

**FINAL REPORT
VALUE ENGINEERING STUDY**

**CDOT Region 2
I-25 North Design Build
El Paso County**

March 2012

BY SOLUTIONS ENGINEERING & FACILITATING, INC.

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SECTION 1 – SUMMARY

This report contains the results of the Value Engineering Study of the CDOT Region 2's I-25 North Design Build Project. The report is organized in a drill down format, that is, all items are presented first in summary format with increasing levels of detail as one delves (drills down) further into the report. This will allow the reader to easily obtain only the information he or she desires.

The first section of the report contains an executive summary of all the value engineering proposals, their estimated savings, and their ultimate disposition. The second section of the report contains a brief project background, the VE Study Team Members, a listing of the Review Board Members, and a brief description of the methodology used. The third section of the report contains detailed information about each VE Proposal. These individual proposal analyses are also organized in a drill down manner. Section Four of the report contains supplemental recommendations, i.e., ideas that the Team thought would add value to the project but do not necessarily reduce life-cycle costs. Section Five of the report contains ideas analyzed by the Team but either failed because they were thought to not be technically viable and/or did not save life-cycle costs. Section Six of the report contains functions analyzed by the VE Team. Section Seven of the report contains all of the ideas ideated by the Team both prior to and during the workshop. Section Eight of the report documents the ultimate disposition of the Team's Proposals and Supplemental Recommendations as made by the decision making board.

SUMMARY

The VE team reviewed the available EA's proposed action concept and agreed on this as the Base Case Scenario to compare cost savings against. The Base Case scenario, estimated at \$21,000,000, provided a \$15,000,000 additional budget that could be used for Additional Requested Elements (ARE's). The base case includes the following salient features:

- A six lane section from the Woodmen Rd. Interchange to the Interquest Interchange
- Minor modifications to the ramp tie-ins
- Reconstruct southbound I-25 and widen & overlay northbound I-25
- Make minor water quality improvements
- Add a southbound I-25 auxiliary lane
- Provide for a future HOV lane south of the Briargate Interchange
- Close the Ackerman Overlook

The EA's proposed action plan contained less technical detail than is normally given to a VE Team and since this project is slated to become a design build project not much further detail would be forthcoming. Therefore, the VE Team had to make more assumptions than normal and had less detailed cost data to compare against.

Because of the unique nature of the project, CDOT requested the VE Team develop a unique set of scenarios which could be used in the design build contractor proposal evaluation process.

This Value Engineering (VE) Study generated fifteen (15) classic proposals and nineteen (19) supplemental recommendations.

Caveats:

- The cost savings shown for each proposal are measured against the conceptual cost estimate developed during the Environmental Analysis and modified by CDOT afterward. Therefore for consistency's sake the VE Team did not add multipliers such as contingency (which varies per design stage), escalation (which varies per bid date), services during construction and overhead and profit for the contractor.
- All savings have been rounded to reflect the level of accuracy of the VE Proposals.

- Cost estimates made by the VE Team are intended to reflect relative values between alternatives. The estimated savings identified within each proposal are based upon comparison of the proposal to the preliminary design basis. Therefore, as is true with all cost estimates, the savings indicated are only an opinion of probable construction cost.
- Only potential savings are shown. As the proposals are implemented, additional costs or savings may result from redesign or modification.
- Some VE Proposals are mutually exclusive; a few are synergistic and could result in greater cost savings if implemented together. Therefore, the potential savings are not the simple sum of all the VE Proposals presented.
- The Value Engineering Team reviewed the cost estimate and opined that the proposed action plan's estimate was about 5% low for the proposed action plan due to low contingency and low price for the maintenance of traffic (MOT) during construction. However, since the project is based on best value (doing the most with funds available), the discrepancy would only affect the number of AREs that could be adopted and therefore the discrepancy is somewhat moot.

VE PROPOSAL SUMMARY TABLE

PROPOSAL NO.	VE PROPOSAL DESCRIPTION	REVIEW BOARD COMMENTS	PAGE NO.
Typical Section and Alignment			
P01-017	Provide Hard Shoulder Running (HSR) in lieu of adding additional through travel lanes. <i>Initial Est. Savings: \$220,000</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: \$220,000</i>	Table.	3-1
P01-008	Maximize construction to the outside areas of the existing roadway. <i>Initial Est. Savings: \$1,080,000</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: \$1,080,000</i>	Accept with Modifications. Project team will make appropriate modifications to maximize.	3-6
P05-002	Switch from a 12-foot inside shoulder to a 10-foot inside shoulder north of Briargate. <i>Initial Est. Savings: \$200,000</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: \$200,000</i>	Decline. Cost savings not worth the effort, also inconsistent with EA which stipulates 12' shoulders up to Monument)	3-8
P01-047	Realign southbound I-25 toward the median to accommodate Ackerman Overlook. <i>Initial Est. Savings: (\$66,000)</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: (\$66,000)</i>	Decline. USAFA does not want to keep Ackerman overlook at currently location, and EA calls for the overlook to be relocated.	3-10
Structures			
P01-010	Using the existing bridges at the Northgate interchange defers the replacement of the Northgate interchange bridges for a future project. <i>Initial Est. Savings: \$4,000,000¹</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: \$0,000</i> ¹ The bridges are not part of the base configuration.	Accept. Bridges will have substandard shoulders, temporarily; bridges are not part of project basic configuration.	3-13
P01-011	Widen the existing 2-foot to 4-foot inside shoulders to 12 feet along NB I-25 from Black Squirrel Creek to Baptist Road, in lieu of adding lanes. Also upgrade ramp geometry at Northgate to reduce the impact that ramp traffic has on mainline I-25. <i>Initial Est. Savings: \$300,000</i> <i>Future Est. Savings: \$1,000,000</i> <i>Total Est. Savings: \$1,300,000</i>	Decline. Not consistent with the EA.	3-15

PROPOSAL NO.	VE PROPOSAL DESCRIPTION	REVIEW BOARD COMMENTS	PAGE NO.
P01-006	Use retaining walls for split profile in lieu of reconstruction. <i>Initial Est. Savings: Not Quantified</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: Not Quantified</i>	Decline. CDOT prefers to have no split profile, but would entertain ideas that are equal to or better than reconstruction; this proposal contradicts the basic configuration which involves reconstructing portions of SB I-25.	3-20
Drainage and Water Quality			
P01-003	Install a valley pan along outside shoulder to intercept and convey water quality and 100-year flows. <i>Initial Est. Savings: \$330,000</i> <i>Future Est. Savings: Positive</i> <i>Total Est. Savings: \$330,000+</i>	Table. Savings by avoiding installation of ponds; let Contractor decide.	3-23
P02-006	Divert pavement runoff for water quality event into existing water quality basins near Pine Creek. <i>Initial Est. Savings: \$25,000</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: \$25,000</i>	Accept. Existing basin in median may be used.	3-29
Traffic			
P01-031	Improve corridor Intelligent Transportation System (ITS); for example signing, ramp metering, etc. <i>Initial Est. Savings: \$2,000,000</i> <i>Future Est. Savings: (\$1,100,000)</i> <i>Total Est. Savings: \$900,000</i>	Decline. Ramp metering is installed in lieu of auxiliary lanes, and would not relieve congestion.	3-33
P01-049	Consider using cantilever sign structures in lieu of sign bridges whenever possible. <i>Initial Est. Savings: \$61,000</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: \$61,000</i>	Accept.	3-37
RFP			
P01-056	Develop portions of the design further before initiating the process of procurement. <i>Initial Est. Savings: Not Quantified</i> <i>Future Est. Savings: Not Quantified</i> <i>Total Est. Savings: Not Quantified</i>	Decline. Insufficient time to develop designs prior to procurement; Contractors prefer less design, as it allows for more innovation.	3-42
P01-051	Assign point values to Additional Requested Elements (AREs). <i>Initial Est. Savings: Not Quantified</i> <i>Future Est. Savings: Not Quantified</i> <i>Total Est. Savings: Not Quantified</i>	Accept.	3-45
P04-002	Use an adjustment factor if Hot Mastic Asphalt (HMA) reconstruction is specified. <i>Initial Est. Savings: Incomplete</i> <i>Future Est. Savings: Incomplete</i> <i>Total Est. Savings: Incomplete</i>	Accept with Modifications. Will need to “level the playing field for concrete” with adjustment factors.	3-47

PROPOSAL NO.	VE PROPOSAL DESCRIPTION	REVIEW BOARD COMMENTS	PAGE NO.
P05-001	Construct all the roadway, shoulders, and auxiliary lanes from the median toward the outside. <i>Initial Est. Savings: \$256,000</i> <i>Future Est. Savings: \$0,000</i> <i>Total Est. Savings: \$256,000</i>	Accept.	3-49

At the time of the VE Study, the estimated construction cost was \$36,000,000.

The Review Board's estimate of savings from the accepted VE Proposals is \$342,000 with an additional \$1,080,000 in accepted with modifications savings, \$220,000 in pending (Tabled) savings, and finally, \$4,330,000 in savings for items not in the original scope. The simple sum for all four categories is: \$5,972,000

SECTION 2 – INTRODUCTION

INTRODUCTION

Value Engineering (VE) analysis identifies the high cost areas of a project during the early design stages. The VE Study then determines less expensive alternative designs that can still be incorporated into the final design drawings and specifications without incurring large costs for redesign or major project delay. These VE proposals are substantiated with technical and economic analyses.

This *Final Report* includes:

- A list of the Review Board members.
- A summary of cost savings as a result of the study.
- A summary of accepted proposals.
- The documentation of the Review Board's reasoning.
- A summary of the rejected proposals will also be included in the Final Report and will include the reason(s) for their rejection. The reasons may include cost-effectiveness, reliability concerns, unusual operation and maintenance problems, or project delays.
- The contents of the *Preliminary Report*.

PROJECT DESCRIPTION

Project Narrative

In 1997 CDOT began addressing congestion on I-25 between South Academy Boulevard and SH 105 (Monument Interchange). In the fall of 2004 the I-25 Environmental Assessment (I-25 EA) was completed and identified the need for capacity improvements within the afore-mentioned segment of the I-25 corridor.

The I-25 North Design Build project purpose is to increase capacity by providing a minimum of 6 through lanes for I-25 north of Colorado Springs from the Woodmen Interchange (Exit 149) to Interquest Parkway (Exit 153). CDOT's desired ultimate goal is to provide 8-lanes through Colorado Springs to north of the Briargate Parkway Interchange (Exit 151) and 6-lanes north to Monument Interchange (Exit 160) consistent with the I-25-EA.

Key Elements of the project include:

- I-25 EA Commitments
- Project Goals
- Additional Lane in Each Direction
- Auxiliary Lanes Between Interchanges (Woodmen Rd to Interquest Pkwy)
- Sign Structures
- Drainage
- Permanent Water Quality Features.

During the month of October 2009 CDOT, FHWA, and the United States Air Force Academy met to establish goals for the I-25 North Design Build Project. From the meeting the following goals were established and adopted by the CDOT Senior Management. These prioritized goals were established for the purpose of developing the I-25 North Design Build Project Proposal.

- 1) Alleviate corridor congestion with expansion and augmentation of other transportation elements
- 2) Minimize the effects of the project to the surrounding natural environment.
- 3) Reduce project impacts on travelers
- 4) Complete the Project by November or December 2013

Majority of the CDOT I-25 North Design Build Project is on an easement from the United States Air Force Academy (USAFA). The USAFA was a cooperating agency in the development of the I-25 EA. The I-25 EA mentions the USAFA concerns and commitments that need to be followed for any improvements to I-25 on USAFA property. The concerns are briefly mentioned below and more detailed information can be found in the I-25 EA regarding commitments to these listed concerns:

- Security Concerns
- Visual Impacts
- Airspace Issues
- Historic Issues
- Threatened and Endangered Species
- Wildlife and Vegetation
- Safety Concerns
- Ackerman Overlook
- Multi-Use Trails
- Noise
- Water Resources
- Construction Impacts

The project budget is \$36 million dollars and the intent of CDOT is to maximize the \$36 million to maximize the goals of the project. Utilizing a two-step selection process, one design/build team will be selected for the project based on a Best Value approach. CDOT is committed to providing, at a minimum, an additional lane and auxiliary lanes from Woodmen Interchange to north of the Interquest Interchange. It is requested the VE Team explore how far the I-25 North Design Build Project could extend beyond the Interquest interchange with the \$36 million.

The Value Engineering Study is also being requested to develop scenarios for widening I-25 from Interquest Interchange to the Monument Interchange for the purpose of identifying future projects.

Focus Areas for the VE Team

- Cost Savings to maximize the \$36 million
- Widening I-25 from Woodmen, 6-lanes w/ auxiliary lanes, to Interquest.
- Correcting super elevation with reconstruction vs. widen and overlay
- Split profile vs. matching NB and SB profiles
- Can the improvements extend beyond Interquest Interchange?
- Pavement - widen and overlay vs. full reconstruction using HMA or PCCP
- Request for Proposal & Technical Requirements
- Traffic Control Phasing
- Identifying risks that may impact project schedule
- Widen or replace bridges at Black Squirrel Creek and Northgate Interchange?
- Explore options for modifying existing culverts
- Ramp metering vs. adding auxiliary lanes
- Maintain existing Ackerman Overlook, while modifying existing on/off ramps

Unchangeable Items for the VE Team – “Sacred Cows”

The term “sacred cows” refers to the constraints on the project where alternatives most likely will be prohibitive, for example, because of time constraints, undesirable traffic congestion or right-of-way restrictions.

- Hold all improvements within the existing USAFA lease and existing ROW for the current project (phase 1). Due to time limitations, it is anticipated that CDOT will not be able to acquire additional easements or ROW for the first phase of the project. The first phase of the project will include widening from Woodmen to Interquest but could go as far as Monument if funding allows. ROW could be considered for phase 2 which may extend from the limit of phase 1 to the County line Interchange.
- Hold impacts to areas designated in the Prebles Meadow Jumping Mouse (PMJM) Biological Opinion and Assessment (BA/BO). The BA/BO will be provided in the technical documentation.
- Keep all current lanes open to traffic during all times with the general exception of 9 PM to 5:30 AM. During this time, traffic may be reduced to one lane in each direction.
- Widening alternatives must fit under/over the existing bridges at Pine Creek (over), Academy Blvd (under), Briargate (under), and Interquest (under).
- All interchanges and ramps must remain open to traffic during construction.
- Keep to current I-25 North Design-Build project schedule
- I-25 EA commitments

CDOT Provided Technical Package

- I-25 EA with Technical Memos
- FONSI
- Biological Assessment & Biological Opinion
- I-25 EA Concept Plans (plan sheets and cross sections)
- DRAFT Request for Proposal
- Tentative I-25 North Design Build Schedule
- As-Built Construction Plans
- ROW Plans
- Material Reports
- Cost Estimates
- AutoCAD drawings (if available)

ORGANIZATION

VE STUDY TEAM

The following individuals were members of the VE Team:

TEAM MEMBER	FIRM	TELEPHONE/E-MAIL
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THE REVIEW BOARD

The Review Board is comprised of the following representatives.

REVIEW BOARD

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The reviewers decided upon the status of the VE proposals in one of four ways:

1. Accept the proposed alternative as it stands. This will require the design team to implement the accepted proposed alternative. Those individuals comprising the Review Board are expected to have this authority for their respective organization.
2. Accept the proposed alternative with modifications. This disposition is similar to item 1 but with some changes imposed by the Review Board.
3. Decline the proposed alternative altogether. This disposition is obvious, but proper reasoning must be given for the *Final Report*.
4. Table (defer) the proposed alternative for further study or information gathering. If a proposed alternative is tabled, it is wise to assign responsibilities to resolve the issue(s), assign a schedule for resolution, and design a decision tree.

METHOD OF THE VE STUDY

VALUE ENGINEERING PROCESS

1. Information Phase

Each VE Team Member was given the plans, specifications, and cost estimate information for the project prior to the workshop. They were given instructions to familiarize themselves with the project prior to an oral briefing to be given by the owner and the designer. The facilitator asked that the design team start with a very broad overview of the project (the exact phrase used was “satellite view”) of the project with concentration on purpose and need for the project. The facilitator then asked the design team to start to gradually cover the project in increasing detail (the phrase used was “airplane view” down to “feet on the ground” view). The facilitator encouraged the other VE Team members to ask very open ended questions.

2. Function Analysis Phase

The next activity done by the VE Team was to review previous highway Function Analysis Technique (FAST) Diagrams. This was done rather than creating one from anew because of time constraints. The FAST Diagram forces an analytical team to look at a project with a fresh outlook. For example, if a technical group was given the assignment to improve a heating/ventilating/air conditioning system (HVAC) system for an office building they could ideate the numerous common systems, e.g., dual duct, variable air volume, multi-zone, etc. However, the phraseology of the problem has already limited the group’s thinking to a mechanical system.

By using function analysis to analyze the HVAC system the VE Team would brainstorm the function “control temperature”. This forces the team to broaden the number of possible solutions thus increasing the odds of achieving an improved solution. For example, by brainstorming the function “control temperature” the study team can look at insulation levels, fenestration schemes, thermal storage, reflective roofing, building axis orientation, landscaping, etc. By using the FAST Diagram the study team has been forced to abandon the paradigm of solely using a mechanical system to control temperature.

This VE Team then selected five functions that it felt covered 80% of the project cost. These functions are listed in Sections 6 & 7 of this report.

3. Creative Phase

The VE Team selected the functions for brainstorming per Pareto’s Law, i.e., the 20% of the functions that drive 80% of the project. The formal brainstorming session generated as many alternative methods as possible for achieving the selected functions. These were then segregated by two categories, Value Engineering Proposals (ideas that have the potential to save life-cycle costs), and Supplemental Recommendations (ideas that would improve the project, but don’t easily fit into either of the previous category).

4. Analysis Phase

A rough analysis was performed by first passing or failing the brainstormed ideas, then combining or grouping similar ideas. The VE Team as a whole then discussed and recorded the relative advantages of the original concept versus the advantages of the alternative plus the risks of implementing the alternative concept. The ideas surviving these discussions were selected as candidates for further development by individual team members.

5. Development Phase

A cursory technical examination followed the analysis phase. The purpose of this examination was to see if the alternative was indeed technically viable and to better explain the alternative to the design team. An order of magnitude economic analysis of technically feasible alternatives was also made. The economic analysis was done on a life-cycle basis where appropriate. The VE Team tried to use the same base cost data as used by CDOT so that a proper comparison could be made with the original concept(s). Ideas that passed these technical and economic analyses and, in the opinion of the VE Team should be incorporated into the design, were prepared as formal proposals.

The VE Team also prepared Supplemental Recommendations. These recommendations are ideas that the VE Team thought would add worth to the project but would not necessarily save capital or future costs. The Supplemental Recommendations were not necessarily priced.

6. Presentation & Implementation Phases

All proposals, supplemental recommendations, and ideas that were analyzed but not proposed were recorded during the VE Study and were compiled to in a *Preliminary Report* presented to the Review Board for their consideration. The Review Board made its decisions on the Proposals and Supplemental Recommendations dispositions subsequent to the VE Team's presentation. The *Final Report* was prepared after the Review Board's decisions were transmitted to the facilitator.

SECTION 3 – PROPOSALS

VALUE ENGINEERING PROPOSAL NO. 01-017

SUMMARY PROPOSAL DESCRIPTION:

Provide Hard Shoulder Running (HSR) in lieu of adding additional through travel lanes.

Estimated potential savings:

Initial:	\$ 220,000
Future:	\$ 0,000
Total:	\$ 220,000

Additional Description:

HSR utilize the highways shoulders as a travel lane during peak demand hours. Shoulders may also be utilized by high occupancy vehicles (HOV), transit, or tolled vehicles.

Related Value Engineering Proposals and/or Supplemental Recommendations:

- [P05-002](#) - Construct all the roadway, shoulders, and auxiliary lanes from the median toward the outside.
- [P01-011](#) - Widen the existing 2-foot to 4-foot inside shoulders to 12 feet along NB I-25 from Black Squirrel Creek to Baptist Road, in lieu of adding lanes. Also upgrade ramp geometry at Northgate to reduce the impact that ramp traffic has on mainline I-25.

EVALUATION
Idea Number: 01-017 Idea Description: Provide Hard Shoulder Running (HSR) in lieu of adding additional through travel lanes.
Advantages of alternative concept: 1. Cost savings. 2. Utilizes more existing infrastructure. 3. Increases capacity during peak hours and special events.
Advantages of original concept: 1. Consistent with driver expectancy throughout the region. 2. Provides for a safe "standard" design consistent with current practices.
Risks of implementing alternative concept: 1. May not be consistent with EA preferred alternative.

Calculations and/or Discussion:

The capacity of a road is often defined as the maximum number of vehicles that can pass a point in a given time, usually measured in vehicles per hour. The 'hard shoulder' is an additional surfaced area of a highway, usually 14 feet wide, adjacent to the through travel lanes, that serves a number of purposes:

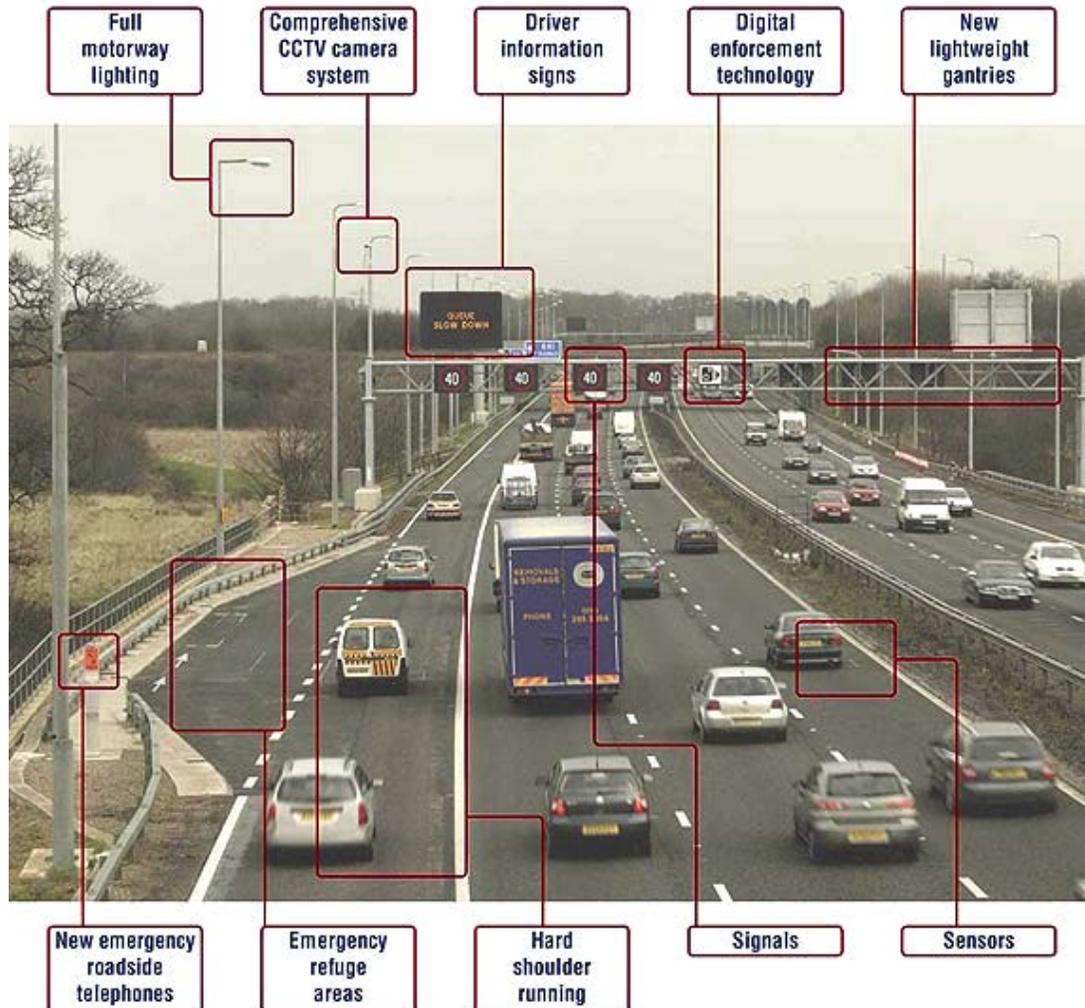
- as an emergency refuge
- as a space to perform lateral avoidance maneuvers
- and as a temporary extra lane during road maintenance.

It may also assist in relation to achieving the desired horizontal sight distances and road structural support.

'**Hard Shoulder Running**' (HSR), however, implies that this additional road space is used to carry through-traffic rather than acting as an emergency reserve, thereby increasing the overall capacity of the roadway. The shoulders can be on either the inside or outside of the roadway depending on the application and specific conditions.

The road network is characterized by periods of peak demand, outside of which there is often spare capacity. A main objective of HSR would be to increase road capacity during peak-hour times as an alternative to building new roads, and with relatively small investment in infrastructure. This extra capacity can be utilized on specific users, that may include; paying travelers (toll facility), High Occupancy Vehicles (more than one person in the vehicle), or the general traveling public. Though the ability to convert a shoulder to a travel lane sounds simple and inexpensive, there are many appurtenances to make the facility operate efficiently and safely, which can be expensive from a capital standpoint and also includes long-term maintenance considerations and cost. Depending on the application and expectation of the facility, significant investments are often required in the owners ITS along with the components related to the HSR application, including monitoring, enforcement, maintenance and

emergency response. The photo below illustrates the components of a typical HSR. This specific example shows an “outside shoulder” application. Along North I-25 an “inside shoulder” application may be more appropriate due to the close proximity of interchanges along the corridor.



The US Department of Transportation has recently produced a summary report on previous and new research analyzing the benefits of converting the hard shoulder to a running lane. The research outlined mixed results, with one freeway segment experiencing statistically significant increases in accident rates, and others significant reductions. However, in the USA, most hard shoulder conversions have been to HOV lanes, resulting in greater speed differentials between HOV and all other lanes during congested periods. These speed differentials do not exist in most European HSR, as the hard shoulders are typically opened only during periods of heavy congestion and are for use by all vehicles, regardless of occupancy levels. Results from US research are, therefore, of limited use in investigating the appropriateness of HSR in the case of the North I-25. In previous research studies, ‘success’ of HSR schemes have been measured using a number of parameters, often relating to accident occurrence and

highway safety. Furthermore, even after detailed cost-benefit analyses, many of the results obtained within research papers are stated as not statistically significant, and there are no standard parameters used to measure (likely) 'success'. Additionally, an element of uncertainty exists in research into the potential for, and success of, HSR schemes throughout the country.

Recent Research Findings 'Supporting' HSR

1. Congestion frequency fell by between 68% and 82% and average car speeds (same traffic volume) rose by 9%
2. Slight decrease in most relevant accidents
3. Congestion-induced accidents dropped considerably
4. Best cost-benefit relationship achieved with hard shoulder open only under high traffic volumes, with a reduced speed limit and variable message signs

Research Findings 'Against' HSR

1. Hard shoulder conversions may decrease upstream accident frequencies, but lead to increases within and downstream as a result of bottleneck relocation
1. The increasing accident rate with emergency bays far exceeds the infrastructure and user cost savings
2. Abandonment of emergency lanes on motorways in Austria will not benefit national economy when flow exceeds 10,000 vehicles per day
3. 33% increase in accident rate can be expected on highways without an emergency lane

Summary

Strengths: Congestion relief; economic, and resource benefits; potential for accident reduction as a result of traffic flow regulation; fewer merge and diverge traffic maneuvers.

Limitations: Emergency access; breakdown safety; altering the role of the hard shoulder; ITS reliability; 'cheap' investment; driver compliance; driver confusion and habitual behavior; overhead signage confusion; other causes of confusion; increased driver stress levels; HSR relationship with demand management.

Due to the relatively high hourly volumes experience for most of the day, HSR along the North I-25 corridor may not be ideal and may not be an ideal substitution of the currently planned conditions along this stretch of I-25. The HSR application, however, may be considered in conjunction with the planned improvements to the north of the Base Case Conditions potentially utilizing existing shoulders and adding the ITS components. CDOT may choose to implement HSR lanes connecting the planned improvements (North Academy Blvd. to Black Squirrel Bridges) to either Northgate or Baptist Road (northbound and/or southbound) depending on available funding and the need.

VALUE ENGINEERING PROPOSAL NO. 01-008

SUMMARY PROPOSAL DESCRIPTION:

Maximize construction to the outside areas of the existing roadway.

Estimated potential savings:

Initial:	\$ 1,080,000
Future:	\$ 0,000
Total:	\$ 1,080,000

Additional Description:

This idea is for consideration in the RFP. The fully analyzed costs to this project are difficult to calculate at this stage of design.

Related Value Engineering Proposals and/or Supplemental Recommendations:

[P05-001](#) - Construct all the roadway, shoulders, and auxiliary lanes from the median toward the outside.

EVALUATION
Idea Number: 01-008
Idea Description: Maximize construction to the outside areas of the existing roadway.
Advantages of alternative concept: 1. Reduces construction traffic control costs.
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. Increases the amount of earthwork in some areas. 2. Would require more difficult median construction in the future.

Calculations and/or Discussion:

Assume construction costs to be approximately \$27,000,000 of the \$36,000,000 budget.

Traffic control costs while working behind concrete barriers typically average about 8% of construction total costs or \$2,160,000 for projects having median and shoulder construction.

Traffic control costs while working behind concrete barriers typically average about 4% of construction total costs or \$1,080,000 for projects having only shoulder construction.

If the widening is constructed to the outside a cost saving of approximately \$1,080,000 may be realized.

VALUE ENGINEERING PROPOSAL NO. 05-002

SUMMARY PROPOSAL DESCRIPTION:

Switch from a 12-foot inside shoulder to a 10-foot inside shoulder north of Briargate.

Estimated potential savings:

Initial:	\$ 200,000
Future:	\$ 0,000
Total:	\$ 200,000

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

- [P01-011](#) - Widen the existing 2-foot to 4-foot inside shoulders to 12 feet along NB I-25 from Black Squirrel Creek to Baptist Road, in lieu of adding lanes. Also upgrade ramp geometry at Northgate to reduce the impact that ramp traffic has on mainline I-25.
- [P01-017](#) - Provide Hard Shoulder Running (HSR) in lieu of adding additional through travel lanes.

EVALUATION
Idea Number: 05-002 Idea Description: Switch from a 12-foot inside shoulder to a 10-foot inside shoulder north of Briargate.
Advantages of alternative concept: 1. Saves cost
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.

Calculations and/or Discussion:

This option reduces the shoulder width from 12' to 10' for I-25 north of Briargate. The desired shoulder width for an urban setting is 12'. A 10' shoulder is an acceptable width and this area of road is considered a transitional area from urban to rural.

The 2' reduction in the shoulder width provides a savings of \$45,000 per mile for one shoulder. The quantities are calculated for a 2' width of shoulder.

159 tons of SMA at \$75/ton = \$12,000
382 tons of HMA at \$50/ton = \$19,000
351 tons of ABC at \$25/ton = \$9,000

Say \$5,000 per mile for earthwork

VALUE ENGINEERING PROPOSAL NO. 01-047

SUMMARY PROPOSAL DESCRIPTION:

Realign southbound I-25 toward the median to accommodate Ackerman Overlook.

Estimated potential savings:

Initial:	\$ (66,000)
Future:	\$ 0,000
Total:	\$ (66,000)

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-047 Idea Description: Realign southbound I-25 toward the median to accommodate Ackerman Overlook.
Advantages of alternative concept: 1. Allows Ackerman Overlook to remain operational in its existing location until the planned future relocation to the north
Advantages of original concept: 1. Relocation of the overlook would eliminate the weave conflict between the overlook on-ramp and the Briagate off-ramp 2. After relocation of the overlook, the freeway would be on a tangent section as opposed to having an inexplicable reverse curve in the alignment (i.e. lane stripping for maintenance just south of Woodmen interchange)
Risks of implementing alternative concept: 1. Nonenoted.

Calculations and/or Discussion:

This proposal considers realigning southbound lanes toward the median at the Ackerman Overlook segment in the proposed alternative. This would allow the existing Ackerman Overlook to remain operational in its current location until the ultimate corridor section is constructed in the future.

Several complications arise when considering this option:

1. The existing median sign structure at station 1117+00 conflicts with the southbound realignment. The maximum realignment possible toward the median is less than 8'. The option, therefore, requires exit ramp and entrance ramp construction along with the construction's associated earthwork or relocation of the median sign structure.
2. The weave distance between the Ackerman on ramp gore point and the Briagate off ramp gore point is approximately 2,000 feet.
3. Existing ground outside the roadway envelope from station 1102+00 to station 1111+00 slopes steeply away from the edge of roadway. Widening for the ramp construction and associated acceleration lanes would need to tie into these steep slopes.
4. There is an existing roadside highway sign just to the south of the overlook that would be in conflict with the ramp and associated acceleration lane construction.
5. The improvements required would be temporary improvements given the planned overlook relocation to the north in the future.

CDOT should consider the relocation of the Ackerman Overlook to the EA Proposed Action location versus relocating to the future USAFA Visitor Center at Northgate.

I-25 North Design Build IM C040-029 (17354) DRAFT Engineers Estimate without ARE's HMA Widening & Overlay - Woodmen to North of Interquest I-25 realignment at Ackerman Overlook to inside						
						
Item	Description	Est. Qty	UNIT	Unit Price	Total Price	
202	Removal of Asphalt Mat (Planing)(6-inches)(Woodmen to Academy)		SY	\$4	\$0	
202	Removal of Asphalt Mat (Planing)(2.5-inches)(Academy to Interquest)		SY	\$3	\$0	
203	Embankment (CIP)	1,200	CY	\$10	\$12,000	
210	Reset Ground Sign	3	LS	\$1,000	\$3,000	
212	Native Seeding		LS	\$80,000	\$0	
304	ABC Class 6 (6-inches)	410	Ton	\$25	\$10,250	
403	HMA (6-inch overlay)(Woodmen to Academy)		TON	\$50	\$0	
403	SMA (2.5-inch overlay)(Academy to Interquest)		TON	\$75	\$0	
403	HMA (6-inches)(Full Depth)	429	TON	\$50	\$21,450	
603	Drainage		LS		\$0	
603	Concrete Box Culvert		LS		\$0	
603	Temporary/Permanent Water Quality		LS		\$0	
606	Guardrail		LS		\$0	
614	Signing		LS		\$0	
627	Striping		LS		\$0	
630	Traffic Control		LS		\$0	
700	Minor Contract Revisions (5% items)		LS		\$2,335	
603	6 x 4 CBC PMJM Crossing - 365 LF		LS	\$160,000.00	\$0	
					Sub-total	\$49,035
					CDOT CE 17.45 %	\$8,557
					Design 7%	\$3,432
					Env./Utilities 5%	\$2,452
					Contingency 5%	\$2,452
					Estimated Total	\$65,928
					Use:	\$66,000.00

VALUE ENGINEERING PROPOSAL NO. 01-010

SUMMARY PROPOSAL DESCRIPTION:

Using the existing bridges at the Northgate interchange defers the replacement of the Northgate interchange bridges for a future project.

Estimated potential savings:

Initial:	\$ 4,000,000 ¹
Future:	\$ 0,000
Total:	\$ 0,000

Additional Description:

This proposal defers the replacement of the Northgate interchange bridges for a future project. The future project would likely have a similar timing to the Powers Blvd. interchange.

¹The bridges are not part of the base configuration. The design build summary sheet shows the bridge replacement estimated at \$4,000,000.

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-010 Idea Description: Using the existing bridges at the Northgate interchange defers the replacement of the Northgate interchange bridges for a future project.
Advantages of alternative concept: 1. This would defer the bridge replacement and it could be designed in the future to be compatible with the new Powers Blvd. interchange.
Advantages of original concept: 1. None noted
Risks of implementing alternative concept: 1. Future funding for the bridge and timing with the Powers Blvd. project.

Calculations and/or Discussion:

The Northgate interchange is outside the limits of the base configuration. This proposal will work in conjunction with other roadway changes that will occur if funding allows as discussed in SR01-035 (Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy. and North Academy Blvd.).

The existing northbound I-25 Northgate Bridge has a clear width between the rails of 54' and currently carries two through lanes and a ramp lane. The current plan for the project is to eliminate the ramp lane on the bridge and use the existing ramp north of the existing bridge to enhance the safety of the interchange. The existing bridge would remain in service and be striped for three through lanes with 8' and 10' shoulders. Utilizing the existing structure built in 1958 defers its replacement, which has the advantage of being more flexible to work in conjunction with the future Powers Blvd. interchange.

The existing southbound I-25 Northgate Bridge has a clear width between the rails of 54' and currently carries two through lanes and a ramp lane. The desired configuration with three through lanes, a ramp lane and shoulders (10' and 8') requires a 66' section. The existing structure will need to be widened by 12'. Several of the scenarios for the project are to complete northbound I-25 north of Interquest Parkway as far as possible. Depending on the scenario no work may occur at the southbound Northgate Bridge, since it is north of Interquest.

Southbound Northgate bridge widening cost is approximately \$450,000.

$$189' \times 12' = 2,268 \text{ sf at } \$200/\text{sf}$$

VALUE ENGINEERING PROPOSAL NO. 01-011

SUMMARY PROPOSAL DESCRIPTION:

Widen the existing 2-foot to 4-foot inside shoulders to 12 feet along NB I-25 from Black Squirrel Creek to Baptist Road, in lieu of adding lanes. Also upgrade ramp geometry at Northgate to reduce the impact that ramp traffic has on mainline I-25.

Estimated potential savings:

Initial:	\$ 300,000
Future:	\$ 1,000,000
Total:	\$ 1,300,000

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

- [P01-017](#) – Provide Hard Shoulder Running (HSR) in lieu of adding additional through travel lanes.
- [P05-002](#) - Switch from a 12-foot inside shoulder to a 10-foot inside shoulder north of Briargate.

EVALUATION

Idea Number: 01-011

Idea Description: Widen the existing 2-foot to 4-foot inside shoulders to 12 feet along NB I-25 from Black Squirrel Creek to Baptist Road, in lieu of adding lanes. Also upgrade ramp geometry at Northgate to reduce the impact that ramp traffic has on mainline I-25.

Advantages of alternative concept:

1. Wider shoulders would increase freeway capacity without having to add lanes
2. Would provide a more consistent area for breakdown vehicles

Advantages of original concept:

1. Provides greater capacity with three NB lanes

Risks of implementing alternative concept:

1. Capacity benefits may not suffice for long period of time, necessitating the need to come back and add the third lane
2. Solely widening the shoulders may be a hard sell to the public and they may not perceive much of a benefit

Calculations and/or Discussion:

Research has been performed and documented that shows that providing wide shoulders increases capacity. The degree to which capacity is increased is dependent on the width of the shoulders.

The Florida Department of Transportation (FDOT) has developed a Quality/Level of Service (LOS) Handbook that documents significant research on the capacity of arterial and freeway facilities, and municipalities and state agencies across the country refer to it when estimating planning-level freeway capacity. The FDOT manual rates paved shoulders as “High” in the table that chronicles “sensitivity on service volumes” for the purposes of estimating capacity.

The Federal Highway Administration (FHWA) produced a document with the following table:

Right-Shoulder Lateral Clearance (ft)	Reduction in Free-Flow Speed (mi/h)			
	Lanes in One Direction			
	2	3	4	≥5
≥6	0.0	0.0	0.0	0.0
5	0.6	0.4	0.2	0.1
4	1.2	0.8	0.4	0.2
3	1.8	1.2	0.6	0.3
2	2.4	1.6	0.8	0.4
1	3.0	2.0	1.0	0.5
0	3.6	2.4	1.2	0.6

Source: Mitigation Strategies for Design Exceptions, FHWA, Chapter 3 – The 13 Controlling Criteria; website: http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter3/3_shoulderwidth.htm

Although the table is specific to the right shoulder, the left shoulder on NB I-25 is fairly narrow and could be having a negative impact on capacity. Estimating from Google Maps, it was assumed that the existing left shoulder narrows to widths in the 2'-4' range; assume 3' and a reduced speed of 1.8 mph. Given the existing 65 mph posted speed, this would equate to a $1.8/65 = \sim 3\%$ reduction in capacity.

Assuming an average width of 3' from Interquest Parkway to Baptist Road, widening to a 12' shoulder would require 9' of widening. If the widening extended from Sta. 1210+00 to Sta. 1450+00, then we'd have 24,000 lineal feet of widening. At a 9' width, this would equate to 216,000 square feet of pavement. Comparatively, widening the roadway to the ultimate three northbound lanes would require roughly 25' of widening (based solely on the typical section), which would equate to 600,000 square feet of pavement. The resulting calculations are:

- 216,000 sf of pavement = 24,000 sy
- 600,000 sf of pavement = 66,667 sy
- At 110 lbs/sy, shoulders only = 2,640,000 lbs = 1,320 tons; ultimate widening = 7,333,333 lbs = 3,667 tons

Using the 6" HMA at \$50/ton and 2.5" SMA at \$75/ton, here are the costs of each alternative:

- Shoulders only = 1,320 tons = \$66,000 of HMA and \$99,000 of SMA = \$165,000
- Widening = 3,667 tons = \$183,350 of HMA and \$275,025 of SMA = \$458,375

Maintenance costs = \$14,000 per lane mile = \$14,000 per 63,360 sf

- Shoulders only = 216,000 sf. = \$47,727
- Widening = 600,000 sf. = \$132,576

LIFE CYCLE COST ANALYSIS				
PROJECT LIFE (IN YEARS): 20		INTEREST: 6.00%		
	ORIGINAL COSTS	ALTERNATIVE "A" COSTS	ALTERNATIVE "B" COSTS	ALTERNATIVE "C" COSTS
INITIAL COSTS:				
BASE COST:	\$458,375.00	\$165,000.00		
OTHER INITIAL COSTS:				
<i>SUBTOTAL INITIAL COSTS:</i>	\$458,375.00	\$165,000.00		
SINGLE EVENT FUTURE COSTS				
YEAR (from base year):				
COST:				
YEAR:				
COST:				
YEAR:				
COST:				
YEAR:				
COST:				
SALVAGE VALUE:				
<i>PRESENT WORTH OF REPLACEMENT COSTS:</i>				
ANNUAL COSTS				
MAINTENANCE COSTS:	\$132,576.00	\$47,727.00		
OPERATIONS COSTS:				
ENERGY COSTS:				
OTHER ANNUAL COSTS:				
<i>SUBTOTAL ANNUAL COSTS:</i>	\$132,576	\$47,727.00		
<i>PRESENT WORTH OF ANNUAL COSTS:</i>	\$1,520,636	\$547,424.93		
<i>NET PRESENT VALUE</i>	\$1,979,011	\$712,425		
<i>CAPITAL SAVINGS</i>		\$293,375		
<i>FUTURE SAVINGS</i>		\$973,211		
<i>TOTAL SAVINGS (original - alternative)</i>		\$1,266,586		

NOTE: Items in italics are calculated

VALUE ENGINEERING PROPOSAL NO. 01-006

SUMMARY PROPOSAL DESCRIPTION:

Use retaining walls for split profile in lieu of reconstruction.

Estimated potential savings:

Initial:	\$ Not Quantified
Future:	\$ 0,000
Total:	\$ Not Quantified

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

[SR01-026](#) - Provide additional wall performance criteria for the RFP.

EVALUATION
Idea Number: 01-006
Idea Description: Use retaining walls for split profile in lieu of reconstruction.
Advantages of alternative concept: 1. Use existing pavement grade for widen and overlay
Advantages of original concept: 1. Reconstruction would correct roadway superlevation to meet standards
Risks of implementing alternative concept: 1. Split profile may not allow for ultimate section

Calculations and/or Discussion:

Verify the ultimate can be constructed with the split profile. There is not enough information to determine if the ultimate section can be constructed with the split profile if the split profile was allowed to remain further investigation would have to be done at a later time. This would be done prior to releasing the proposal to the Design Build Teams.

If the RFP to the Design Build Teams allows the split profile, CDOT would also require the Design Build Team to verify the ultimate section can be built with the split profile.

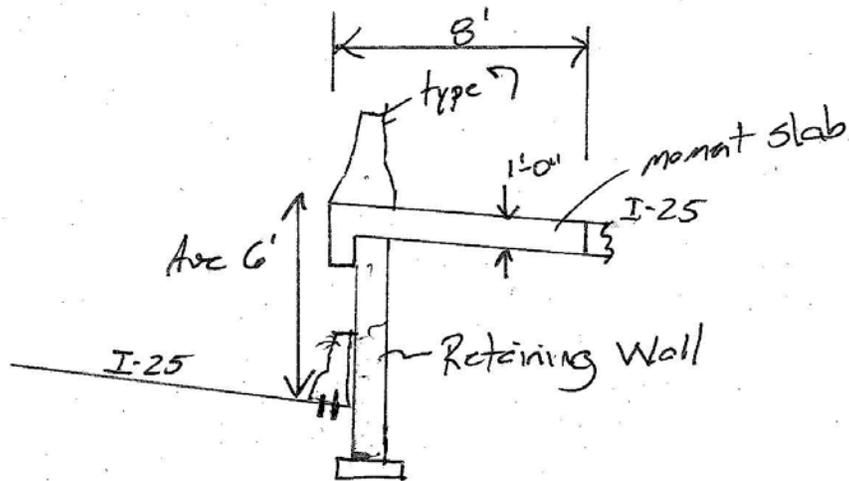
Wall location north and south of Academy Interchange. The wall would be approximately 7,400 feet in length with the limits approximately 1,700 feet south and 5,700 north of the Academy Interchange.

The cost of the wall could be more than matching profiles. Utilizing the cross-sections the average height of the wall was determined to be approximately 6-feet. The unit costs used are \$50 per square foot for MSE Walls and \$60 per square foot for Cantilever Wall. If the wall is constructed a moment slab would be required for the elevated roadway.

The cost of the moment slab is approximately \$1.4 million (see sketch) and would be added to the cost of the MSE and cantilever wall.

Total cost of MSE wall would be approximately $\$2.3M + \$1.4M = \$3.7$ million

Total cost of cantilever wall would be approximately $\$2.7M + \$1.4M = \$4.1$ million.



Concrete $7400' \times 8' \times 1' = 2200 \text{ cy} @ \$450/\text{cy} = \$990,000$
 Reinf. say $140 \text{ lbs/cy} = 308,000 \text{ lbs} @ \$1.25/\text{lb} = 385,000$
 type 7 Reil say $\$60/\text{LF}$

Total moment slab = \$1,400,000

Total Type 7 \$444,000

Conclusion

Further investigation would be needed to determine if the wall or reconstruction scenario is more cost effective. The existing super-elevation appears not to meet current design standards and to correct the super elevation will require reconstruction.

VALUE ENGINEERING PROPOSAL NO. 01-003

SUMMARY PROPOSAL DESCRIPTION:

Install a valley pan along outside shoulder to intercept and convey water quality and 100-year flows.

Estimated potential savings:

Initial:	\$ 330,000
Future:	\$ Positive
Total:	\$ 330,000+

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

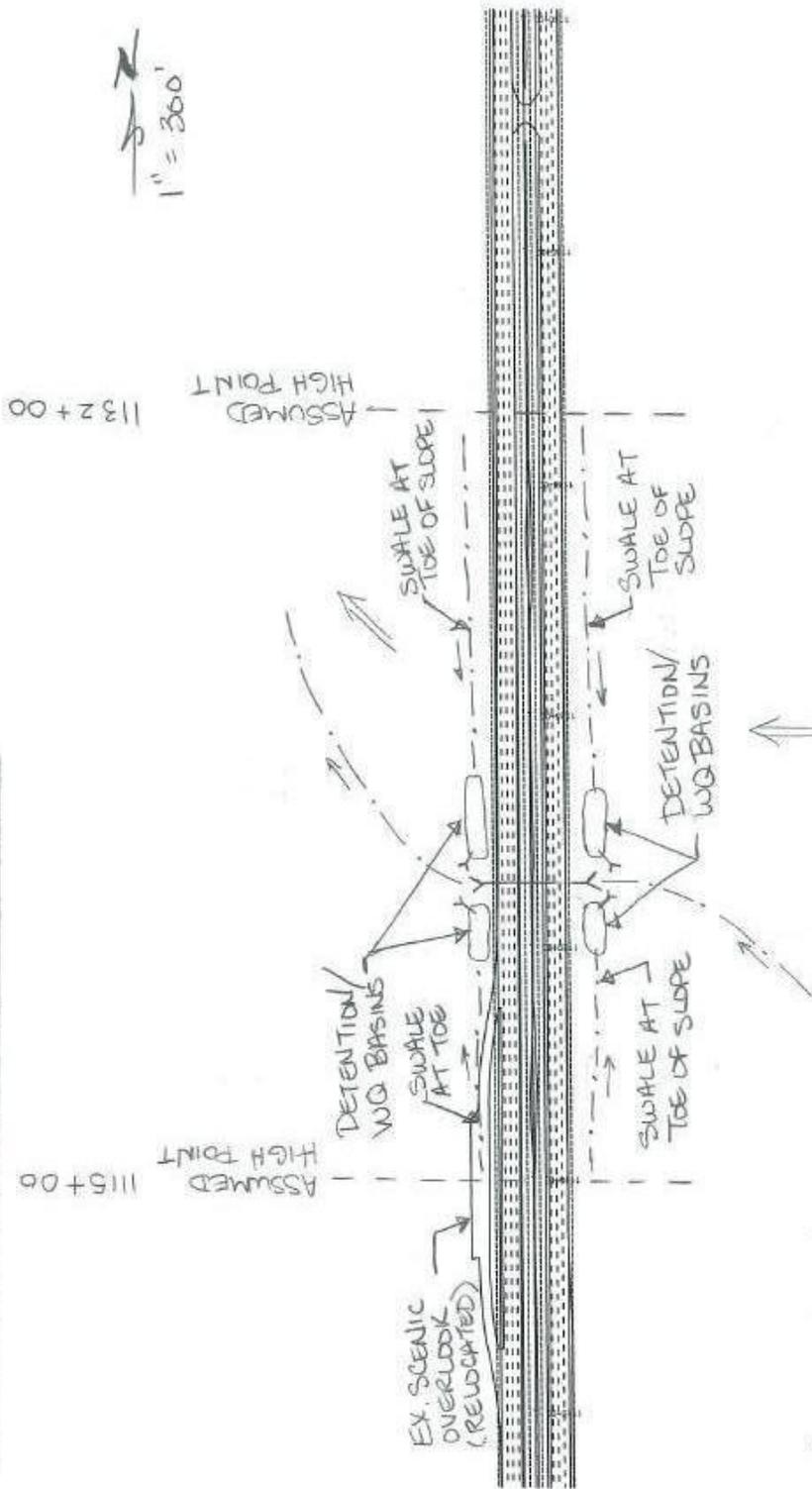
EVALUATION
Idea Number: 01-003 Idea Description: Install a valley pan along outside shoulder to intercept and convey water quality and 100-year flows.
Advantages of alternative concept: <ol style="list-style-type: none">1. Roadway runoff is isolated from offsite flow2. Roadway runoff is elevated up near shoulder elevation to better isolate and convey water to one treatment facility.3. Fewer detention/WQ facilities requiring less CDOT maintenance resources.4. Modified Gutter Type 2 12:1 side slopes do not cause a clear zone safety issue
Advantages of original concept: <ol style="list-style-type: none">1. Potentially shorter tie in to toe of slope2. No storm sewer3. Easier to build safety edge
Risks of implementing alternative concept: <ol style="list-style-type: none">1. Maintenance force concerns about using v-pan along outside shoulder

Calculations and/or Discussion:

Original Concept: Allow runoff to sheetflow off roadway, down the embankment, and be conveyed towards a cross drainage in swales along the toe of slope. Swale flows are conveyed in four separate detention/water quality (WQ) basins before discharging toward the drainageway.

Alternative Concept: Install valley pan along outside shoulder to capture/convey water quality and 100-year flow above ground. Inlet and cross pipe convey flows to a single detention/WQ basin before discharging into the drainageway.

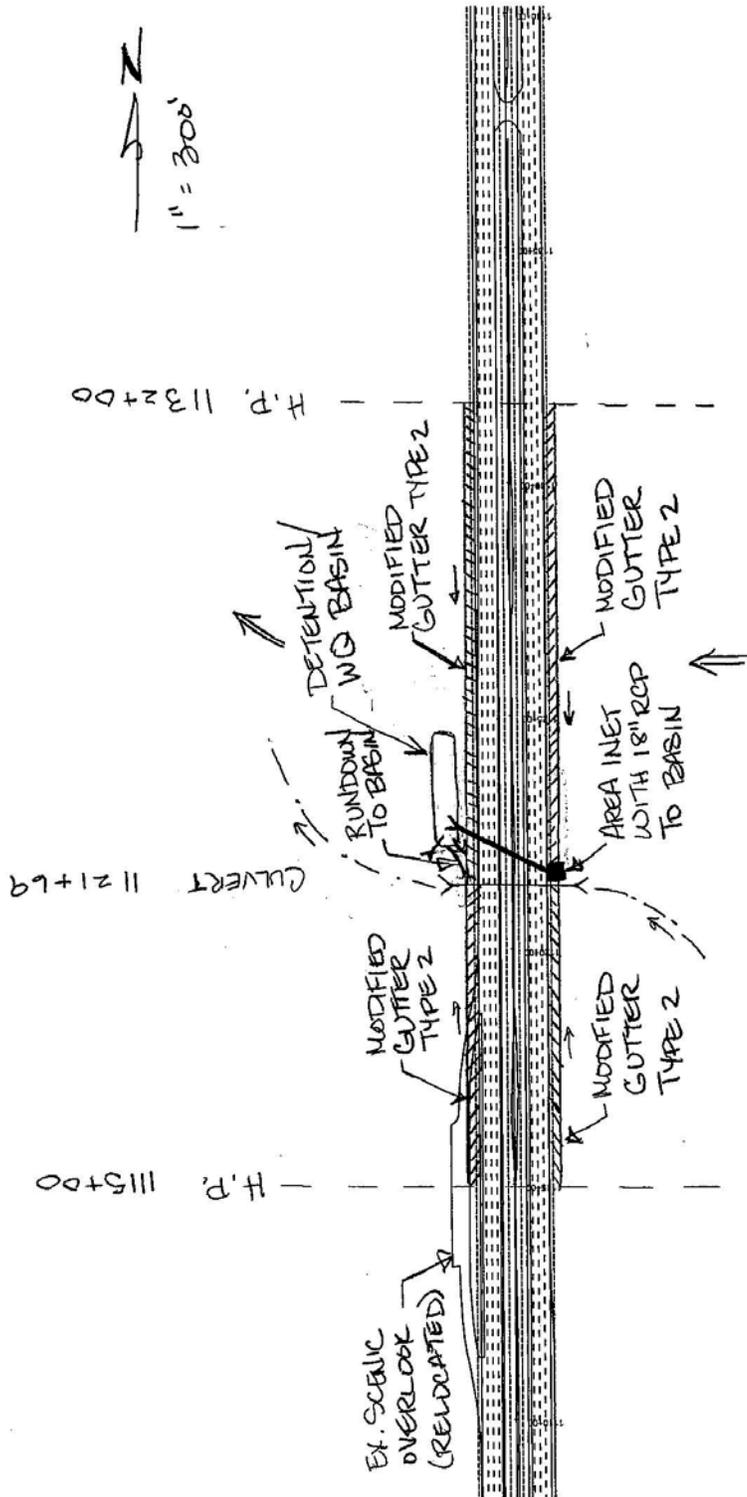
ORIGINAL CONCEPT - ROADSIDE SWALES



ASSUMPTIONS

- SAG IN HWY AT CULVERT
 - LONGITUDINAL SLOPE = 2%
 - BRIARWOOD TO INTERQUEST CROSS SECTION
1103+00 TO 1140+00 WITH 2% CROSS SLOPE
 - SCENIC OVERLOOK RELOCATED
- PREVAILING DRAINAGE SLOPES EAST TO WEST
 - ADEQUATE ROW FOR SWALE AND DETENTION/WQ BASINS

ALTERNATIVE CONCEPT - ONLY TREATING ADDED IMPERVIOUSNESS



ASSUMPTIONS

- SAG IN HWY AT CULVERT
- LONGITUDINAL SLOPE = 2%
- BRIARWOOD TO INTERQUEST CROSS SECTION 1103+00 TO 1140+00 (NO HOV LANES) WITH 2% CROSS SLOPE
- SCENIC OVERLOOK RELOCATED
- PREVAILING DRAINAGE SLOPES EAST TO WEST
- MODIFIED GUTTER TYPE 2, SHOULDER AND 4' OF OUTSIDE LAKE CAPACITY = 7.8 CFS
- TREATING ONLY ADDED IMPERVIOUS AREA = 37 SF/LF $\Rightarrow Q_{100} = 0.73 \text{ CFS} / 100 \text{ LF}$

MODIFIED GUTTER TYPE 2

← 4' → ← 2' → ← 8' SHOULDER → ← 4' OF LANE →



6' MOD. PAN (ABOVE) (2% LONG. SLOPE)

$$Q_{CAP} = 7.79 \text{ cfs}$$

PAN REACHES CAPACITY AFTER = 461 FT

Conceptual Cost Estimate

Original Concept:

Swales at toe of slope to convey to 4 separate detention/WQ basins

Item	Approx. Quantity	Units	Unit Cost	Subtotal
Swale at Toe	3100	CY	\$ 15	\$ 46,500
Small Detention/WQ Basin*	4	EA	\$ 30,000	\$ 120,000
TOTAL				\$ 166,500

* Includes Excavation, Outlet Structure, Outlet Pipe, Overflow Weir, Maintenance Access

Alternative Concept:

Valley Pan along outside shoulder (treating added impervious area only)

Item	Approx. Quantity	Units	Unit Cost	Subtotal
Modified Gutter Type 2 (Valley Pan)	3400	LF	\$ 25	\$ 85,000
Area Inlet	1	EA	\$ 4,000	\$ 4,000
18" RCP	170	LF	\$ 40	\$ 6,800
Large Detention/WQ Basin*	1	EA	\$ 40,000	\$ 40,000
TOTAL				\$ 135,800

* Includes Excavation, Outlet Structure, Outlet Pipe, Overflow Weir, Maintenance Access

Overall Project Costs

Original Concept	\$	518,000 /Mile
Alternative Concept	\$	422,000 /Mile
Difference in Cost	\$	(96,000) /Mile

Total Cost to Project

Miles of Roadway with Valley Pan 3.5 Miles

Project Cost Difference \$ (336,000)

VALUE ENGINEERING PROPOSAL NO. 02-006

SUMMARY PROPOSAL DESCRIPTION:

Divert pavement runoff for water quality event into existing water quality basins near Pine Creek.

Estimated potential savings:

Initial:	\$ 25,000
Future:	\$ 0,000
Total:	\$ 25,000

Additional Description:

Of the three existing water quality basins considered for retrofitting, the only likely viable one is Basin ID WQ-1 and this results in a savings of \$25,000 (not \$85,000 shown in spreadsheet below). Widening to the outside shoulder will likely substantially impact the footprint of the other two existing basins making retrofitting not probable.

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION	
Idea Number: 02-006	
Idea Description: Divert pavement runoff for water quality event into existing water quality basins near Pine Creek.	
Advantages of alternative concept:	
1. Utilizes existing facilities constructed as part of COSMIX or another project.	
Advantages of original concept:	
1. Widening limits may encroach too much into existing facilities located along the outside shoulder requiring new facilities to be installed.	
Risks of implementing alternative concept:	
1. None noted.	

Calculations and/or Discussion:

Two conditions were developed for the water quality of the roadway drainage near Pine Creek: (1) Construct New Facilities and (2) Retrofit Existing Facilities. A summary of each and assumptions are discussed below, a summary table is provided, and some annotated plans are also included within this document.

Alternative 1 - New Facilities

It is assumed that the existing facilities would not be used and that an underground device such as a Vortech/Stormceptor or a water quality basin would be used to treat the water quality for the proposed roadway.

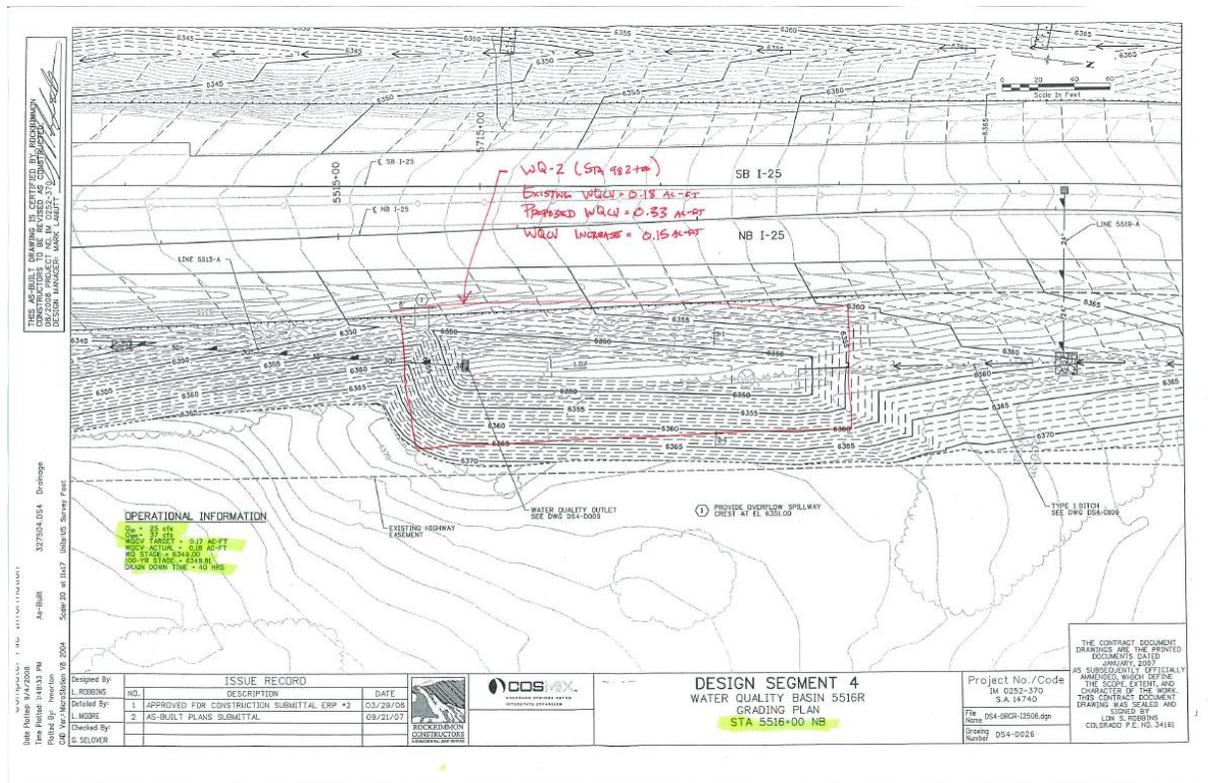
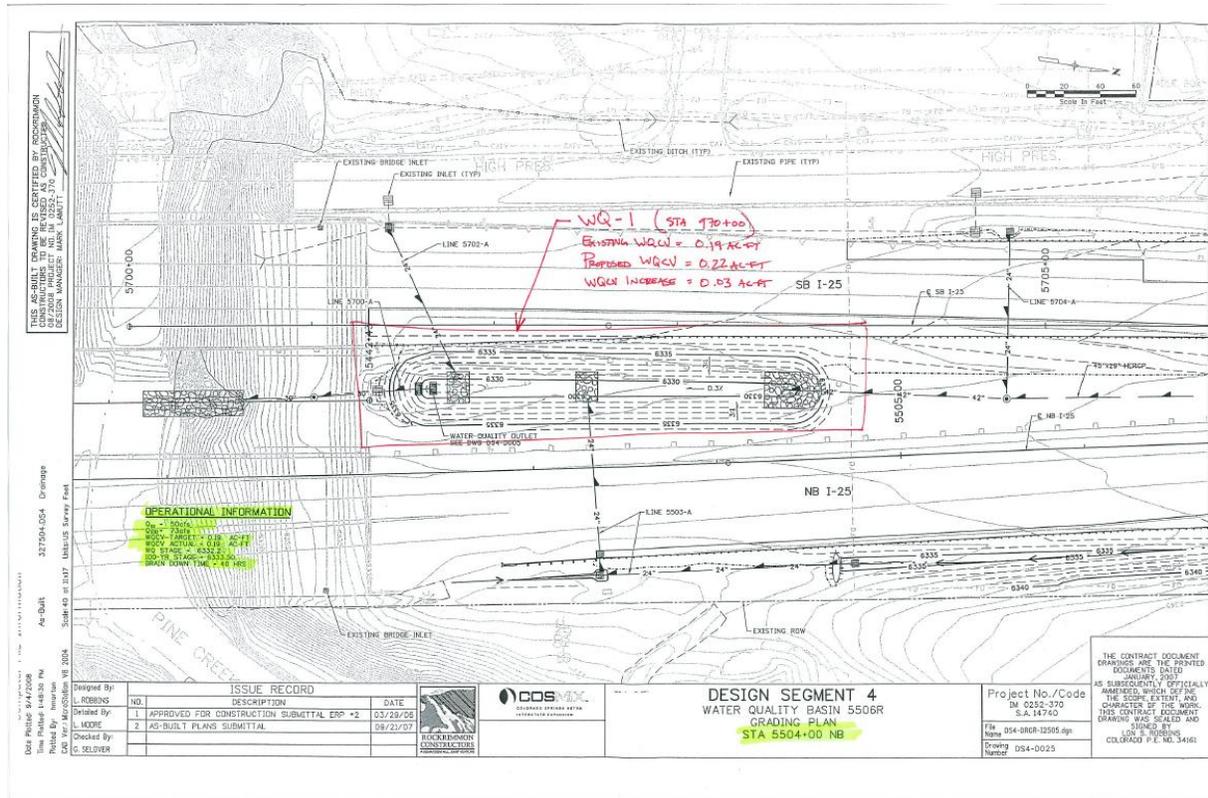
Alternative 2 – Retrofit

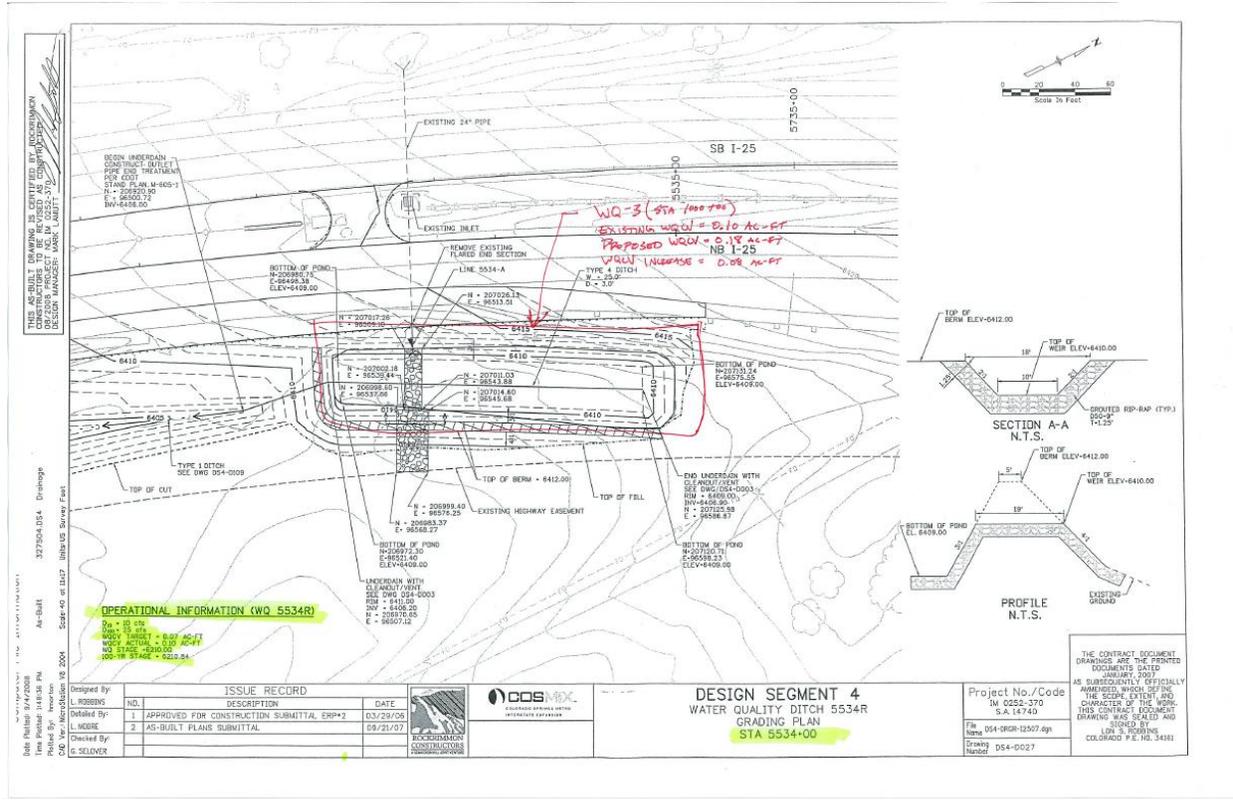
It is assumed that the proposed roadway widening would not affect the location of the existing facilities and thus the existing basins could be retrofitted. The costs include modifications to the orifice plate and minor grading to increase the basin size. Due to widening to the outside, WQ-1 is likely the only basin that could be retrofitted.

Alternative Summary Table

Basin ID	Sta	Existing WQCV	Proposed WQCV	WQCV Change	Alternative 1 - New Facilities	Alternative 2 - Retrofit	Difference
WQ-1	970+00	0.19	0.22	0.03	\$ 30,000	\$ 5,000	\$ 25,000
WQ-2	982+00	0.18	0.33	0.15	\$ 45,000	\$ 10,000	\$ 35,000
WQ-3	1000+00	0.10	0.18	0.08	\$ 30,000	\$ 5,000	\$ 25,000
Total					\$ 105,000	\$ 20,000	\$ 85,000

Note: Throughout the corridor, not just near Pine Creek, existing water quality basins should be utilized wherever they can.





VALUE ENGINEERING PROPOSAL NO. 01-031

SUMMARY PROPOSAL DESCRIPTION:

Improve corridor Intelligent Transportation System (ITS); for example signing, ramp metering, etc.

Estimated potential savings:

Initial:	\$ 2,000,000
Future:	\$ (1,100,000)
Total:	\$ 900,000

Additional Description:

This proposal includes the deferral of southbound auxiliary lanes, Woodmen to Interquest, due to use of ramp metering elements.

Related Value Engineering Proposals and/or Supplemental Recommendations:

[SR01-001](#) - Modify the ramp configuration at North Academy Blvd.

EVALUATION
Idea Number: 01-031 Idea Description: Improve corridor Intelligent Transportation System (ITS); for example signing, ramp metering, etc.
Advantages of alternative concept: <ol style="list-style-type: none">1. Provides lower initial cost when combined with 01-034, Defer SB auxiliary lanes.2. Allows Ackerman Overlook to remain without modification until future when combined with 01-034, Defer SB auxiliary lanes.
Advantages of original concept: <ol style="list-style-type: none">1. SB auxiliary lane is constructed.2. Ackerman relocated north approximately 2300'3. Traffic congestion is lowered due to increased capacity
Risks of implementing alternative concept: <ol style="list-style-type: none">1. Inflated costs by deferring improvements2. Driver expectations - first metered ramps in Colorado Springs3. Traffic impacts due to future construction mobilization and activities

Calculations and/or Discussion:

The proposal is to improve existing ITS components, such as cameras and VMS boards, and to provide additional ITS components to the corridor. Additional components include ramp metering.

The proposal is also combined with deferring southbound auxiliary lane improvements until a later year. For calculation purposes, the auxiliary lane improvements are deferred for 10 years.

I-25 North Design Build IM C040-029 (17354) DRAFT Engineers Estimate without ARE's HMA Reconstruction - Woodmen to North of Interquest Defer SB auxiliary lanes, include ITS improvements						
						
Item	Description	Est. Qty	UNIT	Unit Price	Total Price	
202	Removal of Asphalt Mat	270,000	SY	\$3	\$810,000	
203	Embankment (CIP)	120,000	CY	\$10	\$1,200,000	
212	Native Seeding	1	LS	\$80,000	\$80,000	
304	ABC Class 6 (6-inches)	117,810	Ton	\$25	\$2,945,250	
403	HMA (6-inches)	123,420	TON	\$50	\$6,171,000	
403	SMA (2-inches)	41,140	TON	\$75	\$3,085,500	
603	Drainage	1	LS	\$1,000,000.00	\$1,000,000	
603	Concrete Box Culvert	1	LS	\$300,000.00	\$300,000	
603	Temporary/Permanent Water Quality	1	LS	\$2,000,000.00	\$2,000,000	
606	Guardrail	1	LS	\$750,000.00	\$750,000	
614	Signing	1	LS	\$700,000.00	\$700,000	
614	Ramp Metering	3	LS	\$50,000.00	\$150,000	
627	Striping	1	LS	\$50,000.00	\$50,000	
630	Traffic Control	1	LS	\$1,000,000.00	\$1,000,000	
700	Minor Contract Revisions (5% of items)	1	LS		\$1,012,088	
603	6 x 4 CBC PMJM Crossing - 365 LF		LS			
					Sub-total	\$21,253,838
					CDOT CE 17.45 %	\$3,708,795
					Design 7%	\$1,487,769
					Env./Utilities 5%	\$1,062,692
					Contingency 5%	\$1,062,692
					Estimated Total	\$28,575,785
					Original Estimate	\$30,520,150.00
					Savings	\$1,944,365.48
					Use:	\$2,000,000

LIFE CYCLE COST ANALYSIS				
PROJECT LIFE (IN YEARS): 20		INTEREST: 6.00%		
	ORIGINAL COSTS	ALTERNATIVE "A" COSTS	ALTERNATIVE "B" COSTS	ALTERNATIVE "C" COSTS
INITIAL COSTS:				
BASE COST:	\$2,000,000.00			
OTHER INITIAL COSTS:				
<i>SUBTOTAL INITIAL COSTS:</i>	\$2,000,000.00			
SINGLE EVENT FUTURE COSTS				
YEAR (from base year):		10		
COST:		\$2,000,000.00		
YEAR:				
COST:				
YEAR:				
COST:				
YEAR:				
COST:				
SALVAGE VALUE:				
<i>PRESENT WORTH OF REPLACEMENT COSTS:</i>		\$1,116,789.55		
ANNUAL COSTS				
MAINTENANCE COSTS:				
OPERATIONS COSTS:				
ENERGY COSTS:				
OTHER ANNUAL COSTS:				
<i>SUBTOTAL ANNUAL COSTS:</i>				
<i>PRESENT WORTH OF ANNUAL COSTS:</i>				
<i>NET PRESENT VALUE</i>	\$2,000,000	\$1,116,790		
		\$2,000,000		
		(\$1,116,790)		
<i>TOTAL SAVINGS (original - alternative)</i>		\$883,210		
NOTE: Items in italics are calculated				

VALUE ENGINEERING PROPOSAL NO. 01-049

SUMMARY PROPOSAL DESCRIPTION:

Consider using cantilever sign structures in lieu of sign bridges whenever possible.

Estimated potential savings:

Initial:	\$ 61,000
Future:	\$ 0,000
Total:	\$ 61,000

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-049 Idea Description: Consider using cantilever sign structures in lieu of sign bridges whenever possible.
Advantages of alternative concept: 1. Reduces project cost 2. Limits the impacts to either the roadside or the median, rather than both 3. Reduced maintenance costs
Advantages of original concept: 1. More robust 2. Allows for adding signs in the future
Risks of implementing alternative concept: 1. None noted

Calculations and/or Discussion:

The design basis for determining which type of overhead sign structure to use can be found in the CDOT M&S Standard Plans, specifically S-614-50. One of the critical standards to use in these plans is the design wind speed. The design team determined that the project area is within four miles of the base of the foothills, so the design wind speed for overhead signs was assumed to be 90 mph.

It was assumed that the width of each Exit Direction sign will be 12' for single-lane exit signs and 24' for double-lane exit signs. The sign posts for these overhead signs need to be behind the outside shoulder. Given a shoulder width of 12' and all lane widths being 12', the minimum span for the Exit Direction overhead signs will be 25'; in cases of spanning two travel lanes, it will be difficult to have a span less than 35'. In most cases, 35' spans will not work for cantilever sign structures on this corridor.

Following are inventories of proposed overhead sign bridges along the corridor and the disposition of each structure based on our analysis of the estimated sign sizes and the standards in S-614-50:

- Northbound

- Sta. 1006+50 – Briargate/Pkwy/1 ½ Mile; SH 83/Academy/Blvd/EXIT ONLY
 - Disposition: The required span for the proper positioning of the EXIT ONLY sign would exceed the limits of a cantilever sign at this location, even if the EXIT ONLY sign were the only sign on the structure; > **Must remain a sign bridge**
- Sta. 1087+50 – Interquest/Pkwy/1 ½ Mile; Briargate Pkwy/EXIT ONLY
 - Disposition: The required span for the proper positioning of the EXIT ONLY sign would exceed the limits of a cantilever sign at this location, even if the EXIT ONLY sign were the only sign on the structure; > **Must remain a sign bridge**
- Sta. 1166+50 – Powers Blvd – ?/Baptist Rd – 5; Interquest/Pkwy/EXIT ONLY
 - Disposition: The size of the EXIT ONLY sign would not exceed the limits of a cantilever sign at this location, and there isn't a need for the Post-Interchange Distance sign because one will already be provided at Sta. 1142+00; > **Convert to a cantilever sign structure; Remove the Post-Interchange Distance sign**
- Sta. 1423+50 – St Hwy 105 – 3/County Line Rd – 5 ¼; Baptist Rd/(arrow)
 - Disposition: The size of the “Baptist Rd/(arrow)” sign would not exceed the limits of a cantilever sign at this location, and there isn't a need for the Post-Interchange Distance sign because one will already be provided at Sta. 1402+00; > **Convert to a cantilever sign structure; Remove the Post-Interchange Distance sign**
- Sta. 1554+50 – County Line Rd – 3/Larkspur – 20; SH 105/Monument/Palmer Lake/(arrow)
 - Disposition: The size of the “SH 105/Monument/Palmer Lake/(arrow)” sign would not exceed the limits of a cantilever sign at this location, and there isn't a need for the Post-Interchange Distance sign because one will already be provided at Sta. 1528+50; > **Convert to a cantilever sign structure; Remove the Post-Interchange Distance sign**

- Southbound

- Sta. 1041+00 – Woodmen Rd/1 ¼ Mile; SH 83/Academy/Blvd/EXIT ONLY
 - Disposition: The required span for the proper positioning of the EXIT ONLY sign would exceed the limits of a cantilever sign at this location, even if the EXIT ONLY sign were the only sign on the structure; > **Must remain a sign bridge**
- Sta. 1092+00 – SH 83/Academy/Blvd/3/4 Mile; Briargate Pkwy/EXIT ONLY

- Disposition: The required span for the proper positioning of the EXIT ONLY sign would exceed the limits of a cantilever sign at this location, even if the EXIT ONLY sign were the only sign on the structure; > **Must remain a sign bridge**
- Sta. 1175+50 – Briargate/Pkwy/1 ½ Mile; Interquest/Pkwy/EXIT ONLY
 - Disposition: Both of these signs are required and their total span would exceed the limits of a cantilever sign; > **Must remain a sign bridge**
 - Caveat: The “Briargate/Pkwy/1 ½ Mile” sign could be moved downstream, allowing both signs to be installed on separate cantilever sign structures
- Sta. 1452+50 – Powers Blvd – ?/Interquest Pkwy – ?; Baptist Rd/(arrow)
 - Disposition: The size of the “Baptist Rd/(arrow)” sign would not exceed the limits of a cantilever sign at this location, and there isn’t a need for the Post-Interchange Distance sign because one will already be provided at Sta. 1476+00; > **Convert to a cantilever sign structure; Remove the Post-Interchange Distance sign**
- Sta. 1562+00 – Baptist Rd – 2/Powers Blvd – ?; SH 105/Monument/ Palmer Lake/(arrow)
 - Disposition: The size of the “SH 105/Monument/Palmer Lake/ (arrow)” sign would not exceed the limits of a cantilever sign at this location, and there isn’t a need for the Post-Interchange Distance sign because one will already be provided at Sta. 1588+00; > **Convert to a cantilever sign structure; Remove the Post-Interchange Distance sign**
- Summary
 - Convert 5 sign bridges to cantilever sign structures
 - Remove 5 Post-Interchange Distance signs

In a related item, the following cantilever signs and sign structures should be removed from the plans because they will be installed as part of the Powers Boulevard interchange project, which will be done by others:

- Northbound
 - Sta. 1281+00 – EAST/Powers Blvd/(arrow)
- Southbound
 - Sta. 1318+00 – EAST/Powers Blvd/(arrow)

Approximate cost of cantilever sign structures = \$30,000 (assumed 24-inch pipe)
Approximate cost of sign bridge structures = \$41,000 (assumed 20-inch pipe)
Approximate cost of Post-Interchange Distance signs = \$6,000 (50 sq. ft. per Class III sign panel)

LIFE CYCLE COST ANALYSIS				
PROJECT LIFE (IN YEARS): 20		INTEREST: 6.00%		
	ORIGINAL COSTS	ALTERNATIVE "A" COSTS	ALTERNATIVE "B" COSTS	ALTERNATIVE "C" COSTS
INITIAL COSTS:				
BASE COST:	\$416,000.00	\$355,000.00		
OTHER INITIAL COSTS:				
<i>SUBTOTAL INITIAL COSTS:</i>	\$416,000.00	\$355,000.00		
SINGLE EVENT FUTURE COSTS				
YEAR (from base year):				
COST:				
YEAR:				
COST:				
YEAR:				
COST:				
YEAR:				
COST:				
SALVAGE VALUE:				
<i>PRESENT WORTH OF REPLACEMENT COSTS:</i>				
ANNUAL COSTS				
MAINTENANCE COSTS:				
OPERATIONS COSTS:				
ENERGY COSTS:				
OTHER ANNUAL COSTS:				
<i>SUBTOTAL ANNUAL COSTS:</i>				
<i>PRESENT WORTH OF ANNUAL COSTS:</i>				
<i>NET PRESENT VALUE</i>	\$416,000	\$355,000		
<i>CAPITAL SAVINGS</i>		\$61,000		
<i>FUTURE SAVINGS</i>		\$0		
<i>TOTAL SAVINGS (original - alternative)</i>		\$61,000		

NOTE: Items in italics are calculated

VALUE ENGINEERING PROPOSAL NO. 01-056

SUMMARY PROPOSAL DESCRIPTION:

Develop portions of the design further before initiating the process of procurement.

Estimated potential savings:

Initial:	\$ Not Quantified
Future:	\$ Not Quantified
Total:	\$ Not Quantified

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

- [SR01-001](#) - Modify the ramp configuration at North Academy Blvd.
- [SR01-035](#) - Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy. and North Academy Blvd.
- [SR01-052](#) - Provide roundabouts at the North Academy interchange and the Northgate interchange.

EVALUATION
Idea Number: 01-056 Idea Description: Develop portions of the design further before initiating the process of procurement.
Advantages of alternative concept: 1. Contractor and CDOT knowledge to create RFP 2. CDOT and contractor will hold less risk, lowering overall project cost
Advantages of original concept: 1. Bid project remains on schedule
Risks of implementing alternative concept: 1. Project schedule 2. Risk elements associated with the unknowns of the project will be reflected in higher bid prices.

Calculations and/or Discussion:

In the case of the North I-25 project a \$36,000,000 budget was set and is intended to be allocated as a “Best Value” Design Build procurement. Defining specific project components and project limits for this type of procurement is sometimes difficult. CDOT walks a fine line of drawing conclusions of making assumptions that may not allow for the innovation of creativity from the contracting community. The Base Bid conditions must however be defined enough to allow CDOT to prepare an RFP that is defined enough to assure that the project has the following characteristics:

1. Can be awarded with the available funds
2. Proposals can be compared on an even footing
3. ARE’s are realistic and well defined
4. Innovation can be implemented to match the contractor’s capabilities and equipment

CDOT must have enough definition of the project to be able to define the major risk elements and to make a conscious decision on the value of those risks items and finally assess who should ultimately own that risk (CDOT or the Contractor). Typically when risk is transmitted to the contractor, additional cost in the bid is recognized.

Develop Drainage Design - 50%

The advantages of partial early drainage design are as follows:

1. If a field inventory is created you would know if needed the culvert can be extended or if need replacement the culverts may be difficult to construct across I 25. The contractor will also want to know or he will raise prices to cover risk.
2. Partial design will equip engineers with important information to include in the RFP.

Roadway Design (set profiles and super-elevations) – 40%

The advantage of partial early roadway design is as follows:

1. Present conceptual information will not give the contractor or CDOT enough information to know the desired reconstruction areas, earthwork estimates, etc.
2. Determining the location of WMO vs. reconstruction will allow clear bids.

If Required – Interchange Reconfiguration (Preliminary Design)

The advantages of partial early interchange(s) design are as follows:

1. Many of the present interchange designs are very outdated and inefficient. (1950's). The Northeast acceleration loop ramp at S. Academy is an immediate concern for safety and traffic congestion. There is limited weaving distance in the SB direction between the on ramp from Briargate Parkway to the Academy Blvd. There is also insufficient weaving distance between the loop ramps at the Northgate interchange.

VALUE ENGINEERING PROPOSAL NO. 01-051

SUMMARY PROPOSAL DESCRIPTION:

Assign point values to Additional Requested Elements (AREs).

Estimated potential savings:

Initial:	\$ Not Quantified
Future:	\$ Not Quantified
Total:	\$ Not Quantified

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-0051
Idea Description: Assign point values to Additional Requested Elements (AREs).
Advantages of alternative concept: 1. Maximize \$36 million
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. Perception of arbitrary points system to select.

Calculations and/or Discussion:

Point values for the following configurations

With Basic Configuration ARE's point values:

- ARE - PCCP - 30 points (interchange-interchange)
- Improve ramps at Northgate Interchange - 10 points per ramp
- ITS elements - 10 points per element
- ARE - Replace bridges at Black Squirrel Creek bridges - 30 points per bridge
- ARE - Widen bridges at Black Squirrel Creek bridges - 10 points per bridge

Points are common for Design Build Projects. Assigning point values helps CDOT get what they want on a project, i.e. the Black Squirrel Creek Bridges as ARE's are more critical to relieve congestion than improving the ramps at Northgate.

VALUE ENGINEERING PROPOSAL NO. 04-002

SUMMARY PROPOSAL DESCRIPTION:

Use an adjustment factor if Hot Mastic Asphalt (HMA) reconstruction is specified.

Estimated potential savings:

Initial:	\$ Incomplete
Future:	\$ Incomplete
Total:	\$ Incomplete

Additional Description:

Past alternate bid projects have included an adjustment factor to account for the increased future rehabilitation costs if the HMA alternate is chosen. This was done when the total life cycle cost analysis (LCCA) cost for the HMA was higher while the initial cost for the HMA construction was lower. This allowed CDOT to account for a higher future cost if HMA was bid and attached this cost to the initial cost bid to ensure accurate competition between materials types by accounting for all life cycle costs.

Related Value Engineering Proposals and/or Supplemental Recommendations:

[SR01-040](#) - In the RFP, stipulate the pavement reconstruction method per life cycle cost analysis (LCCA).

EVALUATION
Idea Number: 04-002 Idea Description: Use an adjustment factor if Hot Mastic Asphalt (HMA) reconstruction is specified.
Advantages of alternative concept: 1. Accounts for anticipated future rehabilitation costs for HMA pavement 2. Increase Contractor Competition for pavement
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.

Calculations and/or Discussion:

This proposal was made prior to receipt by the VE panel of the completed LCCA showing initial and future construction costs of the PCCP and HMA alternatives. The LCCA indicates that the total net present worth of initial construction and future rehabilitation costs are lower for the HMA alternative.

LCCA Output: Initial costs, future maintenance costs, future rehab costs

	Alternative 1: PCCP Agency Cost (x\$1000)	Alternative 2: HMA Agency Cost (x\$1000)
Probability Function Percentile (75%)	\$32,179.38	\$28,356.75
Difference in NPV	13.5%	

If the RFP allows alternative materials for reconstruction areas on the project, the successful bidder should be allowed to choose his optimal paving material to facilitate the greatest length of reconstruction at his lowest cost. Even though the LCCA calculates lower total cost for an HMA pavement, an individual design-builder with established PCCP capability may be able to provide a concrete reconstruction of greater length than a competitor with HMA capability. An adjustment factor applied to a proposal for HMA will balance the competition between materials suppliers without justification in the CDOT LCCA.

The proposal is incomplete and awaiting information.

VALUE ENGINEERING PROPOSAL NO. 05-001

SUMMARY PROPOSAL DESCRIPTION:

Construct all the roadway, shoulders, and auxiliary lanes from the median toward the outside.

Estimated potential savings:

Initial:	\$ 256,000
Future:	\$ 0,000
Total:	\$ 256,000

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

[P01-008](#) - Maximize construction to the outside areas of the existing roadway.

EVALUATION
Idea Number: 05-001 Idea Description: Construct all the roadway, shoulders, and auxiliary lanes from the median toward the outside.
Advantages of alternative concept: 1. Will take less earthwork on this project. 2. Future construction will be all outside, which will be easier and less expensive.
Advantages of original concept: 1. Takes advantage of all of the existing roadway structure 2. Do not need to reset signs and guardrail on future projects.
Risks of implementing alternative concept: 1. Auxiliary lanes for future construction will need to be modified.

Calculations and/or Discussion:

The idea of constructing the inside first works very well on the majority of the project except on the section from S. Academy to Briargate, Station 1051 + 00 to Station 1065 + 00 (approximately 1,400 lf). Some of the existing roadway structure in this area would not be able to be used for this idea.

Percent of earthwork eliminated by observing the 500-foot cross sections and applying that percentage to the EA estimate of cy/lf:

Woodmen Interchange - Station 946 + 00 to Station 1025 + 00:

(Earthwork appears to reasonably balance between median fill and less outside shoulder earthwork).

Station 1025+ 00 to Station 1096 + 00 or 7,100 lf (Briargate Interchange) EA estimate uses 9 cy/lf. The following is estimated saving of earthwork:

- Station 1025 + 00 to Station 1030 + 00 12 cy/lf (500 lf x 9 cy/lf = 4,500 cy
- Station 1030 + 00 to Station 1051 + 00 3 cy/lf (2,100 lf x 3 cy/lf = 6,300 cy
- Station 1065 + 00 to Station 1096 + 00 2 cy/lf (3,100 lf x 2 cy/lf = 6,500 cy

Station 1096+ 00 to Station 1179 + 00) (Briargate to Interquest) EA estimate of 5 cy per lf. The following is estimated savings of earthwork:

- Station 1096 + 00 to Station 1179 + 00 1 cy/lf (3,100 lf x 1 cy/lf = 8,300 cy

Total Cubic Yards = 25,600 cy

Cost Savings from Eliminated Earthwork (the eliminated earthwork is from outside shoulders):

- 25,600 cy of estimated earthwork @ \$10/cy = \$256, 000 TOTAL SAVINGS

SECTION 4 - SUPPLEMENTAL RECOMMENDATIONS

The following ideas were generated by the VE Team and thought to have considerable merit. These ideas are thought to offer improvements, but either the economics were not calculable or the idea could not be developed because of insufficient information.

The VE Team suggests that these recommendations be carefully reviewed and given as much thought and effort as the formal VE Proposals.

SUPPLEMENTAL RECOMMENDATIONS SUMMARY TABLE

PROPOSAL NO.	VE PROPOSAL DESCRIPTION	REVIEW BOARD COMMENTS	PAGE NO.
Typical Section			
SR01-012	Construct a passing lane on NB I-25 from Black Squirrel Creek to Baptist Road in lieu of widening to three northbound lanes from Interquest Parkway to Monument.	Decline. Inconsistent with EA.	4-3
SR06-005	Convert the proposed high occupancy vehicle (HOV) lane to a Managed Lane that would permit single-occupant vehicles to use the lane for a fee.	Table. EA implications.	4-6
SR03-003	Provide a shoulder wherever possible during construction for incident clearance; provide emergency pull-outs during construction in locations where a shoulder cannot be provided.	Accept. Having adequate shoulders is a maintenance and safety concern.	4-8
Structures			
SR01-038	Replace the existing scour critical three-span bridges at Black Squirrel Creek with a single-span bridge.	Accept. Assuming replace vs. widening.	4-10
SR01-026	Provide additional wall performance criteria for the RFP.	Accept.	4-12
Drainage and Water Quality			
SR01-002	Stabilize streams within the CDOT easement area.	Accept. This is tied in to project goals and will help us achieve project goals.	4-14
SR01-054	Construct storm sewer in the median in super-elevated segments and install manhole diversion structures to isolate water quality flows.	Accept. Will be required in super-elevated sections.	4-16
Traffic			
SR01-050	Establish traffic signal timing plans along alternate routes, such as SH 83 and Voyager Parkway from Academy Boulevard to Northgate, to allow for quick implementation of a detour in the event of an incident within the construction zone on I-25.	Accept. Does incident management already exist and is it sufficient? Or can project add to it and improve it? If possible, incorporate into existing system.	4-18
SR01-029	Use temporary Intelligent Transportation System (ITS) infrastructure during construction to mitigate congestion caused by construction activities.	Accept.	4-20

PROPOSAL NO.	VE PROPOSAL DESCRIPTION	REVIEW BOARD COMMENTS	PAGE NO.
SR03-009	Provide additional temporary signing to relieve traffic congestion during construction.	Accept.	4-22
SR01-058	Provide corridor lighting from Woodmen to Briargate.	Accept with Modifications. Should project accommodate future lighting? Area may require lighting. Does economy and the state of City of COS funding warrant installation of lighting – can the city afford to light corridor? Possible ARE?	4-24
Interchange			
SR01-001	Modify the ramp configuration at North Academy Blvd.	Accept with Modifications. Possibly make this an EA.	4-27
SR01-035	Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy. and North Academy Blvd.	Decline.	4-33
SR01-052	Provide roundabouts at the North Academy interchange and the Northgate interchange.	Decline.	4-37
SR01-045	Relocate the Ackerman Overlook to the Briargate Interchange southbound ramp.	Decline. Schedule does not allow enough time to obtain easements necessary to relocate overlook.	4-40
RFP			
SR01-040	In the RFP, stipulate the pavement reconstruction method per life cycle cost analysis (LCCA).	Decline.	4-43
SR01-039	Make the Northgate interchange bridges in an Additional Requested Elements (ARE) alternative.	Accept.	4-46
SR01-044	Make the Black Squirrel Creek bridge reconstruction/widening part of the base case.	Accept with Modifications. Just reconstruct NB bridge as part of base configuration (costs reflect that). Make SB an ARE?	4-48
SR02-007	Specify the type of water quality (WQ) features allowed.	Accept.	4-51

SUPPLEMENTAL RECOMMENDATION NO. 01-012

SUMMARY RECOMMENDATION DESCRIPTION:

Construct a passing lane on NB I-25 from Black Squirrel Creek to Baptist Road in lieu of widening to three northbound lanes from Interquest Parkway to Monument.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

[P05-002](#) - Switch from a 12-foot inside shoulder to a 10-foot inside shoulder north of Briargate.

EVALUATION
Idea Number: 01-012 Idea Description: Construct a passing lane on NB I-25 from Black Squirrel Creek to Baptist Road in lieu of widening to three northbound lanes from Interquest Parkway to Monument.
Advantages of alternative concept: 1. Addresses congestion mitigation at a reduced cost 2. Less pavement means reduced maintenance cost
Advantages of original concept: 1. Provides greater capacity for project area 2. Eliminates the need for future work to accomplish ultimate goal of six lanes from Briaragate Parkway to Monument
Risks of implementing alternative concept: 1. Safety issues associated with lane drop at Baptist Road 2. Reduced safety with less shoulder width

DISCUSSION AND/OR CALCULATIONS:

This passing lane would begin at Sta. 1210+00 and end at Sta. 1462+00, which would be to the end of a 300' taper. This would make the total length of the passing lane at 25,200 feet. The typical section would include three 12' travel lanes, an inside 12' shoulder, and an outside 8' shoulder. A reduced shoulder width of 8' is permissible when it is adjacent to a passing lane.

Under the base condition, the three NB lanes would continue from the improvements that will extend up to Interquest Parkway. This typical section would include the same number of lanes as the passing lane alternative and would include two 12' shoulders, but it would begin at Sta. 1170+00 and extend to Sta. 1540+00. The total length of these three NB lanes would be 37,000 feet.

The width of the passing lane alternative would be 56'. At a length of 25,200 feet, this would equate to 1,411,220 sf of pavement. Comparatively, widening the roadway to the ultimate three NB lanes, at 60' wide and 37,000' long, would require 2,220,000 sf of pavement. The resulting calculations are:

- 1,411,220 sf of pavement = 156,802 sy
- 2,220,000 sf of pavement = 246,667 sy
- At 110 lbs/sy (1-inch thickness), shoulders only = 17,248,220 lbs = 8,624 tons;
ultimate widening = 27,133,370 lbs = 13,567 tons

Using the 6" HMA at \$50/ton and 2.5" SMA at \$75/ton, here are the costs of each alternative:

- Passing Lane = 8,624 tons = \$431,200 of HMA and \$646,800 of SMA = \$1,078,000
- Widening = 13,567 tons = \$678,350 of HMA and \$1,017,525 of SMA = \$1,695,875

Maintenance costs = \$14,000/lane mile = \$14,000/63,360 sf.

- Passing Lane = 1,411,220 sf. = \$311,823
- Widening = 2,220,000 sf. = \$490,530

SUPPLEMENTAL RECOMMENDATION NO. 06-005

SUMMARY RECOMMENDATION DESCRIPTION:

Convert the proposed High Occupancy Vehicle (HOV) lane to a Managed Lane that would permit single-occupant vehicles to use the lane for a fee.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION

Idea Number: 06-005

Idea Description: Convert the proposed high occupancy vehicle (HOV) lane to a Managed Lane that would permit single-occupant vehicles to use the lane for a fee.

Advantages of alternative concept:

1. Increase usage of this lane, resulting in reduced congestion in the general-purpose lanes
2. Increase revenue

Advantages of original concept:

1. Implementation would be consistent with the EA
2. Would be less expensive because overhead gantry systems would not have to be installed

Risks of implementing alternative concept:

1. The construction schedule could be detrimentally impacted since the concept would need to be approved through the EA process and additional infrastructure would have to be installed

DISCUSSION AND/OR CALCULATIONS:

This idea could have implications on the approved EA that governs improvements within the project area.

SUPPLEMENTAL RECOMMENDATION NO. 03-003

SUMMARY RECOMMENDATION DESCRIPTION:

Provide a shoulder wherever possible during construction for incident clearance; provide emergency pull-outs during construction in locations where a shoulder cannot be provided.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 03-003 Idea Description: Provide a shoulder wherever possible during construction for incident clearance; provide emergency pull-outs during construction in locations where a shoulder cannot be provided.
Advantages of alternative concept: 1. Provides a place outside of the travel lanes that would allow for motorists to take care of incidents
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.

DISCUSSION AND/OR CALCULATIONS:

If CDOT agrees with this proposal, then this should be written in the specifications of the RFP. Having this in the RFP would satisfy a request made by the USAFA and CSP in earlier discussions with CDOT.

SUPPLEMENTAL RECOMMENDATION NO. 01-038

SUMMARY RECOMMENDATION DESCRIPTION:

Replace the existing scour critical three-span bridges at Black Squirrel Creek with a single-span bridge.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

[SR01-002](#) - Stabilize streams within the CDOT easement area.

[SR01-044](#) - Make the Black Squirrel Creek bridge reconstruction/widening part of base case.

EVALUATION
Idea Number: 01-038 Idea Description: Replace the existing scour critical three-span bridges at Black Squirrel Creek with a single-span bridge.
Advantages of alternative concept: 1. Removing the existing pier restores the channel and addresses the scour critical issue. A new structure with a 75 year design life.
Advantages of original concept: 1. Widening the existing structures is less up front cost.
Risks of implementing alternative concept: 1. The new bridge may cost more than anticipated

DISCUSSION AND/OR CALCULATIONS:

The existing 1954 three-span bridges have a clear width of 42' between the bridge rails. The proposed 60' wide roadway section would require the existing bridges to be widened. The existing bridges are classified as scour critical. Replacing the existing bridges with new single-span bridges is a more viable option in comparison to widening the existing bridges considering the age of the existing structure along with it also being scour critical. The single span bridge eliminates the existing piers addressing the scour critical issue and it allows for channel restoration.

The new bridge could be a single bridge with a barrier separating north and southbound I-25 depending on the roadway configuration. This bridge location with a simple span of around 100' provides the contractor with opportunities to implement accelerated bridge construction techniques.

The cost to widen the existing structures is approximately \$750,000:

- 18' x 100' = 1,800sf/bridge at \$210/sf

(Also note the existing piers would likely not support the widen bridge section and a single column pier would need to be installed.)

The new bridges were estimated at \$2,000,000 in the design build summary (approximately \$170/sf).

SUPPLEMENTAL RECOMMENDATION NO. 01-026

SUMMARY RECOMMENDATION DESCRIPTION:

Provide additional wall performance criteria for the RFP.

Additional Description:

The additional wall criteria will help the contractor know what is acceptable and have better handle on the costs. It will also provide CDOT with the opportunity to avoid review of alternatives that were not desired.

Related Value Engineering Proposals and/or Supplemental Recommendations:

[P01-006](#) - Use retaining walls for split profile in lieu of reconstruction.

EVALUATION
Idea Number: 01-026 Idea Description: Provide additional wall performance criteria for the RFP.
Advantages of alternative concept: 1. Provides a means for getting the desired end product.
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. Care must be taken to not affect the contractor's ability to provide innovative cost effective solutions with too many limitations.

DISCUSSION AND/OR CALCULATIONS:

Book 2 Structures, Section 15 for the North I-25 Design Build provides the basic structures criteria, and the I-25 Design Build Guide for the architectural requirements includes the walls. The following retaining wall items are additional information to consider including in the RFP.

1. It may be worthwhile stating the criteria for top down wall systems such as ground anchors in the same way the MSE wall criteria is referenced. The industry seems to have some variations in design and detailing that is not consistent with CDOT requirements. CDOT Staff Bridge has recently reviewed the standards and would have the criteria for design and testing that should be included. There are several top down wall systems, but much of the criteria would be similar and the RFP could state that other systems are to be submitted for approval.
2. The existing split mainline I-25 profile will require a wall system in the median to accommodate widening the existing. If any wall systems are not allowed for this area it should be stated in the criteria. For example block facing may be harder to keep clean and have more efflorescence in a median location with direct exposure to the deicing chemicals. A moment slab railing system will be required for these wall systems. It may be worth stating if the contractor can submit alternatives or if they need to use the CDOT standards.

SUPPLEMENTAL RECOMMENDATION NO. 01-002

SUMMARY RECOMMENDATION DESCRIPTION:

Stabilize streams within the CDOT easement area.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

[SR01-038](#) - Replace the existing scour critical three-span bridges at Black Squirrel Creek with a single-span bridge.

EVALUATION
Idea Number: 01-002
Idea Description: Stabilize streams within the CDOT easement area.
Advantages of alternative concept: 1. Reduce erosion and potential damage to roadway infrastructure. 2. Public acceptance by adjacent property owners. 3. USAFA concerns addressed.
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.

DISCUSSION AND/OR CALCULATIONS:

Larger Drainageway Crossings of I-25		
		EA
	Approx	Proposed
<u>Drainageway Name</u>	<u>EA Station</u>	<u>Culvert Size</u>
Kettle Creek	1105+00	?
Un-Named	1121+69	2-42" RCPs
Elkhorn Creek	1144+00	10' x 8' CBC
Un-Named	1168+00	54" RCP
Black Squirrel Creek	1217+00	Bridge
*drainages above where proposed culvert greater than or equal to 48" diameter equivalent.		

Determine channel invert and bank stability concerns via the following:

- Between culverts end and easement boundary, is the channel invert slope steeper than 1% and/or estimated velocities excessive?
- Are there visible signs of channel bank or invert erosion within CDOT easement?
- Is there vertical channel invert instability (head-cut) immediately downstream of easement on AFA property and is it likely that head-cut will move upstream, eroding channel within CDOT easement?
- Is there scour hole or wingwall damage at outlet of existing culverts?

If the above are present, consider the following measures:

- Riprap or other erosion control measure at culvert outlets
- Grade control structure (drop structure or check dam) to prevent further erosion of channel invert.
- Grade and flatten channel side slopes where vertical/steep channel side slopes exist.

SUPPLEMENTAL RECOMMENDATION NO. 01-054

SUMMARY RECOMMENDATION DESCRIPTION:

Construct storm sewer in the median in super-elevated segments and install manhole diversion structures to isolate water quality flows.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-054 Idea Description: Construct storm sewer in the median in super-elevated segments and install manhole diversion structures to isolate water quality flows.
Advantages of alternative concept: 1. Installation of median storm sewer system is needed to control spread width and minimize hydroplaning.
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.

DISCUSSION AND/OR CALCULATIONS:

Installation of median storm sewer and inlets is needed to control spread width and intercept flow, but this is not an alternative concept and is, instead, a design requirement.

The storm sewer improvements would apply at the super elevated roadway sections between stations 965+00 – 1015+00, 1035+00 – 1070+00, 1155+00 (approximately 500 feet) and 1220+00 -1225+00. The storm sewer will be required due to the installation of the concrete barrier along the median. Additional locations will require storm sewer in the median due to the highway super elevation that have yet to be defined.

The installation of storm sewer and inlets along the median will improve the drainage conditons by:

- Meeting allowable spread width criteria.
- Being able to control the discharge point at the desired outfall location to maintain the pre-project drainage patterns.

The alternative of installing manhole flow diversion structures to isolate water quality flows and route separately to a water quality control facility is not necessary and fails as an option since the AFA requires that both water quality and detention be provided. Therefore, there is no need to install a flow diversion manhole to divert water quality flows.

SUPPLEMENTAL RECOMMENDATION NO. 01-050

SUMMARY RECOMMENDATION DESCRIPTION:

Establish traffic signal timing plans along alternate routes, such as SH 83 and Voyager Parkway from Academy Boulevard to Northgate, to allow for quick implementation of a detour in the event of an incident within the construction zone on I-25.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-050 Idea Description: Establish traffic signal timing plans along alternate routes, such as SH 83 and Voyager Parkway from Academy Boulevard to Northgate, to allow for quick implementation of a detour in the event of an incident within the construction zone on I-25.
Advantages of alternative concept: 1. Makes implementation of alternative routes more efficient 2. Provides alternative for emergency vehicles
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.

DISCUSSION AND/OR CALCULATIONS:

Implementation of alternate routes will be performed in accordance with the City of Colorado Springs Incident Management Plan. The team should consider additional temporary ITS infrastructure that would assist in evaluating the real-time effectiveness of an alternate route when incidents or construction significantly impact I-25 through the construction zone.

SUPPLEMENTAL RECOMMENDATION NO. 01-029

SUMMARY RECOMMENDATION DESCRIPTION:

Provide a temporary Intelligent Transportation System (ITS) infrastructure during construction to mitigate congestion caused by construction activities.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-029 Idea Description: Provide a temporary Intelligent Transportation System (ITS) infrastructure during construction to mitigate congestion caused by construction activities.
Advantages of alternative concept: <ol style="list-style-type: none">1. Providing travelers with advanced notice of construction impacts could allow them to make different travel choices, resulting in less congestion2. Real-time travel data can assist CDOT and the contractor in responding quickly to incidents3. Some temporary ITS infrastructure can be made permanent after construction
Advantages of original concept: <ol style="list-style-type: none">1. None noted.
Risks of implementing alternative concept: <ol style="list-style-type: none">1. None noted.

DISCUSSION AND/OR CALCULATIONS:

The root of this alternative is providing the traveling public and CDOT will real-time travel information during construction. This allows motorists to make informed travel decisions, such as route choice and what time to travel. Both of these examples result in reduced peak-hour travel demand along the corridor, either because other facilities are carrying this traffic or because traffic has chosen to travel during off-peak hours.

SUPPLEMENTAL RECOMMENDATION NO. 03-009

SUMMARY RECOMMENDATION DESCRIPTION:

Provide additional temporary signing to relieve traffic congestion during construction.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 03-009 Idea Description: Provide additional temporary signing to relieve traffic congestion during construction.
Advantages of alternative concept: 1. Additional signing to relieve traffic congestion during construction
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.

DISCUSSION AND/OR CALCULATIONS:

Three types of signing are recommended for this project:

- Limit trucks to right hand lane only through construction zone.
- Encourage alternate routes.
- Set minimum speed limit through construction zone.

The temporary signing would help with traffic congestion during construction.

SUPPLEMENTAL RECOMMENDATION NO. 01-058

SUMMARY RECOMMENDATION DESCRIPTION:

Provide corridor lighting from Woodmen to Briargate.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-058 Idea Description: Provide corridor lighting from Woodmen to Briargate.
Advantages of alternative concept: 1. Urban section becomes lighted similar to rest of urban section through COSPR 2. Driver expectation and vision 3. Safety
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. Theft of material 2. USAFA has concerns with additional lighting in flight zone area

DISCUSSION AND/OR CALCULATIONS:

Provide for corridor lighting from Woodmen to Briargate. This section can be classified as an “urban section” of highway. The rest of the highway in Colorado Springs’ urban area is lighted. This recommendation provides for driver expectation, increases vision at night, and improves safety.

Theft of material is a disadvantage. Recent experiences in Colorado Springs and even the I-25 corridor would lead to an expectation that at some point valuable copper material will be stolen.

Lighting the corridor could contribute to light noise within the urban area.

Approximate cost to install lighting from Woodmen to Briargate is \$1,600,000.

SUPPLEMENTAL RECOMMENDATION NO. 01-001

SUMMARY RECOMMENDATION DESCRIPTION:

Modify the ramp configuration at North Academy Blvd.

Additional Description:

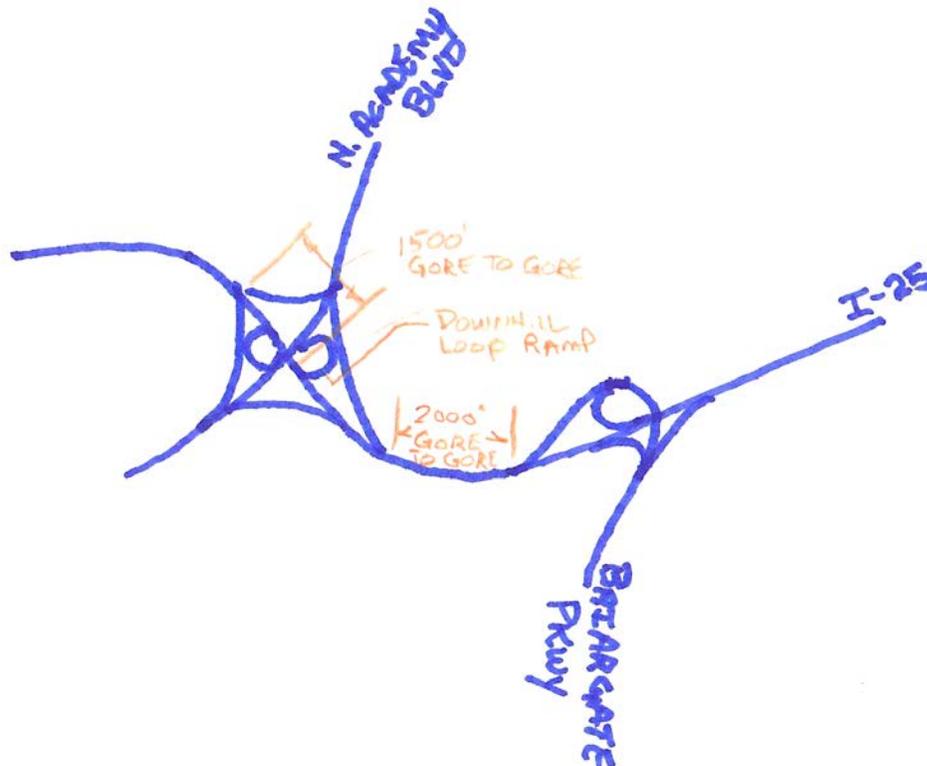
Related Value Engineering Proposals and/or Supplemental Recommendations:

- [SR01-035](#) - Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy and North Academy Blvd.
- [SR01-045](#) - Relocate the Ackerman Overlook to the Briargate Interchange southbound ramp.
- [SR01-052](#) - Provide roundabouts at North Academy interchange and Northgate interchange.

EVALUATION	
Idea Number: 01-001	Idea Description: Modify the ramp configuration at North Academy Blvd.
Advantages of alternative concept:	<ol style="list-style-type: none">1. Improves safety along corridor.2. Reduces congestion along corridor.3. Improves access to I-25.
Advantages of original concept:	<ol style="list-style-type: none">1. Less costly.
Risks of implementing alternative concept:	<ol style="list-style-type: none">1. May require an Interchange Access Request (IAR) with FHWA along with a 1601 CDOT process which, could delay the project.2. USAFA concurrence is required.

DISCUSSION AND/OR CALCULATIONS:

The southbound ramps at Briargate Pkwy and North Academy Blvd currently provide for very limited substandard weaving distances. With four gores in less than 6,500 feet, mainline congestion and safety are compromised, especially with less than 2,000 feet between the Briargate and Academy interchange gores.



The North Academy interchange is currently configured as a Two-Loop Partial Cloverleaf (ParClo) interchange. The current southbound loop ramp gore creates distractions to southbound I-25 drivers as users of the loop ramp are highly visible from southbound I-25 drivers. Many times the southbound I-25 drivers can see the loop ramp drivers accelerating around the loop ramp. I-25 drivers tend to move over a lane to allow for the loop drivers to enter the highway and immediately drift over into the southbound through lanes. This lane shift of the I-25 drivers poses safety concerns and increases mainline congestion. This “condition” will be worsened under the EA’s proposed action (base case) by further tightening the radius of the loop ramp at the gore point to accommodate the mainline widening. Eliminating the loop ramp could increase mainline capacity, reduce congestion, and provide for a safer access configuration.

There are many options to reconfigure the North Academy Interchange and to eliminate the short gore to gore spacing along this stretch of southbound I-25. Options may also include modifications to the Briargate Interchange in combination with improvements of the Academy Interchange. These combined interchange options are included in Supplemental Recommendation 01-035 “Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy and North Academy Blvd”.

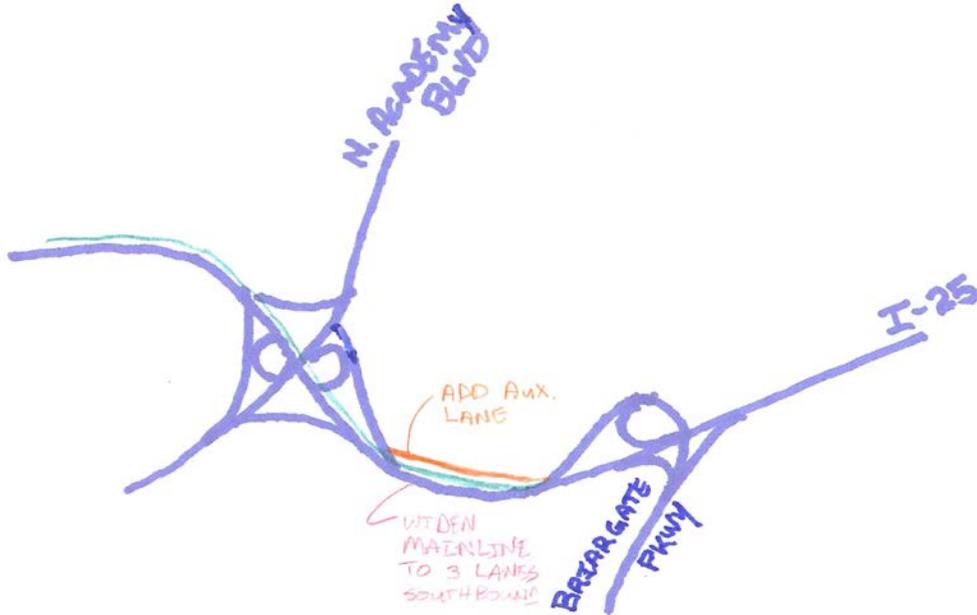
Stand-alone reconfiguration of the North Academy Interchange is also viable in improving mainline conditions and could benefit the operations Academy Blvd. These stand-alone configurations should focus on replacing the loop ramp in order to eliminate the concerns mentioned above. Eliminating or improving the loop ramp could increase mainline capacity, reduce congestion and provide for a safer access configuration.

The Alternatives suggested in this Supplemental Recommendation are focused on lower cost options that utilize the existing Academy bridges and have minimal impacts, including little or no additional right of way. Low cost alternatives may include but are not limited to:

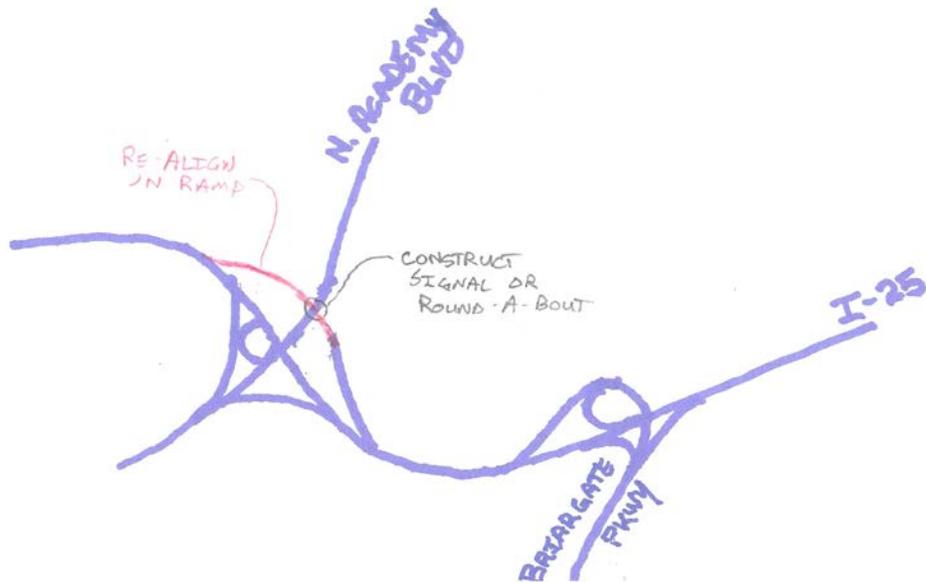
1. Single Loop ParClo
2. Diverging Diamond
3. Ramp Metering

Under any of these scenarios, an interchange reconfiguration will require an extensive operational analysis to assure that the interchange will function properly opening day and into the future. Reconfiguration of an interchange on a state or federal highway will require a CDOT 1601 process along with an Interchange Access Request (IAR) from FHWA supporting changes to access on an interstate highway. These processes and supporting analysis will take a significant amount of time and would likely delay the overall project schedule. The improvements of the above alternatives, however, could easily be added in the future to the base case condition.

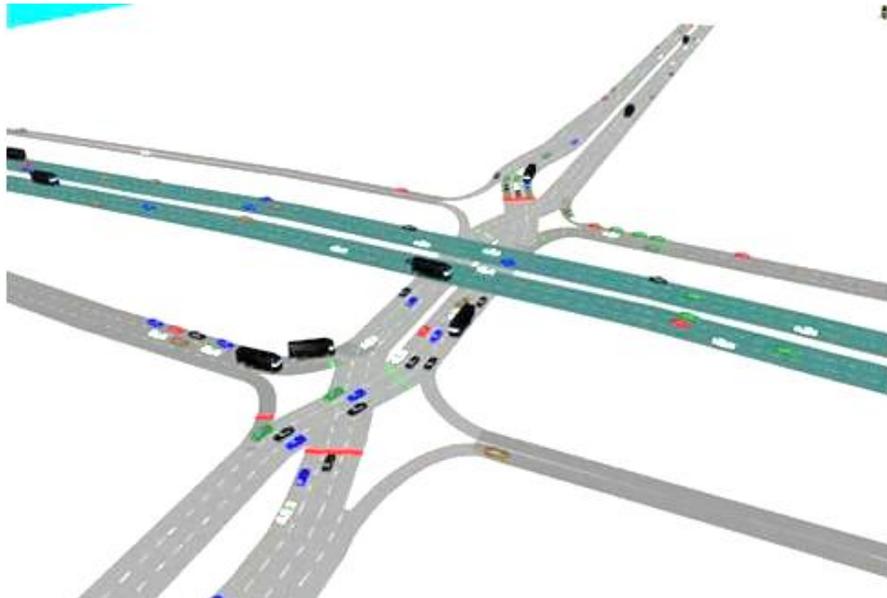
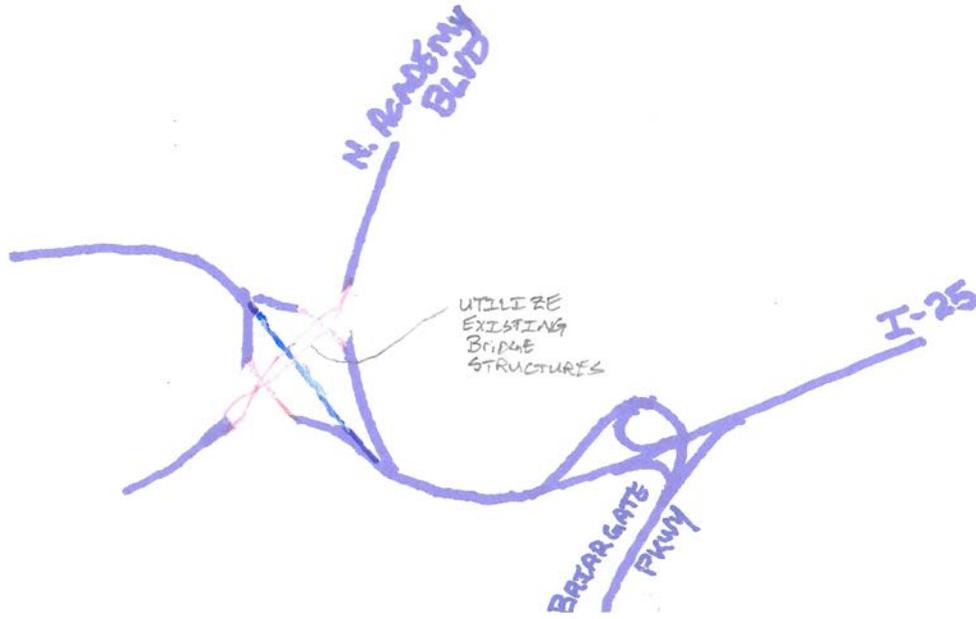
As-Designed Condition



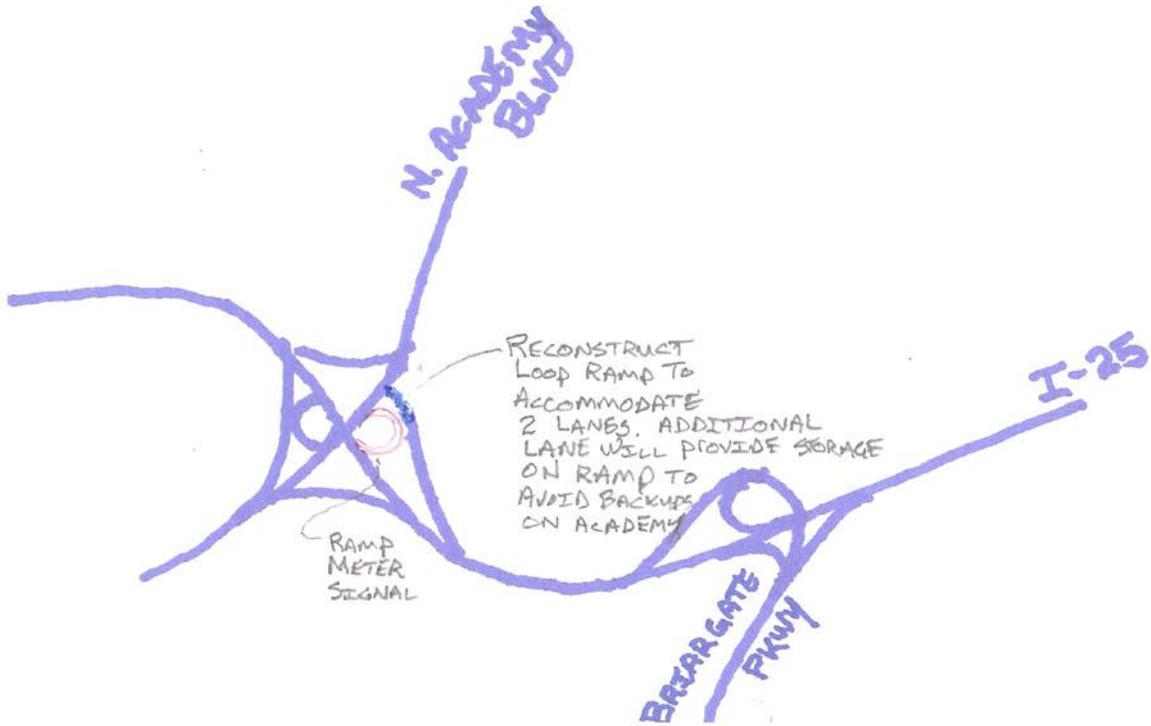
Alternative 1 – Single Loop ParClo



Alternative 2 – Diverging Diamond



Alternative 3 – Ramp Metering



SUPPLEMENTAL RECOMMENDATION NO. 01-035

SUMMARY RECOMMENDATION DESCRIPTION:

Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy. and North Academy Blvd.

Additional Description:

Reduce congestion and improve safety southbound between Briargate Pkwy. and North Academy Blvd interchanges by modifying ramps into a Collector/Distributor (CD) road.

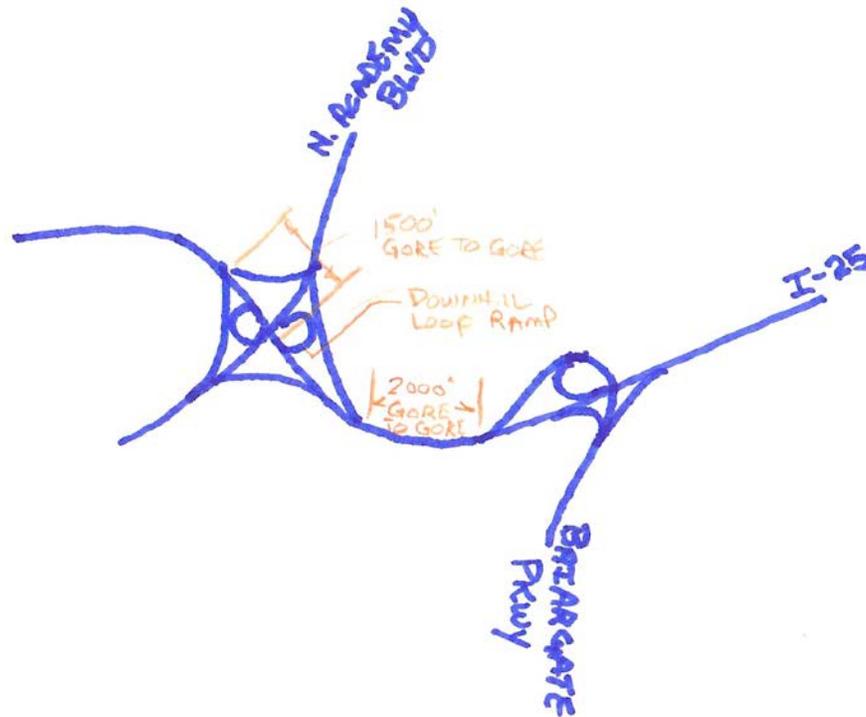
Related Value Engineering Proposals and/or Supplemental Recommendations:

- [SR01-001](#) - Modify the ramp configuration at North Academy Blvd.
- [SR01-045](#) - Relocate the Ackerman Overlook to the Briargate southbound ramp.
- [SR01-052](#) - Provide roundabouts at North Academy interchange and Northgate interchange.

EVALUATION
Idea Number: 01-035 Idea Description: Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy. and North Academy Blvd.
Advantages of alternative concept: 1. Improves safety along corridor. 2. Reduces congestion along corridor. 3. Improves access to I-25.
Advantages of original concept: 1. Maintains higher capacity ramps at North Academy. 2. Reduces delay of southbound Briargate users.
Risks of implementing alternative concept: 1. May require a Interchange Access Request (IAR) with FHWA along with a 1601 CDOT process which could delay the project.

DISCUSSION AND/OR CALCULATIONS:

The southbound ramps at Briargate Pkwy. and North Academy Blvd. currently provide for very limited substandard weaving distances. With three gores in less than 4,000 feet, mainline congestion and safety are compromised. Splitting the interchange movements and combining the Briargate and North Academy ramps could better meter traffic and avoid difficult dangerous weaves.

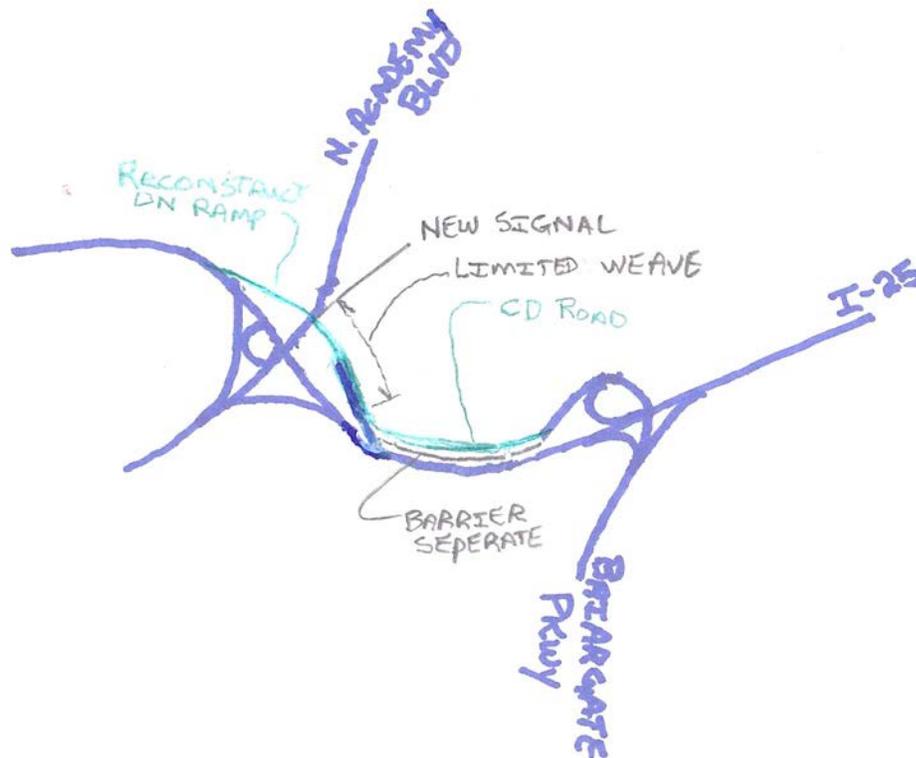


As-Designed Condition

Combining the on movements to a single access point would require creating a CD type road system between the interchanges. Additionally, the North Academy southbound loop ramp can be eliminated and replaced with a traditional Diamond configuration. To avoid USAFA easement, the CD road could be barrier separated from mainline. This CD road could be constructed within the existing right-of-way (or easement); however, additional right of way could improve geometrics.

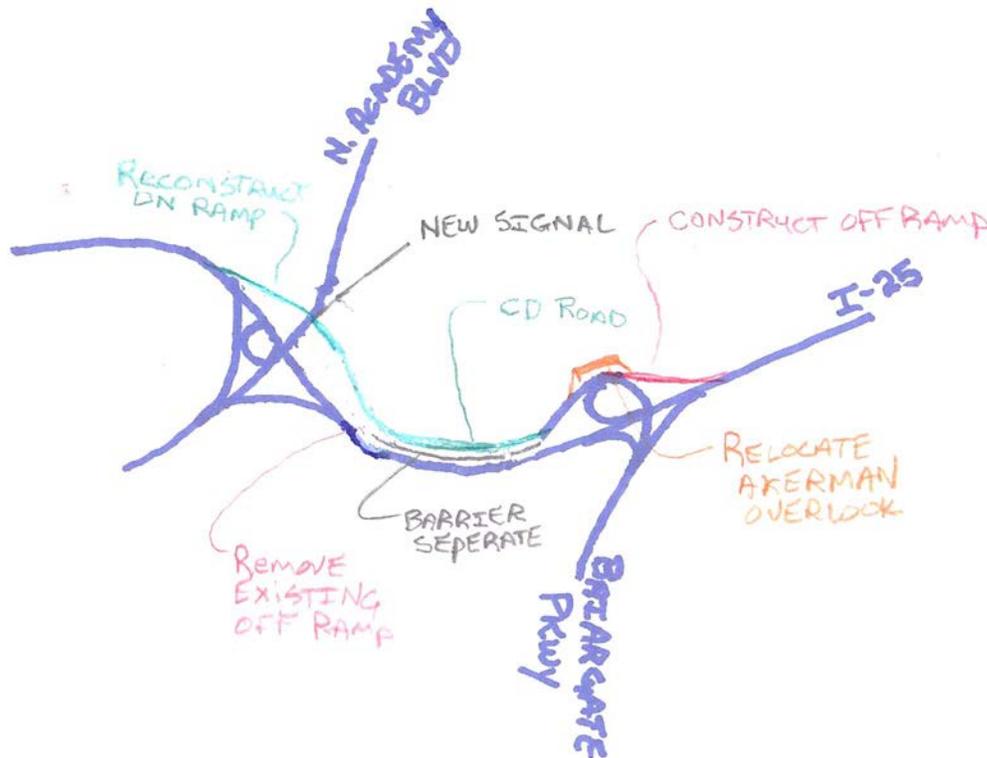
Alternative 1 suggests constructing the CD system and keeping the Academy off ramp at its current location. This will provide for limited weaving opportunity after the off ramp and CD road combines, causing a potential issue with CD road users weaving across the Academy off ramp users to make the eastbound turn at academy.

Alternative 1



Alternative 2 is the same as the first alternative, except the Academy offramp is relocated north of Briargate. This would eliminate the weave concern presented in the first alternative. With this alternative, The Ackerman Overlook could be relocated from I-25 mainline to the new off ramp. The overlook would be in a location that would provide a better view of the Air Force Academy and would be constructed with safer access that meets current roadway design standards.

Alternative 2



Under either of these scenarios, interchange reconfiguration will require an extensive operational analysis to assure that the interchange will function properly opening day and into the future. Reconfiguration of an interchange on a state or federal highway will require a CDOT 1601 process along with an Interchange Access Request (IAR) from FHWA supporting changes to access on an interstate highway. These processes and supporting analysis will take a significant amount of time and would likely delay the overall project schedule. The improvements of the above alternatives, however, could easily be added in the future as clearances are acquired and funding is secured.

SUPPLEMENTAL RECOMMENDATION NO. 01-052

SUMMARY RECOMMENDATION DESCRIPTION:

Provide roundabouts at the North Academy interchange and the Northgate interchange.

Additional Description:

Replace loop ramp configurations at Academy and at Northgate with roundabout configurations. Northgate and Academy revised interchange configurations can be accomplished independent or each other.

Related Value Engineering Proposals and/or Supplemental Recommendations:

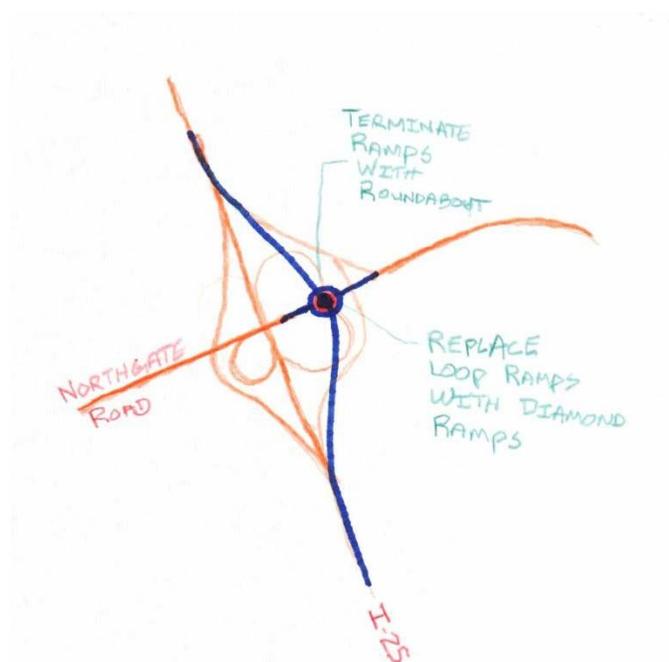
- [SR01-035](#) - Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy. and North Academy Blvd.
- [SR01-001](#) - Modify the ramp configuration at North Academy Blvd.

EVALUATION	
Idea Number: 01-052	Idea Description: Provide roundabouts at the North Academy interchange and the Northgate interchange.
Advantages of alternative concept:	<ol style="list-style-type: none">1. Improved capacity with roundabout versus signalized intersections.2. Removes congestion at northbound Academy to southbound I-25 loop ramp by replacing two merge conditions with a single merge condition
Advantages of original concept:	<ol style="list-style-type: none">1. Do not have to expend funding to reconfigure existing interchange
Risks of implementing alternative concept:	<ol style="list-style-type: none">1. May not reduce congestion on northbound I-25

DISCUSSION AND/OR CALCULATIONS:

Current proposed action has LOS B at the North Academy interchange ramp intersections. By removing the loop ramps and forcing loop ramp volumes through the signalized intersections, the southbound I-25 ramps become LOS D and the northbound ramps become LOS C. In general, since the roundabouts would have a higher capacity than signalized intersections, theoretically the roundabouts would therefore operate at LOS D or better, and LOC C or better for southbound ramps and northbound ramps respectively. The loop ramps would obviously be removed in the alternative option.

Sketch of Concept



There is limited ROW to construct the roundabouts with adequate radius at the Academy interchange. The Academy interchange provides access to the United States Air Force Academy (USAFA) for deliveries and the roundabout radius; therefore, the AFA easement would need to be increased to accommodate trucks. This would probably encroach on the USAFA easement boundary. The Northgate interchange appears to have room to construct the roundabout with adequate radius.

This proposal requires spending budget on reconfiguring the existing North Academy interchange. The existing interchange configuration is the proposed action indicated in the EA. Southbound Academy to southbound I-25 ramp and the northbound Academy to northbound I-25 ramp could still remain as free-flow ramps.

This option will require an operational analysis to ensure proper function on opening day and future. The reconfiguration will require entering the CDOT 1601 process and a FHWA Interchange Access Request modification. These processes will require a significant amount of time and would likely delay the design build schedule.

SUPPLEMENTAL RECOMMENDATION NO. 01-045

SUMMARY RECOMMENDATION DESCRIPTION:

Relocate the Ackerman Overlook to the Briargate Interchange southbound ramp.

Additional Description:

Relocating the Overlook to the Briargate southbound ramp will require a new southbound ramp from I-25 to the Briargate ramp.

Related Value Engineering Proposals and/or Supplemental Recommendations:

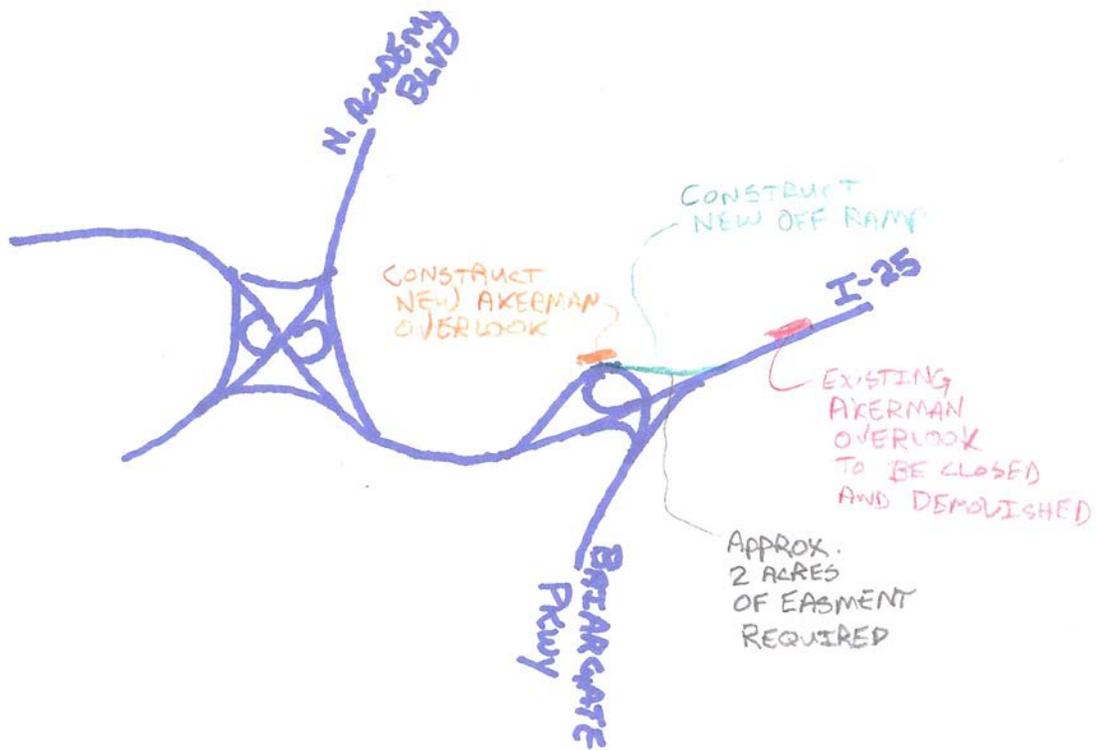
[SR01-001](#) - Modify the ramp configuration at North Academy Blvd.

[SR01-035](#) - Construct a Collector/Distributor (CD) roadway between southbound Briargate Pkwy and North Academy Blvd.

EVALUATION
Idea Number: 01-045 Idea Description: Relocate the Ackerman Overlook to the Briargate Interchange southbound ramp.
Advantages of alternative concept: 1. Provides for a scenic overlook of the Air Force Academy.
Advantages of original concept: 1. No long-term maintenance of a new CD facility.
Risks of implementing alternative concept: 1. The 1601 process and FHWA's Interchange Access Request (IAR) will take time and would delay the schedule of the project. 2. Acceptance by USAFA may delay the project.

DISCUSSION AND/OR CALCULATIONS:

The As-Designed base case condition currently requires that the Ackerman overlook be closed. The current location of the overlook is approximately 1,500 feet north of the Briargate Parkway Interchange, and provides substandard acceleration and deceleration access. This substandard condition poses a safety issue and increase congestion along mainline I-25. It is currently anticipated that a new overlook will be constructed north of the existing in future phases of corridor expansion. There has been public outcry in the past when the overlook was shut down, and it is anticipated that a closure (for any period of time) will not be well received from the public.



Reconfiguration of the Briargate interchange will require an operational analysis to assure that the interchange will function properly opening day and into the future. Reconfiguration of an interchange on a state or federal highway will require a CDOT 1601 process along with an Interchange Access Request (IAR) from FHWA supporting changes to access on an interstate highway. A re-evaluation of the EA may also be required to support a change in the overlook location. These processes and supporting analysis will take a significant amount of time and would likely delay the overall project schedule. Additionally, the new ramp would require approximately 2 acres of additional easement from the USAFA. This could also add additional time and cost to the project. Constructing the off-ramp and the new overlook however could easily be added in the future to the As-Designed base case condition with little or no throwaway.

SUPPLEMENTAL RECOMMENDATION NO. 01-040

SUMMARY RECOMMENDATION DESCRIPTION:

In the RFP, stipulate the pavement reconstruction method per life cycle cost analysis (LCCA).

Additional Description:

CDOT has an established policy for determining the type of pavement for reconstruction projects that is detailed in Chapter 10 of the Pavement Design Manual. The results of the pavement type selection process can be either PCCP, HMA, or alternate bidding to determine pavement type. The life cycle cost analysis (LCCA) will determine the pavement type when the net present value (NPV) of one alternative is greater than 10%. When the alternatives' NPV are within 10% the Region may use either the Pavement Type Selection Committee or alternative materials bids. Pavement type determination should be made prior to completion of the design-build RFP.

Related Value Engineering Proposals and/or Supplemental Recommendations:

[P01-056](#) - Develop portions of the design further before initiating the process of procurement.

EVALUATION
Idea Number: 01-040 Idea Description: In the RFP, stipulate the pavement reconstruction method per life cycle cost analysis (LCCA).
Advantages of alternative concept: 1. Clarifies the construction and materials requirements for the Design-Builder
Advantages of original concept: 1. No formal direction required from CDOT on the pavement typical section in RFP
Risks of implementing alternative concept: 1. If pavement type is prescribed, the unused industry may challenge the pavement type selection and delay project delivery

DISCUSSION AND/OR CALCULATIONS:

According to *Chapter 10 of the 2012 CDOT Pavement Design Manual (PDM)*, a LCCA comparing concrete to asphalt pavements will be prepared for all new or reconstruction projects with more than \$2,000,000 initial pavement material cost. For CDOT projects, the net present value economic analysis will be used. The concrete and paving industries are significantly engaged with the CDOT LCCA process and currently request to review all major construction project LCCA. Each industry will scrutinize the inputs to ensure they are given fair treatment when determining pavement type for construction. Missing, improper, and incomplete LCCA regularly result in challenges escalating to the Chief Engineer level and may delay project schedule. LCCA yielding comparable HMA and PCCP NPV also regularly receive significant industry scrutiny.

This project has had a LCCA completed that compares PCCP reconstruction to HMA reconstruction costs. The results show NPV of the HMA alternative to be 13% lower than the PCCP alternative for reconstruction areas. LCCA interpretation from the Region 2 Materials Program indicates that this difference in the NPV of 13%, even though slightly greater than the 10% threshold in the PDM, warrants consideration of both material types.

According to the policy on pavement type selection (again, Chapter 10 PDM), the consideration of both paving material types can be facilitated by either alternate materials bidding or by selection of a preferred material type by a Pavement Type Selection Committee (PTSC). For this project, if alternate bidding is allowed it could be stated in the RFP that either paving material will be allowed for the reconstruction sections. The pavement template (layer thicknesses) would be prescribed for both the PCCP and the HMA alternates. Requirements for cost adjustment factors applied to either pavement type, typically based on anticipated future rehabilitation costs, may be considered and are discussed under the separate VE proposal P04-002.

If the Region prefers to identify a single pavement reconstruction material for specification in the RFP, the Pavement Type Selection Committee identifies “decision factors” considered important in selecting the preferred alternative. These factors are

ranked and may include initial construction cost, future maintenance requirements, performance of similar pavements in the area, adjacent existing pavements, traffic control during construction (safety and congestion), user costs, conservation of materials and energy (recycling), environmental factors, availability of local materials contractor capabilities, etc. The membership in the PTSC should include all of the following individuals:

- Region Materials Engineer
- Resident Engineer
- Headquarters Pavement Design Program Manager
- Region Program Engineer(s)
- Region Transportation Director
- Region Maintenance Superintendent
- Headquarters Materials and Geotechnical Branch Manager
- Headquarters Project Development Branch Manager
- Federal Highway Administration's Pavement and Materials Engineer

The purpose and process for committee action is detailed in the PDM. Final concurrence with the committee's recommendation is required from the CDOT Chief Engineer.

This process was established years ago to effectively document a region's desired construction material when warranted by comparable LCCA values. It has proven very successful at reducing or eliminating the industry challenges that have derailed project delivery in the past. Anticipate at least one month to complete the committee process.

SUPPLEMENTAL RECOMMENDATION NO. 01-039

SUMMARY RECOMMENDATION DESCRIPTION:

Make the Northgate interchange bridges in an Additional Requested Elements (ARE) alternative.

Additional Description:

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 01-039 Idea Description: Make the Northgate interchange bridges in an Additional Requested Elements (ARE) alternative.
Advantages of alternative concept: 1. Allows flexibility for extending the northbound working limits.
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. The main risk that it would not work with the future Powers interchange or cause limitations for the future interchange.

DISCUSSION AND/OR CALCULATIONS:

The advantage to making this a separate ARE is that it provides CDOT more flexibility and control. If the base overall project costs are lower than anticipated it is an opportunity to evaluate replacing the Northgate interchange bridges. The Northgate bridges were estimated at \$4,000,000 in the design summary.

SUPPLEMENTAL RECOMMENDATION NO. 01-044

SUMMARY RECOMMENDATION DESCRIPTION:

Make the Black Squirrel Creek bridge reconstruction/widening part of the base case.

Additional Description:

Include bridges as ARE's and identify them as widen or replacements.

Related Value Engineering Proposals and/or Supplemental Recommendations:

[SR01-038](#) - Replace the existing scour critical three-span bridges at Black Squirrel Creek with a single-span bridge.

EVALUATION	
Idea Number: 01-044	
Idea Description: Make the Black Squirrel Creek bridge reconstruction/widening part of the base case.	
Advantages of alternative concept:	
1. Relieves congestion and pitch point	
Advantages of original concept:	
1. None noted.	
Risks of implementing alternative concept:	
1. Throw away pavement	

DISCUSSION AND/OR CALCULATIONS:

The bridges were built in 1954 and widened in 1976. The northbound structure, H-17-J, has a sufficiency rating of 66 and the southbound structure, H-17-L, has a sufficiency rating of 76. These ratings are above the minimum of 50. Also the northbound structure is on CDOT's scour critical list. The bridge lengths are 104-feet long.

Widening Discussion

The existing bridges have approximately a 42-foot roadway width; to build to the typical section for the I-25 North Design Build Project, the bridges would need to be widened approximately 20 to 21 feet. Looking at the structure reports, there are various elements of both bridges that would require repair which will add to the cost.

Use a slightly higher cost to cover the repairs, \$175/sf for widening the structures.

Widening Costs

Widen NB only - \$400,000

Widen NB and SB - \$800,000

Replacement Discussion

The existing bridges have approximately a 42-foot roadway width; to build to the typical section for the I-25 North Design Build Project, the bridges would need to be widened approximately 20 to 21 feet. Use 63 feet for replacement width and a cost of \$150/sf. The length is 104 feet per structure.

Replacement Costs

Replacement cost for both bridges is \$2.5 million. The bridges are approximately \$1.25 million each.

Conclusion (assuming bridges would be replaced)

For the bridges to be included in the base case I looked at different 2 scenarios:

Scenario 1

Include northbound and southbound bridges in base case if funds allow.

Scenario 2

Include northbound structure in base case and southbound bridge as an ARE.

If bridges cannot be included in the base case, make both of them ARE's, giving more points to the northbound structure

Considering the existing structures age and condition the bridges can be reconstructed at small increase in cost (approximately \$500,000). With a new structure future maintenance costs would be less than if the structures were widened.

SUPPLEMENTAL RECOMMENDATION NO. 02-007

SUMMARY RECOMMENDATION DESCRIPTION:

Specify the type of water quality (WQ) features allowed.

Additional Description:

The types of WQ features that CDOT will allow will be included in the RFP.

Related Value Engineering Proposals and/or Supplemental Recommendations:

EVALUATION
Idea Number: 02-007
Idea Description: Specify the type of water quality (WQ) features allowed.
Advantages of alternative concept: 1. Confident the specified features will work
Advantages of original concept: 1. None noted
Risks of implementing alternative concept: 1. USAFA concurrence

DISCUSSION AND/OR CALCULATIONS:

Preferred Types:

1. Water quality vaults
2. Swales
3. WQ ponds with orifice plates
4. Vortechincs vaults
5. Other techniques to be approved by CDOT

Will Not Allow:

1. Under drains (perforated pipe with gravel/geotextile)
2. Sand filter inlets
3. Detention will not be allowed for WQ

SECTION 5 – IDEAS ANALYZED BUT NOT PROPOSED

EVALUATION	
Idea Number: 01-004	Idea Description: Extend existing I-25 cross culverts instead of replacing culverts.
Advantages of alternative concept:	1. Lower cost as a result of less pipe installed.
Advantages of original concept:	1. None noted.
Risks of implementing alternative concept:	1. None noted.
Conclusion:	Do not propose this idea because Original I-25 was constructed 50+ years ago and leaving this pipes in the ground and having subsequent failure after this project has been completed will lead to traffic disruptions and excessive user costs along with culvert repairs. In addition, the EA plans indicate many of the culverts need to be replaced because of lack of hydraulic capacity and therefore extension is not viable.

Calculations and/or Discussion:

This idea fails because:

- Original mainline I-25 was constructed 50+ years ago. The cross culverts installed as part of the original construction are at/near their service life. If these culverts are not replaced at this time structural failure prior to the next potential reconstruction (40 years from now?) would cause undue traffic disruptions and user costs.
- A review of the segment between Briargate Interchange to Interquest Interchange indicates there are 5 existing I-25 cross culverts. Based on EA preliminary hydraulic analysis, concept plans show that all 5 culverts are undersized and larger culvert sizes are needed to convey design flow. Pipe extensions are not feasible.

EVALUATION
Idea Number: 01-007 Idea Description: Reduces initial costs for materials required by using metric dimensions.
Advantages of alternative concept: 1. Reduces costs for materials
Advantages of original concept: 1. None noted.
Risks of implementing alternative concept: 1. None noted.
Conclusion: Do not propose this idea because Uncertain acceptance by FHWA and small savings.

Calculations and/or Discussion:

EVALUATION
Idea Number: 01-022 Idea Description: Use regional detention and water quality facilities rather than on-site facilities.
Advantages of alternative concept: 1. Lower capital costs, less maintenance burden and costs, and more effective pollutant removal.
Advantages of original concept: 1. Allows adherence to schedule.
Risks of implementing alternative concept: 1. None noted.
Conclusion: Do not propose this idea because coordination and agreement between El Paso County, the City of Colorado Springs, CDOT, Air Force, and potentially Colorado Department of Health would be required to implement a regional approach. There is not sufficient time in the project schedule for this to happen.

Calculations and/or Discussion:

Advantages of Regional Approach:

- Facilities function better at removing pollutants with larger tributary area.
- One single large facility will eliminate several smaller facilities and associated drainage infrastructure to route flows to smaller facilities.
- Single large facility costs less than several smaller facilities.
- Easier to monitor and perform annual inspections with one single facility than several smaller facilities.
- Can be sized for future upstream imperviousness in order to minimize disruption to development.
- Easier for maintenance (centralized, larger access routes, less clogging, less routine maintenance).

Disadvantages:

- Coordination and agreement between El Paso County, the City of Colorado Springs, CDOT, Air Force, and potentially Colorado Department of Health would be required to implement a regional approach. There is not sufficient time in the project schedule for this to happen.

For other upcoming projects and where schedule allows, CDOT should consider coordinating with other agencies to implement regional water quality approach and realize the benefits it provides.

EVALUATION	
Idea Number: 01-024	Idea Description: Use permeable pavement in shoulders with retention underneath.
Advantages of alternative concept:	1. Reduction or elimination of water quality ponds adjacent to travel lanes
Advantages of original concept:	1. Well documented design, construction and maintenance with conventional water quality techniques
Risks of implementing alternative concept:	1. Untested application by CDOT 2. Improper construction in the retention system below the shoulder pavement could lead to deterioration of adjacent embankment structure beneath interstate travel lanes 3. No established CDOT pavement thickness design process for permeable pavements 4. Special maintenance activities required to ensure long term permeability of pavement and functionality of system in areas where road sanding is used 5. Removal and replacement of permeable pavement and associated water quality feature if shoulder used as travel lane in future configuration. Overlay of permeable pavements has been demonstrated as problematic.
Conclusion:	Do not propose this idea because potential embankment failure, system inoperability and future removal and replacement costs pose significant risks compared to conventional water quality techniques

Calculations and/or Discussion:

The potential benefits initially considered with this proposal are outweighed by the likely need to remove and replace these installations alone. The project's base case calls for building project shoulders with the intention of using them during future corridor expansion projects to eight lanes. Also, CDOT Maintenance forces would likely be required to purchase and use specialized new vacuum cleaning machinery to ensure for long term permeability of the permeable pavement. Removal of road debris and sanding materials is necessary to prevent clogging of the open aggregate structure of permeable pavements.

EVALUATION	
Idea Number: 01-032	Idea Description: Extend northbound three-lane section south from Monument
Advantages of alternative concept:	<ol style="list-style-type: none">1. Maximize use of allocated funding2. Continuation of previous I-25 improvements in Monument
Advantages of original concept:	<ol style="list-style-type: none">1. Improvements in the alternative are disjointed from the base project from a logical south-to-north progression of improvements
Risks of implementing alternative concept:	<ol style="list-style-type: none">1. Most likely will be considerable questioning from the I-25 users, community, political leaders, and management staff
Conclusion:	Do not propose this idea because the recommendation does not meet CDOT's number one goal. The disadvantages are key issues.

Calculations and/or Discussion:

The idea assumes the base case project from Woodmen to just north of Interquest is completed and funding remains. This idea considers adding improvements in the northbound segments of I-25 from Monument to the south in order to maximize use of the \$36 million budget.

The improvements are to begin at the previously completed I-25 project just south of Monument and extend to the south as far as funding will allow. The exact extent of improvements that are completed from Monument south are not specified but include constructing the northbound proposed section. The improvements would need to be included in the RFP as Additional Requested Elements (ARE).

The disadvantages are:

- Improvements in the supplemental recommendation are disjointed from the logical south-to-north progression of improvements.
- There will most likely be considerable questioning from the I-25 users, community, political leaders, and management staff as to why improvements have jumped from the end of the base project to the Monument section.

EVALUATION	
Idea Number: 01-003	Idea Description: Install V-Pans at outside shoulders.
Advantages of alternative concept:	1. None noted.
Advantages of original concept:	1. None noted.
Risks of implementing alternative concept:	1. None noted.
Conclusion:	Do not propose this idea because it is included in Section 10

Calculations and/or Discussion:

The following ideas were dismissed during the initial idea cull. They were not analyzed to the point of listing individual advantages and disadvantages.

INITIALLY FAILED IDEAS TABLE

Idea No.	Idea Description	Reason for Failing Idea
01-005	Use full depth white topping in some areas (8 inches +)	White topping is not an option due to reconstruction required by grade changes.
01-009	Widen Black Squirrel bridge to the outside.	The bridge was built in 1954 and is fast approaching its end of life. The bridge is also on the scour critical list and should be replaced.
01-013	Modify the template.	This is a goal, not an alternative
01-014	Use detention ponds in lieu of permanent water quality improvements.	Detention alone cannot do water quality improvement
01-015	Let the AFA participate on the VE review board.	Too late to fit this into their schedule
01-020	Reconstruct southbound and widen and overlay northbound.	This is part of one of the scenarios
01-025	Stage 1 northbound; Stage 2 southbound.	This is scenario No. 10
01-030	Use Accelerated Bridge Construction (ABC).	There are no bridges in the base case. However, it could apply to Black Squirrel Bridge if the termini are changed.
01-037	Get mouse habitat rebanking from other sources.	This is non-issue
01-048	8-lane to Interquest ultimately.	No apparent advantage
03-015	Have the contractor assign agency liaison.	Administratively needs to be handled by CDOT
06-006	Build ultimate section now.	Can't afford it and still meet main project goals
06-009	Use Travel Demand Management (TDM) strategies.	Too difficult to implement

SECTION 6 – FUNCTIONS CHOSEN FOR BRAINSTORMING

Six functions plus the shotgun list were identified for brainstorming in this VE Study. These functions were chosen per Pareto's Law as those 20% of the functions that drive 80% of the cost. In addition, the risk factor was taken into account when choosing the functions. The six functions (in addition to the shotgun list) were:

1. Shotgun List
2. Control Stormwater
3. Minimize Disruptions
4. Optimize Pavement Section
5. Optimize Roadway Section
6. Reduce Congestion

SECTION 7 – BRAINSTORMING IDEAS

The following table lists all of the ideas generated by the VE Team. They are arranged by the function from which they were generated. Shotgun list ideas are alternatives the VE Team members initially brought to the workshop as a result of their pre-study assignment.

Each idea can be traced to its ultimate disposition by crosschecking the disposition column of this table with Sections 3, 4, and 5 of this report.

Some of the ideas whose disposition is listed as “As Designed” were also assumed to be “as will be designed.”

PLEASE NOTE: One of the rules for creativity exercises in a formal VE Study requires the team members to “stretch” their imaginations by generating sometimes facetious and seeming nonsensical ideas in order to ideate a possible conceptual blockbuster. These ideas, too, are recorded in this table.

Brainstorming List by Function

Idea No.	Idea Description	Disposition	With
	SHOTGUN LIST		
01-001	Modify ramp configuration at Academy.	Supplemental Recommendation	-
01-002	Stabilize streams at crossings.	Supplemental Recommendation	-
01-003	Install V-Pans at outside shoulders.	Pass	-
01-004	Extend culverts in lieu of replacement.	Pass	-
01-005	Use full depth white topping in some areas (8 inches +)	Fail	-
01-006	Use retaining walls for split profile in lieu reconstruction.	Pass	-
01-007	Reduce material by converting dimensions to metric.	Pass	-
01-008	Maximize construction to the outside.	Pass	-
01-009	Widen Black Squirrel bridge to the outside.	Fail	-
01-010	Utilize the existing structure at Northgate and Smith Creek.	Pass	-
01-011	Widen shoulders at Black Squirrel Creek to Baptist and upgrade ramps at Northgate.	Pass	-
01-012	Add passing lane from Black Squirrel Creek to Baptist.	Supplemental Recommendation	-
01-013	Modify the template.	Fail	-
01-014	Use detention ponds in lieu of permanent water quality improvements.	Fail	-
01-015	Let the AFA participate on the VE review board.	Fail	-
01-016	Let the D/B proposers meet with the AFA.	As Designed	-
01-017	Use ITS to allow travel on shoulders in peak periods.	Pass	-
01-018	Put more emphasis on northbound congestion relief, allow asymmetrical termini.	Supplemental Recommendation	-
01-019	Construct a storm sewer in the median.	Combine	01-054
01-020	Reconstruct southbound and widen and overlay northbound.	Fail	-
01-021	Mitigate increased peak flows at AFA.	As Designed	-
01-022	Use regional water quality in lieu of offsite.	Pass	-
01-023	Build shoulders to travel lane standards.	As Designed	-

Idea No.	Idea Description	Disposition	With
01-024	Use permeable pavement in shoulder with retention underneath.	Pass	-
01-025	Stage 1 northbound; Stage 2 southbound.	Fail	-
01-026	Use performance criteria for bridges and walls.	Supplemental Recommendation	-
01-027	Minimize throw away paving by utilizing detours in final configuration.	As Designed	-
01-028	Allow the contractor to modify the maintenance of traffic in stages.	As Designed	-
01-029	Use temporary ITS during construction.	Supplemental Recommendation	-
01-030	Use Accelerated Bridge Construction (ABC).	Fail	-
01-031	Improve ITS, e.g. signing, ramp metering, etc.	Pass	-
01-032	Extend northbound 6-lane section to the south from Monument.	Pass	-
01-033	Remaining funds after Interquest to be devoted to northbound only.	Supplemental Recommendation	-
01-034	Defer southbound auxiliary lanes.	Combine	01-031
01-035	Split configuration at Briargate and North Academy.	Supplemental Recommendation	01-001
01-036	Steepen side slopes.	As Designed	-
01-037	Get mouse habitat rebanking from other sources.	Fail	-
01-038	Use single span at Black Squirrel Bridge.	Supplemental Recommendation	-
01-039	Make an ARE package for northbound Northgate bridge.	Supplemental Recommendation	-
01-040	Stipulate the paving reconstruction method per the LCCA.	Supplemental Recommendation	-
01-041	Clearly identify reconstruction areas dictated by geometrics.	Combine	01-056
01-042	Make provisions for 8-lane element as an Additional Requested Element (ARE).	Combine	01-056
01-043	Make Black Squirrel bridge a single bridge by filling in the middle.	Combine	01-038
01-044	Make Black Squirrel bridge reconstruct/replace part of the base case.	Supplemental Recommendation	01-038
01-045	Put the Ackerman Overlook on the Briargate southbound ramp.	Supplemental Recommendation	01-001
01-046	Develop a sufficient number of ARE's to use all of the allocated funding.	As Designed	-
01-047	Shift southbound to median to accommodate Ackerman Overlook.	Pass	-
01-048	8-lane to Interquest ultimately.	Fail	-
01-049	Cantilever sign structures in lieu of sign bridges.	Pass	-
01-050	Pre-establish signal timing plans on SH83 to accommodate detours.	Supplemental Recommendation	-
01-051	Assign point values to ARE's.	Supplemental Recommendation	-
01-052	Roundabouts at interchanges, e.g., Northgate east of I-25.	Supplemental Recommendation	01-001
01-053	Use SH83 as a relief route.	Supplemental Recommendation	-

Idea No.	Idea Description	Disposition	With
01-054	In superelevated segments, use manhole flow diversion structures in median storm sewer to separate water quality flows.	Pass	-
01-055	Consider grass swale and determine if 80% TSS removal is achieved (where easement is available)	As Designed	-
01-056	Develop design further before initiating procurement, esp., <ul style="list-style-type: none"> • Drainage Design - 50% • Roadway Design - Set profiles and superelevations (40%) • If required - Interchange reconfiguration (preliminary design) 	Pass	-
01-057	Diverging Diamond at North Academy Interchange.	Combine	01-001
01-058	Light corridor from Woodmen to Briargate.	Supplemental Recommendation	-
CONTROL STORMWATER			
02-001	Build swales	As Designed	-
02-002	Construct water quality basins.	As Designed	-
02-003	Build detention basins upstream of AFA easements.	Combine	01-022
02-004	Build drop structures.	Combine	01-002
02-005	Decrease the runoff coefficient by putting in elements that would slow the flow.	As Designed	-
02-006	Divert flow to existing basin near Pine Creek.	Pass	-
02-007	Specify the type of water quality features allowed.	Supplemental Recommendation	-
02-008	Fix only issues created by CDOT and needed to protect the freeway.	As Designed	-
MINIMIZE DISRUPTIONS			
03-001	Specify Courtesy Patrol.	As Designed	-
03-002	Accommodate major events.	As Designed	-
03-003	Provide shoulder and/or breakdown lanes.	Supplemental Recommendation	-
03-004	Maintain four-lane facility.	As Designed	-
03-005	Maintain all accesses.	As Designed	-
03-006	Limit working hours.	As Designed	-
03-007	Limit length of lane closures.	As Designed	-
03-008	Limit construction access.	As Designed	-
03-009	Limit trucks to right hand lanes on the mainline.	Supplemental Recommendation	-
03-010	Encourage alternate routes.	Combine	03-009
03-011	Set minimum speed.	Combine	03-009
03-012	Put A+B in bid contract.	As Designed	-
03-013	Increase the widen and overlay portions of the project.	As Designed	-
03-014	Increase M.O.T. quality control	As Designed	-
03-015	Have the contractor assign agency liaison.	Fail	-
03-016	Set up task order with CSP.	As Designed	-
03-017	Allow High-Early Concrete.	As Designed	-
OPTIMIZE PAVEMENT SECTION			
04-001	Segregate northbound and southbound design.	As Designed	-

Idea No.	Idea Description	Disposition	With
04-002	Put an adjustment factor in for asphalt design.	Pass	-
04-003	Use existing structure where possible.	As Designed	-
04-004	Assign portions of the project to initial cost or LCCA.	Combine	01-056
OPTIMIZE ROADWAY SECTION			
05-001	Construct inside first.	Supplemental Recommendation	-
05-002	10' inside shoulder from Briargate north.	Pass	-
05-003	Widen inside shoulder to accommodate horizontal sight distance.	As Designed	-
05-004	Design ultimate storm sewer to utilize interim culverts as future laterals.	Combine	01-054
05-005	Put safety edge on shoulder.	As Designed	-
REDUCE CONGESTION			
06-001	Add Lanes.	As Designed	-
06-002	Improve shoulders.	As Designed	-
06-003	Add auxiliary lanes.	As Designed	-
06-004	Barrier separate CD road between Briargate and Academy.	Combine	01-035
06-005	Convert HOV to managed lane.	Supplemental Recommendation	-
06-006	Build ultimate section now.	Fail	-
06-007	Eliminate northwest loop ramp at Academy and replace with southwest on ramp.	Combine	01-001
06-008	Eliminate southwest loop ramp at Northgate.	Combine	01-052
06-009	Use Travel Demand Management (TDM) strategies.	Fail	-
06-010	Use parallel acceleration lanes.	As Designed	-

The following table again lists all of the ideas generated by the VE Team. However this time they are arranged by into one of three classifications: "Classic" VE, Request for Proposal (RFP) recommendations, and Scenario Descriptions. Note, some of the ideas were not classified and listed under the category "none".

Brainstorming List by Classification

Idea No.	Idea Description	Disposition	With
	Classic VE		
01-022	Use regional water quality in lieu of offsite.	Pass	-
02-006	Divert flow to existing basin near Pine Creek.	Pass	-
01-058	Light corridor from Woodmen to Briargate.	Supplemental Recommendation	-
01-054	In superelevated segments, use manhole flow diversion structures in median storm sewer to separate water quality flows.	Pass	-
01-050	Pre-establish signal timing plans on SH83 to accommodate detours.	Supplemental Recommendation	-
01-001	Modify ramp configuration at Academy.	Supplemental Recommendation	-
01-049	Cantilever sign structures in lieu of sign bridges.	Pass	-
01-047	Shift southbound to median to accommodate Ackerman Overlook.	Pass	-
01-045	Put the Ackerman Overlook on the Briargate southbound ramp.	Supplemental Recommendation	01-001
01-035	Split configuration at Briargate and North Academy.	Supplemental Recommendation	01-001
02-007	Specify the type of water quality features allowed.	Supplemental Recommendation	-
01-024	Use permeable pavement in shoulder with retention underneath.	Pass	-
01-052	Roundabouts at interchanges, e.g., Northgate east of I-25.	Supplemental Recommendation	01-001
01-018	Put more emphasis on northbound congestion relief, allow asymmetrical termini.	Supplemental Recommendation	-
01-017	Use ITS to allow travel on shoulders in peak periods.	Pass	-
01-011	Widen shoulders at Black Squirrel Creek to Baptist and upgrade ramps at Northgate.	Pass	-
01-010	Utilize the existing structure at Northgate and Smith Creek.	Pass	-
01-008	Maximize construction to the outside.	Pass	-
01-007	Reduce material by converting dimensions to metric.	Pass	-
01-006	Use retaining walls for split profile in lieu reconstruction.	Pass	-
01-004	Extend culverts in lieu of replacement.	Pass	-
01-003	Install V-Pans at outside shoulders.	Pass	-
01-031	Improve ITS, e.g. signing, ramp metering, etc.	Pass	-
06-005	Convert HOV to managed lane.	Supplemental Recommendation	-

Idea No.	Idea Description	Disposition	With
05-001	Construct inside first.	Supplemental Recommendation	-
05-002	10' inside shoulder from Briargate north.	Pass	-
	RFP Recommendations		
01-002	Stabilize streams at crossings.	Supplemental Recommendation	-
01-026	Use performance criteria for bridges and walls.	Supplemental Recommendation	-
01-029	Use temporary ITS during construction.	Supplemental Recommendation	-
01-032	Extend northbound 6-lane section to the south from Monument.	Pass	-
01-033	Remaining funds after Interquest to be devoted to northbound only.	Supplemental Recommendation	-
01-038	Use single span at Black Squirrel Bridge.	Supplemental Recommendation	-
01-051	Assign point values to ARE's.	Supplemental Recommendation	-
01-040	Stipulate the paving reconstruction method per the LCCA.	Supplemental Recommendation	-
01-044	Make Black Squirrel bridge reconstruct/replace part of the base case.	Supplemental Recommendation	01-038
04-002	Put an adjustment factor in for asphalt design.	Pass	-
01-053	Use SH83 as a relief route.	Supplemental Recommendation	-
01-056	Develop design further before initiating procurement, <ul style="list-style-type: none"> o Drainage Design - 50% o Roadway Design - Set profiles and superelevations (40%) o If required - Interchange reconfiguration (preliminary design) 	Pass	-
03-003	Provide shoulder and/or breakdown lanes.	Supplemental Recommendation	-
03-009	Limit trucks to right hand lanes on the mainline.	Supplemental Recommendation	-
01-039	Make an ARE package for northbound Northgate bridge.	Supplemental Recommendation	-
	Scenario Recommendations		
01-012	Add passing lane from Black Squirrel Creek to Baptist.	Supplemental Recommendation	-
	None		
04-004	Assign portions of the project to initial cost or LCCA.	Combine	01-056
01-034	Defer southbound auxiliary lanes.	Combine	01-031
01-036	Steepen side slopes.	As Designed	-
01-037	Get mouse habitat rebanking from other sources.	Fail	-
01-013	Modify the template.	Fail	-
01-009	Widen Black Squirrel bridge to the outside.	Fail	-
05-003	Widen inside shoulder to accommodate horizontal sight distance.	As Designed	-

Idea No.	Idea Description	Disposition	With
03-013	Increase, widen, and overlay portions of the project.	As Designed	-
01-042	Make provisions for 8-lane element as an Additional Requested Element (ARE).	Combine	01-056
01-043	Make Black Squirrel bridge a single bridge by filling in the middle.	Combine	01-038
06-006	Build ultimate section now.	Fail	-
01-016	Let the D/B proposers meet with the AFA.	As Designed	-
06-004	Barrier separate CD road between Briargate and Academy.	Combine	01-035
05-004	Design ultimate storm sewer to utilize interim culverts as future laterals.	Combine	01-054
06-002	Improve shoulders.	As Designed	-
06-001	Add Lanes.	As Designed	-
01-019	Construct a storm sewer in the median.	Combine	01-054
01-020	Reconstruct southbound and widen and overlay northbound.	Fail	-
01-021	Mitigate increased peak flows at AFA.	As Designed	-
06-003	Add auxiliary lanes.	As Designed	-
01-023	Build shoulders to travel lane standards.	As Designed	-
01-048	8-lane to Interquest ultimately.	Fail	-
01-025	Stage 1 northbound; Stage 2 southbound.	Fail	-
01-015	Let the AFA participate on the VE review board.	Fail	-
01-027	Minimize throw away paving by utilizing detours in final configuration.	As Designed	-
01-028	Allow the contractor to modify the maintenance of traffic in stages.	As Designed	-
01-014	Use detention ponds in lieu of permanent water quality improvements.	Fail	-
01-030	Use Accelerated Bridge Construction (ABC).	Fail	-
05-005	Put safety edge on shoulder.	As Designed	-
02-005	Decrease the runoff coefficient by putting in elements that would slow the flow.	As Designed	-
03-012	Put A+B in bid contract.	As Designed	-
03-011	Set minimum speed.	Combine	03-009
03-010	Encourage alternate routes.	Combine	03-009
03-008	Limit construction access.	As Designed	-
03-007	Limit length of lane closures.	As Designed	-
03-006	Limit working hours.	As Designed	-
03-005	Maintain all accesses.	As Designed	-
03-004	Maintain four-lane facility.	As Designed	-
06-009	Use Travel Demand Management (TDM) strategies.	Fail	-
03-002	Accommodate major events.	As Designed	-
03-001	Specify Courtesy Patrol.	As Designed	-
02-008	Fix only issues created by CDOT and needed to protect the freeway.	As Designed	-
01-046	Develop a sufficient number of ARE's to use all of the allocated funding.	As Designed	-
03-015	Have the contractor assign agency liaison.	Fail	-
06-008	Eliminate southwest loop ramp at Northgate.	Combine	01-052
04-003	Use existing structure where possible.	As Designed	-

Idea No.	Idea Description	Disposition	With
06-007	Eliminate northwest loop ramp at Academy and replace with southwest on ramp.	Combine	01-001
04-001	Segregate northbound and southbound design.	As Designed	-
06-010	Use parallel acceleration lanes.	As Designed	-
01-005	Use full depth white topping in some areas (8 inches +)	Fail	-
03-014	Increase M.O.T. quality control	As Designed	-
01-055	Consider grass swale and determine if 80% TSS removal is achieved (where easement is available)	As Designed	-
01-041	Clearly identify reconstruction areas dictated by geometrics.	Combine	01-056
01-057	Diverging Diamond at North Academy Interchange.	Combine	01-001
03-016	Set up task order with CSP.	As Designed	-
02-001	Build swales	As Designed	-
02-002	Construct water quality basins.	As Designed	-
02-003	Build detention basins upstream of AFA easements.	Combine	01-022
02-004	Build drop structures.	Combine	01-002
03-017	Allow High-Early Concrete.	As Designed	-

SECTION 8 – REVIEW BOARD DECISIONS

Summary of Responses to Value Engineering Proposals & Supplemental Recommendations					
Project		CDOT Region 2 I-25 North Design Build – El Paso County			
Definitions of Response Terminology					
Accept: The proposal will be accepted and the original design concept will be modified accordingly.					
Accept with Modifications: Portions of the recommendation will be accepted and/or the proposal will be modified somewhat.					
Table the Decision: The proposal's disposition will be decided at future date. An individual should be assigned responsibility for follow-through.					
Decline: The proposal will not be accepted and the original design concept will be implemented					
VE Proposal No. or Supplemental Recommendation No.	VE Proposal or Supplemental Recommendation Description	Lead Responder	Response	Total Initial Savings (\$)	Total Cost Savings (\$) ¹
P01-017	Provide Hard Shoulder Running in lieu of additional travel lanes.		Table	\$220,000	\$220,000
P01-008	Maximize construction to the outside areas of the existing roadway.		Accept with modifications	\$1,080,000	\$1,080,000
P05-002	Switch from 12' inside shoulder to 10' inside shoulder north of Briargate.		Decline	\$45,000	\$45,000
P01-047	Realign SB I-25 toward median to accommodate Ackerman Overlook.		Decline	-\$66,000	-\$66,000
P01-010	Use existing bridges at Northgate interchange; defers replacement of the bridges to future project.		Accept	\$4,000,000	\$0

VE Proposal No. or Supplemental Recommendation No.	VE Proposal or Supplemental Recommendation Description	Lead Responder	Response	Total Initial Savings (\$)	Total Cost Savings (\$) ¹
P01-011	Widen shoulders along NB I-25 from Black Squirrel Creek to Baptist Rd, in lieu of adding lanes; upgrade ramp geometry at Northgate to reduce the impact that ramp traffic has on mainline I-25.		Decline	\$300,000	\$1,300,000
P01-006	Use retaining walls for split profile in lieu of reconstruction.		Decline	Not Quantified	Not Quantified
P01-003	Install Valley Pan along outside shoulder to intercept and convey water quality and 100-year flows.		Table	\$330,000	\$330,000+
P02-006	Divert pavement runoff for water quality event into existing water quality basins near Pine Creek.		Accept	\$25,000	\$25,000
P01-031	Improve corridor ITS. For example signing, ramp metering, etc.		Decline	\$2,000,000	\$900,000
P01-049	Consider using cantilever sign structures in lieu of sign bridges whenever possible.		Accept	\$61,000	\$61,000
P01-056	Develop portions of the design further before starting procurement.		Decline	Not Quantified	Not Quantified
P01-051	Assign point values to Additional Requested Elements (AREs).		Accept	Not Quantified	Not Quantified
P04-002	Use an adjustment factor if HMA reconstruction is specified.		Accept with modifications	Incomplete	Incomplete

VE Proposal No. or Supplemental Recommendation No.	VE Proposal or Supplemental Recommendation Description	Lead Responder	Response	Total Initial Savings (\$)	Total Cost Savings (\$) ¹
P05-001	Construct all the roadway, shoulders and auxiliary lanes from the median toward the outside.		Accept	\$265,000	\$265,000
SR01-012	Construct a passing lane on NB I-25 from Black Squirrel Creek to Baptist Rd in lieu of widening to three NB lanes from Interquest Parkway to Monument.		Decline	Not Quantified	Not Quantified
SR06-005	Convert the proposed HOV lane to a Managed Lane that would permit single-occupant vehicles to use the lane for a fee.		Table	Not Quantified	Not Quantified
SR03-003	Provide a shoulder wherever possible during construction for incident clearance; provide emergency pullouts during construction in locations where a shoulder cannot be provided.		Accept	Not Quantified	Not Quantified
SR01-038	Replace existing scour critical bridges at Black Squirrel Creek with single span bridge.		Accept	Not Quantified	Not Quantified
SR01-026	Provide additional wall performance criteria for the RFP.		Accept	Not Quantified	Not Quantified
SR01-002	Stabilize streams within CDOT easement area.		Accept	Not Quantified	Not Quantified

VE Proposal No. or Supplemental Recommendation No.	VE Proposal or Supplemental Recommendation Description	Lead Responder	Response	Total Initial Savings (\$)	Total Cost Savings (\$) ¹
SR01-054	Construct storm sewer in median in super-elevated segments and also install manhole diversion structures to isolate water quality flows.		Accept	Not Quantified	Not Quantified
SR01-050	Pre-establish traffic signal timing plans along alternate routes, such as SH 83 and Voyager Parkway from Academy Blvd to Northgate, would allow for quick implementation of a detour in the event of an incident within the construction zone.		Accept	Not Quantified	Not Quantified
SR01-029	Use temporary ITS infrastructure during construction to mitigate congestion caused by construction activities.		Accept	Not Quantified	Not Quantified
SR03-009	Additional temporary signing to relieve traffic congestion during construction.		Accept	Not Quantified	Not Quantified
SR01-058	Provide corridor lighting from Woodmen to Briargate.		Accept with modifications	Not Quantified	Not Quantified
SR01-001	Modify the ramp configuration at North Academy Blvd.		Accept with modifications	Not Quantified	Not Quantified
SR01-035	Construct a Collector/Distributor (CD) roadway between SB Briargate Parkway and North Academy Blvd.		Decline	Not Quantified	Not Quantified

VE Proposal No. or Supplemental Recommendation No.	VE Proposal or Supplemental Recommendation Description	Lead Responder	Response	Total Initial Savings (\$)	Total Cost Savings (\$) ¹
SR01-052	Provide roundabouts at North Academy interchange and Northgate Interchange.		Decline	Not Quantified	Not Quantified
SR01-045	Relocate the Ackerman Overlook to the Briargate interchange SB ramp.-		Decline	Not Quantified	Not Quantified
SR01-040	In the RFP, stipulate the pavement reconstruction method per LCCA.		Decline	Not Quantified	Not Quantified
SR01-039	Make the Northgate interchange bridges an ARE alternative.		Accept	Not Quantified	Not Quantified
SR01-044	Make Black Squirrel Creek bridge reconstruction part of base configuration.		Accept with modifications	Not Quantified	Not Quantified
SR02-007	Specify type of WQ features allowed.		Accept	Not Quantified	Not Quantified
Total Cost Savings of Proposals Accepted =				\$5,431,000	\$1,431,000
Notes:					
1. The Total Cost Savings is the designer's estimated cost savings minus the estimated cost for the design change.					
2. The "Total Cost Savings of Proposals" is the sum of all savings associated with "accepted" or "partially accepted" proposals.					
3. ND - Not Determined, NA - Not Applicable					

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-003
<i>Description:</i>	Install Valley Pan along outside shoulder to intercept and convey water quality and 100-year flows
<i>Recommended Action:</i>	Table
<i>Discussion:</i>	Savings by avoiding installation of ponds; let Contractor decide
Construction Cost Savings Comparison	
VE Team Savings Estimate \$330,000+	
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-006
<i>Description:</i>	Use retaining walls for split profile in lieu of reconstruction
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	CDOT prefers to have no split profile, but would entertain ideas that are equal to or better than reconstruction; this proposal contradicts the basic configuration which involves reconstructing portions of SB I-25
Construction Cost Savings Comparison	
VE Team Savings Estimate Not Quantified	
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-008
<i>Description:</i>	Maximize construction to the outside areas of the existing roadway
<i>Recommended Action:</i>	Accept with Modifications
<i>Discussion:</i>	Project team will make appropriate modifications to maximize
Construction Cost Savings Comparison	
VE Team Savings Estimate	
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-010
<i>Description:</i>	Using the existing bridges at the Northgate Interchange defers the replacement of the Northgate interchange bridges for a future project
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	Bridges will have substandard shoulders, temporarily; bridges are not part of project basic configuration
Construction Cost Savings Comparison	
VE Team Savings Estimate \$4,000,000	
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-011
<i>Description:</i>	Widen the shoulders along NB I-25 from Black Squirrel Creek to Baptist Rd, in lieu of adding lanes; upgrade ramp geometry at Northgate to reduce the impact that ramp traffic has on mainline I-25
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	Not consistent with the EA
Construction Cost Savings Comparison	
VE Team Savings Estimate	\$1,300,000
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-017
<i>Description:</i>	Provide hard shoulder running in lieu of addition through lanes
<i>Recommended Action:</i>	Table
<i>Discussion:</i>	N/A
Construction Cost Savings Comparison	
VE Team Savings Estimate	\$220,000
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-031
<i>Description:</i>	Improve corridor ITS. For example: signing, ramp metering, etc.
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	Ramp metering is installed in lieu of auxiliary lanes, and would not relieve congestion
Construction Cost Savings Comparison	
VE Team Savings Estimate	\$900,000
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-047
<i>Description:</i>	Realign Southbound I-25 toward meadian to accommodate Ackerman Overlook
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	USAFA does not want to keep Ackerman overlook at currently location, and EA calls for the overlook to be relocated
Construction Cost Savings Comparison	
VE Team Savings Estimate	-\$66,000
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-049
<i>Description:</i>	Consider using cantilever sign structures in lieu of sign bridges whenever possible
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	N/A
Construction Cost Savings Comparison	
VE Team Savings Estimate	\$61,000
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-051
<i>Description:</i>	Assign point values to ARE's
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Not Quantified
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P01-056
<i>Description:</i>	Develop portions of the design further before initiating the procurement process
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	Insufficient time to develop designs prior to procurement; Contractors prefer less design, as it allows for more innovation
Construction Cost Savings Comparison	
VE Team Savings Estimate	Not Quantified
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P02-006
<i>Description:</i>	Divert pavement runoff for water quality event into existing water quality basins near Pine Creek
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	Existing basin in median may be used
Construction Cost Savings Comparison	
VE Team Savings Estimate	\$25,000
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P04-002
<i>Description:</i>	Use an adjustment factor if HMA reconstruction is specified
<i>Recommended Action:</i>	Accept with modifications
<i>Discussion:</i>	Will need to “level the playing field for concrete” with adjustment factors
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	P05-001
<i>Description:</i>	Construct all the roadway, shoulders and auxiliary lanes from the median toward the outside
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	\$256,000
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
Proposal or SR No.:	P05-002
Description:	Switch from a 12' inside shoulder to a 10' inside shoulder north of Briargate
Recommended Action:	Decline
Discussion:	Cost savings not worth the effort, also inconsistent with EA which stipulates 12' shoulders up to Monument)
Construction Cost Savings Comparison	
VE Team Savings Estimate	\$45,000
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
Proposal or SR No.:	SR01-001
Description:	Modify the ramp configuration at North Academy Blvd
Recommended Action:	Accept with modifications
Discussion:	Possibly make this an EA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation Project:	
<i>Proposal or SR No.:</i>	SR01-002
<i>Description:</i>	Stabilize streams within CDOT easement area
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	This is tied in to project goals and will help us achieve project goals.
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation Project:	
<i>Proposal or SR No.:</i>	SR01-012
<i>Description:</i>	Construct a passing lane on NB I-25 from Black Squirrel Creek to Baptist Rd in lieu of widening to three NB lanes from Interquest Prkwy to Monument
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	Inconsistent with EA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-026
<i>Description:</i>	Provide additional wall performance criteria for the RFP
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-029
<i>Description:</i>	Use temporary ITS infrastructure during construction to mitigate congestion caused by construction activities
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-035
<i>Description:</i>	Construct a collector/distributor (CD) roadway between SB Briargate Prkwy and North Academy Blvd
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-038
<i>Description:</i>	Replace the existing scour critical three span bridges at Black Squirrel Creek with a single span bridge
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	Assuming replace vs. widening
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-039
<i>Description:</i>	Make the Northgate interchange bridges an ARE alternative
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-040
<i>Description:</i>	In the RFP, Stipulate the pavement reconstruction method per LCCA
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-044
<i>Description:</i>	Make Black Squirrel Creek bridge reconstruction/widening part of base configuration
<i>Recommended Action:</i>	Accept with modifications
<i>Discussion:</i>	Just reconstruct NB bridge as part of base configuration (costs reflect that). Make SB an ARE?
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-045
<i>Description:</i>	Relocate the Ackerman Overlook to the Briargate Interchange SB ramp
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	Schedule does not allow enough time to obtain easements necessary to relocate overlook
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-050
<i>Description:</i>	Pre-establish traffic signal timing plans along alternate routes, such as SH83 and Voyager Prkwy from Academy Blvd to Northgate, would allow for quick implementation of a detour in the event of an incident within the construction zone on I-25
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	Does incident management already exist and is it sufficient? Or can project add to it and improve it? If possible, incorporate into existing system
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-052
<i>Description:</i>	Provide roundabouts at North Academy interchange and Northgate Interchange
<i>Recommended Action:</i>	Decline
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
<i>Estimated Design Cost</i>	
<i>Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)</i>	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-054
<i>Description:</i>	Construct storm sewer in median in super-elevated segments and also install manhole diversion structures to isolate water quality flows
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	Will be required in super-elevated sections
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR01-058
<i>Description:</i>	Provide corridor lighting from Woodmen to Briargate
<i>Recommended Action:</i>	Accept with modifications
<i>Discussion:</i>	Should project accommodate future lighting? Area may require lighting. Does economy and the state of City of COS funding warrant installation of lighting – can the city afford to light corridor? Possible ARE?
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR02-007
<i>Description:</i>	Specify type of WQ features allowed
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR03-003
<i>Description:</i>	Provide a shoulder wherever possible during construction for incident clearance; provide emergency pull-outs during construction in locations where a shoulder cannot be provided
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	Have adequate shoulders is a maintenance and safety concern
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR03-009
<i>Description:</i>	Additional temporary signing to relieve traffic congestion during construction. Combined references 03-010 and 03-011
<i>Recommended Action:</i>	Accept
<i>Discussion:</i>	NA
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

Response to Value Engineering Proposal or Supplemental Recommendation	
Project:	
<i>Proposal or SR No.:</i>	SR06-005
<i>Description:</i>	Convert the proposed HOV lane to a Managed Lane that would permit single-occupant vehicles to use the lane for a fee
<i>Recommended Action:</i>	Table
<i>Discussion:</i>	EA implications
Construction Cost Savings Comparison	
VE Team Savings Estimate	Incomplete
Designer Savings Estimate	
Reason for Difference in Estimates	
Estimated Design Cost	
Total Cost Savings (Designer Savings Cost Estimate - Estimated Design Cost)	

SECTION 9 – POSSIBLE DESIGN SCENARIOS

Because this is a Design Build project, the EA's proposed action for this project contained less technical data detail than is normally available to a VE team. In order to maximize the value from the workshop, the VE Team used part of the workshop to provide possible scenario recommendations to aid CDOT in better defining the Basic Project Configuration. Therefore, the VE Team identified ten possible base case scenarios with Additional Requested Elements (ARE's). The following page contains a summary description of the ten scenarios and their relative costs:

<i>I-25 Design-Build North Project</i>	
<u>Scenario # 1</u>	
-Reconstruct I-25 in both directions to a point south of Briargate Interchange	\$16.0 million to Briargate (HMA)
-Widen, Mill, & Overlay (WMO) from Briargate to a point north of Interquest	\$8.0 mill from B'gate to N. of Intquest
-Plus northbound ARE's To Be Determined (TBD)	\$
-ARE's could be in 1/4 mile segments (and scored on that basis)	\$1.0 million/ quarter mile
<u>Scenario # 2</u>	
-Reconstruct NB I-25 to Briargate	\$8.25 million (HMA)
-WMO SB I-25 & remaining NB I-25 to a point north of Interquest	\$10.75 mill + \$7.5 mill
-ARE's could be in 1/4 mile segments (and scored on that basis)	\$1.0 million/ quarter mile
<u>Scenario # 3</u>	
-Reconstruct SB I-25 to Briargate	\$8.25million (HMA)
-WMO NB I-25 & remaining SB I-25 to a point south of Interquest	\$7.5mill + \$10.75 mill
<u>Scenario # 4</u>	
-Complete WMO of NB I-25 as far north as possible (Monument)	\$32.0 million
-SB WMO Pine Creek to Briargate	\$0.00 million (or) \$7.0 million
<u>Scenario # 5</u>	
-Reconstruct both NB & SB I-25 as far north as possible	\$36.5 million to "welcome sign"
<u>Scenario # 6</u>	
-Reconstruct & WMO I-25 to Briargate	\$14.5 mill (NB=WMO)(SB=Reconst.)
-WMO NB as far as possible beyond Briargate	\$20.0 mill (NB to Northgate)
-ARE's could be in 1/4 mile segments (and scored on that basis)	\$1.0 million/ quarter mile
<u>Scenario # 7</u>	
-WMO I-25 NB to Northgate	\$17 million
-Remaining funds to be used to reconstruct I-25 SB to Briargate	\$8.25 million
-ARE's could be in 1/4 mile segments (and scored on that basis)	\$1.0 million/ quarter mile
<u>Scenario # 8</u>	
-WMO NB I-25 to Northgate	\$17.0 million
-Reconstruct SB I-25 to the Black Squirrel Bridge	\$16.5 million
'-ARE's could be in 1/4 mile SB segments (and scored on that basis) (WMO)	\$0.5 million/ quarter mile
<u>Scenario # 9</u>	
-Reconstruct NB I-25 to Northgate	\$22 million
-Eliminate I-25 SB AUX lane between Interquest & Briargate	\$
-Reconstruct SB I-25 to Briargate	\$8.25 million
-WMO SB I-25 to Interquest	\$10.75 million
<u>Scenario # 10</u>	
-WMO NB I-25 to Baptist	\$28.0 million
-ARE's would be used for interchange improvements	\$1.0 mill ramp imp @ Ngate

SECTION 10 – PROPOSED BASIC PROJECT CONFIGURATION

The VE team developed fifteen proposals, nineteen supplemental recommendations and ten base case scenarios with various AREs. From these, the VE Team made the following recommendation for a Basic Project Configuration and potential ARE's which may be stipulated in the RFP. The definition of the Basic Project Configuration is critical in determining how additional budget can be spent in ARE's. The scenarios were developed to address a variety of value propositions, include reconstruction versus widening and overlaying. Depending on the methods and means which are available to individual contractors, maintaining a variety of options may provide CDOT with more improvements being constructed. This Base condition utilized approximately \$33,500,000 leaving \$2,500,000 for AREs. The team also recommended that the ARE's should be configured and weighted toward completing as much of the northbound lanes as budget allows. The northbound lanes typically run at higher daily and peak hour volumes and are located on uphill grades potentially allowing for a higher return on investment as Additional Requested Elements (AREs) are incorporated.

Scenario # 8	
-WMO NB I-25 to Northgate	\$17.0 million
-Reconstruct SB I-25 to the Black Squirrel Bridge	\$16.5 million
'-ARE's could be in 1/4 mile SB segments (and scored on that basis) (WMO)	\$0.5 million/ quarter mile

<i>I-25 Design-Build North Project</i>					
<i>Logical Termini</i>		Concrete NB & SB Reconstruct	HMA NB & SB Reconstruct	HMA NB - WMO SB - Reconstruct	HMA NB & SB WMO
Pine Creek to Briargate	2.4 mi. = 12,500 ft	\$21.5million	\$16.5million	\$14.5 million	\$14.0 million
Pine Creek to Interquest	3.7 mi. = 19,500 ft	\$32.5 million	\$25 million	\$22.5 million	\$21.5 million
Pine Creek to North of Black Squirrel	4.6 mi. = 24,300 ft	\$42.0 million	\$32.5 million	\$27.5 million	\$25.5 million
Pine Creek to Welcome Sign	5.4 mi. = 28,500 ft	\$49 million	\$37.5 million	\$33 million	\$29.5 million
Pine Creek to Northgate	6.4 mi. = 33,800 ft	\$57 million	\$44 million	\$38 million	\$34 million
Pine Creek to Baptist Raod	8.9 mi. = 47,00 ft	\$82.0 million	\$76 million	\$57.0 million	\$51.0 million
Pine Creek to Monument	10.7 mi. =55,700 ft	\$98 million	\$76 million	\$68 million	\$60 million
<i>6-lane roadway from Pine Creek</i>			<u>HMA</u>	<u>Concrete</u>	
		<u>WMO</u>	<u>Reconstruct</u>	<u>Reconstruct</u>	
	To Interquest	\$5.0 million/mile	\$6.5 million/mile	\$8.5 million/mile	
	To North of Black Squirrel	\$4.8 million/mile	\$6.3 million/mile	\$8.2 million/mile	
	To Welcome Sign	\$4.8 million/mile	\$6.3 million/mile	\$8.2 million/mile	
	To Northgate	\$4.6 million/mile	\$6.0 million/mile	\$8.0 million/mile	
Additional Requested Elements					
	-	Minor ramp improvements at Northgate ≈ \$1.0 million?			
	-	Minor ramp improvements at North Academy ≈ \$1.0 million?			
	-	1/4 mile segments North ≈ \$1.0 million/mile both NB & SB.			