



**I-70 Mountain Corridor CSS**

Partnerships Powered by Context

# Tunnel Visioning

## A Design Workshop for the Twin Tunnels

Prepared for



March 2011



# Tunnel Visioning

## A Design Workshop for the Twin Tunnels

### Executive Summary

During the week of February 21<sup>st</sup>, 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 5<sup>th</sup> 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 3<sup>rd</sup> lane, but implement hard shoulder running
- Don't build the 3<sup>rd</sup> 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

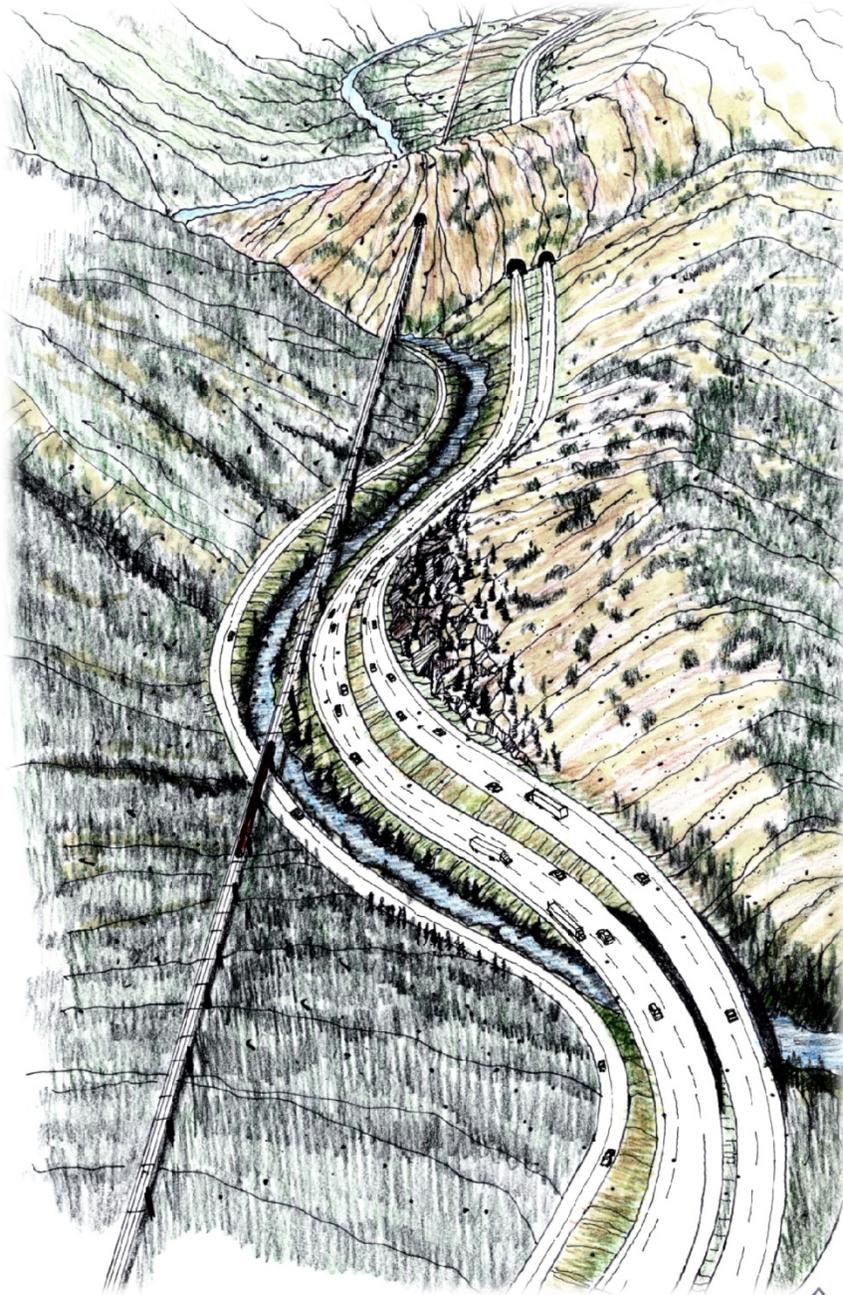
initial meeting. Specifically, this Concept Package was preferred by the Technical Team because: it addresses the most immediate mobility issues; it improves the tightest curve, a location of many accidents; the pre-design, design, and construction can be accomplished in 4 to 5 years; it is consistent 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*  
WIDENING OF THE TWIN TUNNELS ON I-70





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



## **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](http://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 21<sup>st</sup> 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
<p><b>Monday 2/21- Large Stakeholder Group</b></p> <p><i>1. Define Desired Outcomes and Actions</i>  <i>2. Endorse the Process</i>  <i>3. Establish Criteria</i>  <i>4. Develop Alternatives</i></p>	<p><u>Morning:</u> Share History and Discuss Concerns</p> <p><u>Afternoon:</u> Brainstorm Critical Measures of Success and Short Term Solutions</p>
<p><b>Tuesday 2/22- Technical Experts</b></p> <p><i>5. Evaluate, Select, and Refine Alternatives</i></p>	<p><u>Morning:</u> Functional Analysis of Ideas</p> <p><u>Afternoon:</u> Screen Ideas and Create Viable Concepts</p>

<b>Wednesday 2/23- Technical Experts</b> <i>5.Evaluate, Select, and Refine Alternatives</i>	<u>Morning:</u> Technical Evaluation of Concepts <u>Afternoon:</u> Peer Review of Alternatives
<b>Thursday 2/24 - Technical Experts</b> <i>5.Evaluate, Select, and Refine Alternatives</i>	<u>Morning:</u> More Technical Evaluation of Concepts <u>Afternoon:</u> Packaging the Concepts
<b>Friday 2/25 - Large Stakeholder Group</b> <i>6.Finalize Documentation and Evaluate Process</i>	<u>Morning:</u> 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.

<b>Critical Success Factor</b>	<b>Measurement</b>	<b>Considerations</b>
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.

<b>Build Concepts and Variations</b>
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

<b>Build Concepts and Variations</b>
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
<b>Operational Concepts - ideas that might improve mobility w/out building</b>
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
<b>Enhancements - ideas that could improve on several or all build concepts</b>
1. Flare and light tunnel portals, ATMS
2. Enhance County Road 314 for improved emergency response access
3. Improve trails
<b>Funding Elements - ideas to gain funding to build the improvements</b>
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	

<b>Ideas and Variations</b>	<b>Where it Went</b>	<b>Comments</b>
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
<b>8) Third bore</b>		
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
<b>Operational Concepts</b>		
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	
<b>Enhancements</b>		
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
<b>Funding Elements</b>		
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 3<sup>rd</sup> 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 3<sup>rd</sup> 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.

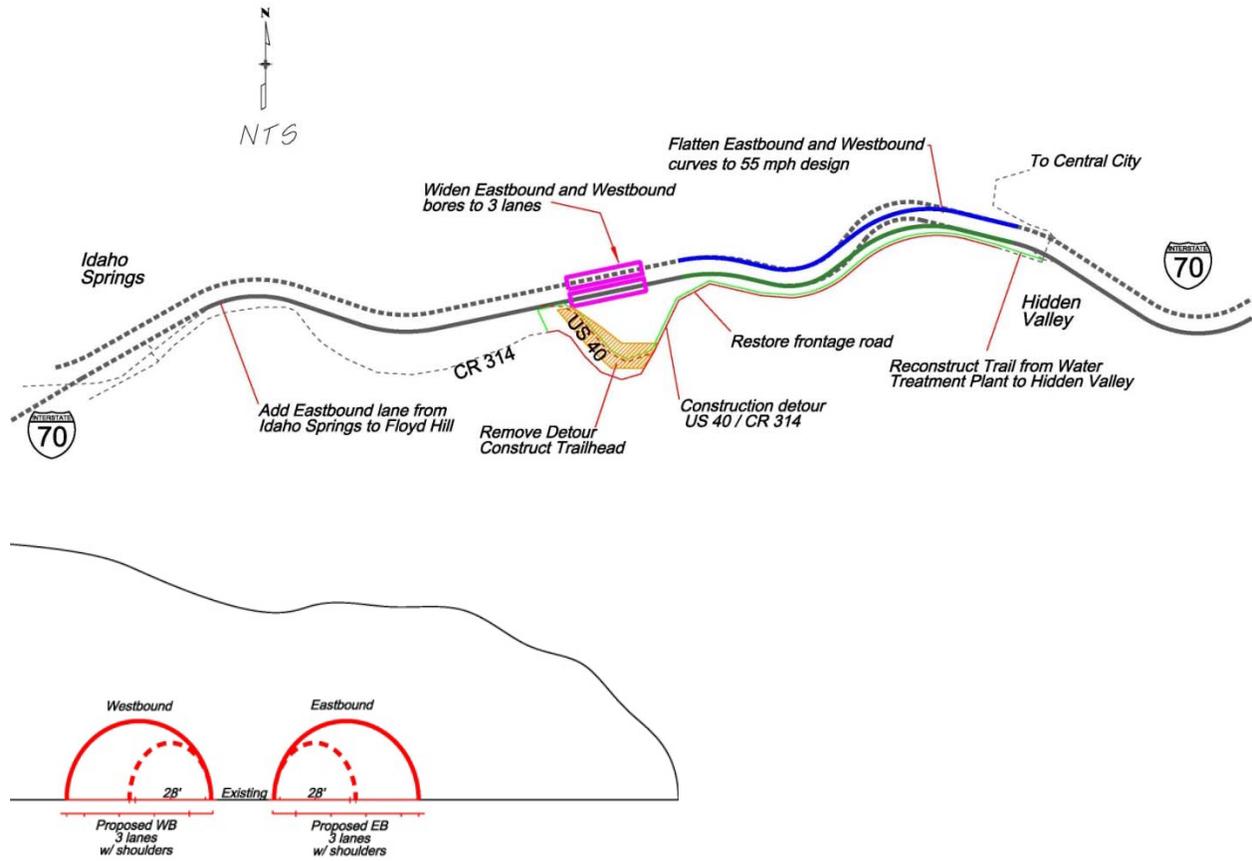
Then widen the eastbound and westbound tunnels to accommodate 3 lanes in each direction with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

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.

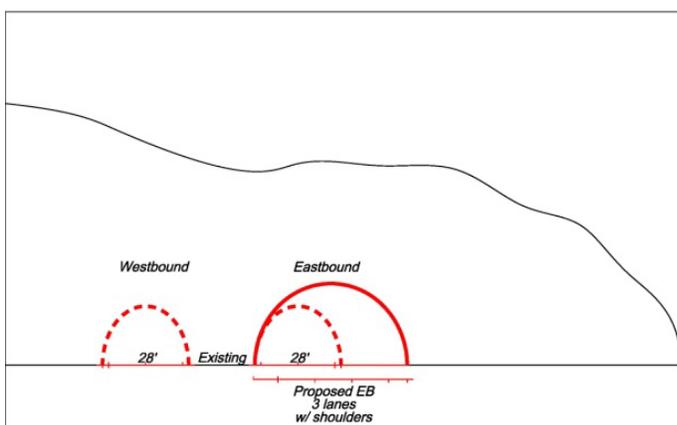
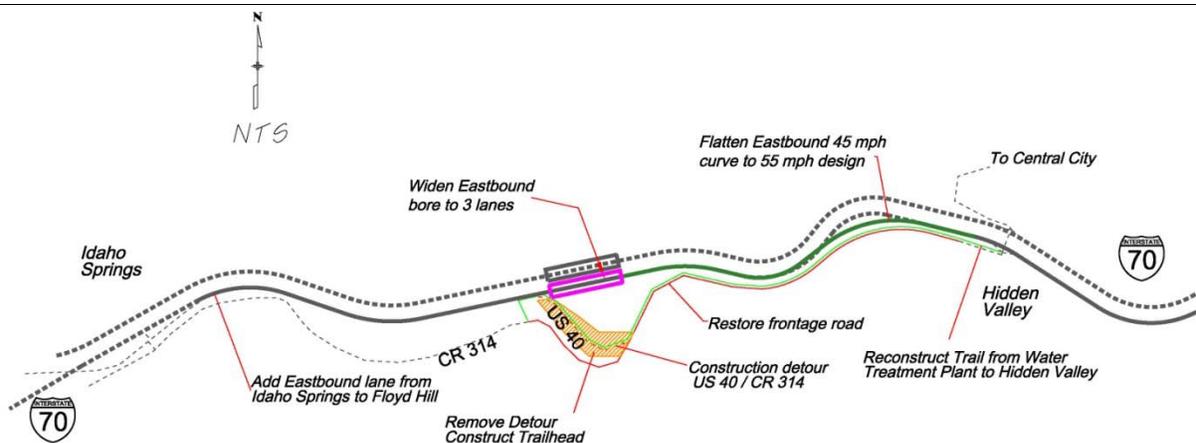
Then widen the eastbound tunnel to accommodate 3 eastbound lanes with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

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.

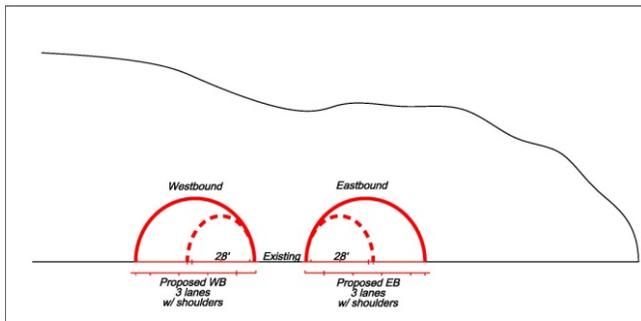
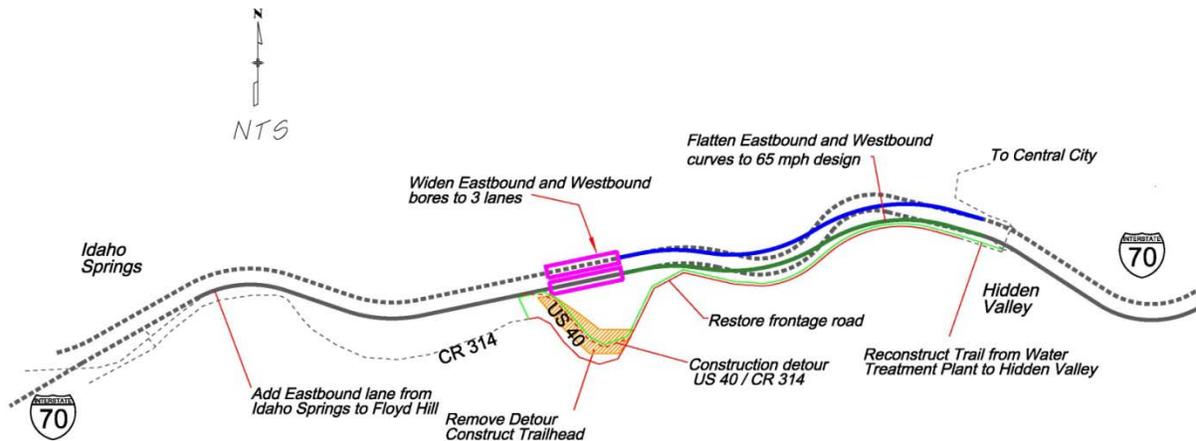
Then widen the eastbound and westbound tunnels to accommodate 3 lanes in each direction with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

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.

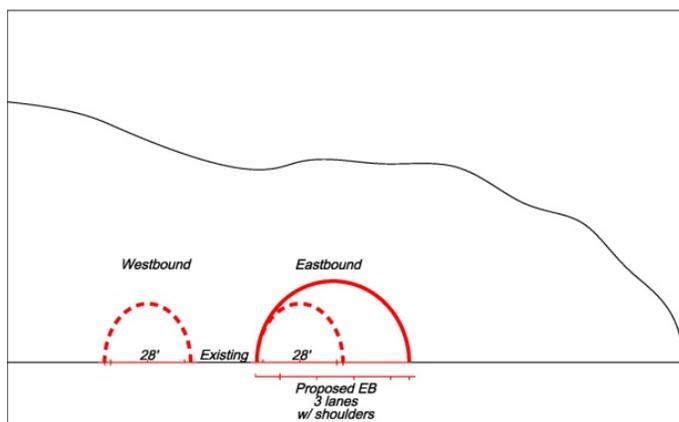
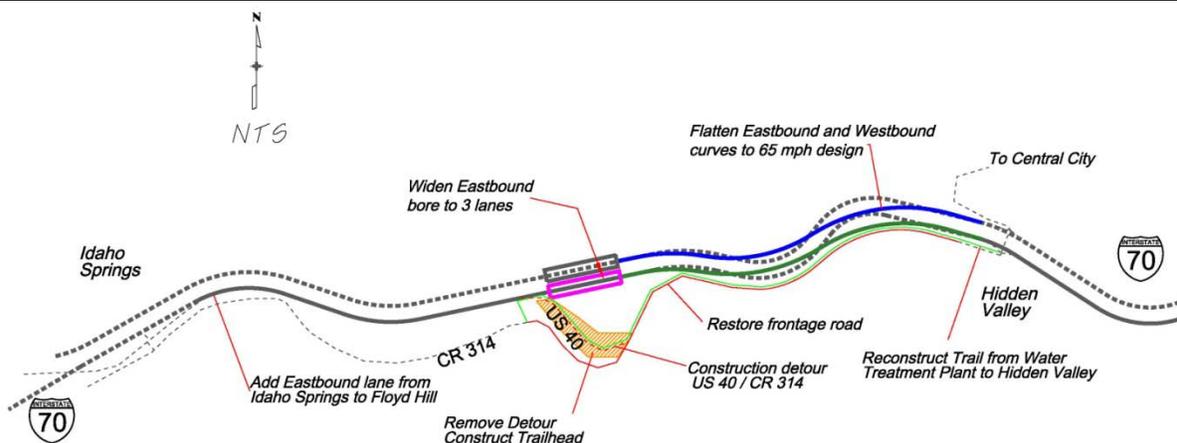
Then widen the eastbound tunnel to accommodate 3 eastbound lanes with improved shoulders. This widening could temporarily accommodate the use of the shoulder as a third eastbound lane.

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



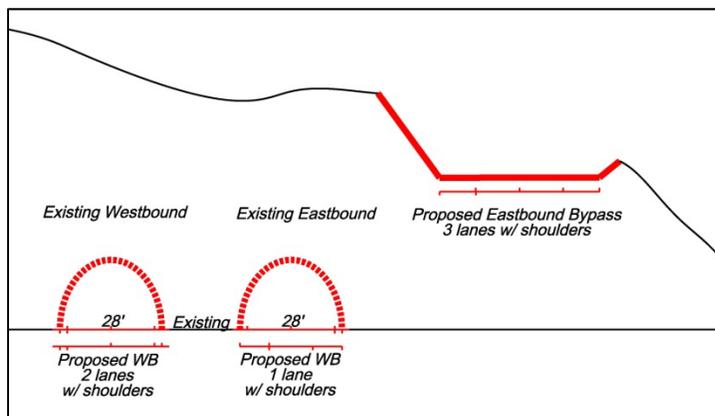
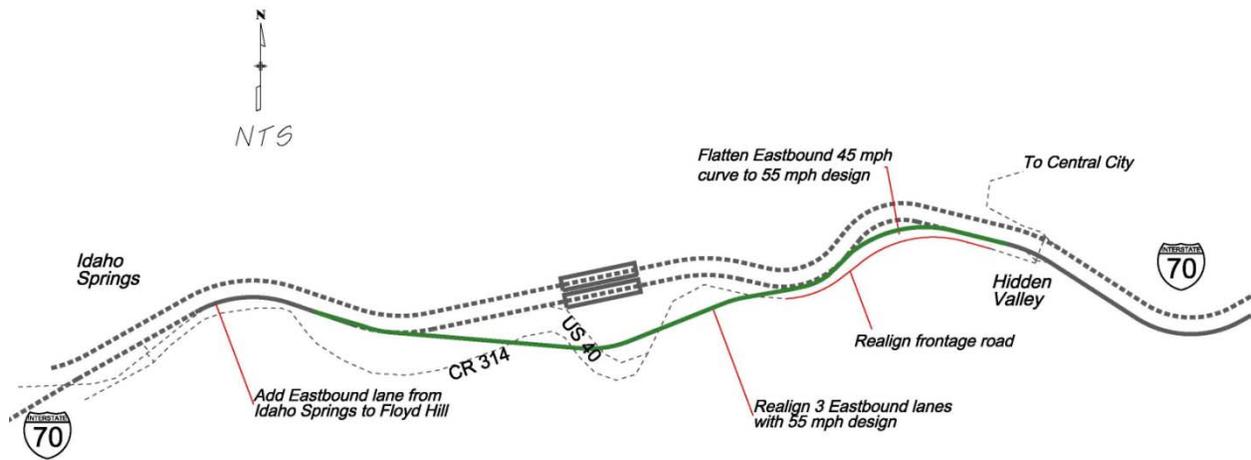
## Concept Package 5 -- 55mph EB Tunnel Bypass

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



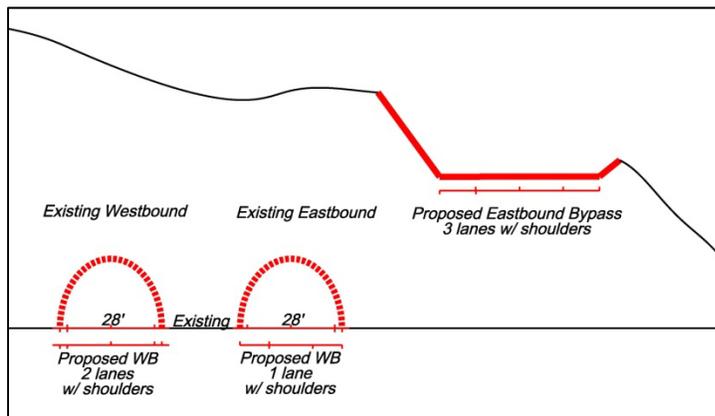
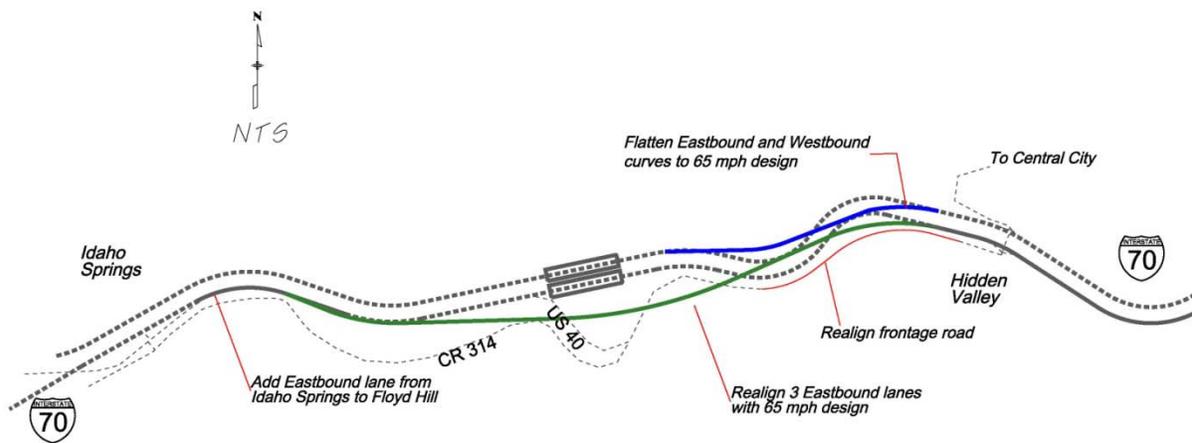
## Concept Package 6 -- 65mph EB Tunnel Bypass

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.

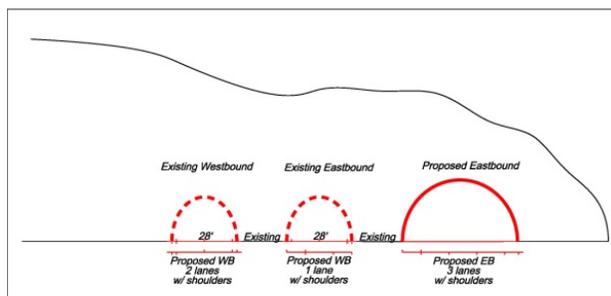
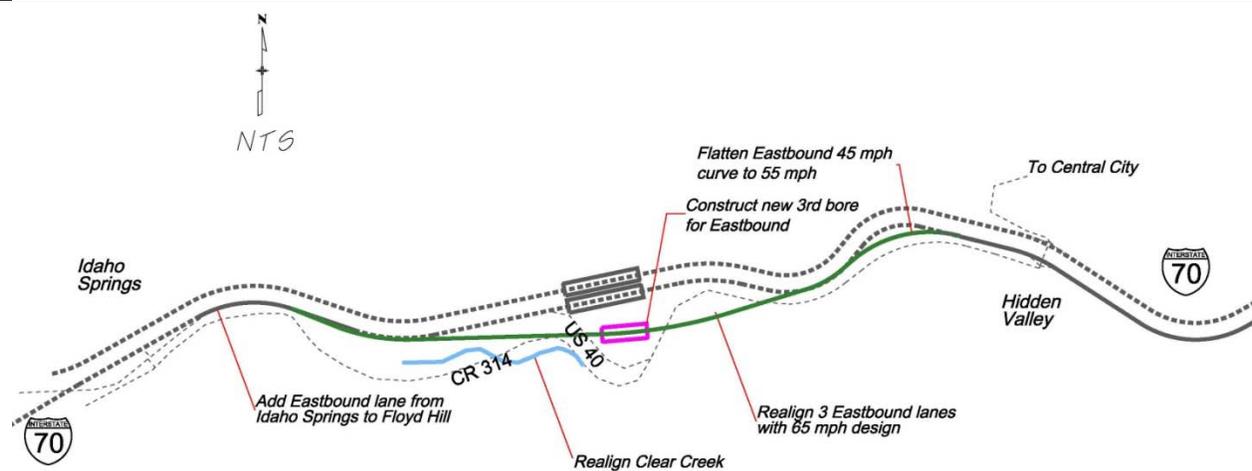
Westbound lanes would remain in their existing location. Further, the existing eastbound tunnel could be used for an additional westbound lane.

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 1<sup>st</sup> 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 3 <sup>rd</sup> 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*
	<b>Preliminary Cost Estimates</b>		<b>\$100 M</b>	<b>\$55 M</b>	<b>\$105 M</b>	<b>\$80 M</b>	<b>\$66 M</b>	<b>\$85 M</b>	<b>\$80 M</b>
	<b>COSTS PRESENTED ON FRIDAY 2/25/2011</b>		<b>\$100</b>	<b>\$55</b>	<b>\$105</b>	<b>\$80</b>	<b>\$65</b>	<b>\$85</b>	<b>\$75</b>

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

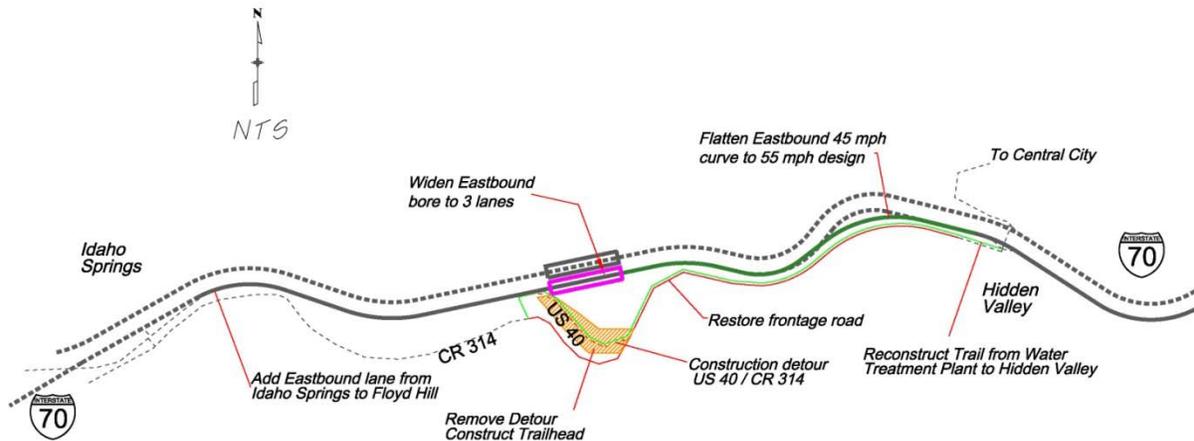
The Technical Team agreed, unanimously, that their recommendation would be Concept Package 2 with variations that should be considered during the environmental documentation.

### 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 3<sup>rd</sup> lane, but implement hard shoulder running
- Don't build the 3<sup>rd</sup> 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



<b>Critical Success Factors</b>	<b>Concept Package 2</b> 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.