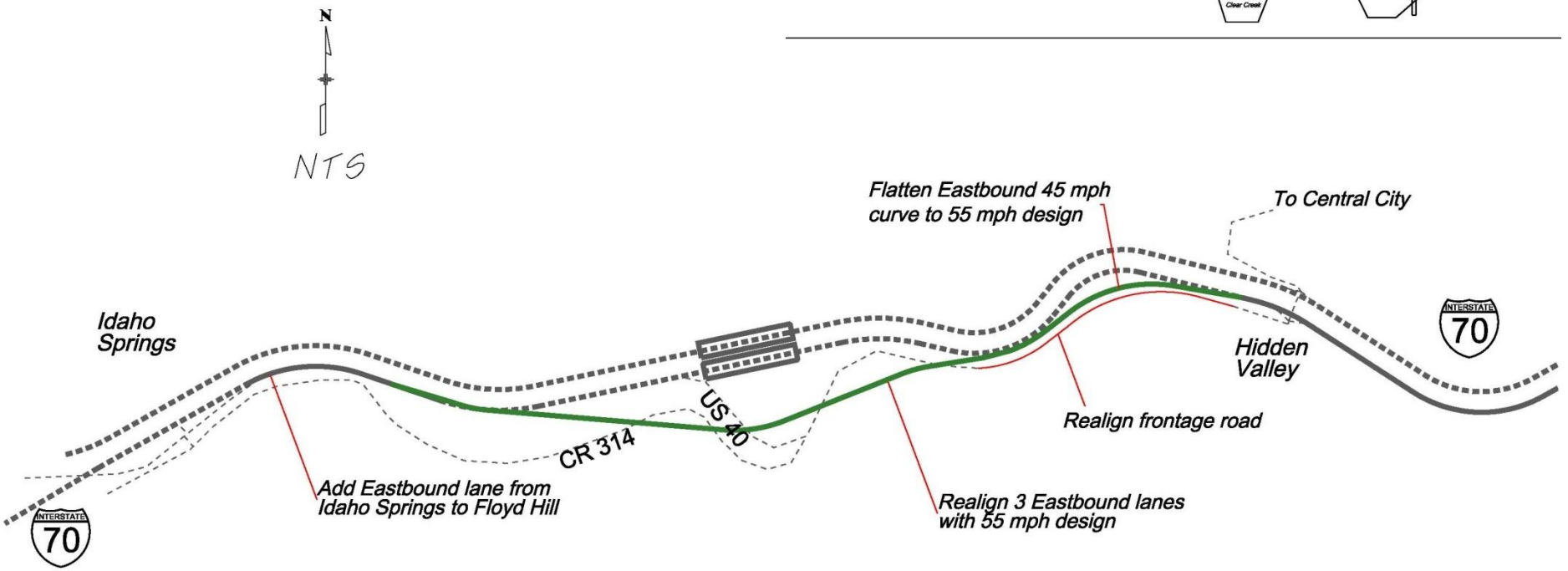




Concept Package 5

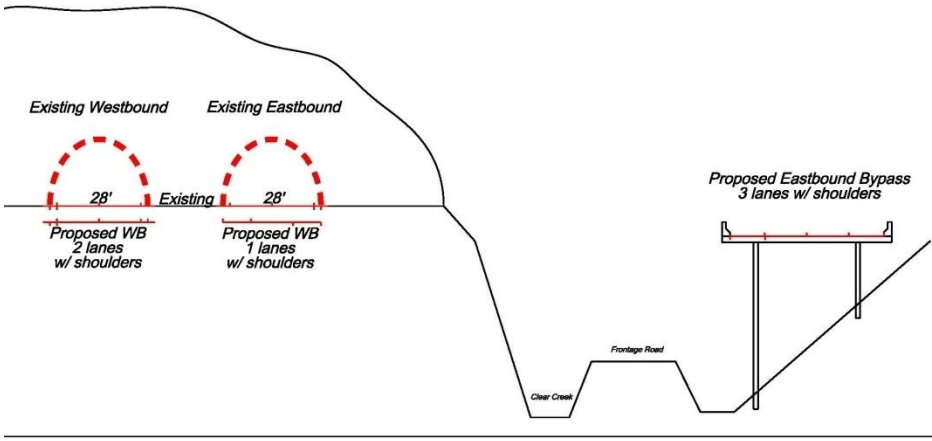
- **Realign 3 EB lanes south of existing I-70 on a viaduct with a 55 mph design**
- **WB lanes remain in existing location**
- **Could use the existing EB tunnel for WB lanes**
- **Add a 3rd lane from Idaho Springs to Floyd Hill**

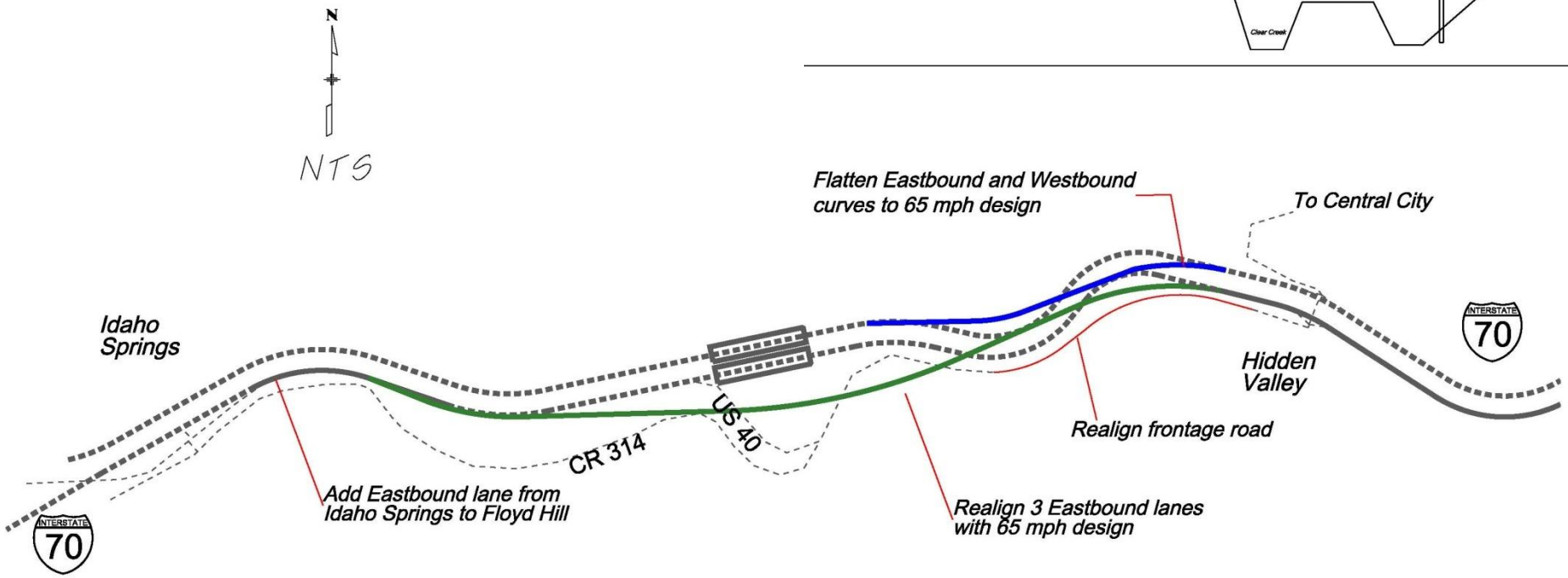




Concept Package 6

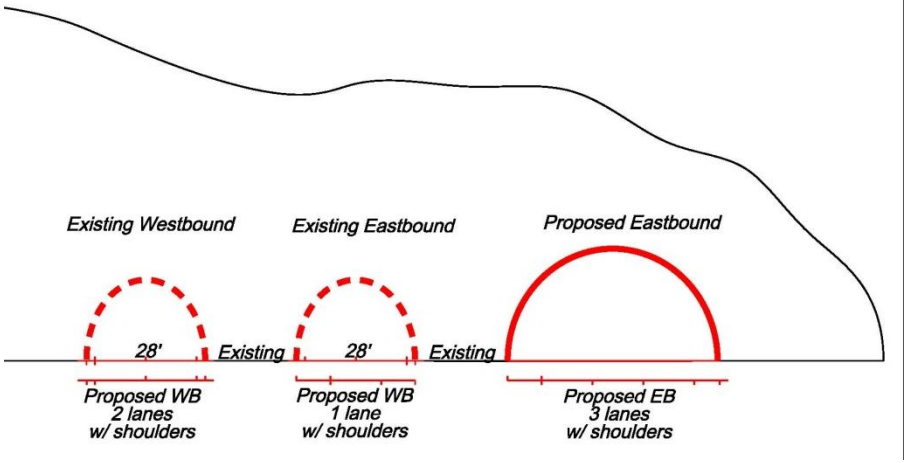
- **Realign 3 EB lanes on a viaduct south of the existing I-70 with a 65 mph design**
- **Rework to the WB lanes for 65 mph design**
- **Could use the existing EB tunnel for WB lanes**
- **Add a 3rd lane from Idaho Springs to Floyd Hill**

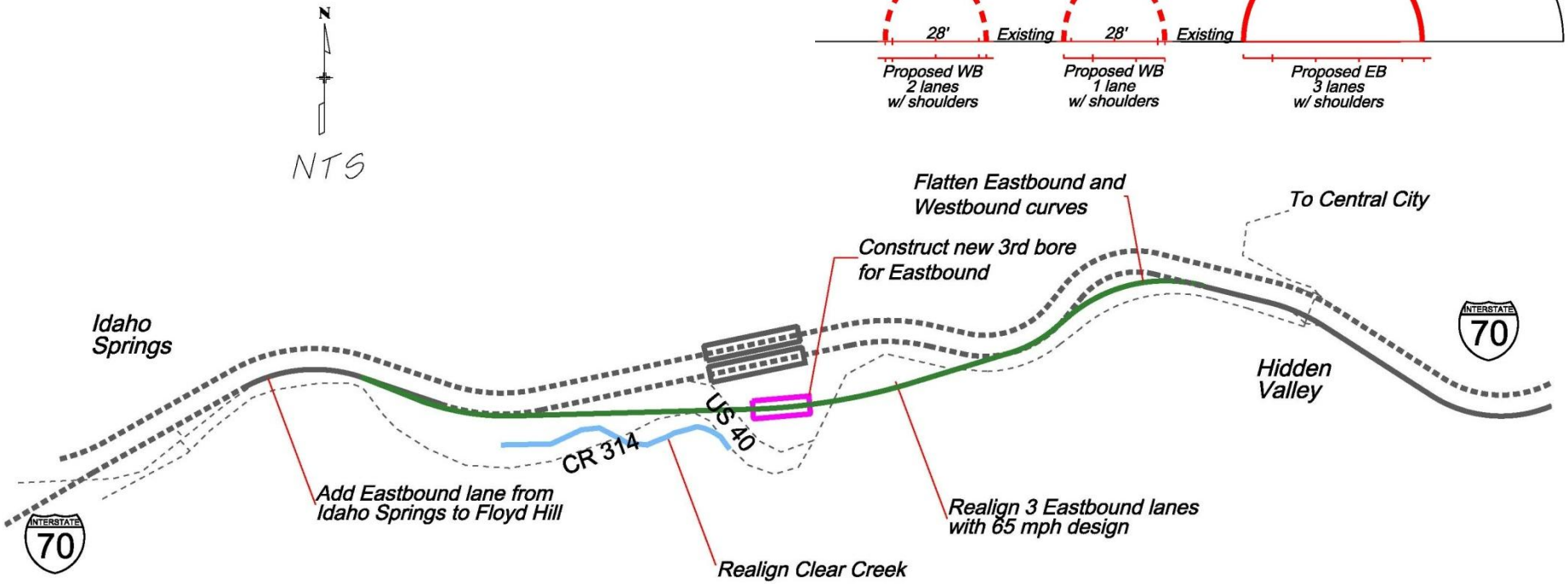




Concept Package 7

Construct a new 3rd tunnel for EB lanes
WB lanes remain in existing location
Could use the existing EB tunnel for WB lanes
Flatten EB 45 mph curve to 55 mph
Add a 3rd lane from Idaho Springs to Floyd Hill





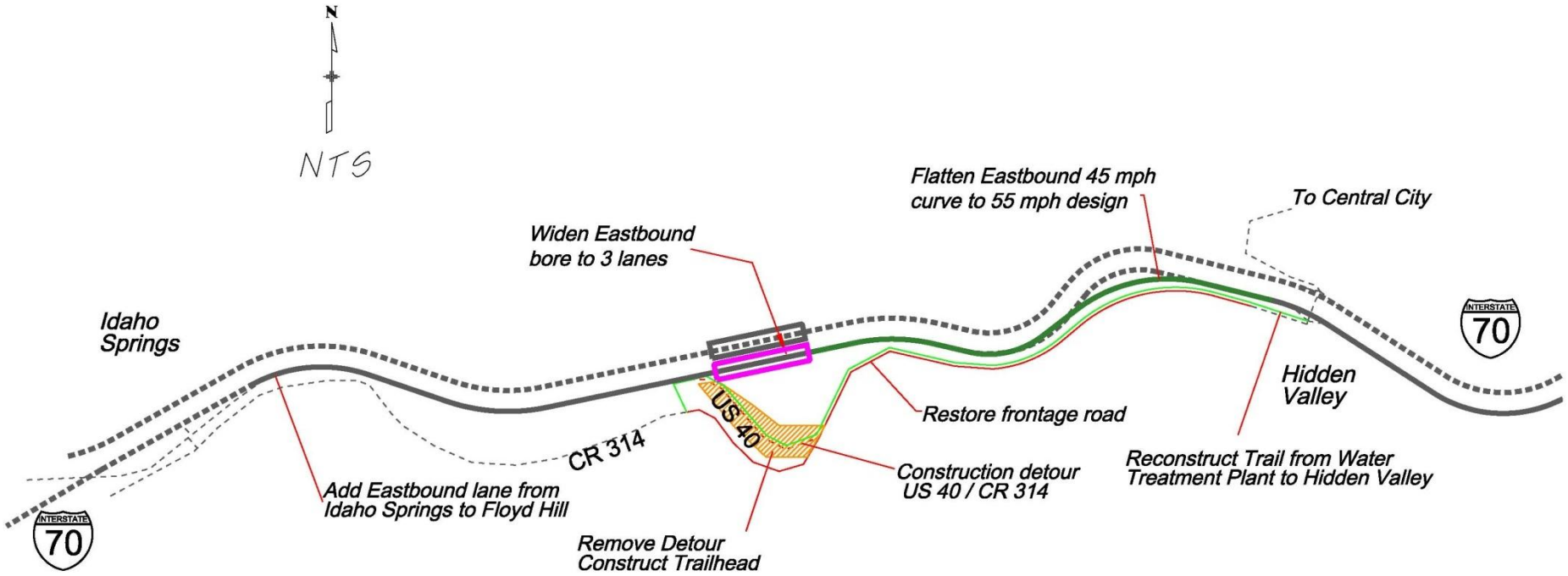
This Concept Package is the design analyzed in the PEIS as the Preferred Alternative

Evaluating Concept Packages

	Costs	CP1	CP2	CP3	CP4	CP5	CP6	CP7
Widen EB & WB Tunnels	$50	$50		$50				
Widen EB Tunnel	$25		$25		$25			
Construct 3rd Lane	$57							$57
Realign EB w/ 65 mph	$80						$80	
Realign EB w/55 mph	$58.8					$58.8		
Flatten EB & WB to 65 mph	$40.6			$40.6	$40.6			
Flatten EB & WB to 55 mph	$35.8	$35.8						
Flatten EB 45 mph curve	$14.6		$14.6					$14.6
3rd Lane – HV to FH	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8
3rd Lane – IS to HV	$3.4	$3.4	$3.4	$3.4	$3.4	$3.4	$3.4	$3.4
Improve shoulders		Optional Feature for CP1, CP2, CP3 and CP4. Cost not included						
US40 for detour	$2.4	$2.4	$2.4	$2.4	$2.4			
Restore FR, trail, trailhead	$4.6	$4.6	$4.6	$4.6	$4.6			
PRELIMINARY COST ESTIMATES		$100	$55	$105	$80	$65	$85	$75

The Recommendation

Concept Package 2
Widen EB Tunnel/Fix 45 mph EB Curve



The Recommendation

	Costs	CP1	CP2	CP3	CP4	CP5	CP6	CP7
Widen EB & WB Tunnels	$50	$50		$50				
Widen EB Tunnel	$25		$25		$25			
Construct 3rd Lane	$57							$57
Realign EB w/ 65 mph	$80						$80	
Realign EB w/55 mph	$58.8					$58.8		
Flatten EB & WB to 65 mph	$40.6			$40.6	$40.6			
Flatten EB & WB to 55 mph	$35.8	$35.8						
Flatten EB 45 mph curve	$14.6		$14.6					$14.6
3rd Lane – HV to FH	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8
3rd Lane – IS to HV	$3.4	$3.4	$3.4	$3.4	$3.4	$3.4	$3.4	$3.4
Improve shoulders			Option					
US40 for detour	$2.4	$2.4	$2.4	$2.4	$2.4			
Restore FR, trail, trailhead	$4.6	$4.6	$4.6	$4.6	$4.6			
PRELIMINARY COST ESTIMATES		$100	$55	$105	$80	$65	$85	$75

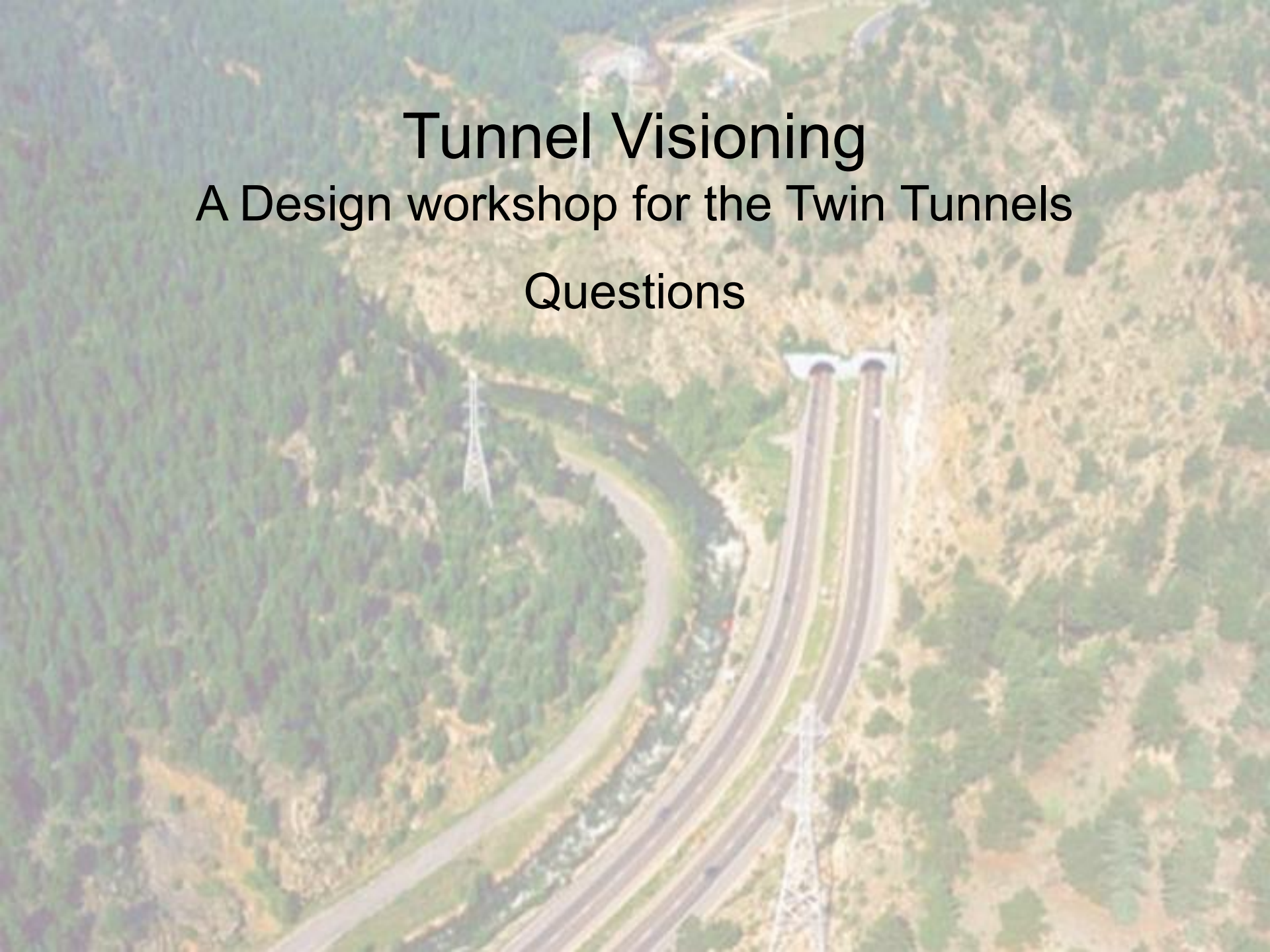
Variations to be considered

In addition to the elements outlined in Concept Package 2,
the following variations should be considered

- Eliminate 45 mph curve reconstruction
- Don't build 3rd lane – use shoulder for peak period EB lane
- Don't build 3rd lane or reconstruct 45 mph curve
- Reconstruct all the curves to 55 mph design
- Reconstruct all the curves to 65 mph design
- Add WB cross-over to accommodate peak periods westbound with reversible lane

Next Steps

- Present to the Transportation Commission
- Initiate Tier 2 Documents
  - Determine the level of document needed
  - Begin the historic consultation
  - Begin the 4(f) analysis
- Develop a Funding Plan
- Establish an information exchange among the stakeholders
  - Form the Project Leadership Team



Tunnel Visioning

A Design workshop for the Twin Tunnels

Questions

TUNNEL VISIONING DESIGN CHARETTE

WELCOME BACK

February 21st -25th, 2011

I-70 Mountain Corridor CSS
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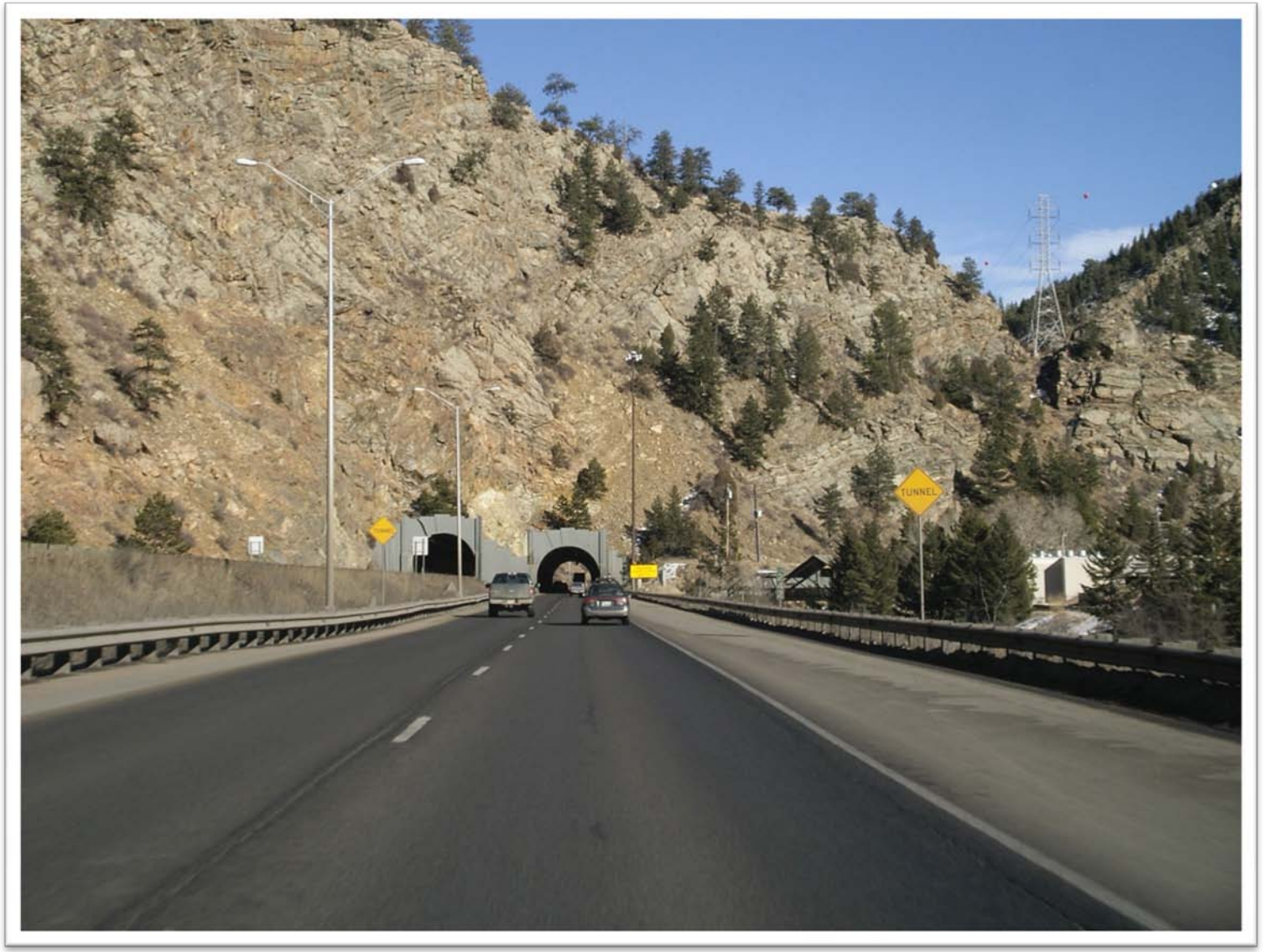
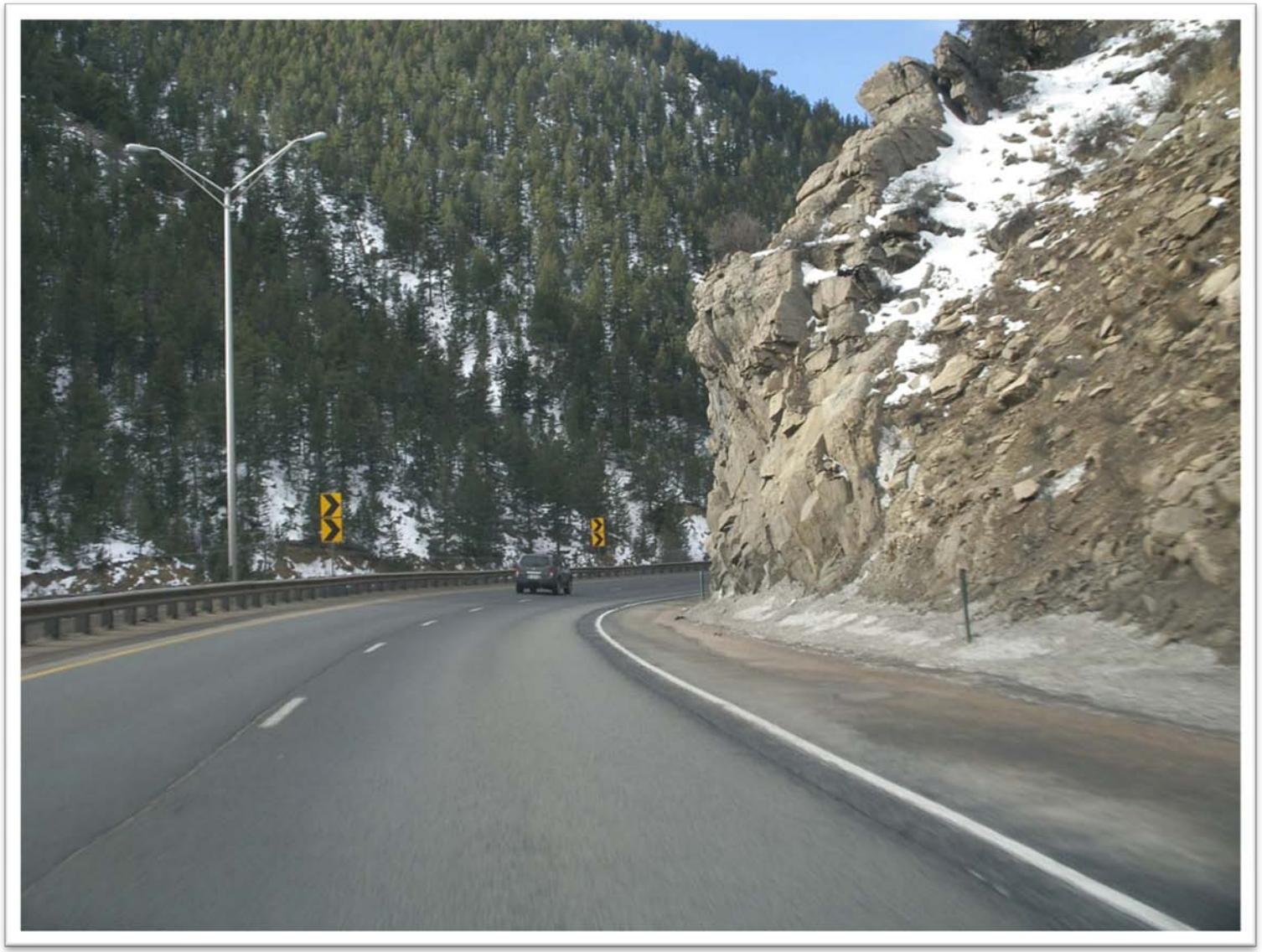

TUNNEL


TRUCKERS
SHARP CURVES
2000 FT



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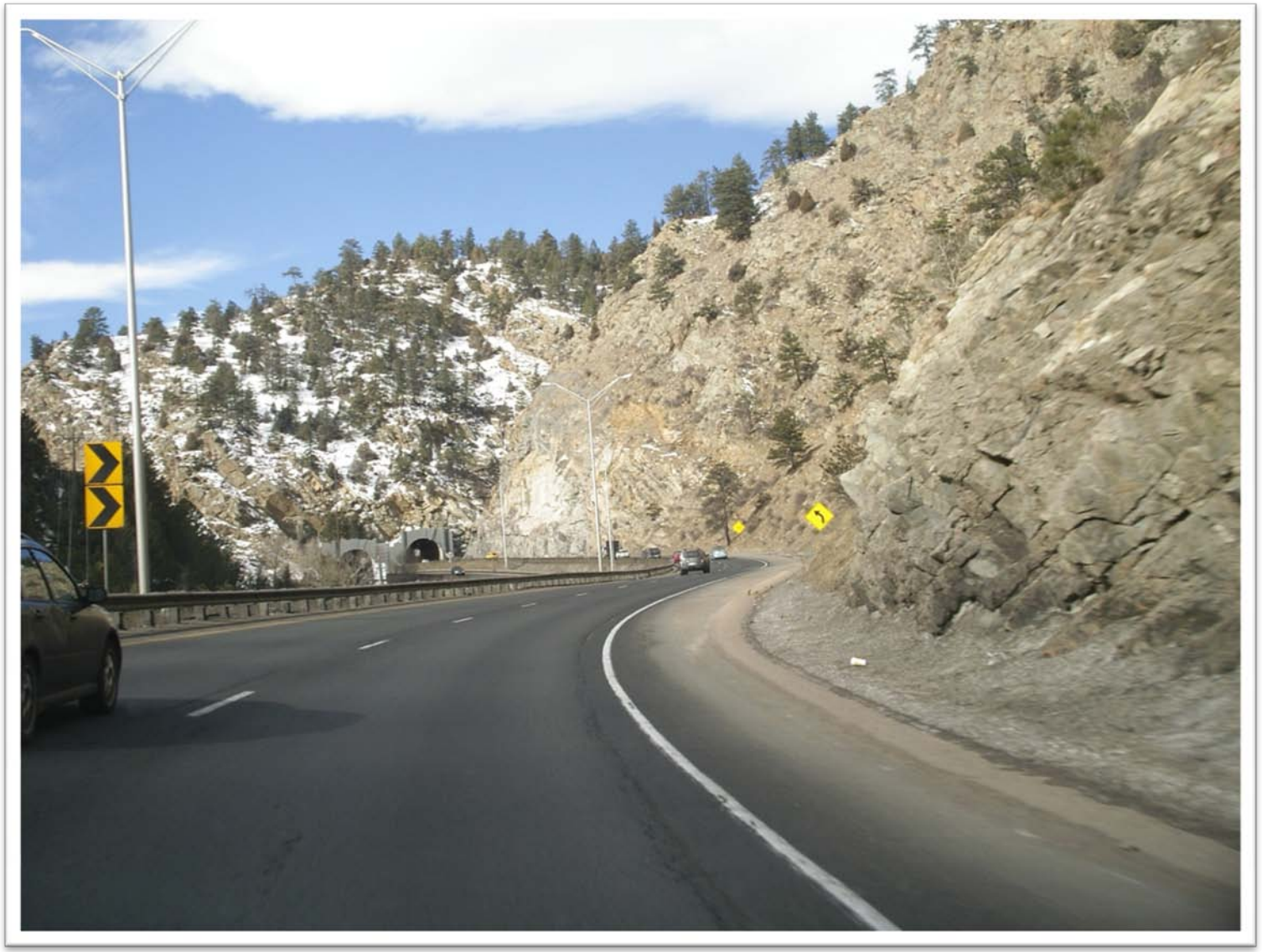

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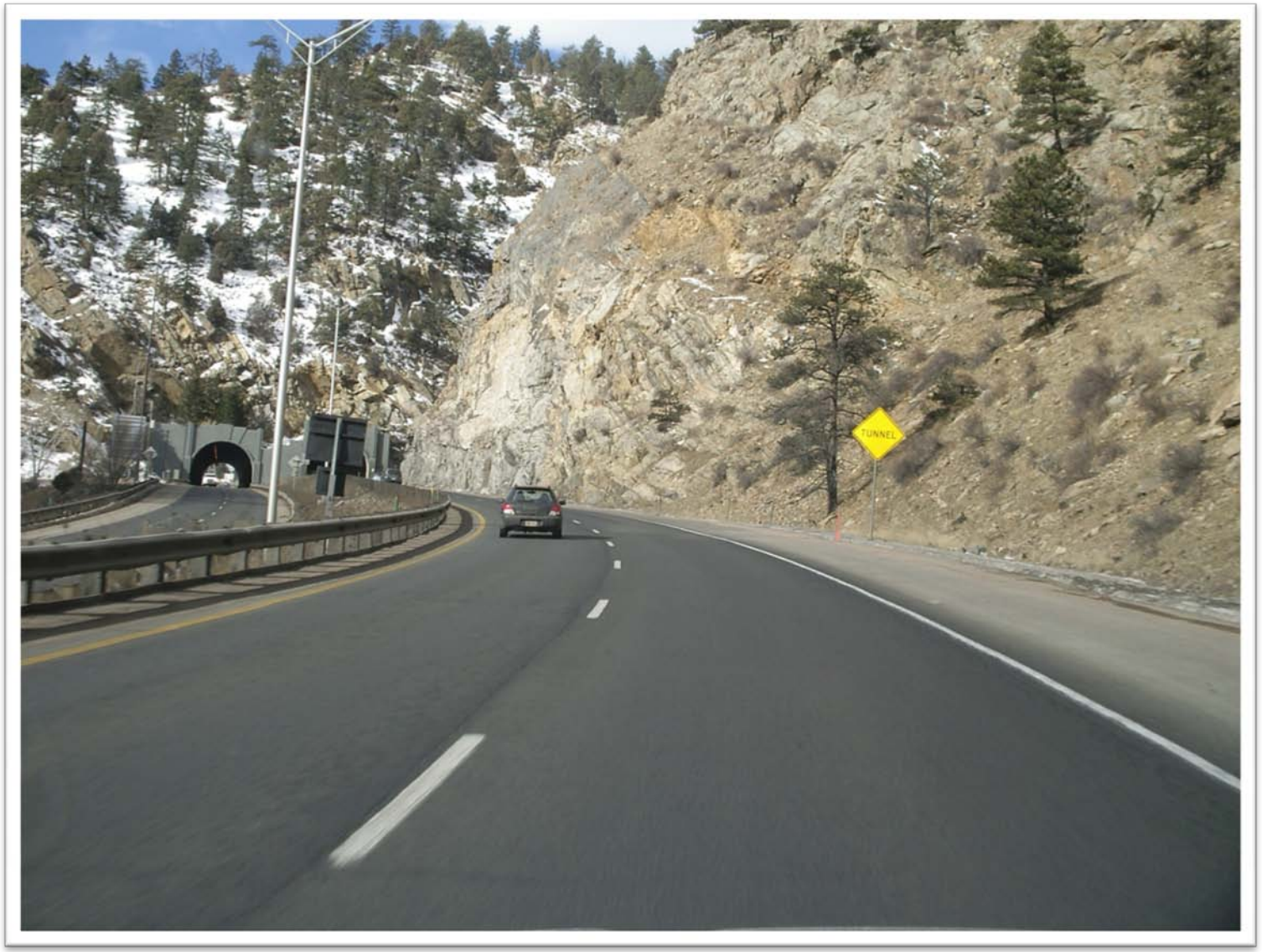
TUNNEL


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Goal for Tunnel Visioning

Develop improvements that address near term and current mobility needs

This week

Monday 2/21– 8am
Define Desired Outcomes and Actions and Endorse the Process

Establish Criteria and Develop Alternatives

Morning:
Share History and Discuss Concerns
Afternoon:
Brainstorm Critical Measures of Success and Short Term Solutions

Tuesday 2/22– 8am
Evaluate, Select, and Refine Alternatives

Morning:
Functional Analysis of Ideas
Afternoon:
Screen Ideas and Create Viable Concepts

Wednesday 2/23– 8am
Evaluate, Select, and Refine Alternatives

Morning:
Technical Evaluation of Concepts
Afternoon:
Peer Review of Alternatives

Thursday 2/24 – 8am
Evaluate, Select, and Refine Alternatives

Morning:
More Technical Evaluation of Concepts
Afternoon:
Packaging the Concepts

Friday 2/25 – 10am
Finalize Documentation and Evaluate Process

Morning:
Conclusion and Report-out of Technical Findings
Afternoon:
Prepare Overall Recommendations and Determine Next Steps

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CRITICAL SUCCESS FACTORS

or

Evaluation Criteria

Improve Mobility
Compatibility with existing plans
Timing of Implementation
Capitol Cost
Level of Environmental Change
Level of Economic Benefit
Flexibility of design and long term usability
Community Stakeholder acceptance
Attractive solution to gain funding and political support
Safety
Construction Disruption

How the Brainstorm Ideas Were Used

Concepts and Variations	Where it Went	Comments
Realign 3 WB lanes into a new tunnel from west of Hidden Valley to the west end, north of the existing tunnel	Not included in a concept package	- 1400 ft tunnel - Less than 1000 from existing tunnel Capital, maintenance and operation costs high
Realign EB and WB lanes on elevated viaduct or walled structure from Hidden Valley to Twin Tunnels	CP1, CP2, CP3, CP4, CP5, CP7	Expanded to two options: - Realign with structure - Realign with rock cuts
Third bore at a new elevation south of existing EB bore	CP7	
Operational Concepts		
Tickets for national forest (limit access)	Not considered in this process	
Add ATMS		- Considered as part of 7e - Currently being studied
Funding Elements		
Congestion Pricing	Not in the scope of this process	

Concept Packaging

C1	Widen Both Tunnels/ 55mph Design
C2	Widen EB Tunnel / Fix 45 mph Curve EB
C3	Widen Both Tunnels / 65 mph Design
C4	Widen EB Tunnel / 65 mph Design
C5	55 mph EB Tunnel Bypass
C6	65 mph EB Tunnel Bypass
C7	New EB Tunnel / Fix 45 mph Curve EB

Your Technical Team's Recommendation

Concept Package 2
Widen EB Tunnel/Fix 45 mph EB Curve

- Construction detour on old US 40/ CR 314
- Widen EB bore to 3 lanes
- Could use shoulder for third lane during peak period prior to construction of additional lane
- Flatten 45 mph EB curve west of Hidden Valley
- Add EB lane from east Idaho Springs to Floyd Hill
- Restore frontage road, trail and trailhead

Variations to be considered

In addition to the elements outlined in Concept Package 2,
the following variations should be considered

- Eliminate 45 mph curve reconstruction
- Don't build 3rd lane – use shoulder for peak period EB lane
- Don't build 3rd lane or reconstruct 45 mph curve
- Reconstruct all the curves to 55 mph design
- Reconstruct all the curves to 65 mph design
- Add WB cross-over to accommodate peak periods westbound with reversible lane

Lunch

Questions

- Process we went through
- Packages – what is included; what is not
- Analysis of the Packages

Next Steps

- Present to the Transportation Commission
- Initiate Tier 2 Documents
- Develop Funding Plan
- Establish an information exchange