North I-25 Project

Cost Estimate Review

FINAL REPORT

July 2010

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Executive Summary

The Federal Highway Administration (FHWA), the Colorado Department of Transportation (CDOT), and their consultants participated in a workshop to review the cost estimate and schedule for the North I-25 Project at the CDOT Region 6 Offices in Denver, Colorado during July of 2010. The objective of the review was to verify the accuracy and reasonableness of the current CDOT total cost estimate and schedule and to develop a probability range for the cost estimate that represents the project's current stage of development.

It should be noted that this project is in the final stages of the environmental process. The Final Environmental Impact Statement (EIS) is currently scheduled for February 2011 with a Phase I Record of Decision (ROD) anticipated for summer 2011. This cost estimate review analyzed the cost estimates for both the overall Final EIS Preferred Alternative and Phase I of the project.

Significant results of the review:

- The anticipated project schedule is determined by anticipated funding. Furthermore, the project has a long delivery timeframe and the project estimate in terms of year of expenditure (YOE) dollars is considerably more expensive when compared to the base (2009) costs. The three phases of the preferred alternative are currently scheduled for completion in years 2035, 2055, and 2075, respectively.
- The CDOT post-review Preferred Alternative project estimate is $2.178 billion (2009 dollars) and $7.712 billion (YOE). Based on the review, the escalated range of costs for the total project is between $6.748 billion and $11.495 billion with an 80% confidence.
- The CDOT post-review Phase I project estimate is $641.0 million (2009 dollars) and $1.101 billion (YOE). Based on the review, the escalated range of costs for the total project is between $1.098 billion and $1.374 billion with an 80% confidence.

- The current Phase I estimate of $1.101 billion is at a 10% confidence level. The estimate at the 70% level of confidence is $1.271 billion. This is the minimum level of funding that must be committed to the project for the approval of the Major Project Financial Plan.
- Project schedule could potentially lower or increase YOE cost. For example, for each year Phase I is delayed, the project cost is expected to increase by approximately $48 million. This is consistent with the results of the analysis showing that the most significant influence on the project cost was the escalation of the construction costs.

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APPENDIX

CHAPTER 1 – REVIEW SUMMARY

Introduction

The Federal Highway Administration (FHWA) and the Colorado Department of Transportation (CDOT) conducted a workshop in Denver, Colorado to review the cost and schedule estimates for the North I-25 Project. The workshop was conducted at the CDOT's Region 6 Office on July 12-15, 2010.

The intent of the review was to verify the accuracy and reasonableness of the current CDOT total cost estimate and schedule and to develop a probability range for the cost estimate that represents the current stage of project development. This document summarizes and reports the results of this review. Appendix F of this report includes the Review Team's close-out presentation given on July 15, 2010.

It should be noted that the environmental document for this project will be progressed as a phased Record of Decision (ROD). Thus, this cost estimate review analyzed the cost estimates for both the overall Final Environmental Impact Statement (EIS) Preferred Alternative and Phase I of the project.

Review Objective

The objective of the cost estimate review was to conduct an unbiased risk-based review to verify the accuracy and reasonableness of the current total cost estimate to complete the project and to develop a probability range for the cost estimate that represents the current stage of project design. Part of this study is to also review the proposed construction schedule to determine its impact on the project cost.

Basis of Review

The "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users" (SAFETEA-LU) (Pub.L. 109-59, 119 Stat. 1144) requires the financial plan for all Federal-aid projects with an estimated total cost of $500,000,000 or more to be approved by the Secretary (i.e. FHWA) based on reasonable assumptions. The $500,000,000 threshold includes all project costs (Engineering, Construction, Right-of-Way (ROW), Utilities, Construction Engineering, Inflation, etc.). The FHWA has interpreted "reasonable assumptions" to be a risk based analysis. Projects that are $100- $500 million are subject to review at the discretion of the FHWA Division Office. The cost estimate reviews are required to provide the risk based assessment of the estimate and are used in the approval of the financial plan.

Project Background

DESCRIPTION

The CDOT, in cooperation with the FHWA and the Federal Transit Administration (FTA), has begun to develop a project known as the North I-25 Project that will make improvements to the Interstate 25 corridor from the Fort Collins-Wellington area to Denver. The three phase project includes the following activities:

- General Purpose Lanes: One new general purpose lane in each direction of I-25 between State Highway 66 and State Highway 14.
- Tolled Express Lanes (TEL): One buffer-separated TEL in each direction of I-25 from the existing high occupancy vehicle/toll lanes at 84th Avenue to SH 14.
- Interchange Improvements: 16 interchanges along the corridor will be upgraded.
- Express Bus: Addition of express bus service with 13 stations along I-25, US 34 and Harmony Road with service from Fort Collins and Greeley to downtown Denver and from Fort Collins to Denver International Airport.
- Commuter Rail: Addition of commuter rail service with 9 stations connecting Fort Collins to Longmont and Thornton using the Burlington Northern Santa Fe Railroad, generally paralleling US 287 and tying into FasTracks North metro rail in Thornton which will connect to Downtown Denver. Passengers may also connect to the FasTracks northwest rail in Longmont, which will travel to Boulder.
- Commuter Bus: Addition of commuter bus service with 8 stations along US 85 connecting Greeley to downtown Denver.

- Congestion Management: These improvements include accommodations for ridesharing, carpools, and vanpools, along with additional bicycle and pedestrian facilities. Also, signal timing, ramp metering on I-25 and signage may be improved.

Phase I consist of the following work activities:

- Widening I-25 between SH 66 and SH 56 with one TEL in each direction.
- Widening I-25 between SH 392 and Prospect.
- Widening I-25 between 120th Avenue and approximately US 36 with one buffer-separated TEL in each direction.
- I-25 interchange replacements and upgrades at SH 14, Prospect, SH 56, CR 34, SH 7, 104th Avenue. Thornton Parkway and 84th Avenue will be constructed to their ultimate configurations.
- Six carpool lots upgraded at I-25 interchanges.
- Commuter rail right of way preservation.
- I-25 regional bus service will be initiated connecting Fort Collins and Greeley to downtown Denver and Denver International Airport, including construction of four transit stations and the purchase of 27 buses.
- Commuter bus along US 85 connecting Greeley to downtown Denver would be implemented, including construction of five stations, 17 queue jumps/transit signal priority intersections and the purchase of five buses.
- One or more of the existing bus maintenance facilities in northern Colorado will be upgraded.

PURPOSE AND NEED

The purpose of the proposed project is to meet long-term travel needs between the For-Collins-Wellington area, the rapidly growing population centers along the I-25 corridor, and south to the Denver Metro area. To meet long-term travel needs, the project must improve safety, mobility and accessibility, and provide modal alternatives and interrelationships.

The project is needed because there has been an increased frequency and severity of crashes, increased traffic congestion leading to mobility and accessibility problems, aging and functionally obsolete infrastructure, and lack of modal alternatives.

LOCATION

The project is located north of Denver along the I-25 corridor. The project area extends from SH 1 in Fort Collins/Wellington at the north end to US 36 on the south, and from US 287 and the Burlington Northern and Santa Fe (BNSF) Railway routes on the west to US 85 and the Union Pacific Railroad (UPRR) routes on the east. The project spans portions of four counties: Adams, Boulder, Larimer, and Weld. The project involves three transportation planning regions (TPRs): the Denver Regional Council of Governments (DRCOG), the North Front Range Metropolitan Planning Organization (NFRMPO), and the Upper Front Range Regional Planning Commission (UFRRPC). Major population centers in the project area include Fort Collins, Greeley, Loveland, and the communities in the northern portion of the Denver metropolitan area (Denver Metro Area).

The limits of the entire North I-25 Project are shown in Figure 1, North I-25 Project Location Map.

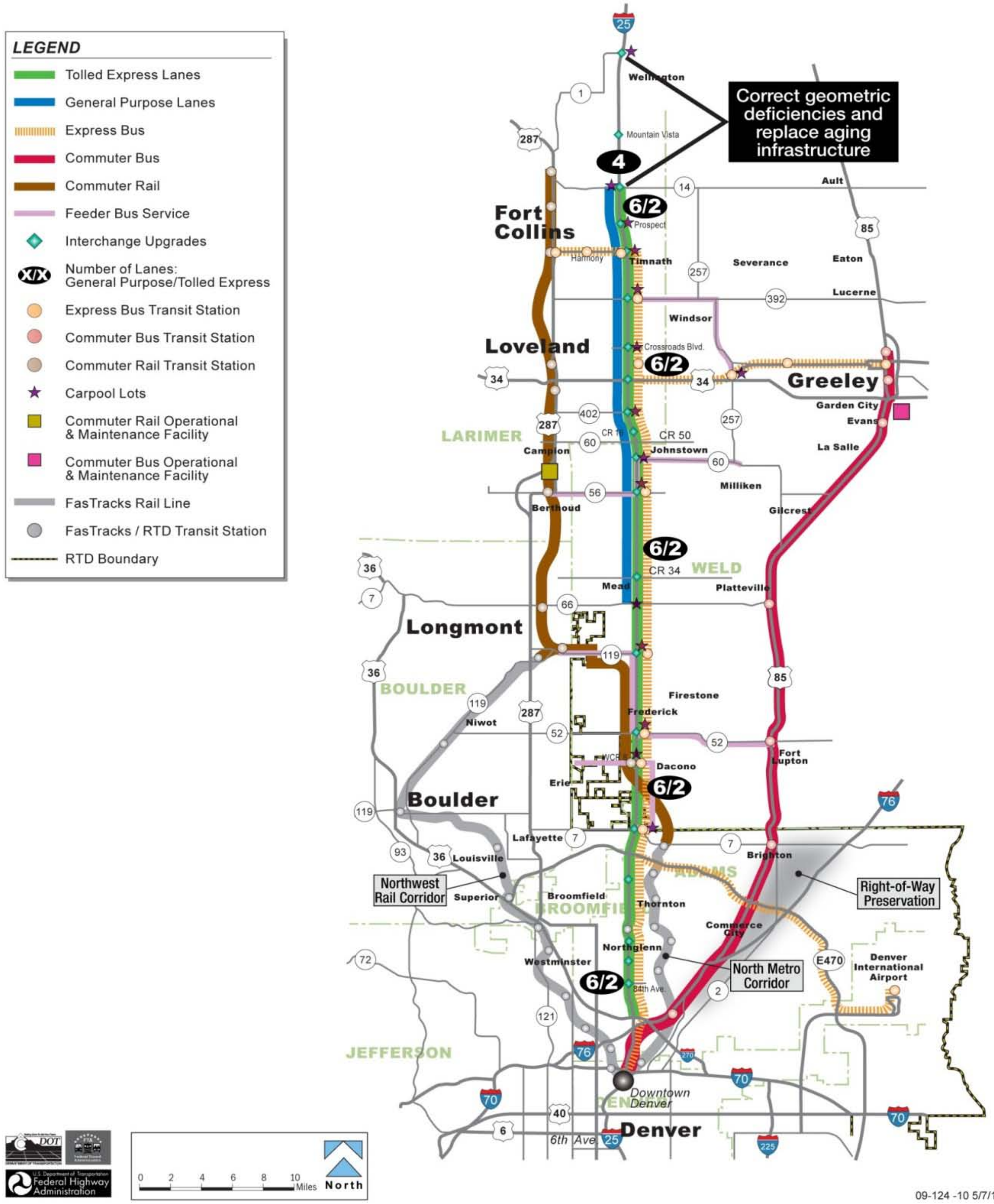

FIGURE 1 North I-25 Project Location Map

SCHEDULE

This project is currently in the final stages of the environmental process. The Draft EIS was approved in October 2008. The Final EIS is currently scheduled for February 2011 with a Phase I ROD anticipated for summer 2011. The project is currently at a 5-20% design level. Construction is not anticipated to start until 2020. The current construction schedule is based on the 2035 long range fiscally constrained plan that identifies when the funds will become available for construction. The project schedule is shown in Table 1.

PROJECT SCHEDULE	
Draft EIS	October 2008
Preferred Alternative Identified	December 2009
Final EIS	February 2011
Phase I Record of Decision	June 2011
Phase I Construction Duration	2020-2035
Phase II Construction Duration	2036-2055
Phase II Construction Duration	2056-2075

Table 1 North I-25 Project Schedule

Estimate Summary

The CDOT provided a cost estimate for the project prior to the workshop. The CDOT pre-review estimate for the preferred alternative was $2,184.1 million in 2009 dollars and included design/engineering, construction, construction engineering, environmental mitigation, ROW, costs expended, inflation, and contingencies. Adjustments were made during the review that decreased the estimate to $2,178.5 million in 2009 dollars. The pre-review estimate for Phase I was $648.5 million in 2009 dollars and decreased to $640.9 million in 2009 dollars after changes were made to the estimate.

Cost estimates, especially those for Major Projects, usually contain a degree of uncertainty due to unknowns and risks associated with the level of design detail completion. For this reason, it is logical to use a probabilistic approach and express the estimate as a range rather than a point value. To express the estimate as a range, risks and opportunities were developed and the workshop review team selected assumption curves that best modeled the cost impacts and probabilities based on the uncertainty associated with those risks and opportunities. The assumption curves were incorporated into a Monte Carlo simulation program to forecast a range of estimated project costs. Chapter 3 discusses the assumptions and results of the probabilistic analysis for this project in more detail.

Estimate Adjustments

During the review, changes were made to some of the items in the pre-review estimate. These changes are identified as follows:

- Inflation Factor
  - Lowered to 3.3% (from 4.35%)
    - Assumption curve from 2.7% to 5.3%
  - Added separate factor for ROW (5%)
    - Assumption curve from 4% to 6%
- Concrete pavement lowered, $41/sy to $38.50/sy
- Type 7 guardrail lowered from $90/lf to $75/lf
- Cable guardrail raised, $10/lf to $20/lf
- Erosion control (highway) allowance from 3.1% to 5%
- Mobilization (highway - R4) from 15.7% to 11.0%
- Retaining Wall 10’-20’ (rail) from $700/lf to $690/lf
- Unforeseen Condition (rail) from 1% to 5%
- ROW (rail) from $24.8m to $26.4m

Threats and Opportunities

During the course of the review the team identified and discussed numerous threats and opportunities. A threat is anything that can add to the cost of the project. An opportunity is anything that can reduce the cost of the project. Some of these are listed below.

Threats:

- Funding availability
  - Letting delay (increase in inflation)
- Market conditions
  - Material prices (i.e. steel, fuel)
  - Unknown future inflation
- Environmental permit delays
  - Regulation changes
- Design, criteria changes, soils
- Uncertainty on owner/operator of rail and bus
- Rail line on new alignment
- Railroad agreements, payments, design reviews
- Land use changes (ROW, ridership)
- Project timeframe (65 years)
- Unknown procurement method

Opportunities:

- Market conditions
  - Material prices (i.e. steel, fuel)
  - Potential reduction in inflation
  - Better pricing through competition
- Technology
  - Bridges, ITS
- Retaining wall/ROW trade-off
- Final design
- Schedule acceleration – Funding availability
- Innovative procurement
- More regional commuter rail experience in the future
- Not overly complex roadway project

Review Findings

The review team found many examples of good estimating practices. Some of these include the following:

- Use of unit prices and historical percentages from recent similar projects in the I-25 corridor
- More detailed estimate than typical at this stage of a project
- Up front consideration of variation in prices and quantities
- Used lessons learned from previous CERs
- Involvement of CDOT executive/region management

Review Recommendations

During the workshop the Review Team developed the following recommendations for implementation:

- Finalize and submit environmental document, project management plan, and financial plan
- Refine and manage project schedule and budget
- Manage threats and opportunities through a risk management plan
- Look for opportunities to accelerate schedule to take advantage of current market conditions and inflation savings
- Develop consistent CDOT escalation rate

Next Steps

FHWA uses the resulting estimated cost of the project at the 70% confidence level in the Final EIS document. Additionally, a Financial Management Information System (FMIS) Major Project Identifier should be requested for the project and the project's major project classification with the FHWA's Project Delivery Team should be changed to "active".

CHAPTER 2 – REVIEW METHODOLOGY

Study Objective

The objectives of the review were to verify the accuracy and reasonableness of the current total cost estimate and schedule to complete the project and to develop a probability range for the cost estimate that represents the current phase of project development. The project is currently in the final stages of the environmental phase.

Review Team

The project review team was developed with the intent of having individuals with a strong knowledge of the project and/or major project work and expertise in specific disciplines of the project. Throughout the workshop, the review team discussed the development of the project, cost estimate quantities, unit prices, assumptions, opportunities and risks. Individuals with specific project expertise briefed the review team on that portion of the project or estimate development process. The review agenda and sign-in sheet of the participants are provided in Appendices A and B, respectively.

The Review Team was comprised of the following members:

- FHWA
    - Division Office
    - Resource Center
    - Headquarters
- CDOT
- Project Consultants – Felsburg Holt & Ullevig

Documents provided by CDOT prior to the Review Team attending this workshop and documents available during the workshop were:

- Project History and Schedule

- Project Cost Estimate and Estimate Basis
- Draft Environmental Impact Statement
- Project Schematics and Aerial Layouts
- Comparable Project Data
- Inflation Data (from CDOT Construction Index, area Metropolitan Planning Organizations (MPO), and Regional Transportation District (RTD))

Review Process

- Project Team input
    - FHWA, CDOT and Project Consultants
- Basis of Review
    - Review based on estimates provided by the Team in advance with revisions made during the review
    - Review to determine the reasonableness of assumptions used in the estimate
    - Not an independent FHWA estimate
    - Did not verify quantities and unit prices
- Methodology
    - Estimate Review
        - Understanding of estimate development process
        - Explanation of contingencies and projected escalation rates
        - Identification of threats and opportunities for various items
    - Modeled Variation of Inputs
        - Reviewed major cost elements
        - Developed impacts and probabilities for significant project threats and opportunities
        - Developed probability assumption distributions
    - Performed Monte Carlo simulation to generate a project estimate forecast as a range

CHAPTER 3 – PROBABILITY ANALYSIS

The objective of the probability analysis during the workshop was to determine the review team's confidence level in the current values being produced for the estimate. The results of this probability analysis could then be used to determine if the risk/contingency factors in the estimate are reasonable.

The review team discussed each work package and major component, including the current estimate, scope, schedule, risks and opportunities. Based on this review, probability curves were selected for each of the major line items in the project estimates for each contract, considering the probability that the final bid or contract value would be within a certain range of the current estimate. Next, a forecast curve was generated from the random sampling (10,000 iterations) of the input probability curves previously defined by the review team. This type of analysis provided a statistical level of certainty that the variation of the forecast distribution curve reflected the underlying variation of the cost inputs as determined by the review team. The resulting forecast curves were then analyzed to provide information on the confidence level in the project cost estimates and remaining budgets.

The review team used a statistical software tool called Crystal Ball® in order to establish a sense of perspective on the cost expectations for the project. This software selection is an add-in program for use with the Excel™ spreadsheet program and it permitted the application of Monte Carlo simulation technology to analyze key components of current cost estimates prepared by the project delivery team. As is the case with many real-world problems involving elements of uncertainty, the analysis of the variables is much too complex to be solved by strict analytical methods. There are simply too many combinations of input values to calculate every possible result. In the case of this workshop cost model, the Monte Carlo simulation supplied random numbers for selected cells identified as "assumption cells"; with these random numbers falling within the range of real-life possibilities defined by the Review Team. Each set of these random numbers is essential input to a "what-if" scenario. In this case, each scenario outcome represents a possible outcome from an expected real-world bidding and construction cycle. The model is recalculated for each scenario many times and builds a final forecast probability curve that reflects the combined uncertainty of the assumption cells on the model's output. This plotted probability curve provides a range that can be expected for a final project cost, with degrees of certainty to model the potential final outcome.

The outcome depicted in this final probability curve is typically stated in the following manner: “There is an 80% (or whatever percentage depicted) degree of certainty that the construction cost will be in a range from $x to $y, provided that our understandings and related assumptions do not change significantly between now and the end of construction.” In order for this to work correctly the Review Team must supply the program with the probable range of unit costs and quantities for each assumption cell in the spreadsheet, and must supply an indicative characterization for the probability spread for each of these cells. This shows up in the form of probability distribution curves. The triangular probability curves are commonly used when relying on expert opinion. In the case of this workshop, the Review Team utilized a triangular probability distribution for the vast majority of assumption cells. The probability assumption curves depict how the Project Team modeled the major cost elements for this Project. Based on these assumption curves, the Monte Carlo analysis would select a random number for each of these curves and sum each random selection for the resulting probabilities. The probability assumption curves shown in this section are only for those items that have a significant impact on the results of the analysis.

Forecast Results for Total Project Cost

Figures 2 and 3 depict the forecast curve for the total project cost in YOE dollars for the Preferred Alternative and Phase I, respectively. These costs include design/engineering, construction, construction engineering, environmental mitigation, ROW, costs expended, escalation, and contingencies. The certainty in Figure 2, shown by the blue shaded area, represents an 80% probability that the total YOE cost for the project will be between $6,748.0 million and $11,495.4 million. Additionally, the figure shows that the estimate at the 70% level of confidence is $9.474.9 million (YOE). This can be interpreted as a 70% probability that the total Preferred Alternative cost will be $9,474.9 million (YOE) or less. Alternatively, there is a 30% probability the project cost will be $9,474.9 million (YOE) or higher.

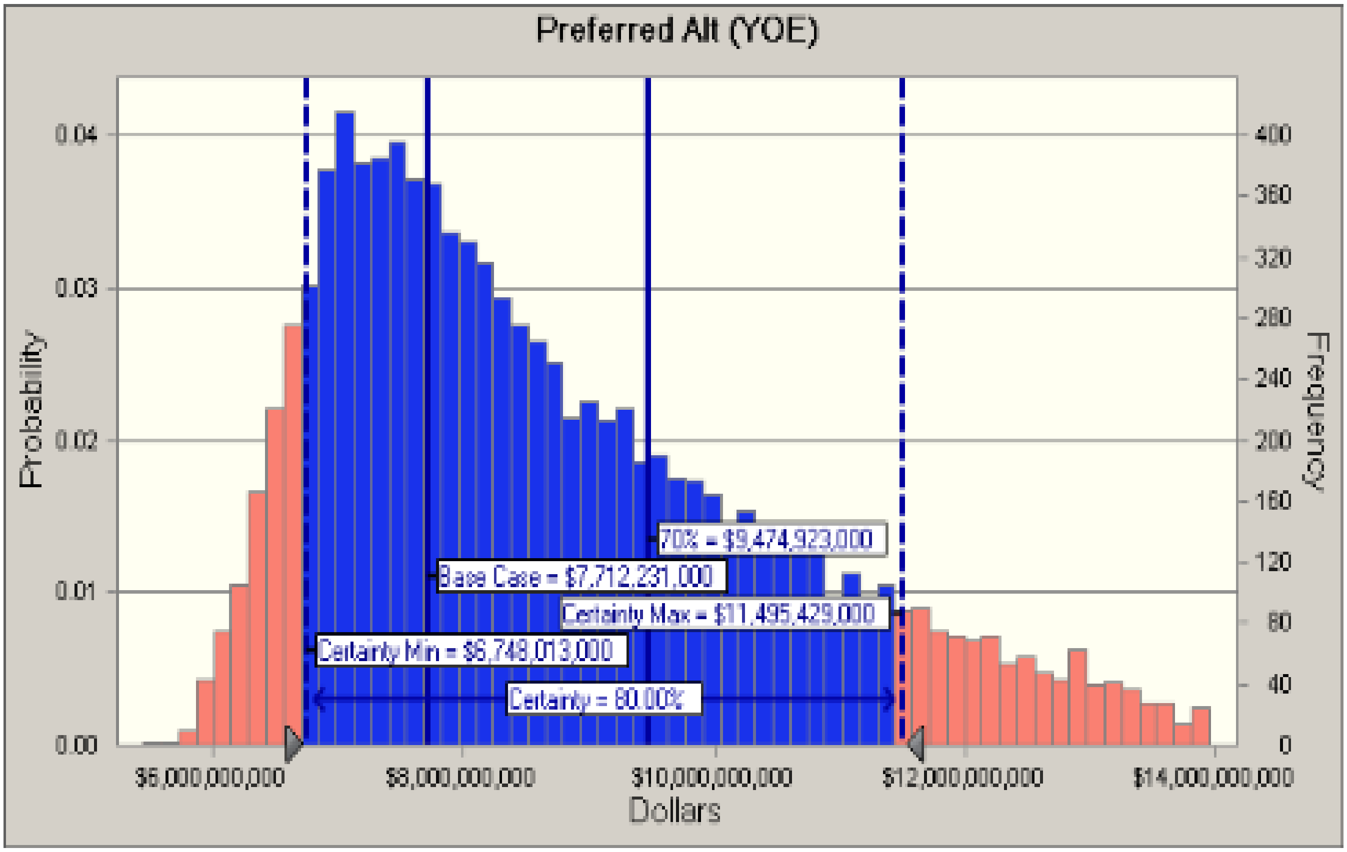

FIGURE 2 – Distribution of Total Project Year of Expenditure Costs for the Preferred Alternative showing base cost and 70% probability cost

Figure 3 shows that there is an 80% chance that the total Phase 1 project cost will be between $1,098.3 million and $1,374.1 million (YOE). Additionally, the figure shows that the estimate at the 70% level of confidence is $1,271.2 million (YOE). The cost at the 70% probability is considered the minimum amount of funding needed to approve the Major Project Financial Plan for the project. The base case (i.e. estimate after adjustments made during review) of $1,100.6 million (YOE) is also shown in Figure 3. As shown, the cost at 70% minimum exceeds the base case estimate by $170.6 million dollars. This difference is approximately a 16% increase to the base case estimate.

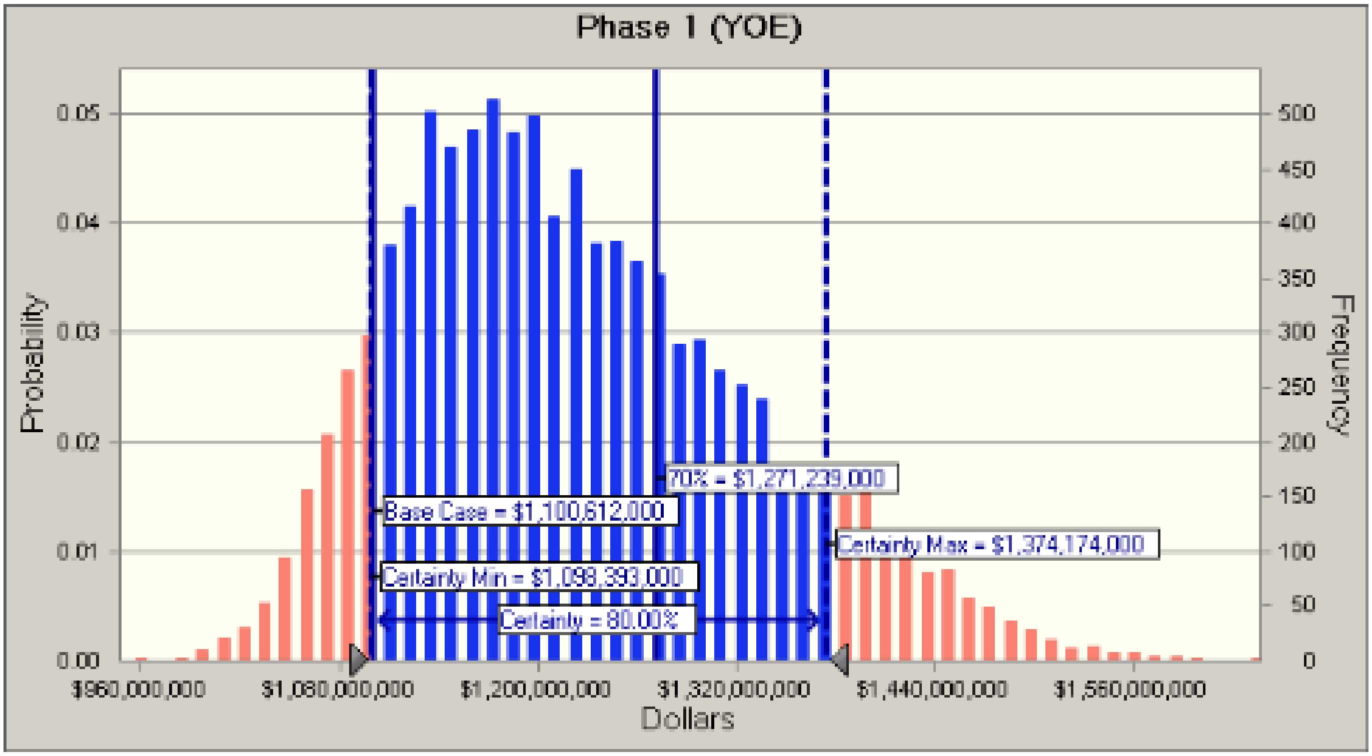

FIGURE 3 – Distribution of Total Project Year of Expenditure Costs for Phase I showing base cost and 70% probability cost

Percentile Rankings of Total Project Cost

The values that comprise Figures 2 and 3 are shown in Table 2 as percentile rankings of the total project costs in YOE dollars for the Preferred Alternative and Phase I. As shown in the table, there is a 70% probability that total Phase I project costs will be less than $1,271.2 million. However, there is only a 10% probability the project costs will be less than $1,098.4 million and a 10% probability of the project costs will exceed $1,374.1 million.

Percentile	Preferred Alternative	Phase 1
0%	$5,449,159,000	$953,461,000
10%	$6,748,013,000	$1,098,393,000
20%	$7,125,178,000	$1,130,345,000
30%	$7,482,515,000	$1,156,061,000
40%	$7,856,255,000	$1,181,538,000
50%	$8,290,487,000	$1,207,181,000
60%	$8,817,202,000	$1,237,705,000
70%	$9,474,923,000	$1,271,239,000
80%	$10,305,317,000	$1,312,975,000
90%	$11,495,429,000	$1,374,174,000
100%	$16,346,966,000	$1,629,202,000

TABLE 2 – Percentile Rankings of Total Project Cost in Year of Expenditure Dollars

Sensitivity Analysis

The sensitivity charts in Figures 4 and 5 show how the variation in the cost estimate components impact the variation of the total cost estimate for the project. Those inputs at the top of the graph have greater impact on the variation in total project costs (both positively and negatively) while those at the bottom have less impact. As shown in Figure 4, the unit cost of construction escalation accounts for 81.5% of the total project cost variability. This chart can be used to better understand the key drivers in the project cost estimate. Assumption curves for inputs with a significant impact on the total cost estimate are discussed in greater detail below.

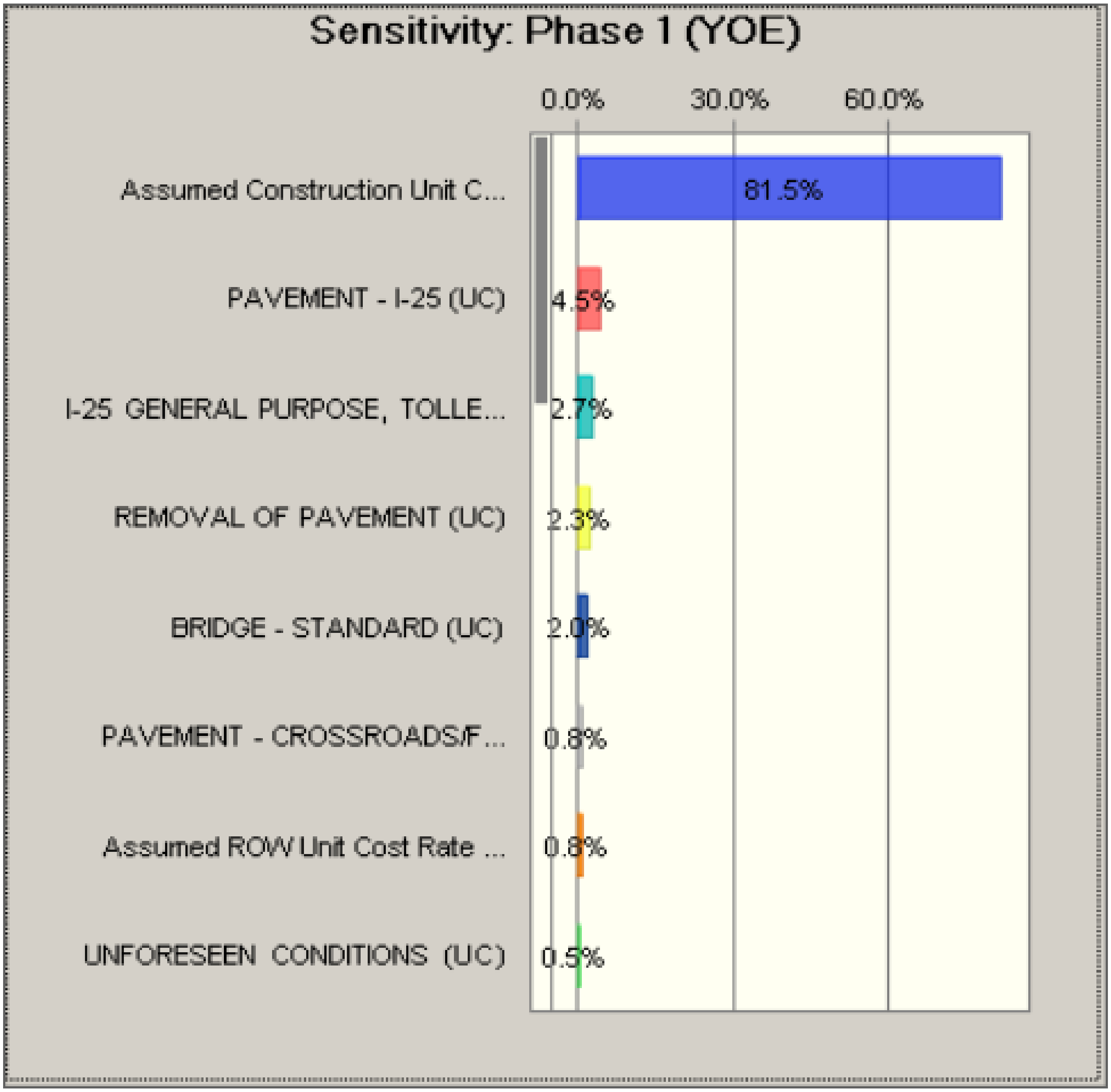

FIGURE 4 – Sensitivity Chart for Year of Expenditure Costs of the Preferred Alternative

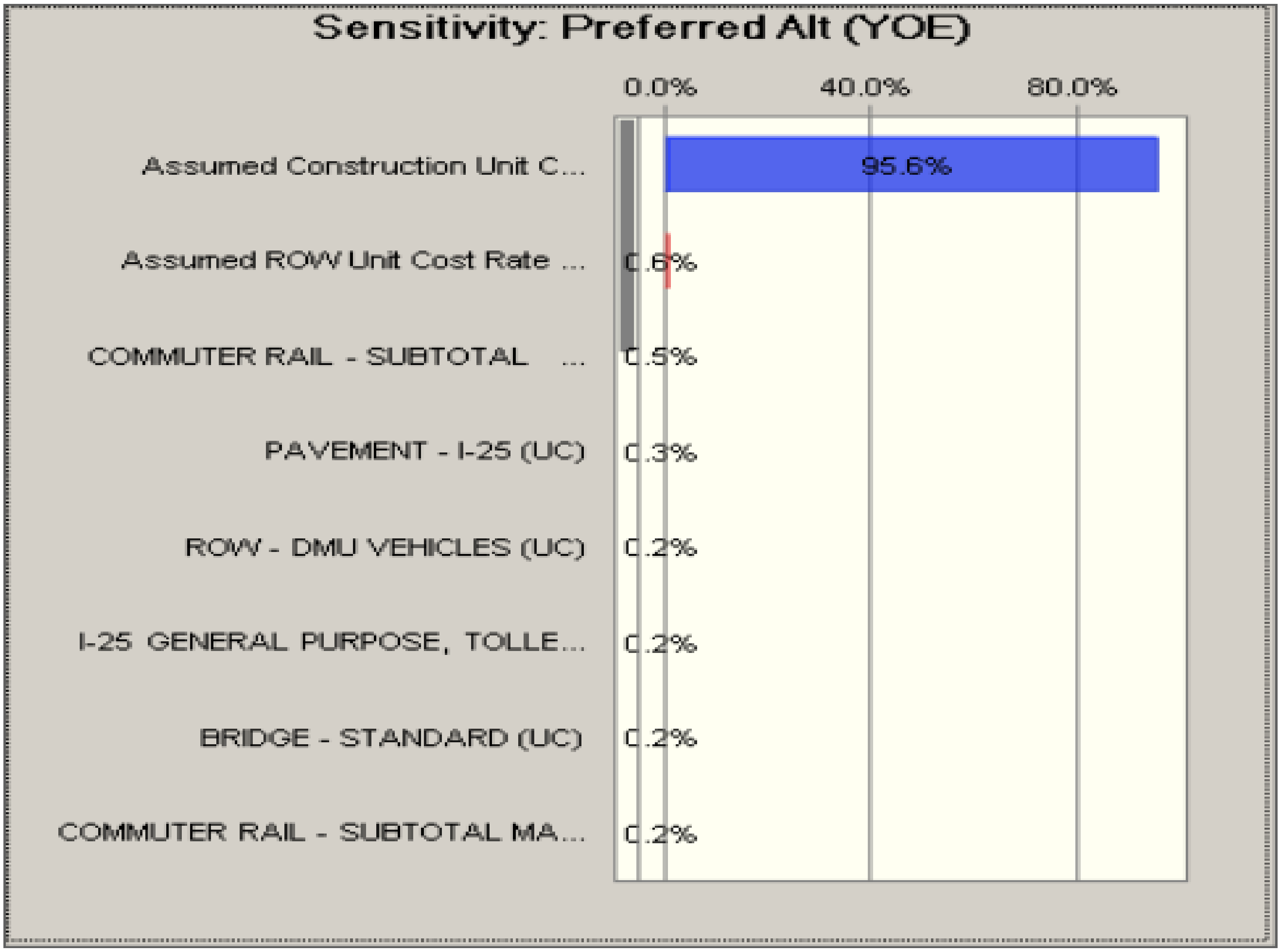

FIGURE 5 – Sensitivity Chart for Year of Expenditure Costs of Phase I

Selected Assumptions Curves

Assumed Construction Unit Cost Rate of Escalation

This project's anticipated schedule assumes the Preferred Alternative will be constructed by 2075 and that Phase I of the project will be completed by 2035. After reviewing data from CDOT's Construction Cost Index, as well as escalation rates and methodologies of area MPOs and the RTD, the project team decided the best way to handle inflation was to use a constant escalation rate for the duration of the project. This approach seemed to better reflect the long project length and fluctuations in the economy that typically occur from year to year. An escalation rate of 3.3% with a range of 2.74 -5.34% was used. Figure 6 shows the assumption curve for construction unit cost rate of escalation. This range represents a low to moderate level of inflation.

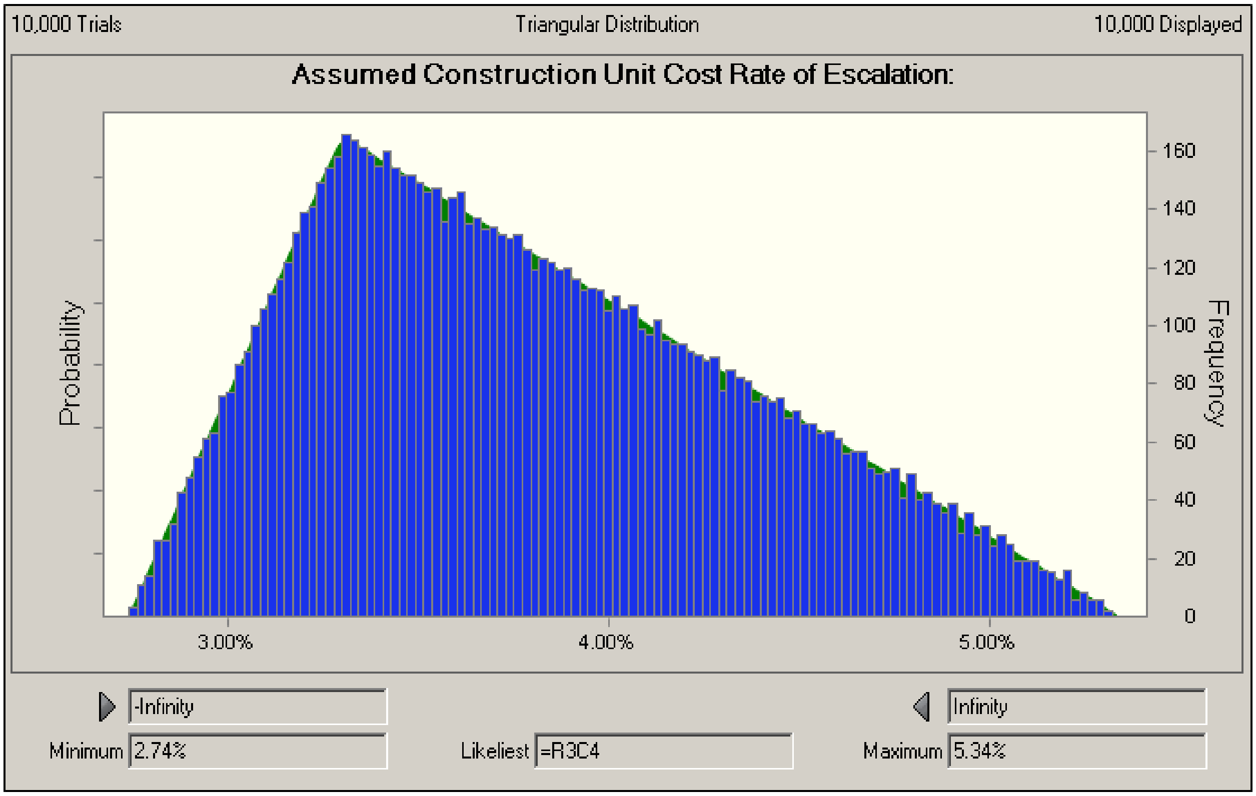

FIGURE 6 – Assumption Curve for the Construction Unit Cost Rate of Escalation

Assumed ROW Unit Cost Rate of Escalation

The project team also modeled the uncertainty of the rate of escalation for ROW. Based on data such as the home price index from 1970 to 2010 and market value assessments from area assessors' offices, CDOT's ROW Unit recommended a ROW rate of escalation of 5%. Based on this input, the escalation rate was modeled as having a possible minimum value of 4% and a maximum value of 6%. Figure 7 shows the triangular distribution curve used to model this variation in ROW unit cost rate of escalation.

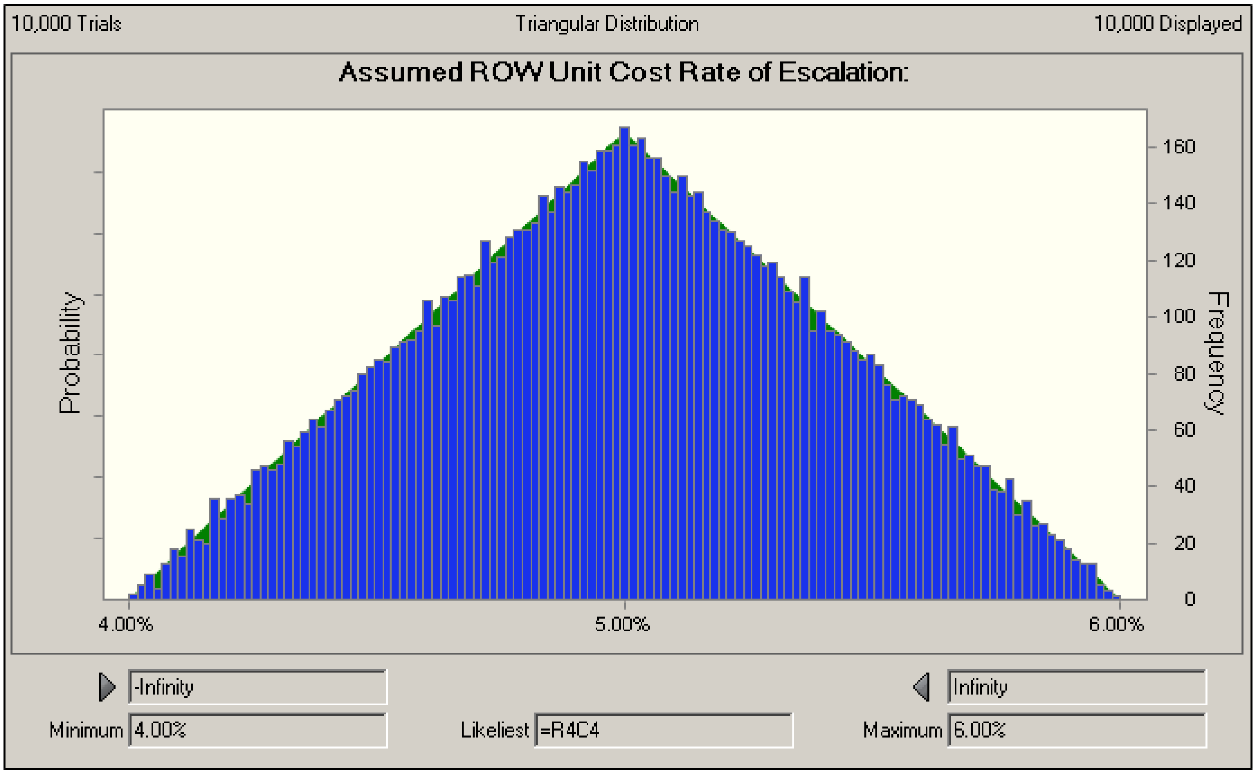

FIGURE 7 – Assumption Curve for the Assumed ROW Unit Cost Rate of Escalation

Earthwork – Region 4 (UC)

During the review, it was determined there is uncertainty in the cost associated with the earthwork for Region 4. The unit cost of earthwork included embankment material, unclassified excavation and muck excavation and was based on similar, recently completed projects on I-25 in Region 4. The cost of earthwork ranged from 15% to 30% of the quantified, major items in the estimate with a midpoint of 22.8%. Figure 8 shows the Student's t distribution used to model the variation in the unit cost of earthwork in Region 4.

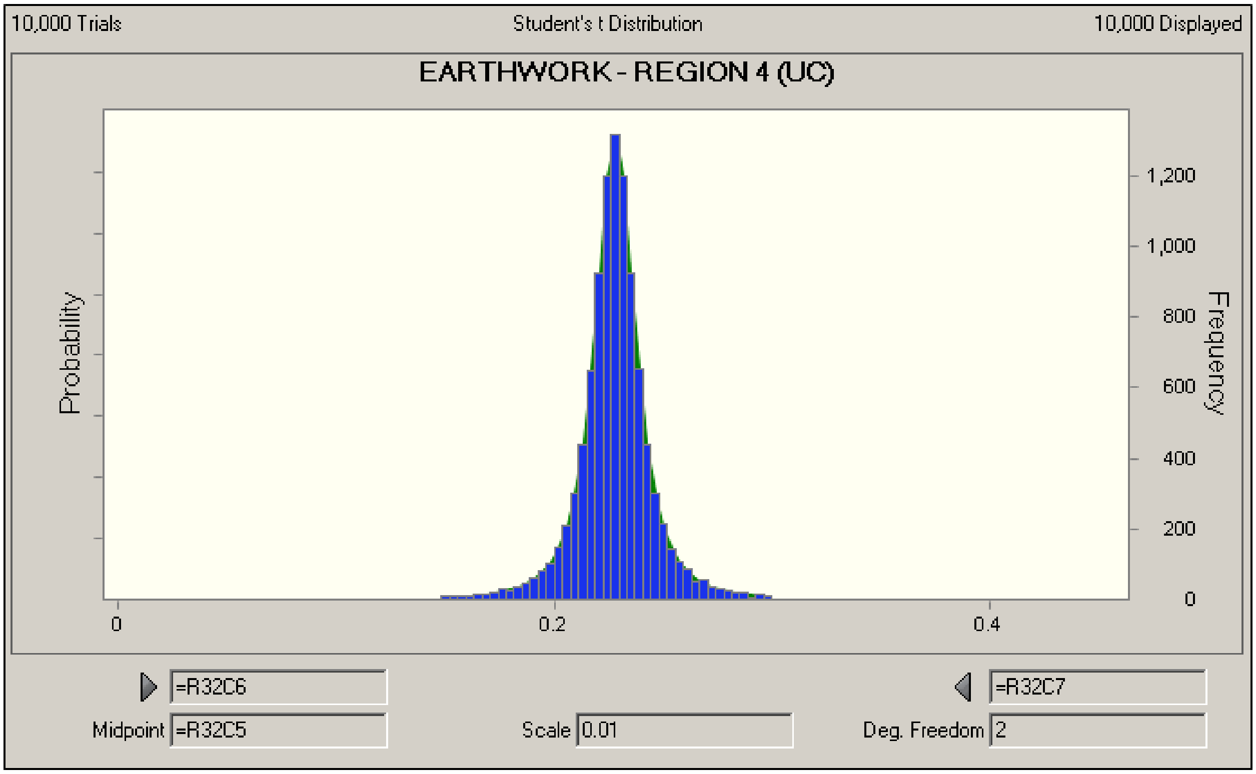

FIGURE 8 – Assumption Curve for Construction Inflation in Year 2013

Commuter Rail Unforeseen Conditions

The costs of the commuter rail are a major component of the Preferred Alternative. Additionally, because of the current level of design, limited experience with commuter rail in the region, unidentified owner/operator of the rail service, and lack of final agreements with the railroad companies, the project team determined there are unknowns associated with the cost of the commuter rail that should be modeled using the Monte Carlo simulation. Based on these considerations, the cost of items related to unforeseen conditions was estimated at 5% of the construction cost of the commuter rail bid items with a variation from 0% to 5%. Figure 9 shows the triangular distribution curve used to model the variation in the unforeseen conditions for commuter rail.

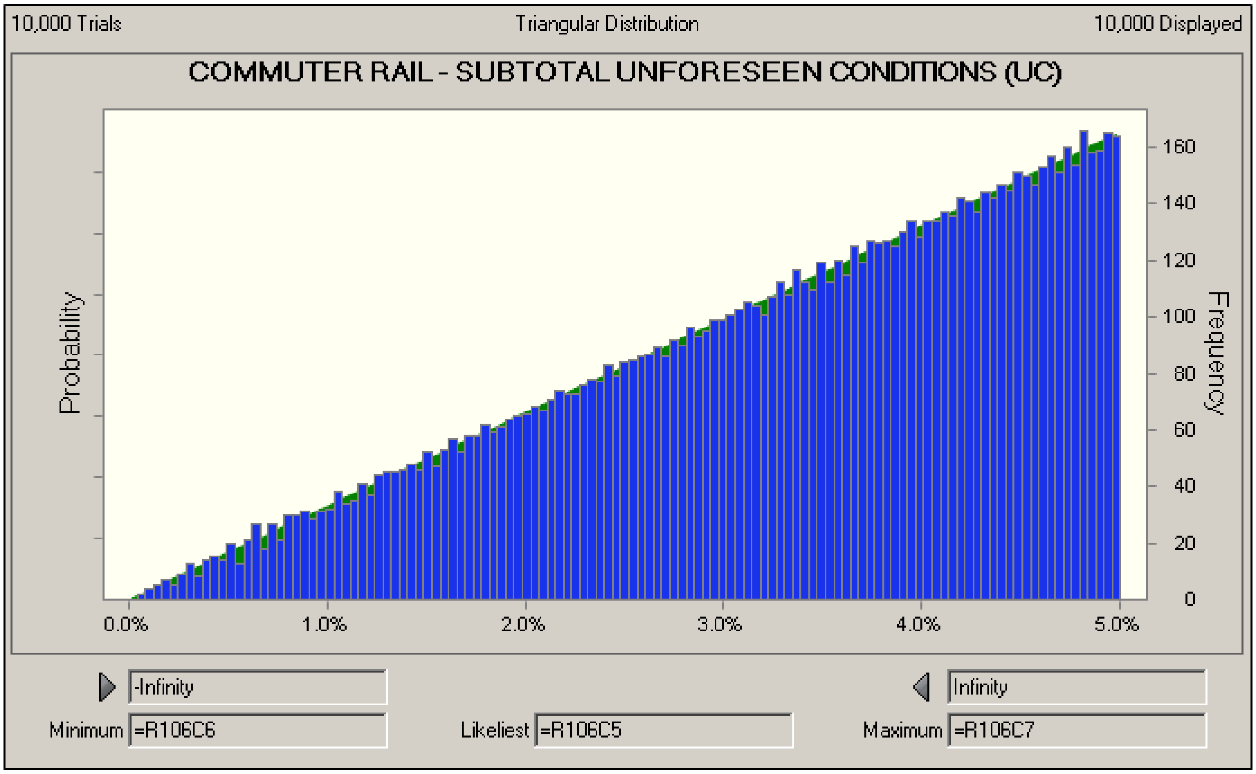

FIGURE 9 – Assumption Curve for Commuter Rail Unforeseen Conditions

Schedule Analysis

Because of the current development stage of the project and duration of the project, the project team determined that it would be beneficial to analyze some of the effects of the schedule on the cost estimate. The current schedule is based on the 2035 long range fiscally constrained plan that identifies when the funds will become available for construction. It was determined that a one-year delay in the current project schedule for the Preferred Alternative would increase project cost by approximately $385.1 million. For Phase 1, a one-year delay to the project would be an additional $48.4 million.

Additionally, an analysis was performed that modeled variability associated with the schedule of the project. Ranges were place on the mid-year of construction in the original cost estimate worksheet and a Monte Carlo simulation was executed. For example, the construction of the SH 7 Par-clo Interchange scheduled to take place in Phase I was modeled as most likely occurring in 2030 with a possibility of occurring between 2025 and 2035. Table 3 shows the results of this analysis and its comparison with the forecast results discussed in previous sections of this report that did not model the variability of schedule. The results are most significant for the Preferred Alternative. These results show that by adding flexibility to the schedule and the possibility of accelerating construction, the total project 70% level of confidence cost for the Preferred Alternative decreases by approximately $600 million. The full Crystal Ball Report for this analysis is included in the Appendix D.

		FORECAST	
		No Schedule Variability	**Schedule Variability**
PREFERRED ALTERNATIVE	70% (YOE)	$9,474,923,000	$8,877,822,000
	Baseline (YOE)	$7,712,231,000	$7,712,231,000
	70% (2009)	$2,144,469,000	$2,144,113,000
	Baseline (2009)	$2,178,470,000	$2,178,470,000
PHASE I	70% (YOE)	$1,271,239,000	$1,211,703,000
	Baseline (YOE)	$1,100,612,000	$1,100,612,000
	70% (2009)	$677,280,000	$677,424,000
	Baseline (2009)	$640,997,000	$640,997,000

TABLE 2 – Percentile Rankings of Total Project Cost in Year of Expenditure Dollars

Summary

This probabilistic analysis resulted in a cost estimate at the 70% confidence level of $9,474.9 million (YOE) for the Preferred Alternative of the North I-25 Project. The cost for Phase I at the 70% confidence level was $1,271.2 million (YOE). These costs should be reported in the Final EIS for the project, as well as in any project information conveyed to the public. The 70% confidence level is also the minimum amount of funding that must be shown for the approval of the Financial Plan. The Appendix includes a PDF file of the entire report of inputs and results of this analysis.

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APPENDIX

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Appendix A

CER Agenda

AGENDA
FHWA Cost Estimate Review Meeting

CDOT Region 4 - North I-25 EIS
Monday, July 12 to Friday July 16, 2010

@CDOT Region 6
North Holly Office Training Classroom
4670 Holly Street, Unit D Denver, CO 80216

Project Introduction — Monday, July 12

8:00	AM	Field Review
12:00	PM	Lunch
1:00	PM	Introductions and Overview of CER Process by FHWA
2:00	PM	Project and Cost Estimate Methodology Overview
2:30	PM	Escalation
3:30	PM	Removals/Relocations
5:00	PM	Adjourn

Roadway — Tuesday, July 13

8:30	AM	Construction/Reconstruction (Base and Surface Treatments)
9:30	AM	Earthwork
10:30	AM	Landscaping, Roadside Features
11:30	AM	Lunch
12:30	PM	Bridges/Structures/Retaining Walls/Sound Walls
1:30	PM	Port of Entry
2:30	PM	Unforeseen Conditions
3:30	PM	Utilities/Planning and Engineering
4:30	PM	Right-of-Way
5:00	PM	Adjourn

Transit and Additional Roadway — Wednesday, July 14

8:30	AM	Express Bus and Commuter Bus
9:30	AM	Carpool Lots
10:30	AM	Commuter Rail including Insurance and Legal
11:30	AM	Lunch
12:30	PM	Lighting, Traffic Signals, Permanent Signing/Striping
1:30	PM	Intelligent Transportation System, Managed Lane System
2:30	PM	Construction Traffic Control
3:30	PM	Drainage/Erosion Control
4:30	PM	Mobilization
5:00	PM	Adjourn

Team Work and Closeout — Thursday, July 15

8:30	AM	Items not previously covered (or follow upon previous line items)
9:30	AM	CER Team Work
12:00	PM	Lunch
1:00	PM	Closeout Dry Run
2:00	PM	Closeout Presentation
5:00	PM	Adjourn

Friday, July 16 Closeout Presentation (If the review progresses longer than expected, then the Closeout Presentation could be Friday morning; TBD)

Appendix B

CER Sign-In Sheet

7-12-10

Cost Estimate Review

Name	Organization	Email
Holly Buck	Felsburg Holt Ullevig	Holly.Buck@fhuengco
Ina Zisman	CDOT	INA.ZISMAN@DOT.STATE.CO.US
MYRON HORA	CDOT	MYRON.HORA@DOT.STATE.CO.U
ANGIE DRUMM	CDOT	
TOM ANZIA	FELSBURG HOLT & ULLEVIG	TOM.ANZIA@FHUENG.COM
DAVID Kosmiski	CDOT R6	david.kosmiski@dot.state.co.
Ralph Rizzo	FHWA	Ralph.J.Rizzo@dot.gov
GUS BIEBER	CDOT	GUSTAF.BIEBER@DOT.STATE.C
Johnny Olson	CDOT	J.OLSON@DOT.State.co.u.
Monica Pavlik	FHWA	monica.pavlik@dot.gov
Shaun Cutting	FHWA	shaun.cutting@DOT.GOV
Kathie Kelly	FHWA	Katherine.Kelly@dot.gov
Mark Gosselin	CDOT	mark.gosselin@dot.state.co.u
LONG NGUYEN	CDOT	Long.Nguyen@dot.state.co.us
Doug Pearson	CDOT	douglas.pearson@dot.state.co.
Brian Wiltshire	Felsburg Holt + Ullevig	brian.wiltshire@fhueng.com
LATOYA JOHNSON	FHWA	latoya.johnson@fhwa.dot.gov
CAROL PARR	CDOT	Carol.parr@dot.state.co.US
Bernie	FHWA RC	BERNIE.KUTA@DOT.GOV
GARY STROME	CDOT R4 MAT'LS.	GARY.STROME@dot.state.us
Jill Schlaefer	CDOT HQ EPB	
JEFF KEELY	CDOT R6	jeffrey.keely@dot.state.co.
Rudy Sipnefski	CDOT R4	Rudy.Sipnefski@dot.state.co.us
CINDY OTEGUI	Felsburg Holt & Ullevig	cindy.otegui@fhueng.com
~~GUS BIEBER~~	~~CDOT~~	~~GUSTAF.BIEBER@DOT.STATE.CO~~
RICHARD OSMUN	CDOT STAFF BR	RICHARD.OSMUN@ - - -
Bob Grube	CDOT R-4 ROW	Bob.Grube@DOT.STATE.CO.U
Jim Krogman	Jacobs Engineering	Jim.Krogman@Jacobs.com
Danielle Smith	Jacobs Engineering	Danielle.Smith@Jacobs.com
Steven Griffin	CDOT R4	Steven.Griffin@dot...

Name	Organization	Email
Kendra Gabbert	Felsburg Holt and Ullevig	kendra.gabbert@fhueng.co
Ina Zisman	CDOT	INA.ZISMAN@DOT.STATE.CO.US

I 25 North Corridor
Closeout Presentation – July 15

Bernie Kuta	FHWA RC
Latoya Johnson	FHWA HQ
Ralph Rizzo	FHWA RC
Johnny Olson	CDOT R4-RTD
MYRON HORA	CDOT R4 RPEM
Ina Zisman	CDOT R4 Traffic
Cindy Otegui	Felsburg Holt & Ullevig
Kendra Gabbert	FHU
Holly Buck	FHU
ANGIE DRUMM	CDOT Govt Rel
Carol Parr	CDOT R4
Mark Gosselin	CDOT R4
TOM ANZIA	FHU
GUS BIEBER	CDOT
LONG NGUYEN	CDOT
Brian Wiltshire	Felsburg Holt + Ullevig
[redacted]	[redacted]
Shawn Cutting	FHWA
Pam Hutton	CDOT
Peggy Catlin	CDOT
Kathie Kelly	FHWA CO DIV
Monica Pavlik	FHWA CO DIV
VIVIEN HOANG	FHWA CO DIV
David Kosmiski	CDOT – R6

Appendix C

CER Probability Analysis Report

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Crystal Ball Report - Custom
Simulation started on 7/15/2010 at 1:19 AM
Simulation stopped on 7/15/2010 at 1:20 AM

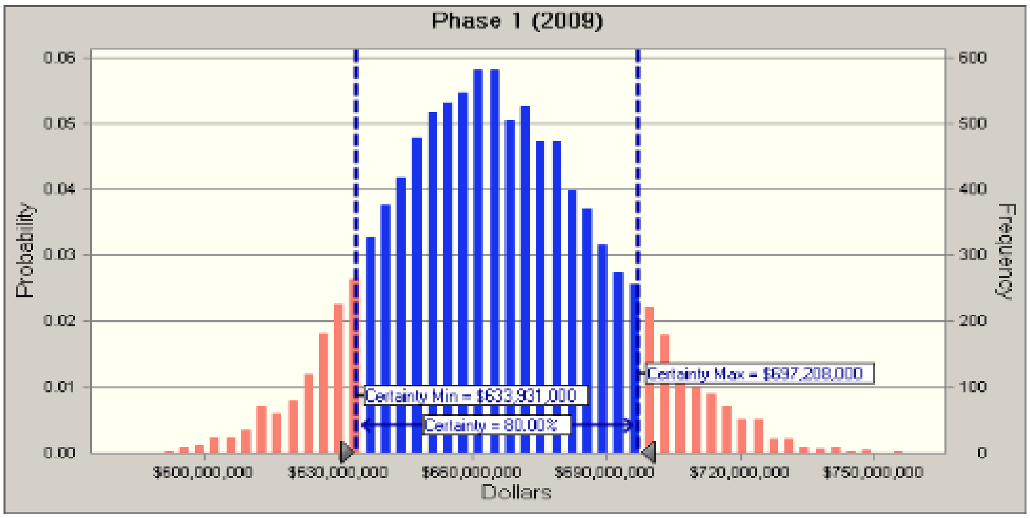
Run preferences:	
Number of trials run	10,000
Extreme speed	
Latin Hypercube (size)	500
Seed	999
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	26.53
Trials/second (average)	377
Random numbers per sec	50,893
Crystal Ball data:	
Assumptions	135
Correlations	0
Correlated groups	0
Decision variables	0
Forecasts	4

Forecasts

Worksheet: [North_I-25 CER 7-14-2010pm FINAL.xlsx]Phase 1 (2009)

Forecast: Phase 1 (2009) **Cell: P133**

Summary:
Certainty level is 80.00%
Certainty range is from $633,931,000 to $697,208,000
Entire range is from $576,217,000 to $763,906,000
Base case is $640,997,000
After 10,000 trials, the std. error of the mean is $245,694



Statistics:	Forecast values
Trials	10,000
Base Case	$640,997,000
Mean	$664,803,375
Median	$663,905,000
Mode	$646,761,000
Standard Deviation	$24,569,361
Variance	#################
Skewness	0.1574
Kurtosis	2.94
Coeff. of Variability	0.0370
Minimum	$576,217,000
Maximum	$763,906,000
Range Width	$187,689,000
Mean Std. Error	$245,694

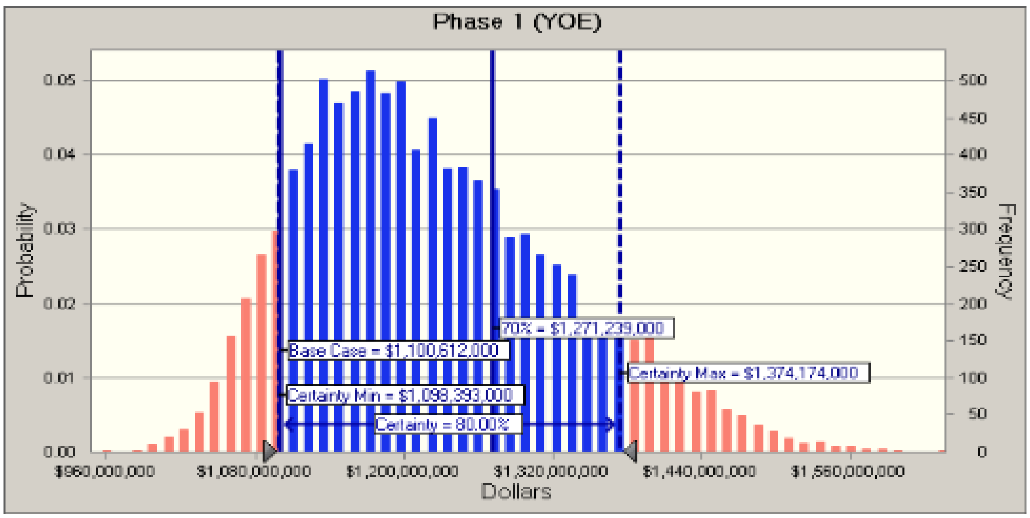
Forecast: Phase 1 (2009) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$576,217,000
10%	$633,931,000
20%	$643,808,000
30%	$651,091,000
40%	$657,702,000
50%	$663,899,000
60%	$670,289,000
70%	$677,280,000
80%	$685,512,000
90%	$697,208,000
100%	$763,906,000

Worksheet: [North_I-25 CER 7-14-2010pm FINAL.xlsx]Phase 1 (YOE)

Forecast: Phase 1 (YOE) **Cell: P133**

Summary:
Certainty level is 80.00%
Certainty range is from $1,098,393,000 to $1,374,174,000
Entire range is from $953,461,000 to $1,629,202,000
Base case is $1,100,612,000
After 10,000 trials, the std. error of the mean is $1,048,970



Statistics:	Forecast values
Trials	10,000
Base Case	$1,100,612,000
Mean	$1,222,720,245
Median	$1,207,185,000
Mode	$1,112,381,000
Standard Deviation	$104,896,978
Variance	#################
Skewness	0.5502
Kurtosis	2.85
Coeff. of Variability	0.0858
Minimum	$953,461,000
Maximum	$1,629,202,000
Range Width	$675,741,000
Mean Std. Error	$1,048,970

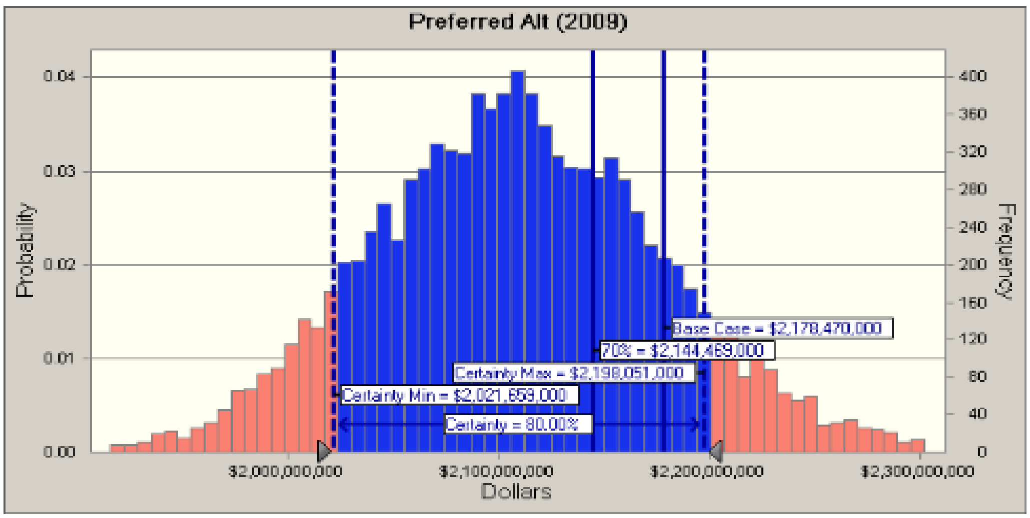
Forecast: Phase 1 (YOE) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$953,461,000
10%	$1,098,393,000
20%	$1,130,345,000
30%	$1,156,061,000
40%	$1,181,538,000
50%	$1,207,181,000
60%	$1,237,705,000
70%	$1,271,239,000
80%	$1,312,975,000
90%	$1,374,174,000
100%	$1,629,202,000

Worksheet: [North_I-25 CER 7-14-2010pm FINAL.xlsx]Preferred Alt (2009)

Forecast: Preferred Alt (2009) **Cell: P133**

Summary:
- Certainty level is 80.00%
- Certainty range is from $2,021,659,000 to $2,198,051,000
- Entire range is from $1,884,248,000 to $2,358,783,000
- Base case is $2,178,470,000
- After 10,000 trials, the std. error of the mean is $688,127



Statistics:	Forecast values
Trials	10,000
Base Case	$2,178,470,000
Mean	$2,108,980,935
Median	$2,107,467,500
Mode	$2,094,284,000
Standard Deviation	$68,812,712
Variance	#################
Skewness	0.1257
Kurtosis	2.97
Coeff. of Variability	0.0326
Minimum	$1,884,248,000
Maximum	$2,358,783,000
Range Width	$474,535,000
Mean Std. Error	$688,127

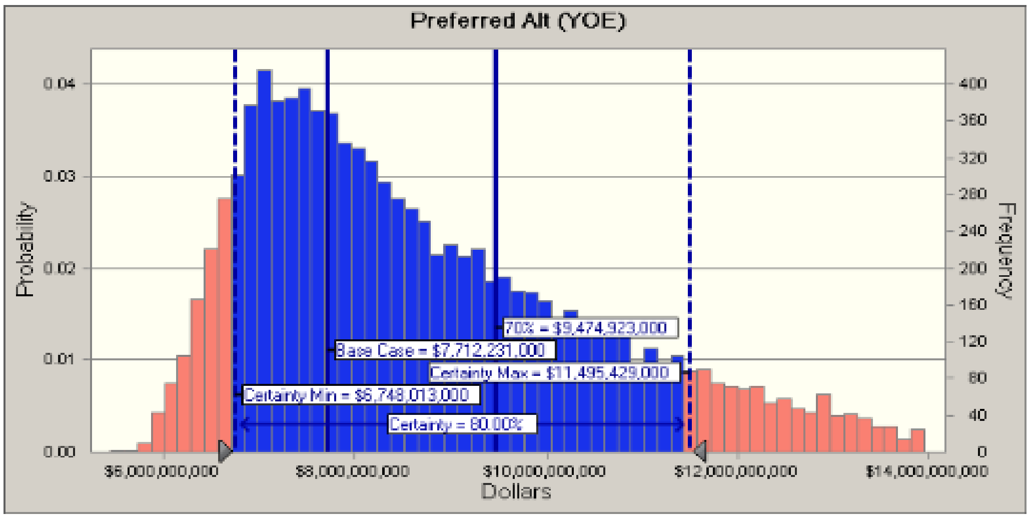
Forecast: Preferred Alt (2009) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$1,884,248,000
10%	$2,021,659,000
20%	$2,049,994,000
30%	$2,071,716,000
40%	$2,090,949,000
50%	$2,107,467,000
60%	$2,124,171,000
70%	$2,144,469,000
80%	$2,166,145,000
90%	$2,198,051,000
100%	$2,358,783,000

Worksheet: [North_I-25 CER 7-14-2010pm FINAL.xlsx]Preferred Alt (YOE)

Forecast: Preferred Alt (YOE) **Cell: P133**

Summary:
Certainty level is 80.00%
Certainty range is from $6,748,013,000 to $11,495,429,000
Entire range is from $5,449,159,000 to $16,346,966,000
Base case is $7,712,231,000
After 10,000 trials, the std. error of the mean is $18,560,855



Statistics:	Forecast values
Trials	10,000
Base Case	$7,712,231,000
Mean	$8,748,202,522
Median	$8,290,684,000
Mode	$7,341,484,000
Standard Deviation	$1,856,085,473
Variance	#################
Skewness	0.8967
Kurtosis	3.24
Coeff. of Variability	0.2122
Minimum	$5,449,159,000
Maximum	$16,346,966,000
Range Width	$10,897,807,000
Mean Std. Error	$18,560,855

Forecast: Preferred Alt (YOE) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$5,449,159,000
10%	$6,748,013,000
20%	$7,125,178,000
30%	$7,482,515,000
40%	$7,856,255,000
50%	$8,290,487,000
60%	$8,817,202,000
70%	$9,474,923,000
80%	$10,305,317,000
90%	$11,495,429,000
100%	$16,346,966,000

End of Forecasts

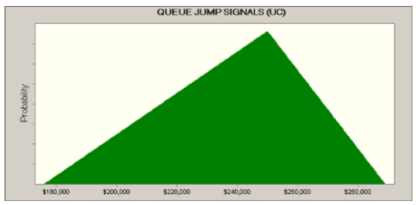
Assumptions

Worksheet: [North_I-25 CER 7-14-2010pm FINAL.xlsx]Unit Costs

Assumption: QUEUE JUMP SIGNALS (UC) **Cell: E64**

Triangular distribution with parameters:

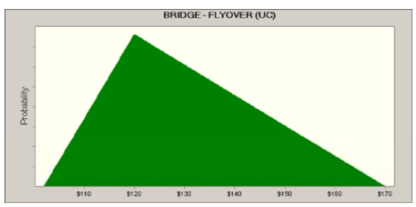
Minimum	$176,000	(=$F$64)
Likeliest	$250,000	(=$E$64)
Maximum	$289,000	(=$G$64)



Assumption: BRIDGE - FLYOVER (UC) **Cell: E24**

Triangular distribution with parameters:

Minimum	$102	(=$F$24)
Likeliest	$120	(=$E$24)
Maximum	$170	(=$G$24)

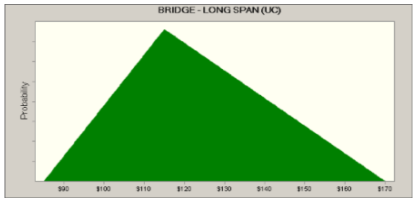


Assumption: BRIDGE - LONG SPAN (UC) **Cell: E22**

Triangular distribution with parameters:

Minimum	$85	(=$F$22)
Likeliest	$115	(=$E$22)
Maximum	$170	(=$G$22)

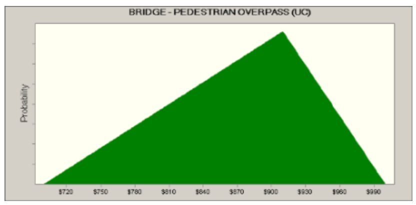
Assumption: BRIDGE - LONG SPAN (UC) (cont'd) **Cell: E22**



Assumption: BRIDGE - PEDESTRIAN OVERPASS (UC) **Cell: E23**

Triangular distribution with parameters:

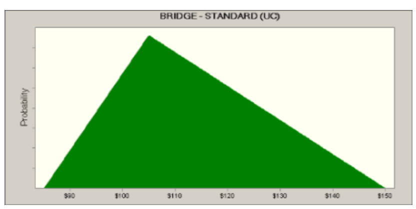
Minimum	$700	(=$F$23)
Likeliest	$910	(=$E$23)
Maximum	$1,000	(=$G$23)



Assumption: BRIDGE - STANDARD (UC) **Cell: E21**

Triangular distribution with parameters:

Minimum	$85	(=$F$21)
Likeliest	$105	(=$E$21)
Maximum	$150	(=$G$21)

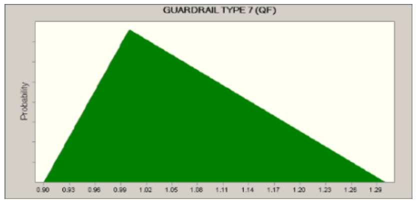


Assumption: GUARDRAIL TYPE 7 (QF) **Cell: H18**

Triangular distribution with parameters:

Minimum	0.90	(=$I$18)
Likeliest	1.00	(=$H$18)
Maximum	1.30	(=$J$18)

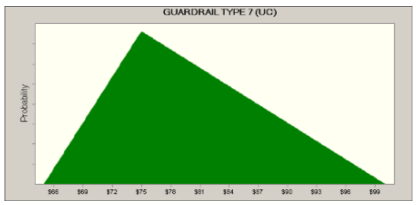
Assumption: GUARDRAIL TYPE 7 (QF) (cont'd) **Cell: H18**



Assumption: GUARDRAIL TYPE 7 (UC) **Cell: E18**

Triangular distribution with parameters:

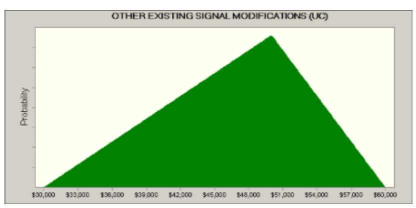
Minimum	$65	(=$F$18)
Likeliest	$75	(=$E$18)
Maximum	$100	(=$G$18)



Assumption: OTHER EXISTING SIGNAL MODIFICATIONS (UC) **Cell: E65**

Triangular distribution with parameters:

Minimum	$30,000	(=$F$65)
Likeliest	$50,000	(=$E$65)
Maximum	$60,000	(=$G$65)

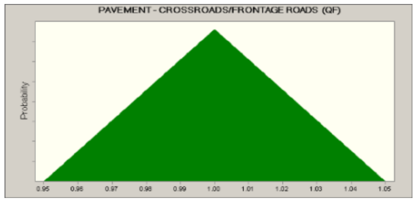


Assumption: PAVEMENT - CROSSROADS/FRONTAGE ROADS (QF) **Cell: H16**

Triangular distribution with parameters:

Minimum	0.95	(=$I$16)
Likeliest	1.00	(=$H$16)
Maximum	1.05	(=$J$16)

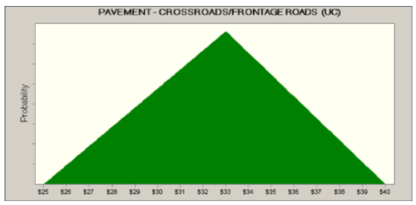
Assumption: PAVEMENT - CROSSROADS/FRONTAGE ROADS (QF) (cont'd) **Cell: H16**



Assumption: PAVEMENT - CROSSROADS/FRONTAGE ROADS (UC) **Cell: E16**

Triangular distribution with parameters:

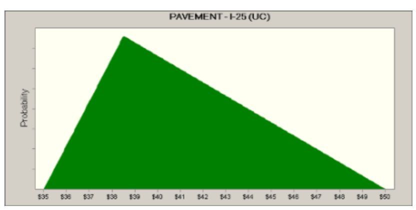
Minimum	$25	(=$F$16)
Likeliest	$33	(=$E$16)
Maximum	$40	(=$G$16)



Assumption: PAVEMENT - I-25 (UC) **Cell: E14**

Triangular distribution with parameters:

Minimum	$35	(=$F$14)
Likeliest	$39	(=$E$14)
Maximum	$50	(=$G$14)

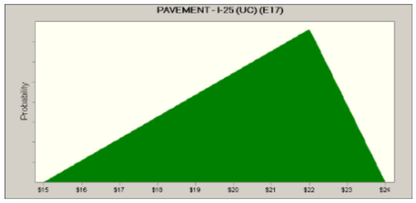


Assumption: PAVEMENT - I-25 (UC) (E17) **Cell: E17**

Triangular distribution with parameters:

Minimum	$15	(=$F$17)
Likeliest	$22	(=$E$17)
Maximum	$24	(=$G$17)

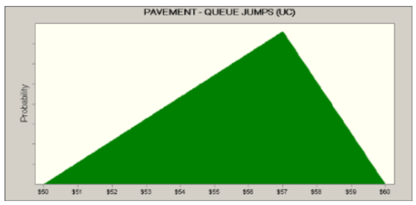
Assumption: PAVEMENT - I-25 (UC) (E17) (cont'd) **Cell: E17**



Assumption: PAVEMENT - QUEUE JUMPS (UC) **Cell: E56**

Triangular distribution with parameters:

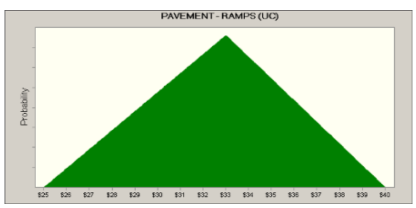
Minimum	$50	(=$F$56)
Likeliest	$57	(=$E$56)
Maximum	$60	(=$G$56)



Assumption: PAVEMENT - RAMPS (UC) **Cell: E15**

Triangular distribution with parameters:

Minimum	$25	(=$F$15)
Likeliest	$33	(=$E$15)
Maximum	$40	(=$G$15)

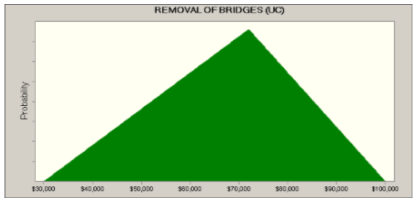


Assumption: REMOVAL OF BRIDGES (UC) **Cell: E11**

Triangular distribution with parameters:

Minimum	$30,000	(=$F$11)
Likeliest	$72,000	(=$E$11)
Maximum	$100,000	(=$G$11)

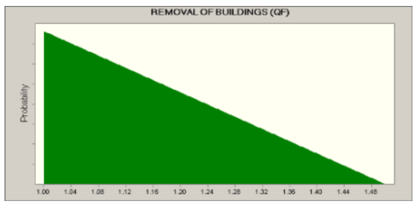
Assumption: REMOVAL OF BRIDGES (UC) (cont'd) **Cell: E11**



Assumption: REMOVAL OF BUILDINGS (QF) **Cell: H12**

Triangular distribution with parameters:

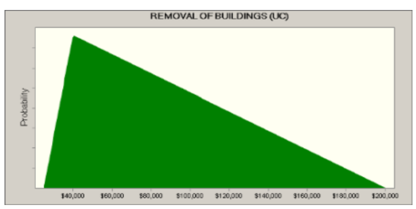
Minimum	1.00	(=$I$12)
Likeliest	1.00	(=$H$12)
Maximum	1.50	(=$J$12)



Assumption: REMOVAL OF BUILDINGS (UC) **Cell: E12**

Triangular distribution with parameters:

Minimum	$25,000	(=$F$12)
Likeliest	$40,000	(=$E$12)
Maximum	$200,000	(=$G$12)

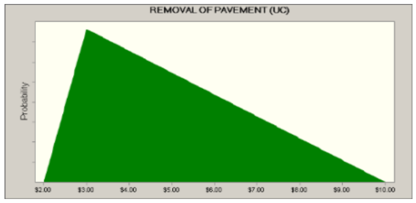


Assumption: REMOVAL OF PAVEMENT (UC) **Cell: E10**

Triangular distribution with parameters:

Minimum	$2.00	(=$F$10)
Likeliest	$3.00	(=$E$10)
Maximum	$10.00	(=$G$10)

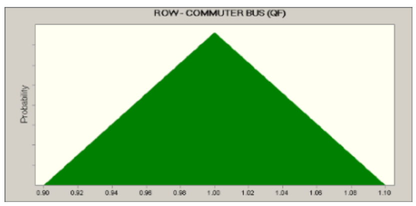
Assumption: REMOVAL OF PAVEMENT (UC) (cont'd) **Cell: E10**



Assumption: ROW - COMMUTER BUS (QF) **Cell: H73**

Triangular distribution with parameters:

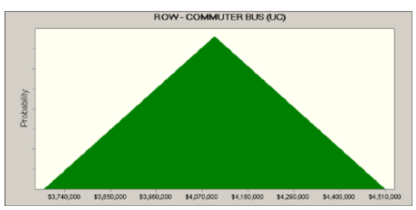
Minimum	0.90	(=$I$73)
Likeliest	1.00	(=$H$73)
Maximum	1.10	(=$J$73)



Assumption: ROW - COMMUTER BUS (UC) **Cell: E73**

Triangular distribution with parameters:

Minimum	$3,690,000	(=$F$73)
Likeliest	$4,100,000	(=$E$73)
Maximum	$4,510,000	(=$G$73)

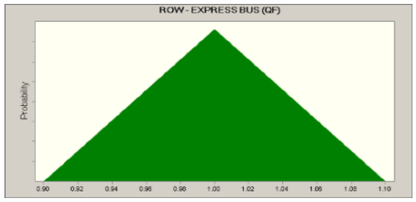


Assumption: ROW - EXPRESS BUS (QF) **Cell: H72**

Triangular distribution with parameters:

Minimum	0.90	(=$I$72)
Likeliest	1.00	(=$H$72)
Maximum	1.10	(=$J$72)

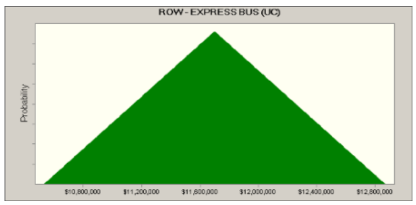
Assumption: ROW - EXPRESS BUS (QF) (cont'd) **Cell: H72**



Assumption: ROW - EXPRESS BUS (UC) **Cell: E72**

Triangular distribution with parameters:

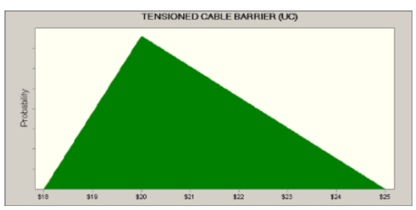
Minimum	$10,530,000	(=$F$72)
Likeliest	$11,700,000	(=$E$72)
Maximum	$12,870,000	(=$G$72)



Assumption: TENSIONED CABLE BARRIER (UC) **Cell: E19**

Triangular distribution with parameters:

Minimum	$18	(=$F$19)
Likeliest	$20	(=$E$19)
Maximum	$25	(=$G$19)



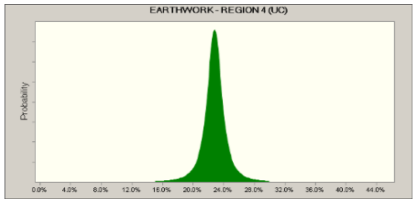
Assumption: EARTHWORK - REGION 4 (UC) **Cell: E32**

Student's t distribution with parameters:

Midpoint	22.8%	(=$E$32)
Scale	1.0%	
Deg. Freedom	2	

Selected range is from 15.0% to 30.0%

Assumption: EARTHWORK - REGION 4 (UC) (cont'd) **Cell: E32**

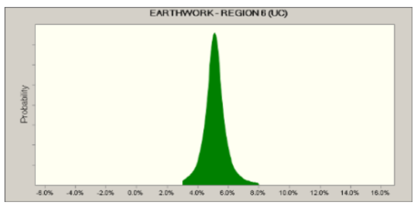


Assumption: EARTHWORK - REGION 6 (UC) **Cell: E33**

Student's t distribution with parameters:

Midpoint	5.1%	(=$E$33)
Scale	0.5%	
Deg. Freedom	2	

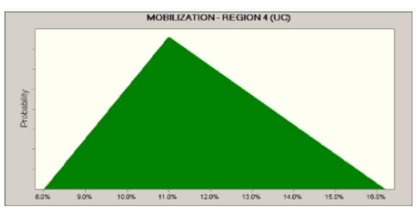
Selected range is from 3.0% to 8.0%



Assumption: MOBILIZATION - REGION 4 (UC) **Cell: E40**

Triangular distribution with parameters:

Minimum	8.0%	(=$F$40)
Likeliest	11.0%	(=$E$40)
Maximum	16.2%	(=$G$40)

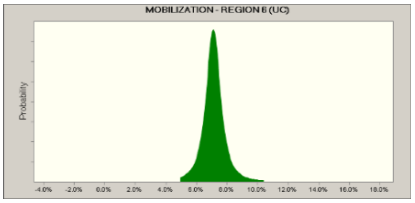


Assumption: MOBILIZATION - REGION 6 (UC) **Cell: E41**

Student's t distribution with parameters:

Midpoint	7.1%	(=$E$41)
Scale	0.5%	
Deg. Freedom	2	

Selected range is from 4.9% to 10.4%



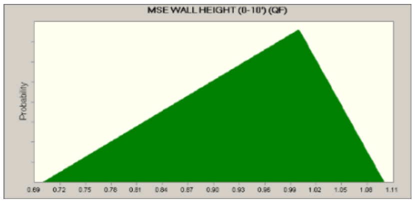
Assumption: MSE WALL HEIGHT (0-10') (QF) **Cell: H26**

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

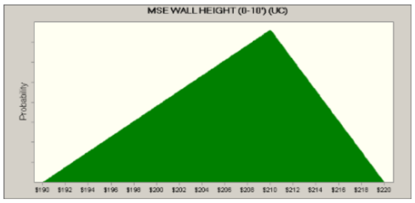
Minimum	0.70	(=$I$26)
Likeliest	1.00	(=$H$26)
Maximum	1.10	(=$J$26)



Assumption: MSE WALL HEIGHT (0-10') (UC) **Cell: E26**

Triangular distribution with parameters:

Minimum	$190	(=$F$26)
Likeliest	$210	(=$E$26)
Maximum	$220	(=$G$26)



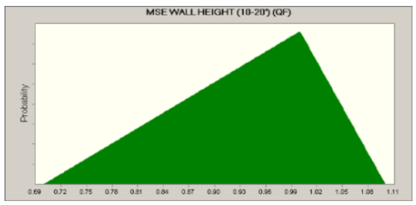
Assumption: MSE WALL HEIGHT (10-20') (QF) **Cell: H27**

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

Minimum	0.70	(=$I$27)
Likeliest	1.00	(=$H$27)
Maximum	1.10	(=$J$27)



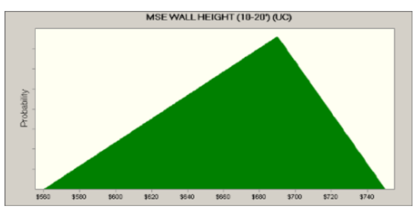
Assumption: MSE WALL HEIGHT (10-20') (UC) **Cell: E27**

OPPORTUNTIES: market conditions, 5-20% design level

THREATS: market conditions, 5-20% design level

Triangular distribution with parameters:

Minimum	$560	(=$F$27)
Likeliest	$690	(=$E$27)
Maximum	$750	(=$G$27)



Assumption: MSE WALL HEIGHT (20'+) (QF) **Cell: H28**

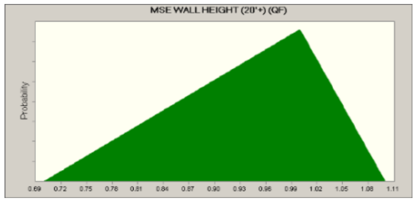
OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

Minimum	0.70	(=$I$28)
Likeliest	1.00	(=$H$28)
Maximum	1.10	(=$J$28)

Assumption: MSE WALL HEIGHT (20'+) (QF) (cont'd) **Cell: H28**



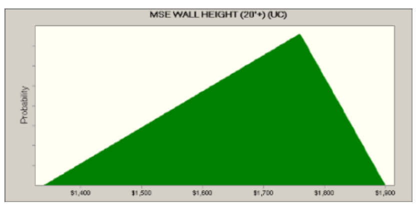
Assumption: MSE WALL HEIGHT (20'+) (UC) **Cell: E28**

OPPORTUNTIES: market conditions, 5-20% design level

THREATS: market conditions, 5-20% design level

Triangular distribution with parameters:

Minimum	$1,340	(=$F$28)
Likeliest	$1,760	(=$E$28)
Maximum	$1,900	(=$G$28)



Assumption: Assumed Construction Unit Cost Rate of Escalation: **Cell: D3**

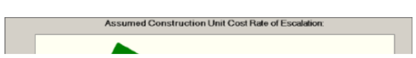
CO Escalation Rates
CDOT: 3.3% based on CCI (average of cumulative average of inflation since 1987)
NFR: 3.0% used for revenue and construction projection
DRGOG/OFMB: 3.3 % used for revenue projection, applied annually
RTD: 3.3-3.8%
US36 CER: 3.8%; min = 3.0% & max = 4.6%

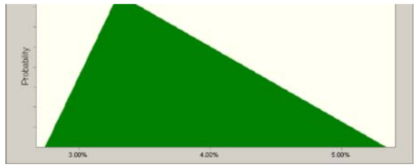
Threats: Other large projects in area, FastTracks, CDOT, material shortages, ie steel, asphalt, cement. More stimulous money may decrease competition. Availability of skilled workforce.

Opportunities: Continued low prices,

Triangular distribution with parameters:

Minimum	2.74%	
Likeliest	3.30%	(=$D$3)
Maximum	5.34%	




Probability
3.00%
4.00%
5.00%

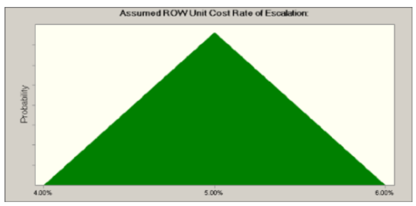
Assumption: Assumed ROW Unit Cost Rate of Escalation: **Cell: D4**

Based on data such as home price index from 1970 to 2010, assessor's office

5% escalation annually
Range of 4-7%
THREATS: Transitional development along corridor, i.e. agricultural (7K to 10K/acre) to industrial/residential ($7/sf)
OPPORTUNITIES: Land-use planning, stabilization of ROW market, ROW preservation

Triangular distribution with parameters:

Minimum	4.00%	
Likeliest	5.00%	(=$D$4)
Maximum	6.00%	

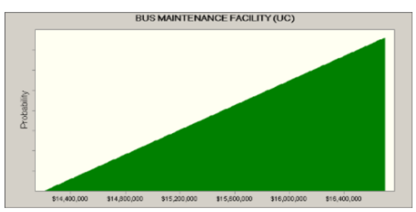


Assumption: BUS MAINTENANCE FACILITY (UC) **Cell: E62**

Based on detailed breakdown with unit cost from other facilities

Triangular distribution with parameters:

Minimum	$14,205,200	(=$F$62)
Likeliest	$16,700,000	(=$E$62)
Maximum	$16,700,000	(=$G$62)



Assumption: CARPOOL PARKING (UC) **Cell: E43**

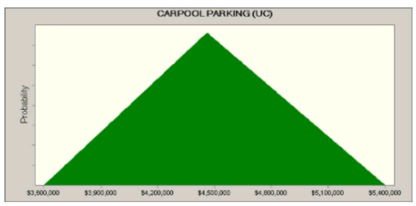
Not for commuter rail or express lots, solely existing or new park and ride lots - 5 locations
Based on historical data from RTD

OPPORTUNITIES: more usage of commuter rail lots

THREATS: less usage of commuter rail lots, development in corridor

Triangular distribution with parameters:

Minimum	$3,600,000	(=$F$43)
Likeliest	$4,460,000	(=$E$43)
Maximum	$5,400,000	(=$G$43)



Assumption: COMMUTER BUS STATIONS (UC) **Cell: E58**

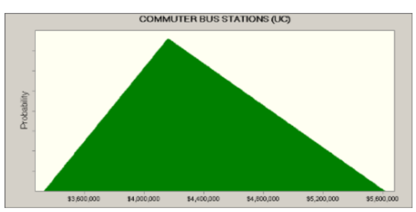
Average of cost of different types/sized stations
Based on RTD West corridor/Southwest Corridor extension projects and RTD 2010 Program Review cost

OPPORTUNITIES: market conditions, lower bid prices, cost sharing with local agencies, ROW available for larger surface lots

THREATS: level of security, increased ridership, timeframe of ridership model (only modeled to 2035)

Triangular distribution with parameters:

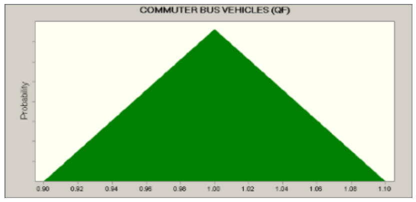
Minimum	$3,328,000	(=$F$58)
Likeliest	$4,160,000	(=$E$58)
Maximum	$5,616,000	(=$G$58)



Assumption: COMMUTER BUS VEHICLES (QF) **Cell: H75**

Triangular distribution with parameters:

Minimum	0.90	(=$I$75)
Likeliest	1.00	(=$H$75)
Maximum	1.10	(=$J$75)

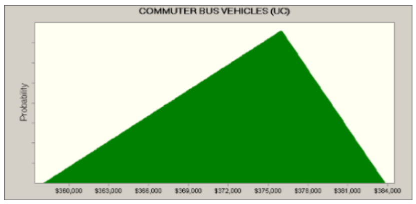


Assumption: COMMUTER BUS VEHICLES (UC) **Cell: E75**

-Assumed 40' coach style bus
-Cost based on RTD Annual Program Review
-Assumes 3-5% range; High range based on APTA report of average bus costs

Triangular distribution with parameters:

Minimum	$358,100	(=$F$75)
Likeliest	$376,000	(=$E$75)
Maximum	$383,800	(=$G$75)



Assumption: COMMUTER RAIL - SUBTOTAL BASE COMMUNICATION SYSTEM (QF) **Cell: H93**

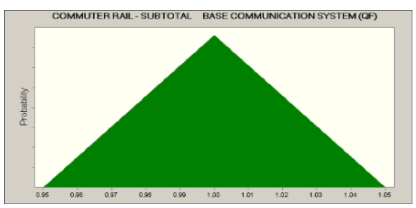
Related to quantity changes in trackwork

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$93)
Likeliest	1.00	(=$H$93)
Maximum	1.05	(=$J$93)



Assumption: COMMUTER RAIL - SUBTOTAL BASE COMMUNICATION SYSTEM (UC) Cell: E93

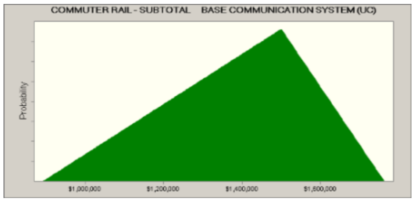
Includes for all communications along track
Cost based on cost on similar projects in the U.S.

OPPORTUNITIES: Will need to tie-in to systems to the south of corridor/BSNF, technology advances

THREATS: Will need to tie-in to systems to the south of corridor/BSNF

Triangular distribution with parameters:

Minimum	$892,000	(=$F$93)
Likeliest	$1,500,000	(=$E$93)
Maximum	$1,762,780	(=$G$93)



Assumption: COMMUTER RAIL - SUBTOTAL RURAL FENCE (QF) Cell: H96

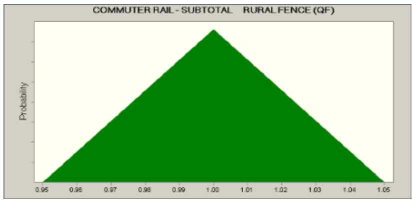
Related to quantity changes in trackwork

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$96)
Likeliest	1.00	(=$H$96)
Maximum	1.05	(=$J$96)



Assumption: COMMUTER RAIL - SUBTOTAL RURAL FENCE (UC) Cell: E96

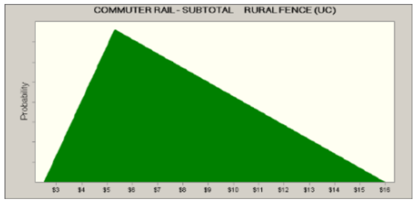
OPPORTUNITIES: 20-30% design level, type of fence, location of fence (rural vs. urban)

THREATS: 20-30% design level, type of fence, location of fence (rural vs. urban)

Triangular distribution with parameters:

Minimum	$3	(=$F$96)
Likeliest	$5	(=$E$96)
Maximum	$16	(=$G$96)

Assumption: COMMUTER RAIL - SUBTOTAL RURAL FENCE (UC) (cont'd) **Cell: E96**



Assumption: COMMUTER RAIL - SUBTOTAL 13' GRAVEL ACCESS ROAD (QF) **Cell: H91**

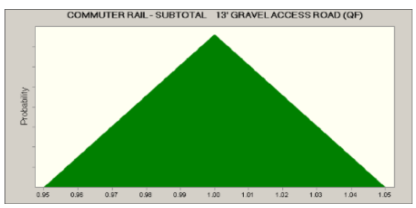
Related to quantity changes in trackwork

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$91)
Likeliest	1.00	(=$H$91)
Maximum	1.05	(=$J$91)



Assumption: COMMUTER RAIL - SUBTOTAL 13' GRAVEL ACCESS ROAD (UC) **Cell: E91**

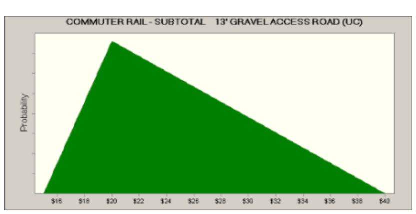
Includes 12" surface of access road

THREATS: market conditions, haul distances

OPPORTUNITIES: material extension of subballast

Triangular distribution with parameters:

Minimum	$15	(=$F$91)
Likeliest	$20	(=$E$91)
Maximum	$40	(=$G$91)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL ACTIVATION & TESTING (U Cell: E95

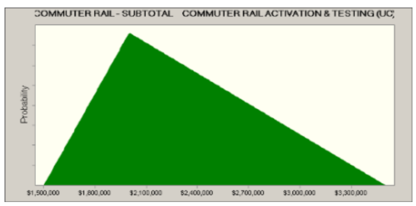
Standard testing in the industry
Based on size of the facility

OPPORTUNITIES: number of construction phases

THREATS: number of construction phases

Triangular distribution with parameters:

Minimum	$1,500,000	(=$F$95)
Likeliest	$2,000,000	(=$E$95)
Maximum	$3,500,000	(=$G$95)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL BRIDGE - span <140' (no c Cell: E80

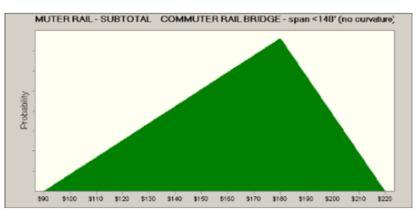
-Based on RTD historical cost data
-Two commuter rail projects recently awarded by RTD

OPPORTUNITIES: 20-30% design level, new technology, lighter track, new alignment

THREATS: 20-30% design level, complexity of bridge design, new alignment, roadway and water crossings

Triangular distribution with parameters:

Minimum	$90	(=$F$80)
Likeliest	$180	(=$E$80)
Maximum	$220	(=$G$80)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL BRIDGE - span >140' (or w Cell: E81

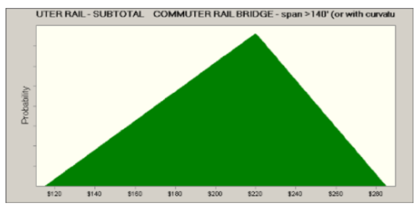
-Based on RTD historical cost data
-Two commuter rail projects recently awarded by RTD

OPPORTUNITIES: 20-30% design level, new technology, lighter track, new alignment

THREATS: 20-30% design level, complexity of bridge design, new alignment, roadway and water crossings

Triangular distribution with parameters:

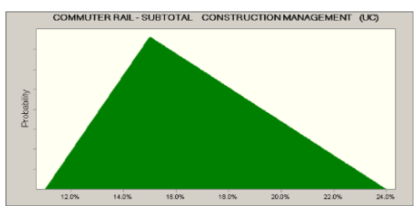
Minimum	$115	(=$F$81)
Likeliest	$220	(=$E$81)
Maximum	$285	(=$G$81)



Assumption: COMMUTER RAIL - SUBTOTAL CONSTRUCTION MANAGEMENT (UC) Cell: E113

Triangular distribution with parameters:

Minimum	11.0%	(=$F$113)
Likeliest	15.0%	(=$E$113)
Maximum	24.0%	(=$G$113)



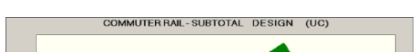
Assumption: COMMUTER RAIL - SUBTOTAL DESIGN (UC) Cell: E112

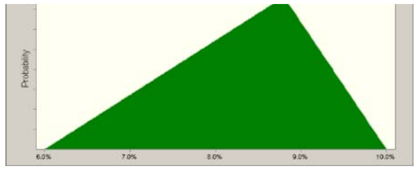
THREATS: BSNF design/review process

OPPORTUNITIES: BSNF design/review process

Triangular distribution with parameters:

Minimum	6.0%	(=$F$112)
Likeliest	8.8%	(=$E$112)
Maximum	10.0%	(=$G$112)




Probability
6.0%
7.0%
8.0%
9.0%
10.0%

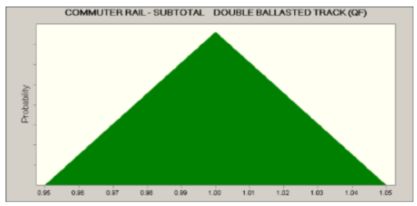
Assumption: COMMUTER RAIL - SUBTOTAL DOUBLE BALLASTED TRACK (QF) Cell: H87

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$87)
Likeliest	1.00	(=$H$87)
Maximum	1.05	(=$J$87)



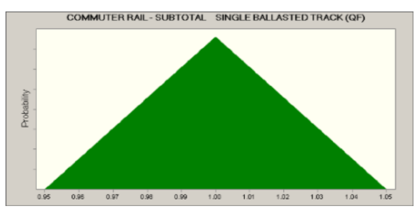
Assumption: COMMUTER RAIL - SUBTOTAL SINGLE BALLASTED TRACK (QF) Cell: H88

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$88)
Likeliest	1.00	(=$H$88)
Maximum	1.05	(=$J$88)



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (0-10') (QF) Cell: H83

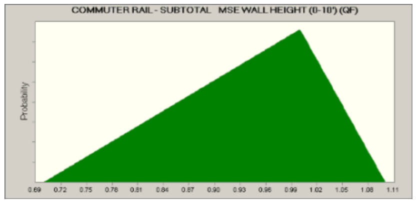
OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

Minimum	0.70	(=$I$83)
Likeliest	1.00	(=$H$83)
Maximum	1.10	(=$J$83)

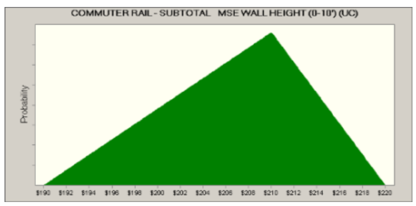
Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (0-10') (QF) (cont'd) Cell: H83



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (0-10') (UC) Cell: E83

Triangular distribution with parameters:

Minimum	$190	(=$F$83)
Likeliest	$210	(=$E$83)
Maximum	$220	(=$G$83)



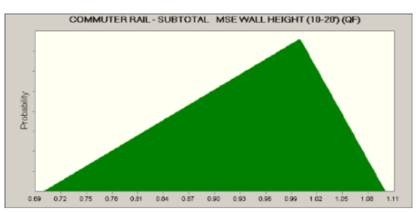
Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (10-20') (QF) Cell: H84

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

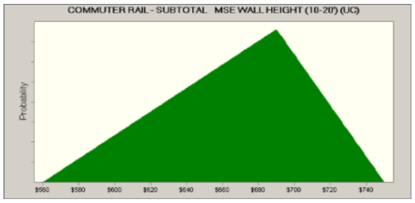
Minimum	0.70	(=$I$84)
Likeliest	1.00	(=$H$84)
Maximum	1.10	(=$J$84)



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (10-20') (UC) **Cell: E84**

Triangular distribution with parameters:

Minimum	$560	(=$F$84)
Likeliest	$690	(=$E$84)
Maximum	$750	(=$G$84)



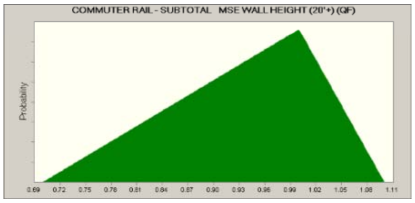
Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (20'+) (QF) **Cell: H85**

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

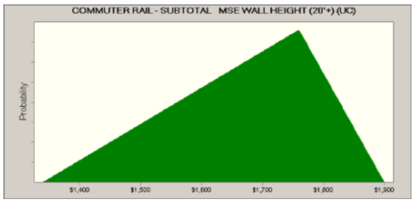
Minimum	0.70	(=$I$85)
Likeliest	1.00	(=$H$85)
Maximum	1.10	(=$J$85)



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (20'+) (UC) **Cell: E85**

Triangular distribution with parameters:

Minimum	$1,340	(=$F$85)
Likeliest	$1,760	(=$E$85)
Maximum	$1,900	(=$G$85)



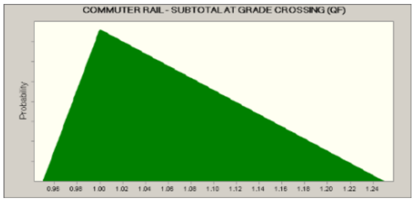
Assumption: COMMUTER RAIL - SUBTOTAL AT GRADE CROSSING (QF) **Cell: H97**

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, additional request from locals

Triangular distribution with parameters:

Minimum	0.95	(=$I$97)
Likeliest	1.00	(=$H$97)
Maximum	1.25	(=$J$97)



Assumption: COMMUTER RAIL - SUBTOTAL AT GRADE CROSSING (UC) **Cell: E97**

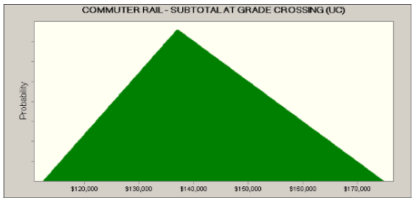
Average of different types of crossing

OPPORTUNITIES: quiet zones not implemented

THREATS: existing roadway widened

Triangular distribution with parameters:

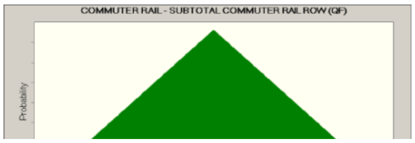
Minimum	$112,400	(=$F$97)
Likeliest	$137,000	(=$E$97)
Maximum	$174,840	(=$G$97)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL ROW (QF) **Cell: H114**

Triangular distribution with parameters:

Minimum	0.90	(=$I$114)
Likeliest	1.00	(=$H$114)
Maximum	1.10	(=$J$114)




0.90
0.92
0.94
0.96
0.98
1.00
1.02
1.04
1.06
1.08
1.10

Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL STATIONS (UC) **Cell: E104**

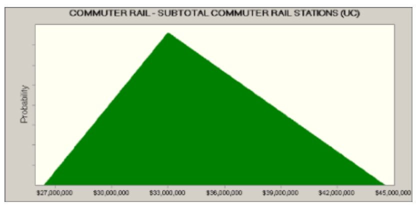
Average of cost of different types/sized stations
Based on RTD West corridor/Southwest Corridor extension projects and RTD 2010 Program Review cost

OPPORTUNITIES: market conditions, lower bid prices, cost sharing with local agencies, ROW available for larger surface lots

THREATS: level of security, increased ridership, timeframe of ridership model (only modeled to 2035)

Triangular distribution with parameters:

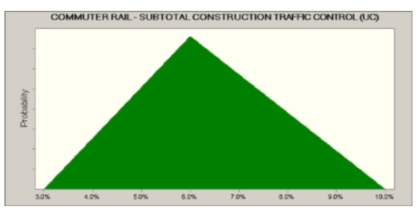
Minimum	$26,400,000	(=$F$104)
Likeliest	$33,000,000	(=$E$104)
Maximum	$44,550,000	(=$G$104)



Assumption: COMMUTER RAIL - SUBTOTAL CONSTRUCTION TRAFFIC CONTROL (UC) **Cell: E101**

Triangular distribution with parameters:

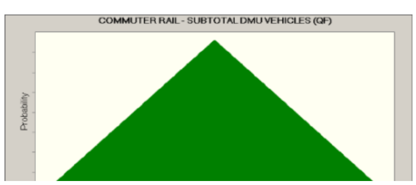
Minimum	3.0%	(=$F$101)
Likeliest	6.0%	(=$E$101)
Maximum	10.0%	(=$G$101)

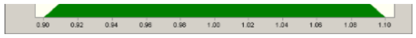


Assumption: COMMUTER RAIL - SUBTOTAL DMU VEHICLES (QF) **Cell: H116**

Triangular distribution with parameters:

Minimum	0.90	(=$I$116)
Likeliest	1.00	(=$H$116)
Maximum	1.10	(=$J$116)




0.90
0.92
0.94
0.96
0.98
1.00
1.02
1.04
1.06
1.08
1.10

Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) **Cell: E78**

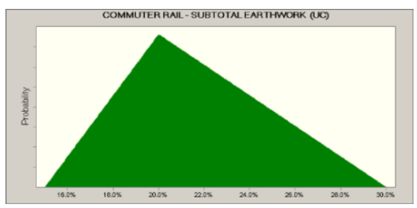
-Assumes cost of single track and maintenance road; based on alignment for trackline
-Percentage of trackwork cost

OPPORTUNITIES: 15-20% design level, soft soils - proximity to major rivers, haul distances, material suitability, unknown borrow sources

THREATS: 15-20% design level, changes in BNSF requirements, no final agreements in place with BNSF, material suitability, major aggregates supplies in project area

Triangular distribution with parameters:

Minimum	15.0%	(=$F$78)
Likeliest	20.0%	(=$E$78)
Maximum	30.0%	(=$G$78)



Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) (E87) **Cell: E87**

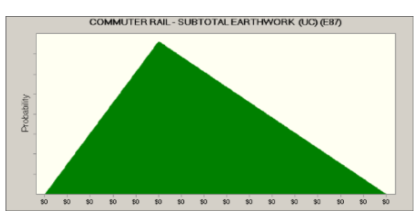
-Based on RTD 2010 Program review
-Includes cost for all track items from subgrade

OPPORTUNITIES: changes to FTA/FRA requirements, market conditions - steel/concrete prices

THREATS: changes to FTA/FRA requirements, market conditions - steel/concrete prices

Triangular distribution with parameters:

Minimum	$0	(=$F$78)
Likeliest	$0	(=$E$78)
Maximum	$0	(=$G$78)



Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) (E88) **Cell: E88**

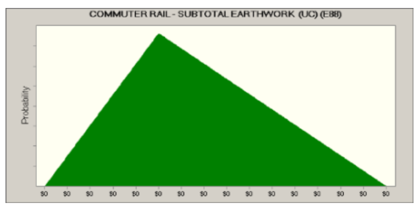
-Based on RTD 2010 Program review
-Includes cost for all track items from subgrade

OPPORTUNITIES: changes to FTA/FRA requirements, market conditions - steel/concrete prices

THREATS: changes to FTA/FRA requirements, market conditions - steel/concrete prices

Triangular distribution with parameters:

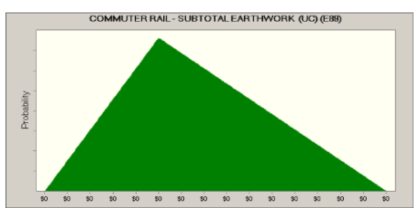
Minimum	$0	(=$F$78)
Likeliest	$0	(=$E$78)
Maximum	$0	(=$G$78)



Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) (E89) **Cell: E89**

Triangular distribution with parameters:

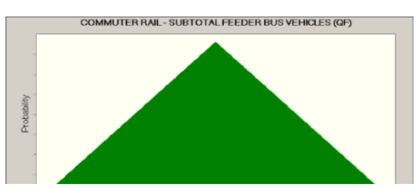
Minimum	$0	(=$F$78)
Likeliest	$0	(=$E$78)
Maximum	$0	(=$G$78)

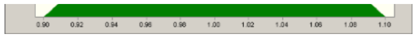


Assumption: COMMUTER RAIL - SUBTOTAL FEEDER BUS VEHICLES (QF) **Cell: H115**

Triangular distribution with parameters:

Minimum	0.90	(=$I$115)
Likeliest	1.00	(=$H$115)
Maximum	1.10	(=$J$115)




0.90
0.92
0.94
0.96
0.98
1.00
1.02
1.04
1.06
1.08
1.10

Assumption: COMMUTER RAIL - SUBTOTAL INSURANCE LEGAL (UC) **Cell: E107**

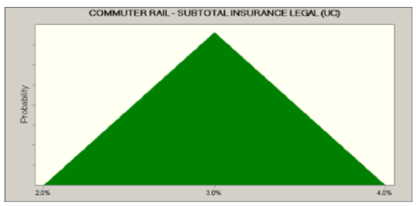
Includes contractor's bonding and legal cost
Based on West Corridor project cost
Owner Controlled Insurance (OCIP)

OPPORTUNITIES: contractor's bonding ratings, type of procurement

THREATS: contractor's bonding ratings, type of procurement

Triangular distribution with parameters:

Minimum	2.0%	(=$F$107)
Likeliest	3.0%	(=$E$107)
Maximum	4.0%	(=$G$107)



Assumption: COMMUTER RAIL - SUBTOTAL MAINTENANCE & OPERATIONS FACILITY (UC) **Cell: E105**

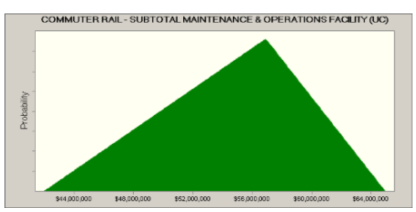
Used estimate M&O facility in California as a template
Min/Max based on including different characteristics of facility

OPPORTUNITIES: design level, estimate does not use local cost

THREATS: design level, estimate does not use local cost

Triangular distribution with parameters:

Minimum	$41,963,200	(=$F$105)
Likeliest	$56,900,000	(=$E$105)
Maximum	$64,946,300	(=$G$105)



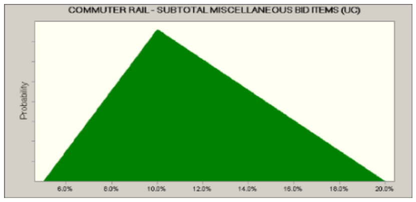
Assumption: COMMUTER RAIL - SUBTOTAL MISCELLANEOUS BID ITEMS (UC) **Cell: E103**

Includes structural fill, electrical conduit, public information, landscaping

Triangular distribution with parameters:

Minimum	5.0%	(=$F$103)
Likeliest	10.0%	(=$E$103)
Maximum	20.0%	(=$G$103)

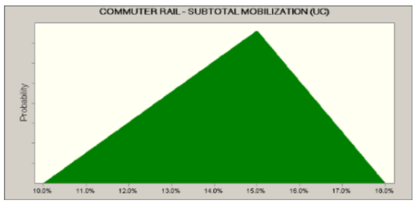
Assumption: COMMUTER RAIL - SUBTOTAL MISCELLANEOUS BID ITEMS (UC) (cont'd) **Cell: E103**



Assumption: COMMUTER RAIL - SUBTOTAL MOBILIZATION (UC) **Cell: E102**

Triangular distribution with parameters:

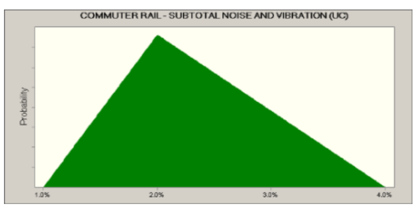
Minimum	10.0%	(=$F$102)
Likeliest	15.0%	(=$E$102)
Maximum	18.0%	(=$G$102)



Assumption: COMMUTER RAIL - SUBTOTAL NOISE AND VIBRATION (UC) **Cell: E99**

Triangular distribution with parameters:

Minimum	1.0%	(=$F$99)
Likeliest	2.0%	(=$E$99)
Maximum	4.0%	(=$G$99)

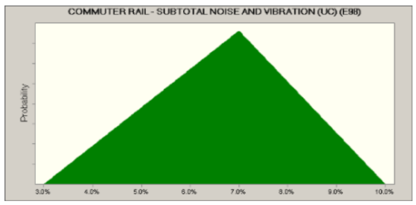


Assumption: COMMUTER RAIL - SUBTOTAL NOISE AND VIBRATION (UC) (E98) **Cell: E98**

-Based on RTD cost for Northwest Corridor
-Percentage of quantified commuter rail construction cost

Triangular distribution with parameters:

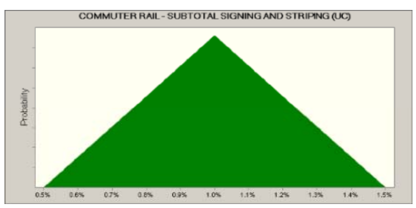
Minimum	3.0%	(=$F$98)
Likeliest	7.0%	(=$E$98)
Maximum	10.0%	(=$G$98)



Assumption: COMMUTER RAIL - SUBTOTAL SIGNING AND STRIPING (UC) **Cell: E100**

Triangular distribution with parameters:

Minimum	0.5%	(=$F$100)
Likeliest	1.0%	(=$E$100)
Maximum	1.5%	(=$G$100)



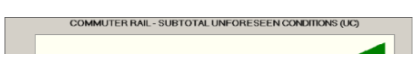
Assumption: COMMUTER RAIL - SUBTOTAL UNFORESEEN CONDITIONS (UC) **Cell: E106**

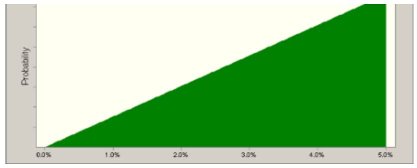
OPPORTUNITIES: Lessons learned from current RTD projects, unknown operator/owner (RTD?)

THREATS: No final agreements with BSNF, coordination issues with BSNF and existing RTD commuter rail, unknown operator/owner (RTD?), less tolerance in rail construction, subsurface issues/conditions, hazardous materials on existing rail line, 60-year horizon for construction of commuter rail (30 years until 1st project starts construction), abondoned mines

Triangular distribution with parameters:

Minimum	0.0%	(=$F$106)
Likeliest	5.0%	(=$E$106)
Maximum	5.0%	(=$G$106)




Probability
0.0%
1.0%
2.0%
3.0%
4.0%
5.0%

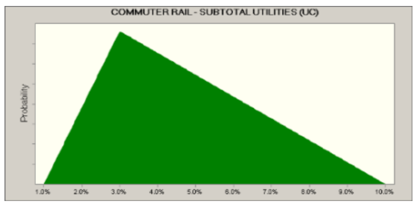
Assumption: COMMUTER RAIL - SUBTOTAL UTILITIES (UC) **Cell: E108**

Based on Northwest Corridor project
Percentage of commuter rail construction cost
OPPORTUNITIES: portions on existing alignment

THREATS: portions of new alignment, possibly parallel utilites in existing RR ROW

Triangular distribution with parameters:

Minimum	1.0%	(=$F$108)
Likeliest	3.0%	(=$E$108)
Maximum	10.0%	(=$G$108)



Assumption: CONSTRUCTION TRAFFIC CONTROL (UC) **Cell: E37**

Includes detour pavement, flagging, traffic control management, temporary signing, TCD, temporary concrete barrier

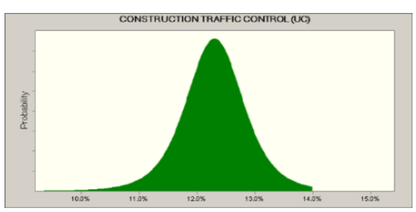
OPPORTUNITIES: contract phasing, larger projects w/ less crossovers, complete closures of interchanges with vertical alignment changes

THREATS: contract phasing, smaller projects with more crossovers, separating mainline and interchange contracts

Student's t distribution with parameters:

Midpoint	12.3%	(=$E$37)
Scale	0.5%	
Deg. Freedom	5	

Selected range is from 5.0% to 14.0%



Assumption: DRAINAGE (UC) **Cell: E34**

Includes all crossing items, water quality ponds, pipe, culverts, riprap, manholes, inlets, trash guards

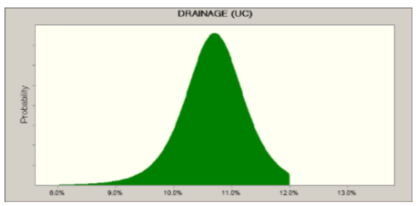
OPPORTUNITIES: very low level complexity (typical project), 20-30% design level, new technology such as stormwater vault systems, less ROW with vault systems

THREATS: 20-30% design level, no utility information, areas in Region 4 will become MS4 areas in future

Student's t distribution with parameters:

Midpoint	10.7%	(=$E$34)
Scale	0.5%	
Deg. Freedom	5	

Selected range is from 8.0% to 12.0%



Assumption: EROSION CONTROL (UC) **Cell: E35**

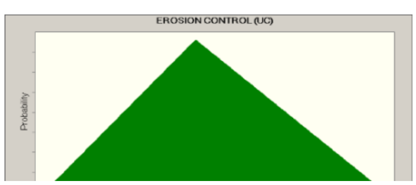
-Includes items such as topsoil, silt fence, sediment basins, seeding, mulching, soil retention blankets, erosion control supervisor
-Percentage of quantified items
-Historical projects were prior to consent decree

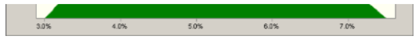
THREATS: Additional EPA regulations

OPPORTUNITIES: New direction at CDOT Environmental Programs Branch (EPB), BMP improvements/advances

Triangular distribution with parameters:

Minimum	3.0%	(=$F$35)
Likeliest	5.0%	(=$E$35)
Maximum	7.5%	(=$G$35)




3.0%
4.0%
5.0%
6.0%
7.0%

Assumption: EXPRESS BUS STATIONS (UC) **Cell: E57**

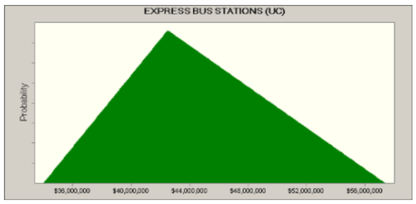
Average of cost of different types/sized stations
Based on RTD West corridor/Southwest Corridor extension projects and RTD 2010 Program Review cost

OPPORTUNITIES: market conditions, lower bid prices, cost sharing with local agencies, ROW available for larger surface lots

THREATS: level of security, increased ridership, timeframe of ridership model (only modeled to 2035)

Triangular distribution with parameters:

Minimum	$34,000,000	(=$F$57)
Likeliest	$42,500,000	(=$E$57)
Maximum	$57,375,000	(=$G$57)



Assumption: EXPRESS BUS VEHICLES (QF) **Cell: H74**

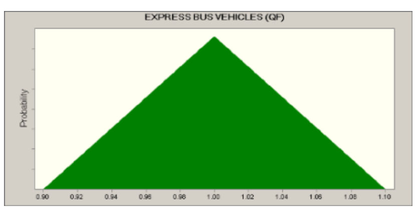
Ridership based on 2035

OPPORTUNITIES:

THREATS: development/growth in corridor

Triangular distribution with parameters:

Minimum	0.90	(=$I$74)
Likeliest	1.00	(=$H$74)
Maximum	1.10	(=$J$74)



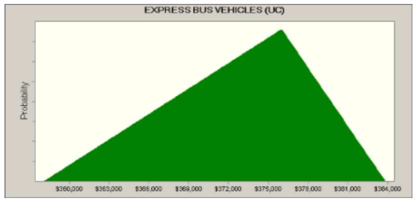
Assumption: EXPRESS BUS VEHICLES (UC) **Cell: E74**

-Assumed 40' coach style bus
-Cost based on RTD Annual Program Review
-Assumes 3-5% range; High range based on APTA report of average bus costs

Triangular distribution with parameters:

Minimum	$358,100	(=$F$74)
Likeliest	$376,000	(=$E$74)
Maximum	$383,800	(=$G$74)

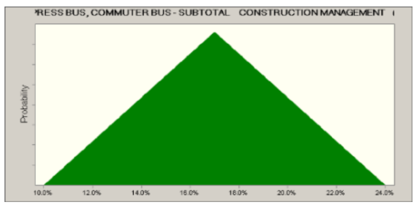
Assumption: EXPRESS BUS VEHICLES (UC) (cont'd) **Cell: E74**



Assumption: EXPRESS BUS, COMMUTER BUS - SUBTOTAL CONSTRUCTION MANAGEMENT **Cell: E70**

Triangular distribution with parameters:

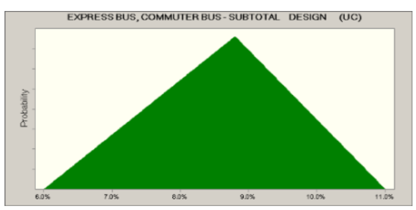
Minimum	10.0%	(=$F$70)
Likeliest	17.0%	(=$E$70)
Maximum	24.0%	(=$G$70)



Assumption: EXPRESS BUS, COMMUTER BUS - SUBTOTAL DESIGN (UC) **Cell: E69**

Triangular distribution with parameters:

Minimum	6.0%	(=$F$69)
Likeliest	8.8%	(=$E$69)
Maximum	11.0%	(=$G$69)



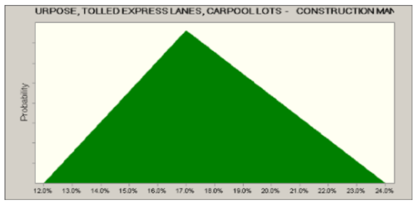
Assumption: I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS - CON Cell: E52

OPPORTUNITIES: using CDOT forces, D-B contracting, larger projects may be CE exemption

THREATS:

Triangular distribution with parameters:

Minimum	12.0%	(=$F$52)
Likeliest	17.0%	(=$E$52)
Maximum	24.0%	(=$G$52)



Assumption: I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS - DESI Cell: E51

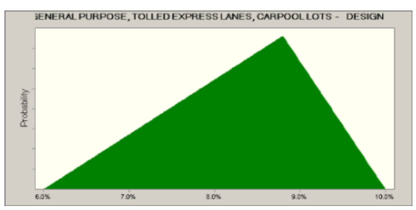
Includes phased ROD updates

OPPORTUNITIES: D-B contracting

THREATS: reorganization of project phasing, construction management, funding availability/schedule delay

Triangular distribution with parameters:

Minimum	6.0%	(=$F$51)
Likeliest	8.8%	(=$E$51)
Maximum	10.0%	(=$G$51)



Assumption: INTELLIGENT TRANSPORTATION SYSTEM ELEMENTS (UC) Cell: E44

Includes LED VMS, CCTV, weather station

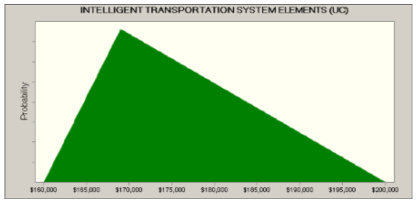
THREATS: new technology, decreased spacing of signs

OPPORTUNITIES: new technology

Triangular distribution with parameters:

Minimum	$160,000	(=$F$44)
Likeliest	$169,000	(=$E$44)
Maximum	$200,000	(=$G$44)

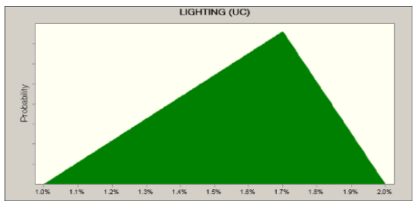
Assumption: INTELLIGENT TRANSPORTATION SYSTEM ELEMENTS (UC) (cont'd) **Cell: E44**



Assumption: LIGHTING (UC) **Cell: E30**

Triangular distribution with parameters:

Minimum	1.0%	(=$F$30)
Likeliest	1.7%	(=$E$30)
Maximum	2.0%	(=$G$30)



Assumption: MANAGED LANE SYSTEM (UC) **Cell: E45**

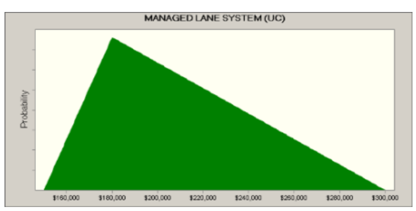
-Includes items such as electronic equipment, cabinets, power supply, cameras related to the managed lane system
-Based on historical national data from Wilbur Smith

OPPORTUNITIES: new technology

THREATS: costs based mainly on East Coast projects, new technology

Triangular distribution with parameters:

Minimum	$150,000	(=$F$45)
Likeliest	$180,000	(=$E$45)
Maximum	$300,000	(=$G$45)



Assumption: MISCELLANEOUS BID ITEMS (UC) **Cell: E42**

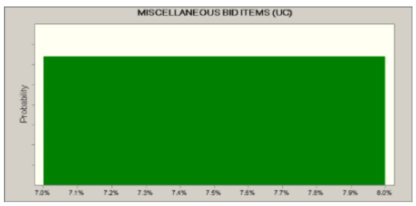
Includes items such as sandblasting, blading, resetting items, health and safety officers, solid waste disposal, geotextile items, fencing, curb and gutter, electrical conduit, rumble strips, traffic attenuators, field office, surveying, public information

THREATS: 5-20% design level, character of work could change and cause increase to miscellaneous items

OPPORTUNITIES: 5-20% design level, cost already included in estimate

Uniform distribution with parameters:

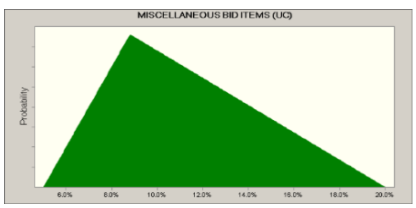
Minimum	7.0%	(=$F$42)
Maximum	8.0%	(=$G$42)



Assumption: MISCELLANEOUS BID ITEMS (UC) **Cell: E61**

Triangular distribution with parameters:

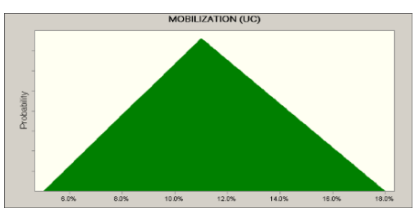
Minimum	5.0%	(=$F$61)
Likeliest	8.8%	(=$E$61)
Maximum	20.0%	(=$G$61)



Assumption: MOBILIZATION (UC) **Cell: E60**

Triangular distribution with parameters:

Minimum	5.0%	(=$F$60)
Likeliest	11.0%	(=$E$60)
Maximum	18.0%	(=$G$60)

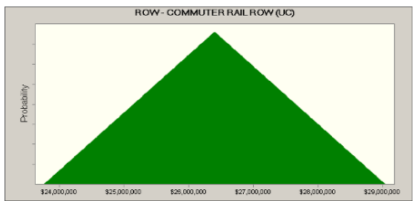


Assumption: ROW - COMMUTER RAIL ROW (UC) **Cell: E114**

Includes cost for removal of structures

Triangular distribution with parameters:

Minimum	$23,760,000	(=$F$114)
Likeliest	$26,400,000	(=$E$114)
Maximum	$29,040,000	(=$G$114)



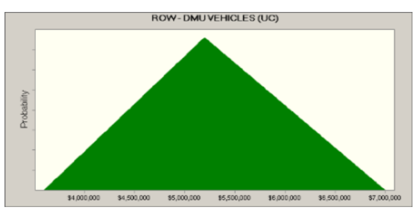
Assumption: ROW - DMU VEHICLES (UC) **Cell: E116**

Based on RTD Annual Program Review
Range based on Nationwide review of costs (Jacobs)

THREATS: Current design has not received FRA approval, Changes in FRA regulations
OPPORTUNITIES:

Triangular distribution with parameters:

Minimum	$3,600,000	(=$F$116)
Likeliest	$5,200,000	(=$E$116)
Maximum	$7,000,000	(=$G$116)



Assumption: ROW - FEEDER BUS VEHICLES (UC) **Cell: E115**

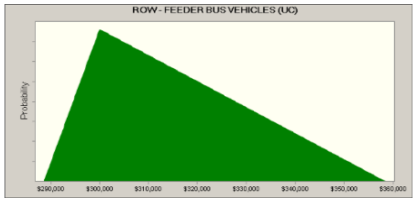
Cost based on RTD Program Review
Maximum is based on nationwide (APTA) cost of buses

Triangular distribution with parameters:

Minimum	$288,600	(=$F$115)
Likeliest	$300,000	(=$E$115)

Maximum	$358,400	(=$G$115)

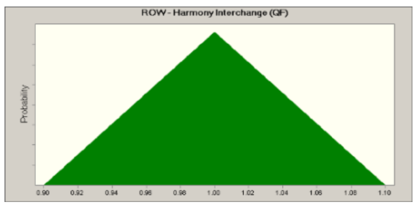
Assumption: ROW - FEEDER BUS VEHICLES (UC) (cont'd) **Cell: E115**



Assumption: ROW - Harmony Interchange (QF) **Cell: H134**

Triangular distribution with parameters:

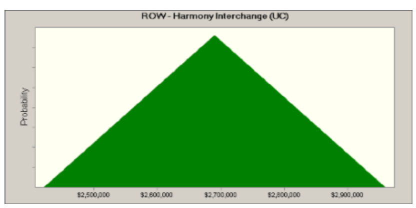
Minimum	0.90	(=$I$134)
Likeliest	1.00	(=$H$134)
Maximum	1.10	(=$J$134)



Assumption: ROW - Harmony Interchange (UC) **Cell: E134**

Triangular distribution with parameters:

Minimum	$2,421,000	(=$F$134)
Likeliest	$2,690,000	(=$E$134)
Maximum	$2,959,000	(=$G$134)

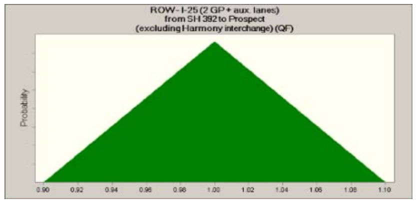


Assumption: ROW - I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony **Cell: H128**

Triangular distribution with parameters:

Minimum	0.90	(=$I$128)
Likeliest	1.00	(=$H$128)
Maximum	1.10	(=$J$128)

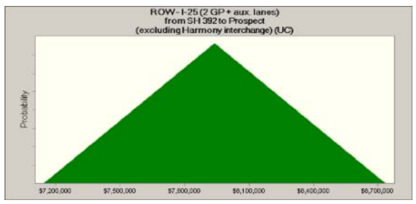
Assumption: ROW - I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony **Cell: H128**



Assumption: ROW - I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony **Cell: E128**

Triangular distribution with parameters:

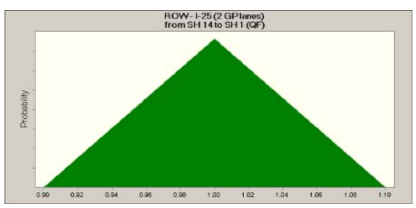
Minimum	$7,146,000	(=$F$128)
Likeliest	$7,940,000	(=$E$128)
Maximum	$8,734,000	(=$G$128)



Assumption: ROW - I-25 (2 GP lanes) from SH 14 to SH 1 (QF) **Cell: H133**

Triangular distribution with parameters:

Minimum	0.90	(=$I$133)
Likeliest	1.00	(=$H$133)
Maximum	1.10	(=$J$133)

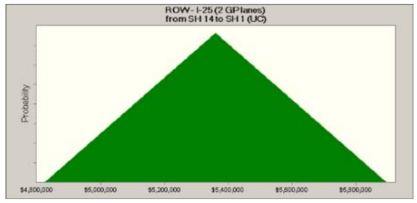


Assumption: ROW - I-25 (2 GP lanes) from SH 14 to SH 1 (UC) **Cell: E133**

Triangular distribution with parameters:

Minimum	$4,824,000	(=$F$133)
Likeliest	$5,360,000	(=$E$133)
Maximum	$5,896,000	(=$G$133)

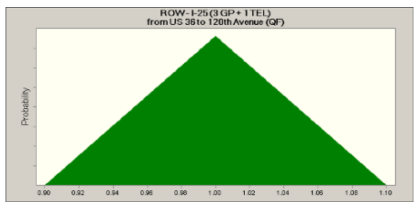
Assumption: ROW - I-25 (2 GP lanes) □from SH 14 to SH 1 (UC) (cont'd) **Cell: E133**



Assumption: ROW - I-25 (3 GP + 1 TEL) □from US 36 to 120th Avenue (QF) **Cell: H123**

Triangular distribution with parameters:

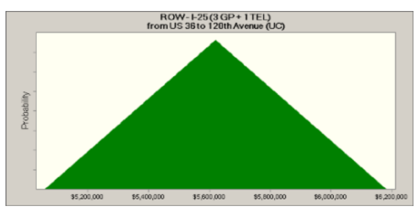
Minimum	0.90	(=$I$123)
Likeliest	1.00	(=$H$123)
Maximum	1.10	(=$J$123)



Assumption: ROW - I-25 (3 GP + 1 TEL) □from US 36 to 120th Avenue (UC) **Cell: E123**

Triangular distribution with parameters:

Minimum	$5,058,000	(=$F$123)
Likeliest	$5,620,000	(=$E$123)
Maximum	$6,182,000	(=$G$123)

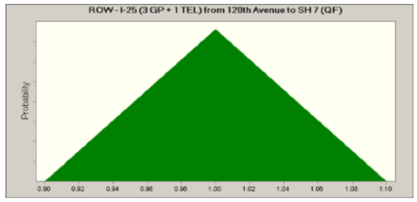


Assumption: ROW - I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7 (QF) **Cell: H131**

Triangular distribution with parameters:

Minimum	0.90	(=$I$131)
Likeliest	1.00	(=$H$131)
Maximum	1.10	(=$J$131)

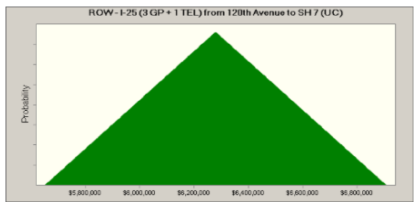
Assumption: ROW - I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7 (QF) (cont'd) **Cell: H131**



Assumption: ROW - I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7 (UC) **Cell: E131**

Triangular distribution with parameters:

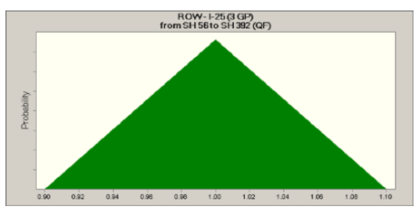
Minimum	$5,652,000	(=$F$131)
Likeliest	$6,280,000	(=$E$131)
Maximum	$6,908,000	(=$G$131)



Assumption: ROW - I-25 (3 GP) from SH 56 to SH 392 (QF) **Cell: H132**

Triangular distribution with parameters:

Minimum	0.90	(=$I$132)
Likeliest	1.00	(=$H$132)
Maximum	1.10	(=$J$132)

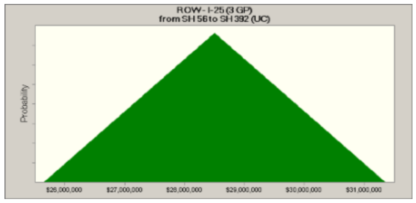


Assumption: ROW - I-25 (3 GP) from SH 56 to SH 392 (UC) **Cell: E132**

Triangular distribution with parameters:

Minimum	$25,650,000	(=$F$132)
Likeliest	$28,500,000	(=$E$132)
Maximum	$31,350,000	(=$G$132)

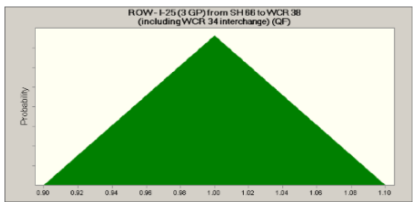
Assumption: ROW - I-25 (3 GP) from SH 56 to SH 392 (UC) (cont'd) **Cell: E132**



Assumption: ROW - I-25 (3 GP) from SH 66 to WCR 38 (including WCR 34 interchange) (QF) **Cell: H125**

Triangular distribution with parameters:

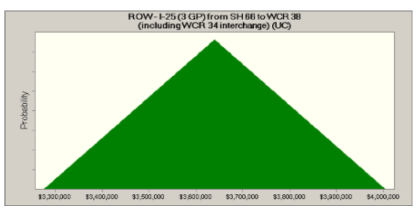
Minimum	0.90	(=$I$125)
Likeliest	1.00	(=$H$125)
Maximum	1.10	(=$J$125)



Assumption: ROW - I-25 (3 GP) from SH 66 to WCR 38 (including WCR 34 interchange) (UC) **Cell: E125**

Triangular distribution with parameters:

Minimum	$3,276,000	(=$F$125)
Likeliest	$3,640,000	(=$E$125)
Maximum	$4,004,000	(=$G$125)

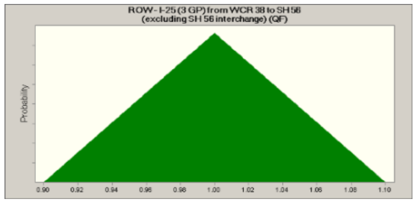


Assumption: ROW - I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange) (QF) **Cell: H126**

Triangular distribution with parameters:

Minimum	0.90	(=$I$126)
Likeliest	1.00	(=$H$126)
Maximum	1.10	(=$J$126)

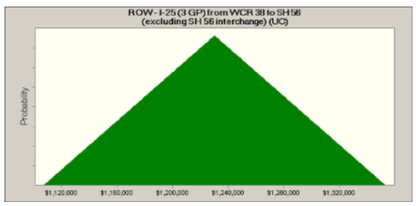
Assumption: ROW - I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange) (QF) **Cell: H126**



Assumption: ROW - I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange) (UC) **Cell: E126**

Triangular distribution with parameters:

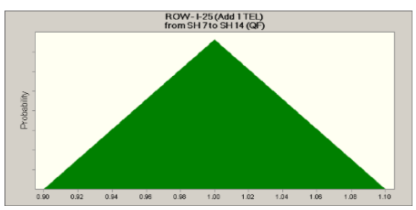
Minimum	$1,107,000	(=$F$126)
Likeliest	$1,230,000	(=$E$126)
Maximum	$1,353,000	(=$G$126)



Assumption: ROW - I-25 (Add 1 TEL) from SH 7 to SH 14 (QF) **Cell: H136**

Triangular distribution with parameters:

Minimum	0.90	(=$I$136)
Likeliest	1.00	(=$H$136)
Maximum	1.10	(=$J$136)

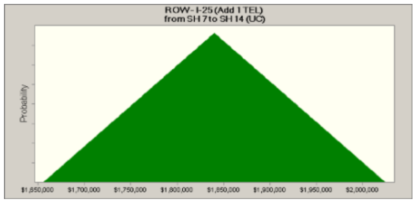


Assumption: ROW - I-25 (Add 1 TEL) from SH 7 to SH 14 (UC) **Cell: E136**

Triangular distribution with parameters:

Minimum	$1,656,000	(=$F$136)
Likeliest	$1,840,000	(=$E$136)
Maximum	$2,024,000	(=$G$136)

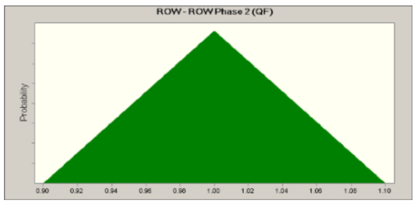
Assumption: ROW - I-25 (Add 1 TEL) □from SH 7 to SH 14 (UC) (cont'd) **Cell: E136**



Assumption: ROW - ROW Phase 2 (QF) **Cell: H130**

Triangular distribution with parameters:

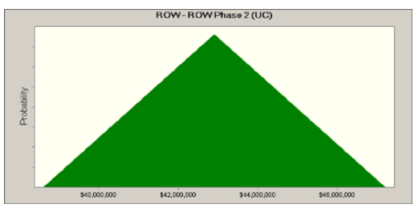
Minimum	0.90	(=$I$130)
Likeliest	1.00	(=$H$130)
Maximum	1.10	(=$J$130)



Assumption: ROW - ROW Phase 2 (UC) **Cell: E130**

Triangular distribution with parameters:

Minimum	$38,610,000	(=$F$130)
Likeliest	$42,900,000	(=$E$130)
Maximum	$47,190,000	(=$G$130)

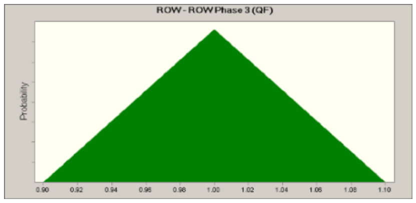


Assumption: ROW - ROW Phase 3 (QF) **Cell: H135**

Triangular distribution with parameters:

Minimum	0.90	(=$I$135)
Likeliest	1.00	(=$H$135)
Maximum	1.10	(=$J$135)

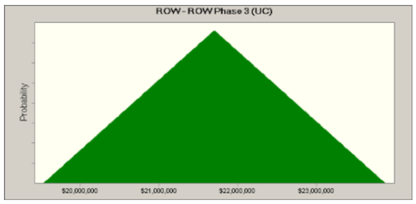
Assumption: ROW - ROW Phase 3 (QF) (cont'd) **Cell: H135**



Assumption: ROW - ROW Phase 3 (UC) **Cell: E135**

Triangular distribution with parameters:

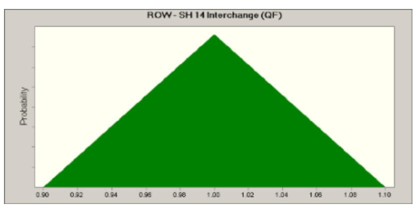
Minimum	$19,530,000	(=$F$135)
Likeliest	$21,700,000	(=$E$135)
Maximum	$23,870,000	(=$G$135)



Assumption: ROW - SH 14 Interchange (QF) **Cell: H129**

Triangular distribution with parameters:

Minimum	0.90	(=$I$129)
Likeliest	1.00	(=$H$129)
Maximum	1.10	(=$J$129)

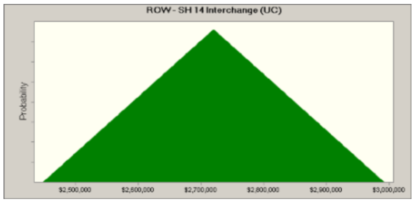


Assumption: ROW - SH 14 Interchange (UC) **Cell: E129**

Triangular distribution with parameters:

Minimum	$2,448,000	(=$F$129)
Likeliest	$2,720,000	(=$E$129)
Maximum	$2,992,000	(=$G$129)

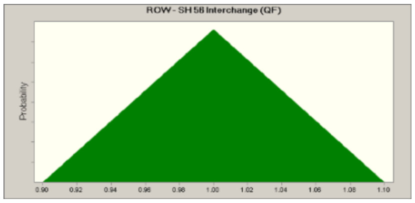
Assumption: ROW - SH 14 Interchange (UC) (cont'd) **Cell: E129**



Assumption: ROW - SH 56 Interchange (QF) **Cell: H127**

Triangular distribution with parameters:

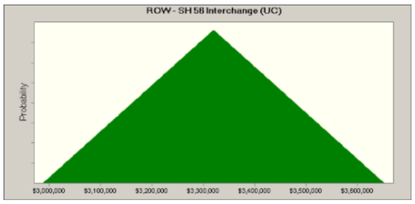
Minimum	0.90	(=$I$127)
Likeliest	1.00	(=$H$127)
Maximum	1.10	(=$J$127)



Assumption: ROW - SH 56 Interchange (UC) **Cell: E127**

Triangular distribution with parameters:

Minimum	$2,988,000	(=$F$127)
Likeliest	$3,320,000	(=$E$127)
Maximum	$3,652,000	(=$G$127)

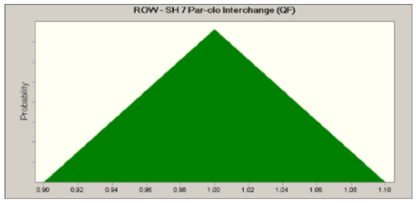


Assumption: ROW - SH 7 Par-clo Interchange (QF) **Cell: H124**

Triangular distribution with parameters:

Minimum	0.90	(=$I$124)
Likeliest	1.00	(=$H$124)
Maximum	1.10	(=$J$124)

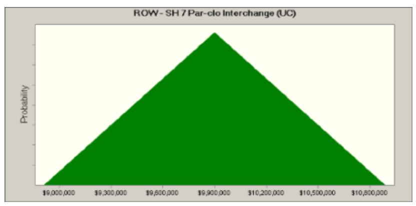
Assumption: ROW - SH 7 Par-clo Interchange (QF) (cont'd) **Cell: H124**



Assumption: ROW - SH 7 Par-clo Interchange (UC) **Cell: E124**

Triangular distribution with parameters:

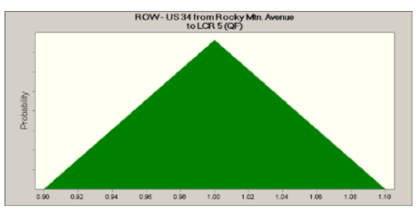
Minimum	$8,910,000	(=$F$124)
Likeliest	$9,900,000	(=$E$124)
Maximum	$10,890,000	(=$G$124)



Assumption: ROW - US 34 from Rocky Mtn. Avenue to LCR 5 (QF) **Cell: H137**

Triangular distribution with parameters:

Minimum	0.90	(=$I$137)
Likeliest	1.00	(=$H$137)
Maximum	1.10	(=$J$137)

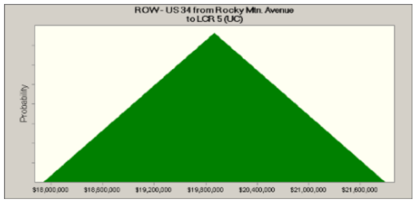


Assumption: ROW - US 34 from Rocky Mtn. Avenue to LCR 5 (UC) **Cell: E137**

Triangular distribution with parameters:

Minimum	$17,910,000	(=$F$137)
Likeliest	$19,900,000	(=$E$137)
Maximum	$21,890,000	(=$G$137)

Assumption: ROW - US 34 from Rocky Mtn. Avenue to LCR 5 (UC) (cont'd) **Cell: E137**

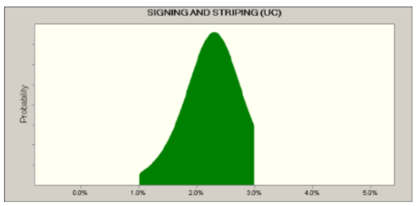


Assumption: SIGNING AND STRIPING (UC) **Cell: E36**

Student's t distribution with parameters:

Midpoint	2.3%	(=$E$36)
Scale	0.5%	
Deg. Freedom	5	

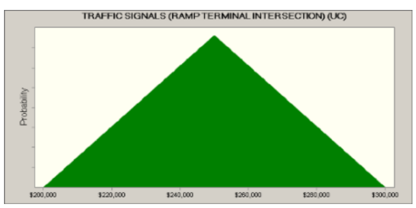
Selected range is from 1.0% to 3.0%



Assumption: TRAFFIC SIGNALS (RAMP TERMINAL INTERSECTION) (UC) **Cell: E46**

Triangular distribution with parameters:

Minimum	$200,000	(=$F$46)
Likeliest	$250,000	(=$E$46)
Maximum	$300,000	(=$G$46)



Assumption: UNFORESEEN CONDITIONS (UC) **Cell: E48**

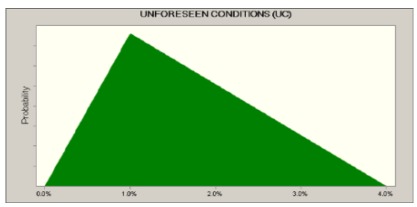
Includes cost of unknown unknowns
Percentage of construction cost

THREATS: potential for coal mine subsidence, 60-year horizon of project (scope creep)

OPPORTUNITIES: existing roadway, very low complexity project, no major issues with hazardous materials/historic properties anticipated due to completed studies, low chance of increasing scope of project, projects recently completed along corridor

Triangular distribution with parameters:

Minimum	0.0%	(=$F$48)
Likeliest	1.0%	(=$E$48)
Maximum	4.0%	(=$G$48)



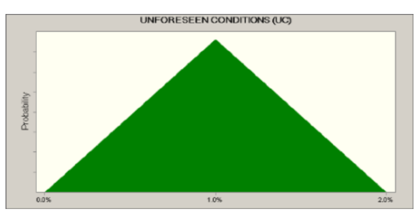
Assumption: UNFORESEEN CONDITIONS (UC) **Cell: E66**

THREATS: requirements of operating agency, requirements of locals, subsurface conditions, hazardous materials

OPPORTUNITIES: requirements of operating agency, construction in localized areas for queue jumps

Triangular distribution with parameters:

Minimum	0.0%	(=$F$66)
Likeliest	1.0%	(=$E$66)
Maximum	2.0%	(=$G$66)



Assumption: URBAN DESIGN / LANDSCAPING (UC) **Cell: E38**

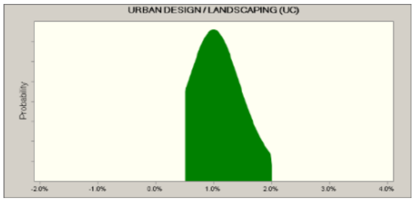
Student's t distribution with parameters:

Midpoint	1.0%	(=$E$38)

Scale	0.5%
Deg. Freedom	5

Selected range is from 0.5% to 2.0%

Assumption: URBAN DESIGN / LANDSCAPING (UC) (cont'd) **Cell: E38**



Assumption: UTILITIES (UC) **Cell: E49**

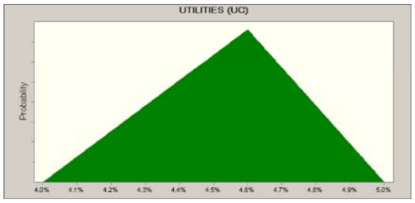
-Percentage of total construction cost
-Includes cost for relocations, design

OPPORTUNITIES: no parallel utilities in ROW, most crossing utilities at interchanges, 5-20% design level, access control limits the amount of utilities in interstate ROW

THREATS: 5-20% design level, potentially more cost in urban sections of project, additonal utilities in the future

Triangular distribution with parameters:

Minimum	4.0%	(=$F$49)
Likeliest	4.6%	(=$E$49)
Maximum	5.0%	(=$G$49)

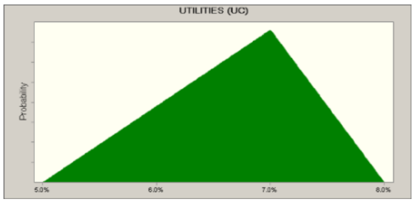


Assumption: UTILITIES (UC) **Cell: E67**

Based on construction in urban areas

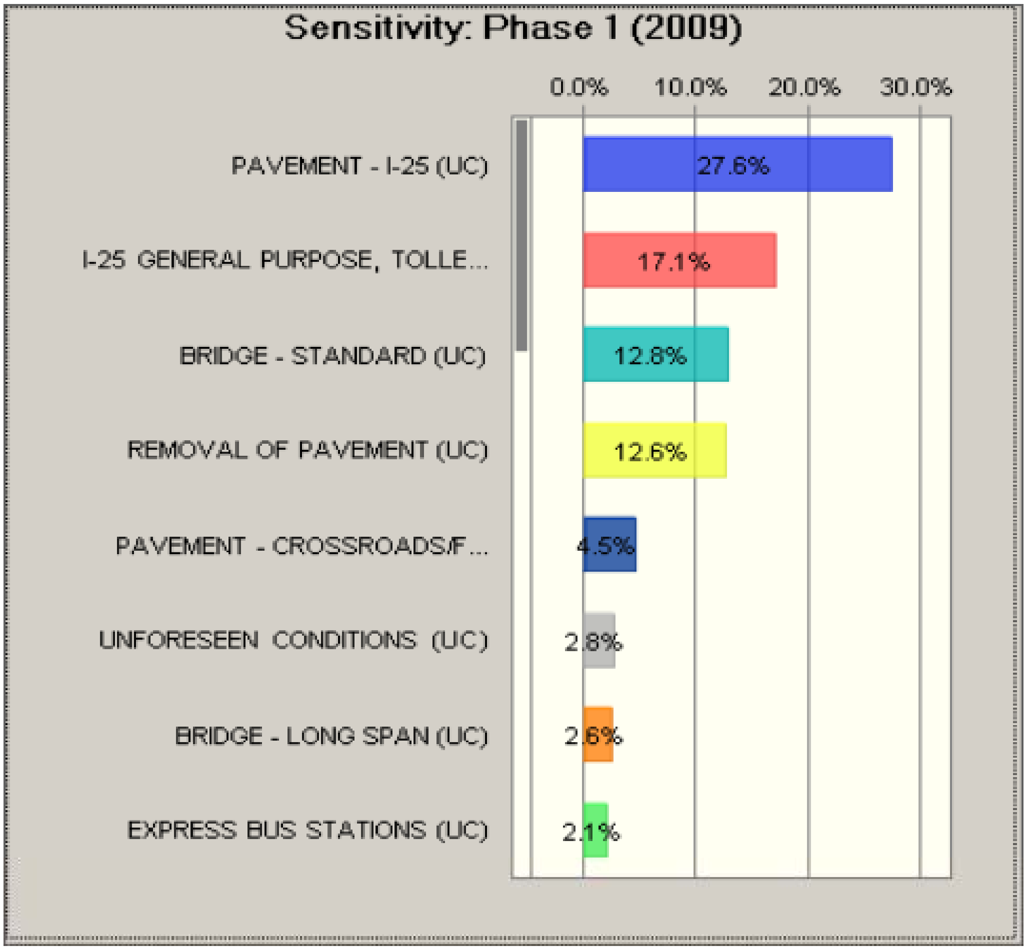
Triangular distribution with parameters:

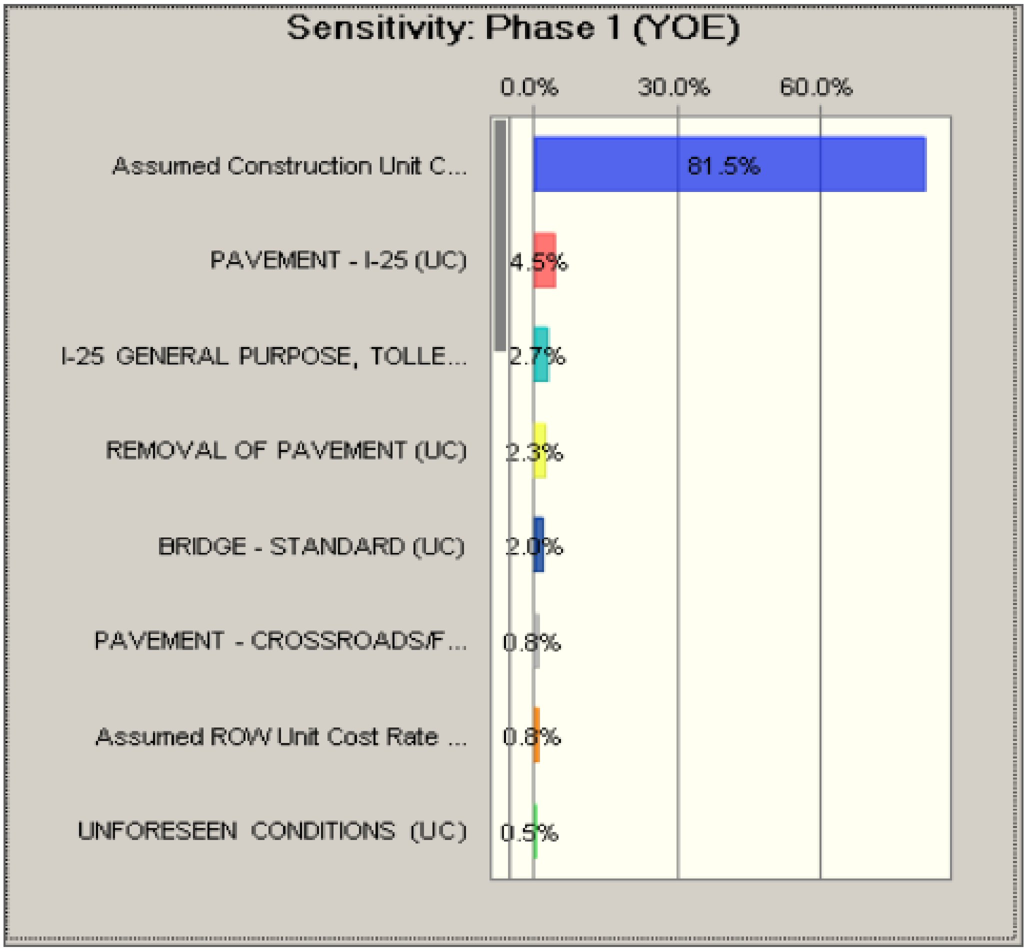
Minimum	5.0%	(=$F$67)
Likeliest	7.0%	(=$E$67)
Maximum	8.0%	(=$G$67)

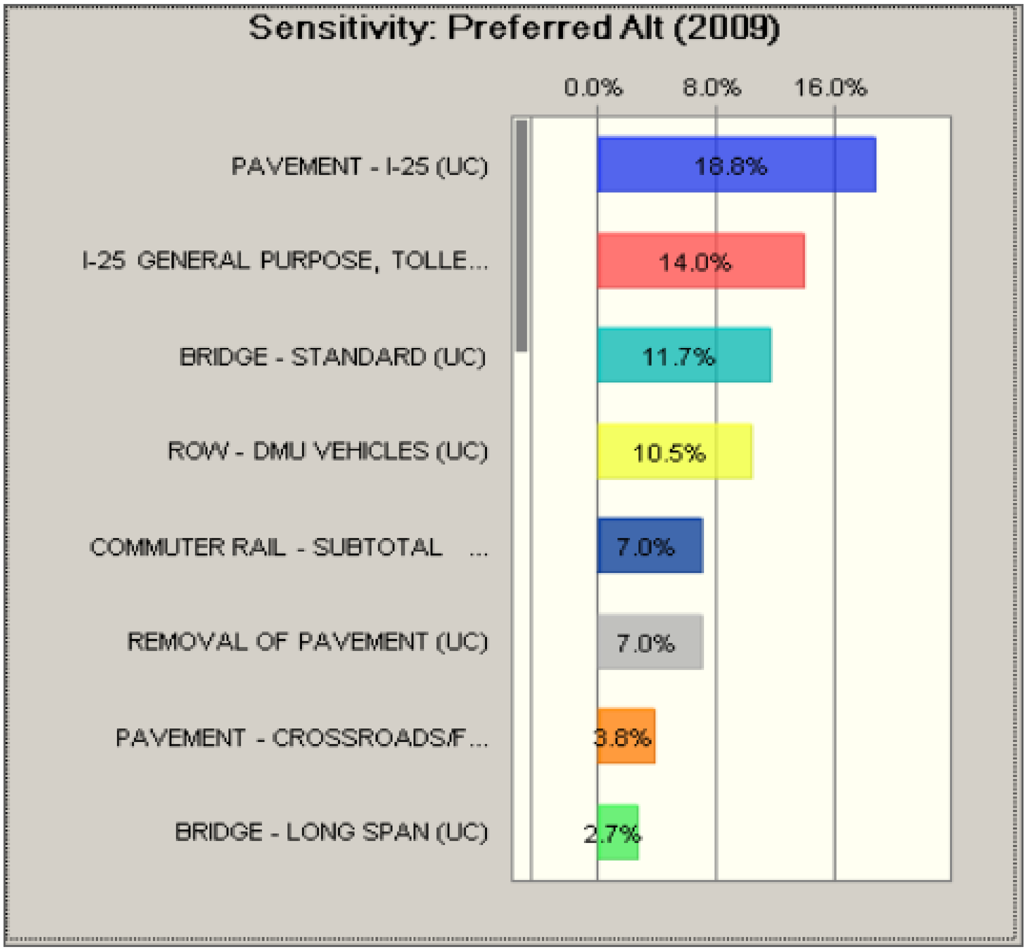


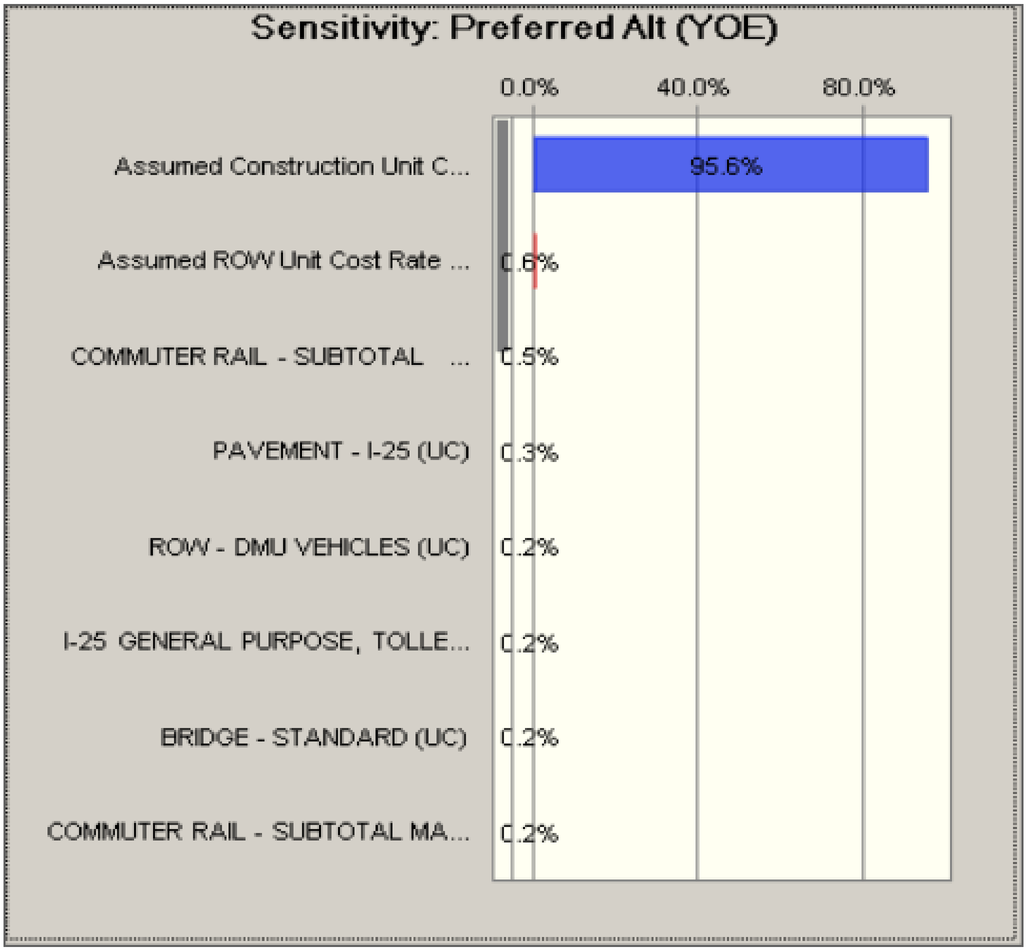
End of Assumptions

Sensitivity Charts




Sensitivity: Phase 1 (YOE)
0.0%
30.0%
60.0%
Assumed Construction Unit C...
81.5%
PAVEMENT - I-25 (UC)
4.5%
I-25 GENERAL PURPOSE, TOLLE...
2.7%
REMOVAL OF PAVEMENT (UC)
2.3%
BRIDGE - STANDARD (UC)
2.0%
PAVEMENT - CROSSROADS/F...
0.8%
Assumed ROW Unit Cost Rate ...
0.8%
UNFORESEEN CONDITIONS (UC)
0.5%


Sensitivity: Preferred Alt (2009)
0.0%
8.0%
16.0%
PAVEMENT - I-25 (UC)
18.8%
I-25 GENERAL PURPOSE, TOLLE...
14.0%
BRIDGE - STANDARD (UC)
11.7%
ROW - DMU VEHICLES (UC)
10.5%
COMMUTER RAIL - SUBTOTAL ...
7.0%
REMOVAL OF PAVEMENT (UC)
7.0%
PAVEMENT - CROSSROADS/F...
3.8%
BRIDGE - LONG SPAN (UC)
2.7%



End of Sensitivity Charts

Appendix D

CER Probability Analysis Report with Schedule Variability

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Crystal Ball Report - Custom
Simulation started on 7/15/2010 at 12:28 PM
Simulation stopped on 7/15/2010 at 12:29 PM

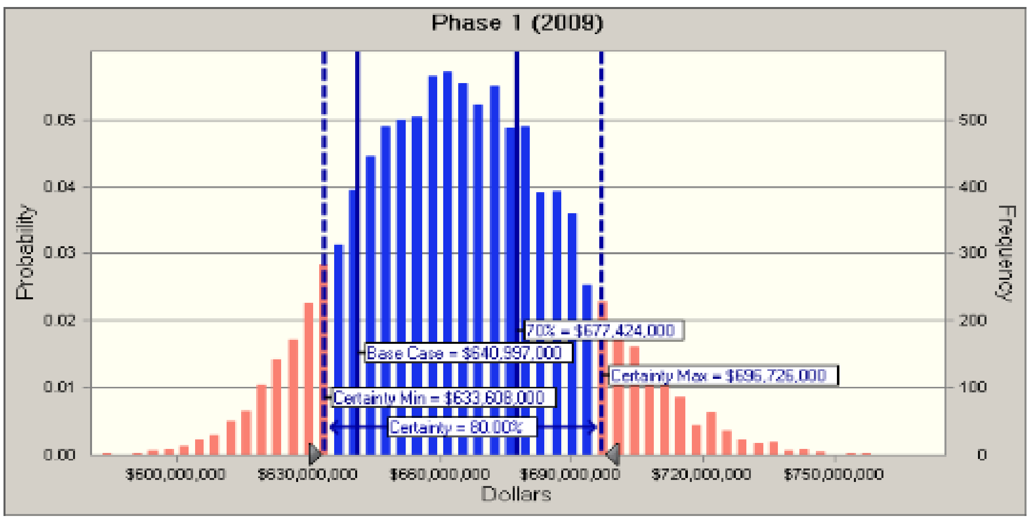
Run preferences:	
Number of trials run	10,000
Extreme speed	
Latin Hypercube (size)	500
Seed	999
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	26.58
Trials/second (average)	376
Random numbers per sec	57,946
Crystal Ball data:	
Assumptions	154
Correlations	0
Correlated groups	0
Decision variables	0
Forecasts	4

Forecasts

Worksheet: [North_I-25 CER 7-14-2010pm - schedule variability FINAL.xlsx]Phase 1 (2009)

Forecast: Phase 1 (2009) **Cell: P133**

Summary:
- Certainty level is 80.00%
- Certainty range is from $633,608,000 to $696,726,000
- Entire range is from $581,952,000 to $773,320,000
- Base case is $640,997,000
- After 10,000 trials, the std. error of the mean is $247,512



Statistics:	Forecast values
Trials	10,000
Base Case	$640,997,000
Mean	$664,820,219
Median	$664,066,500
Mode	$642,914,000
Standard Deviation	$24,751,233
Variance	#################
Skewness	0.1949
Kurtosis	3.02
Coeff. of Variability	0.0372
Minimum	$581,952,000
Maximum	$773,320,000
Range Width	$191,368,000
Mean Std. Error	$247,512

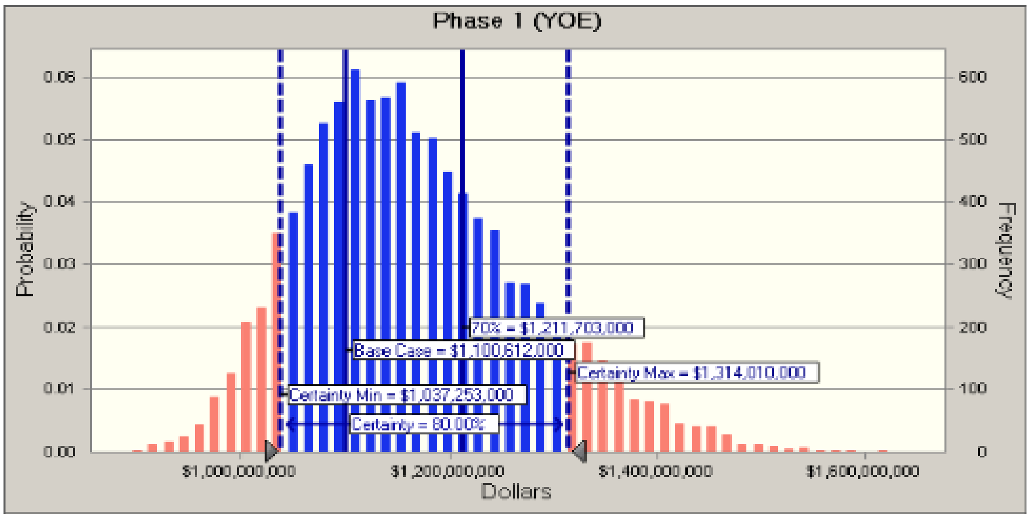
Forecast: Phase 1 (2009) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$581,952,000
10%	$633,608,000
20%	$643,512,000
30%	$650,979,000
40%	$657,827,000
50%	$664,066,000
60%	$670,687,000
70%	$677,424,000
80%	$685,541,000
90%	$696,726,000
100%	$773,320,000

Worksheet: [North_I-25 CER 7-14-2010pm - schedule variability FINAL.xlsx]Phase 1 (YOE)

Forecast: Phase 1 (YOE) **Cell: P133**

Summary:
Certainty level is 80.00%
Certainty range is from $1,037,253,000 to $1,314,010,000
Entire range is from $862,774,000 to $1,667,613,000
Base case is $1,100,612,000
After 10,000 trials, the std. error of the mean is $1,072,605



Statistics:	Forecast values
Trials	10,000
Base Case	$1,100,612,000
Mean	$1,164,764,218
Median	$1,151,631,000
Mode	$986,977,000
Standard Deviation	$107,260,521
Variance	#################
Skewness	0.5758
Kurtosis	3.21
Coeff. of Variability	0.0921
Minimum	$862,774,000
Maximum	$1,667,613,000
Range Width	$804,839,000
Mean Std. Error	$1,072,605

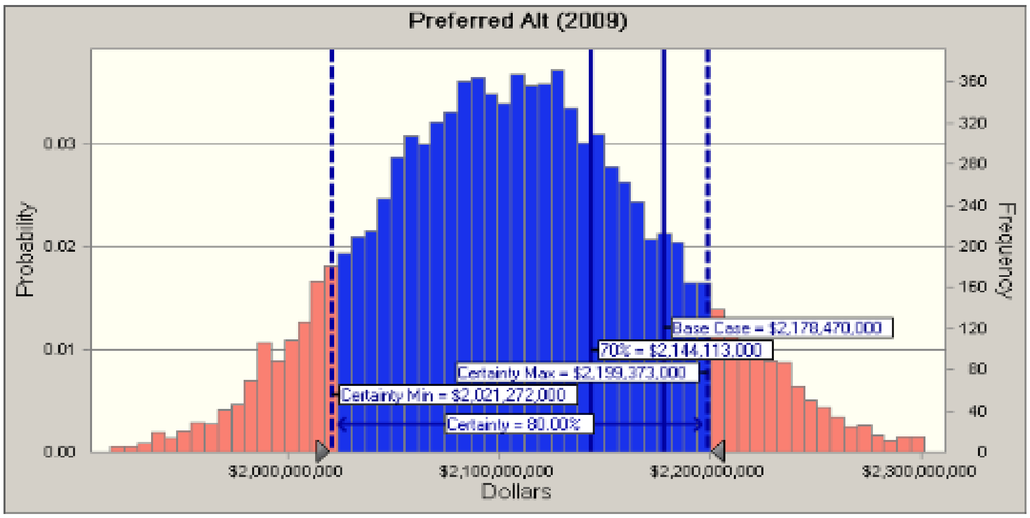
Forecast: Phase 1 (YOE) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$862,774,000
10%	$1,037,253,000
20%	$1,073,241,000
30%	$1,100,386,000
40%	$1,125,918,000
50%	$1,151,626,000
60%	$1,179,447,000
70%	$1,211,703,000
80%	$1,252,161,000
90%	$1,314,010,000
100%	$1,667,613,000

Worksheet: [North_I-25 CER 7-14-2010pm - schedule variability FINAL.xlsx]Preferred Alt (2009)

Forecast: Preferred Alt (2009) **Cell: P133**

Summary:
Certainty level is 80.00%
Certainty range is from $2,021,272,000 to $2,199,373,000
Entire range is from $1,876,484,000 to $2,396,810,000
Base case is $2,178,470,000
After 10,000 trials, the std. error of the mean is $687,356



Statistics:	Forecast values
Trials	10,000
Base Case	$2,178,470,000
Mean	$2,109,036,680
Median	$2,107,405,000
Mode	$2,071,863,000
Standard Deviation	$68,735,622
Variance	#################
Skewness	0.1324
Kurtosis	2.93
Coeff. of Variability	0.0326
Minimum	$1,876,484,000
Maximum	$2,396,810,000
Range Width	$520,326,000
Mean Std. Error	$687,356

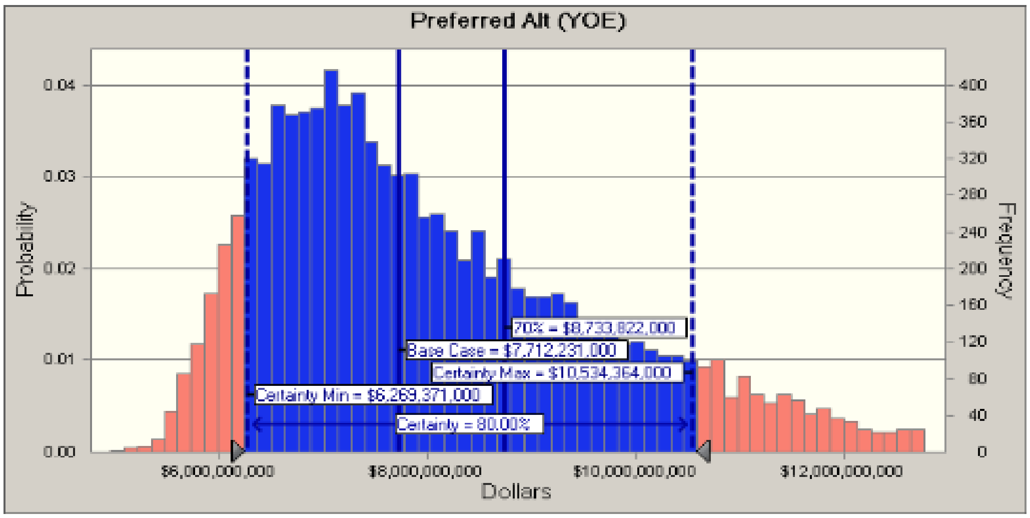
Forecast: Preferred Alt (2009) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$1,876,484,000
10%	$2,021,272,000
20%	$2,050,479,000
30%	$2,071,268,000
40%	$2,089,506,000
50%	$2,107,387,000
60%	$2,125,383,000
70%	$2,144,113,000
80%	$2,166,475,000
90%	$2,199,373,000
100%	$2,396,810,000

Worksheet: [North_I-25 CER 7-14-2010pm - schedule variability FINAL.xlsx]Preferred Alt (YOE)

Forecast: Preferred Alt (YOE) **Cell: P133**

Summary:
- Certainty level is 80.00%
- Certainty range is from $6,269,371,000 to $10,534,364,000
- Entire range is from $4,960,329,000 to $15,312,757,000
- Base case is $7,712,231,000
- After 10,000 trials, the std. error of the mean is $16,697,769



Statistics:	Forecast values
Trials	10,000
Base Case	$7,712,231,000
Mean	$8,086,309,110
Median	$7,689,762,500
Mode	$5,823,920,000
Standard Deviation	$1,669,776,901
Variance	#################
Skewness	0.9052
Kurtosis	3.38
Coeff. of Variability	0.2065
Minimum	$4,960,329,000
Maximum	$15,312,757,000
Range Width	$10,352,428,000
Mean Std. Error	$16,697,769

Forecast: Preferred Alt (YOE) (cont'd) **Cell: P133**

Percentiles:	Forecast values
0%	$4,960,329,000
10%	$6,269,371,000
20%	$6,643,707,000
30%	$6,990,275,000
40%	$7,310,036,000
50%	$7,689,750,000
60%	$8,152,023,000
70%	$8,733,822,000
80%	$9,467,772,000
90%	$10,534,364,000
100%	$15,312,757,000

End of Forecasts

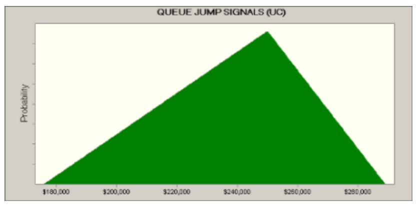
Assumptions

Worksheet: [North_I-25 CER 7-14-2010pm - schedule variability FINAL.xlsx]Unit Costs

Assumption: QUEUE JUMP SIGNALS (UC) **Cell: E64**

Triangular distribution with parameters:

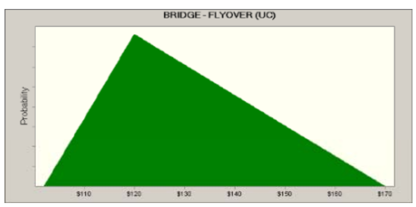
Minimum	$176,000	(=$F$64)
Likeliest	$250,000	(=$E$64)
Maximum	$289,000	(=$G$64)



Assumption: BRIDGE - FLYOVER (UC) **Cell: E24**

Triangular distribution with parameters:

Minimum	$102	(=$F$24)
Likeliest	$120	(=$E$24)
Maximum	$170	(=$G$24)

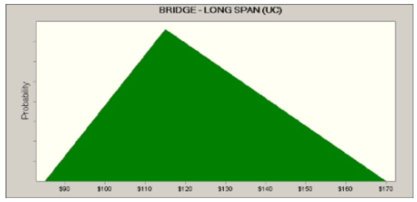


Assumption: BRIDGE - LONG SPAN (UC) **Cell: E22**

Triangular distribution with parameters:

Minimum	$85	(=$F$22)
Likeliest	$115	(=$E$22)
Maximum	$170	(=$G$22)

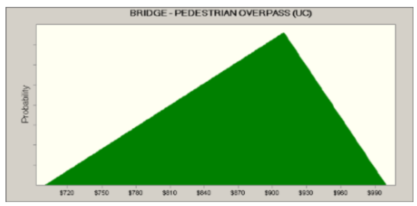
Assumption: BRIDGE - LONG SPAN (UC) (cont'd) **Cell: E22**



Assumption: BRIDGE - PEDESTRIAN OVERPASS (UC) **Cell: E23**

Triangular distribution with parameters:

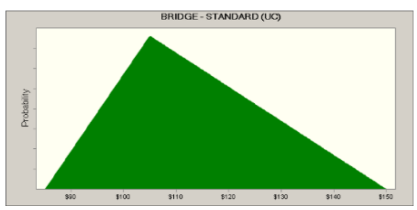
Minimum	$700	(=$F$23)
Likeliest	$910	(=$E$23)
Maximum	$1,000	(=$G$23)



Assumption: BRIDGE - STANDARD (UC) **Cell: E21**

Triangular distribution with parameters:

Minimum	$85	(=$F$21)
Likeliest	$105	(=$E$21)
Maximum	$150	(=$G$21)

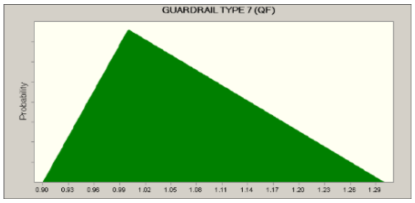


Assumption: GUARDRAIL TYPE 7 (QF) **Cell: H18**

Triangular distribution with parameters:

Minimum	0.90	(=$I$18)
Likeliest	1.00	(=$H$18)
Maximum	1.30	(=$J$18)

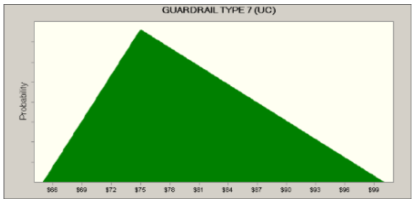
Assumption: GUARDRAIL TYPE 7 (QF) (cont'd) **Cell: H18**



Assumption: GUARDRAIL TYPE 7 (UC) **Cell: E18**

Triangular distribution with parameters:

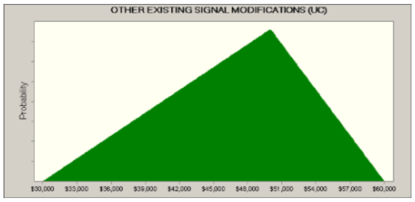
Minimum	$65	(=$F$18)
Likeliest	$75	(=$E$18)
Maximum	$100	(=$G$18)



Assumption: OTHER EXISTING SIGNAL MODIFICATIONS (UC) **Cell: E65**

Triangular distribution with parameters:

Minimum	$30,000	(=$F$65)
Likeliest	$50,000	(=$E$65)
Maximum	$60,000	(=$G$65)

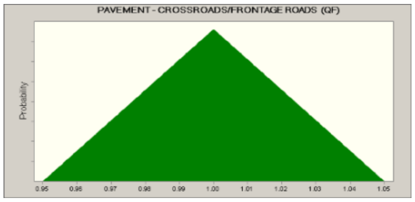


Assumption: PAVEMENT - CROSSROADS/FRONTAGE ROADS (QF) **Cell: H16**

Triangular distribution with parameters:

Minimum	0.95	(=$I$16)
Likeliest	1.00	(=$H$16)
Maximum	1.05	(=$J$16)

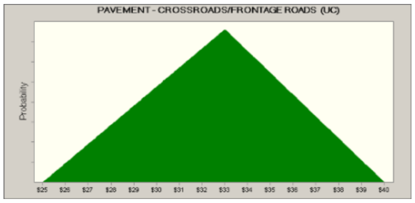
Assumption: PAVEMENT - CROSSROADS/FRONTAGE ROADS (QF) (cont'd) **Cell: H16**



Assumption: PAVEMENT - CROSSROADS/FRONTAGE ROADS (UC) **Cell: E16**

Triangular distribution with parameters:

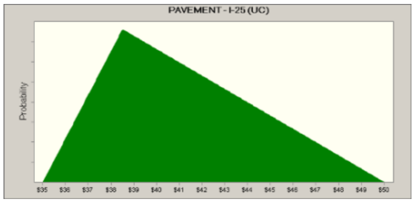
Minimum	$25	(=$F$16)
Likeliest	$33	(=$E$16)
Maximum	$40	(=$G$16)



Assumption: PAVEMENT - I-25 (UC) **Cell: E14**

Triangular distribution with parameters:

Minimum	$35	(=$F$14)
Likeliest	$39	(=$E$14)
Maximum	$50	(=$G$14)

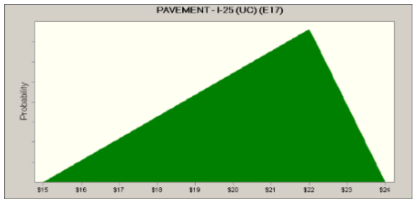


Assumption: PAVEMENT - I-25 (UC) (E17) **Cell: E17**

Triangular distribution with parameters:

Minimum	$15	(=$F$17)
Likeliest	$22	(=$E$17)
Maximum	$24	(=$G$17)

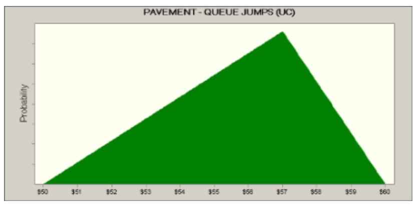
Assumption: PAVEMENT - I-25 (UC) (E17) (cont'd) **Cell: E17**



Assumption: PAVEMENT - QUEUE JUMPS (UC) **Cell: E56**

Triangular distribution with parameters:

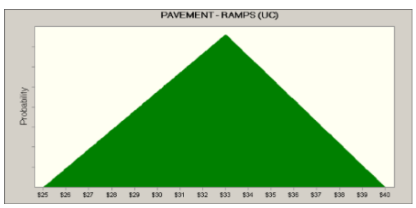
Minimum	$50	(=$F$56)
Likeliest	$57	(=$E$56)
Maximum	$60	(=$G$56)



Assumption: PAVEMENT - RAMPS (UC) **Cell: E15**

Triangular distribution with parameters:

Minimum	$25	(=$F$15)
Likeliest	$33	(=$E$15)
Maximum	$40	(=$G$15)

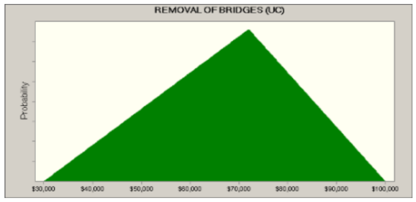


Assumption: REMOVAL OF BRIDGES (UC) **Cell: E11**

Triangular distribution with parameters:

Minimum	$30,000	(=$F$11)
Likeliest	$72,000	(=$E$11)
Maximum	$100,000	(=$G$11)

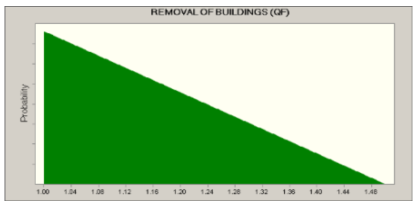
Assumption: REMOVAL OF BRIDGES (UC) (cont'd) **Cell: E11**



Assumption: REMOVAL OF BUILDINGS (QF) **Cell: H12**

Triangular distribution with parameters:

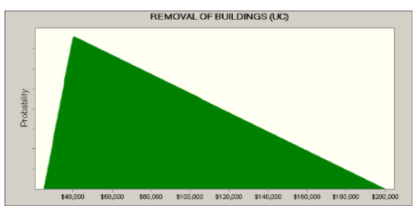
Minimum	1.00	(=$I$12)
Likeliest	1.00	(=$H$12)
Maximum	1.50	(=$J$12)



Assumption: REMOVAL OF BUILDINGS (UC) **Cell: E12**

Triangular distribution with parameters:

Minimum	$25,000	(=$F$12)
Likeliest	$40,000	(=$E$12)
Maximum	$200,000	(=$G$12)

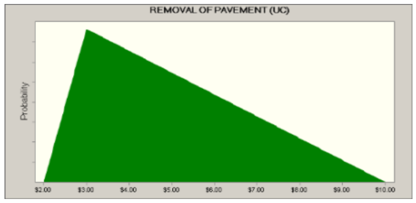


Assumption: REMOVAL OF PAVEMENT (UC) **Cell: E10**

Triangular distribution with parameters:

Minimum	$2.00	(=$F$10)
Likeliest	$3.00	(=$E$10)
Maximum	$10.00	(=$G$10)

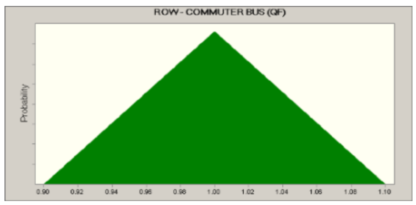
Assumption: REMOVAL OF PAVEMENT (UC) (cont'd) **Cell: E10**



Assumption: ROW - COMMUTER BUS (QF) **Cell: H73**

Triangular distribution with parameters:

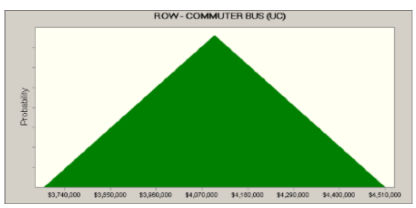
Minimum	0.90	(=$I$73)
Likeliest	1.00	(=$H$73)
Maximum	1.10	(=$J$73)



Assumption: ROW - COMMUTER BUS (UC) **Cell: E73**

Triangular distribution with parameters:

Minimum	$3,690,000	(=$F$73)
Likeliest	$4,100,000	(=$E$73)
Maximum	$4,510,000	(=$G$73)

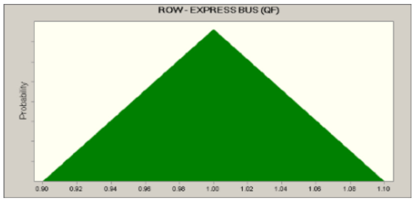


Assumption: ROW - EXPRESS BUS (QF) **Cell: H72**

Triangular distribution with parameters:

Minimum	0.90	(=$I$72)
Likeliest	1.00	(=$H$72)
Maximum	1.10	(=$J$72)

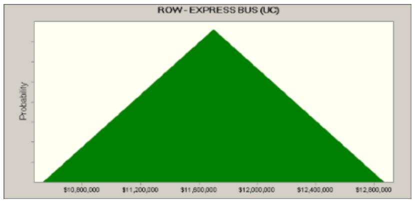
Assumption: ROW - EXPRESS BUS (QF) (cont'd) **Cell: H72**



Assumption: ROW - EXPRESS BUS (UC) **Cell: E72**

Triangular distribution with parameters:

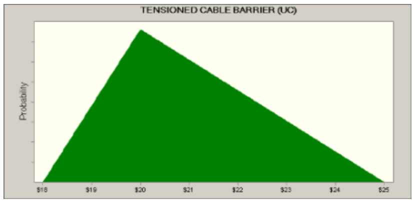
Minimum	$10,530,000	(=$F$72)
Likeliest	$11,700,000	(=$E$72)
Maximum	$12,870,000	(=$G$72)



Assumption: TENSIONED CABLE BARRIER (UC) **Cell: E19**

Triangular distribution with parameters:

Minimum	$18	(=$F$19)
Likeliest	$20	(=$E$19)
Maximum	$25	(=$G$19)



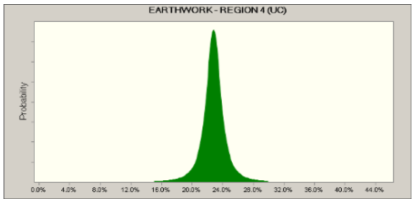
Assumption: EARTHWORK - REGION 4 (UC) **Cell: E32**

Student's t distribution with parameters:

Midpoint	22.8%	(=$E$32)
Scale	1.0%	
Deg. Freedom	2	

Selected range is from 15.0% to 30.0%

Assumption: EARTHWORK - REGION 4 (UC) (cont'd) **Cell: E32**

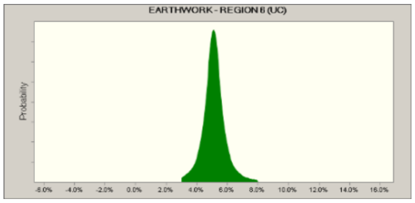


Assumption: EARTHWORK - REGION 6 (UC) **Cell: E33**

Student's t distribution with parameters:

Midpoint	5.1%	(=$E$33)
Scale	0.5%	
Deg. Freedom	2	

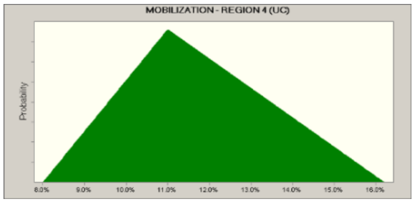
Selected range is from 3.0% to 8.0%



Assumption: MOBILIZATION - REGION 4 (UC) **Cell: E40**

Triangular distribution with parameters:

Minimum	8.0%	(=$F$40)
Likeliest	11.0%	(=$E$40)
Maximum	16.2%	(=$G$40)

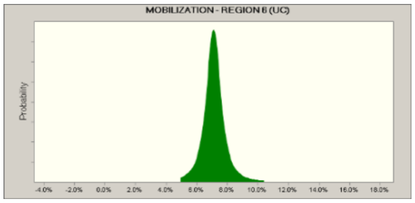


Assumption: MOBILIZATION - REGION 6 (UC) **Cell: E41**

Student's t distribution with parameters:

Midpoint	7.1%	(=$E$41)
Scale	0.5%	
Deg. Freedom	2	

Selected range is from 4.9% to 10.4%



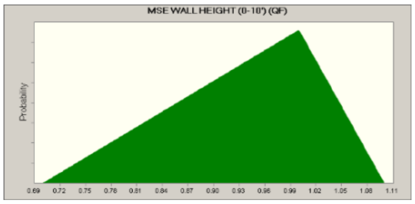
Assumption: MSE WALL HEIGHT (0-10') (QF) **Cell: H26**

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

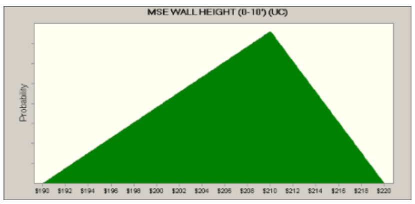
Minimum	0.70	(=$I$26)
Likeliest	1.00	(=$H$26)
Maximum	1.10	(=$J$26)



Assumption: MSE WALL HEIGHT (0-10') (UC) **Cell: E26**

Triangular distribution with parameters:

Minimum	$190	(=$F$26)
Likeliest	$210	(=$E$26)
Maximum	$220	(=$G$26)



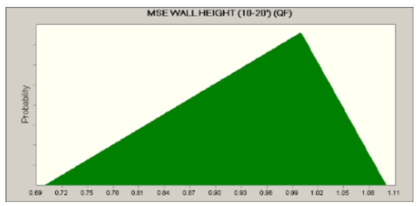
Assumption: MSE WALL HEIGHT (10-20') (QF) **Cell: H27**

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

Minimum	0.70	(=$I$27)
Likeliest	1.00	(=$H$27)
Maximum	1.10	(=$J$27)



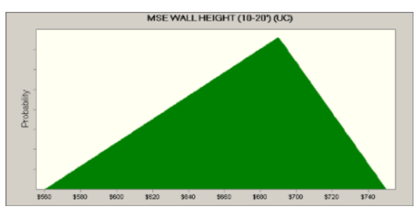
Assumption: MSE WALL HEIGHT (10-20') (UC) **Cell: E27**

OPPORTUNTIES: market conditions, 5-20% design level

THREATS: market conditions, 5-20% design level

Triangular distribution with parameters:

Minimum	$560	(=$F$27)
Likeliest	$690	(=$E$27)
Maximum	$750	(=$G$27)



Assumption: MSE WALL HEIGHT (20'+) (QF) **Cell: H28**

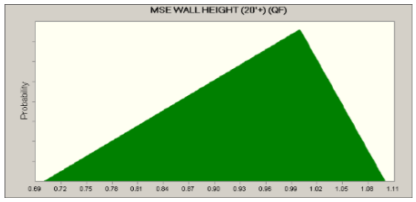
OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

Minimum	0.70	(=$I$28)
Likeliest	1.00	(=$H$28)
Maximum	1.10	(=$J$28)

Assumption: MSE WALL HEIGHT (20'+) (QF) (cont'd) **Cell: H28**



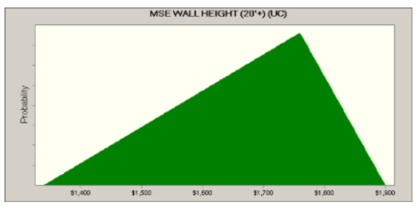
Assumption: MSE WALL HEIGHT (20'+) (UC) **Cell: E28**

OPPORTUNTIES: market conditions, 5-20% design level

THREATS: market conditions, 5-20% design level

Triangular distribution with parameters:

Minimum	$1,340	(=$F$28)
Likeliest	$1,760	(=$E$28)
Maximum	$1,900	(=$G$28)



Assumption: Assumed Construction Unit Cost Rate of Escalation: **Cell: D3**

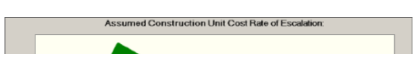
CO Escalation Rates
CDOT: 3.3% based on CCI (average of cumulative average of inflation since 1987)
NFR: 3.0% used for revenue and construction projection
DRGOG/OFMB: 3.3 % used for revenue projection, applied annually
RTD: 3.3-3.8%
US36 CER: 3.8%; min = 3.0% & max = 4.6%

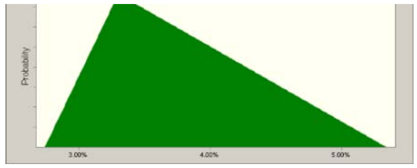
Threats: Other large projects in area, FastTracks, CDOT, material shortages, ie steel, asphalt, cement. More stimulous money may decrease competition. Availability of skilled workforce.

Opportunities: Continued low prices,

Triangular distribution with parameters:

Minimum	2.74%	
Likeliest	3.30%	(=$D$3)
Maximum	5.34%	




Probability
3.00%
4.00%
5.00%

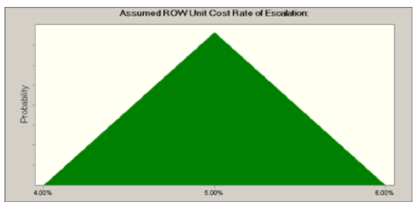
Assumption: Assumed ROW Unit Cost Rate of Escalation: **Cell: D4**

Based on data such as home price index from 1970 to 2010, assessor's office

5% escalation annually
Range of 4-7%
THREATS: Transitional development along corridor, i.e. agricultural (7K to 10K/acre) to industrial/residential ($7/sf)
OPPORTUNITIES: Land-use planning, stabilization of ROW market, ROW preservation

Triangular distribution with parameters:

Minimum	4.00%	
Likeliest	5.00%	(=$D$4)
Maximum	6.00%	

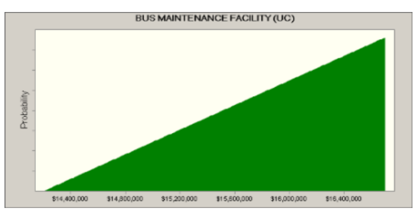


Assumption: BUS MAINTENANCE FACILITY (UC) **Cell: E62**

Based on detailed breakdown with unit cost from other facilities

Triangular distribution with parameters:

Minimum	$14,205,200	(=$F$62)
Likeliest	$16,700,000	(=$E$62)
Maximum	$16,700,000	(=$G$62)



Assumption: CARPOOL PARKING (UC) **Cell: E43**

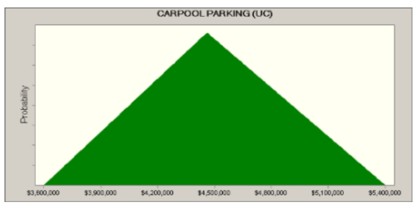
Not for commuter rail or express lots, solely existing or new park and ride lots - 5 locations
Based on historical data from RTD

OPPORTUNITIES: more usage of commuter rail lots

THREATS: less usage of commuter rail lots, development in corridor

Triangular distribution with parameters:

Minimum	$3,600,000	(=$F$43)
Likeliest	$4,460,000	(=$E$43)
Maximum	$5,400,000	(=$G$43)



Assumption: COMMUTER BUS STATIONS (UC) **Cell: E58**

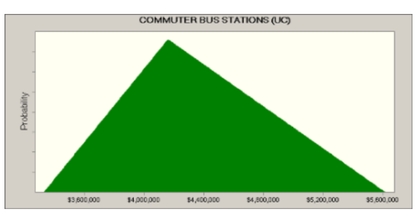
Average of cost of different types/sized stations
Based on RTD West corridor/Southwest Corridor extension projects and RTD 2010 Program Review cost

OPPORTUNITIES: market conditions, lower bid prices, cost sharing with local agencies, ROW available for larger surface lots

THREATS: level of security, increased ridership, timeframe of ridership model (only modeled to 2035)

Triangular distribution with parameters:

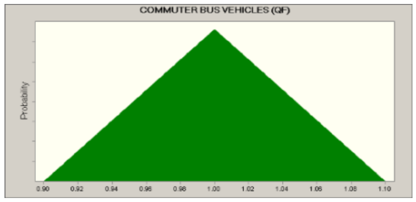
Minimum	$3,328,000	(=$F$58)
Likeliest	$4,160,000	(=$E$58)
Maximum	$5,616,000	(=$G$58)



Assumption: COMMUTER BUS VEHICLES (QF) **Cell: H75**

Triangular distribution with parameters:

Minimum	0.90	(=$I$75)
Likeliest	1.00	(=$H$75)
Maximum	1.10	(=$J$75)

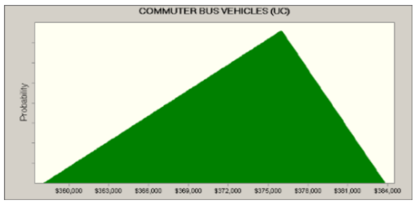


Assumption: COMMUTER BUS VEHICLES (UC) **Cell: E75**

-Assumed 40' coach style bus
-Cost based on RTD Annual Program Review
-Assumes 3-5% range; High range based on APTA report of average bus costs

Triangular distribution with parameters:

Minimum	$358,100	(=$F$75)
Likeliest	$376,000	(=$E$75)
Maximum	$383,800	(=$G$75)



Assumption: COMMUTER RAIL - SUBTOTAL BASE COMMUNICATION SYSTEM (QF) **Cell: H93**

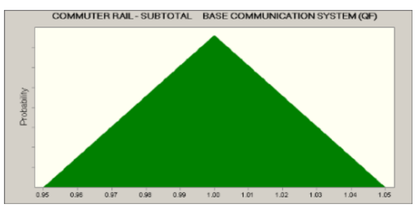
Related to quantity changes in trackwork

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$93)
Likeliest	1.00	(=$H$93)
Maximum	1.05	(=$J$93)



Assumption: COMMUTER RAIL - SUBTOTAL BASE COMMUNICATION SYSTEM (UC)Cell: E93

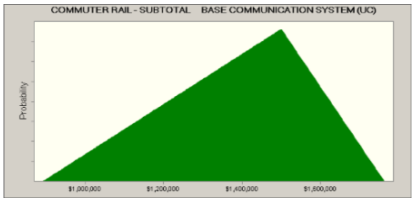
Includes for all communications along track
Cost based on cost on similar projects in the U.S.

OPPORTUNITIES: Will need to tie-in to systems to the south of corridor/BSNF, technology advances

THREATS: Will need to tie-in to systems to the south of corridor/BSNF

Triangular distribution with parameters:

Minimum	$892,000	(=$F$93)
Likeliest	$1,500,000	(=$E$93)
Maximum	$1,762,780	(=$G$93)



Assumption: COMMUTER RAIL - SUBTOTAL RURAL FENCE (QF) Cell: H96

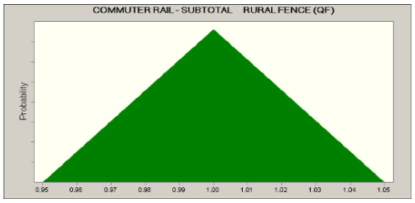
Related to quantity changes in trackwork

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$96)
Likeliest	1.00	(=$H$96)
Maximum	1.05	(=$J$96)



Assumption: COMMUTER RAIL - SUBTOTAL RURAL FENCE (UC) Cell: E96

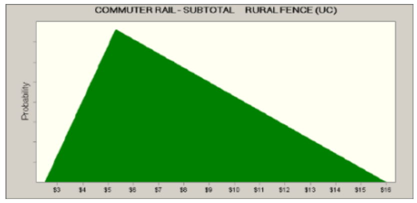
OPPORTUNITIES: 20-30% design level, type of fence, location of fence (rural vs. urban)

THREATS: 20-30% design level, type of fence, location of fence (rural vs. urban)

Triangular distribution with parameters:

Minimum	$3	(=$F$96)
Likeliest	$5	(=$E$96)
Maximum	$16	(=$G$96)

Assumption: COMMUTER RAIL - SUBTOTAL RURAL FENCE (UC) (cont'd) **Cell: E96**



Assumption: COMMUTER RAIL - SUBTOTAL 13' GRAVEL ACCESS ROAD (QF) **Cell: H91**

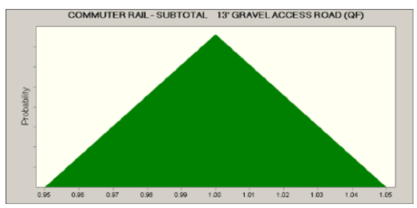
Related to quantity changes in trackwork

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$91)
Likeliest	1.00	(=$H$91)
Maximum	1.05	(=$J$91)



Assumption: COMMUTER RAIL - SUBTOTAL 13' GRAVEL ACCESS ROAD (UC) **Cell: E91**

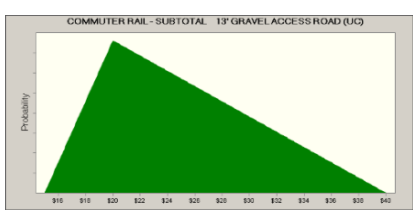
Includes 12" surface of access road

THREATS: market conditions, haul distances

OPPORTUNITIES: material extension of subballast

Triangular distribution with parameters:

Minimum	$15	(=$F$91)
Likeliest	$20	(=$E$91)
Maximum	$40	(=$G$91)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL ACTIVATION & TESTING (U Cell: E95

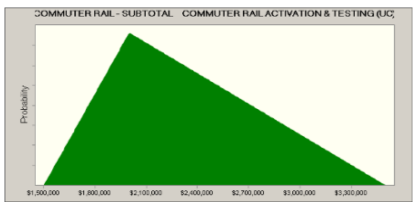
Standard testing in the industry
Based on size of the facility

OPPORTUNITIES: number of construction phases

THREATS: number of construction phases

Triangular distribution with parameters:

Minimum	$1,500,000	(=$F$95)
Likeliest	$2,000,000	(=$E$95)
Maximum	$3,500,000	(=$G$95)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL BRIDGE - span <140' (no c Cell: E80

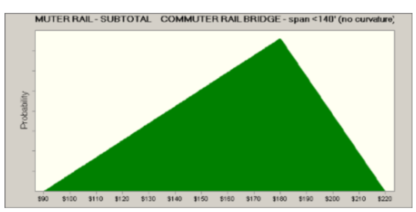
-Based on RTD historical cost data
-Two commuter rail projects recently awarded by RTD

OPPORTUNITIES: 20-30% design level, new technology, lighter track, new alignment

THREATS: 20-30% design level, complexity of bridge design, new alignment, roadway and water crossings

Triangular distribution with parameters:

Minimum	$90	(=$F$80)
Likeliest	$180	(=$E$80)
Maximum	$220	(=$G$80)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL BRIDGE - span >140' (or wi Cell: E81

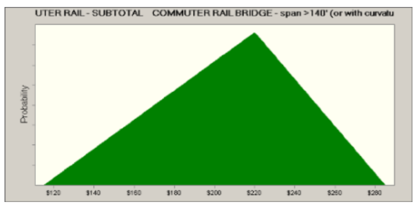
-Based on RTD historical cost data
-Two commuter rail projects recently awarded by RTD

OPPORTUNITIES: 20-30% design level, new technology, lighter track, new alignment

THREATS: 20-30% design level, complexity of bridge design, new alignment, roadway and water crossings

Triangular distribution with parameters:

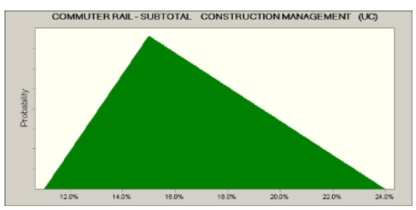
Minimum	$115	(=$F$81)
Likeliest	$220	(=$E$81)
Maximum	$285	(=$G$81)



Assumption: COMMUTER RAIL - SUBTOTAL CONSTRUCTION MANAGEMENT (UC) Cell: E113

Triangular distribution with parameters:

Minimum	11.0%	(=$F$113)
Likeliest	15.0%	(=$E$113)
Maximum	24.0%	(=$G$113)



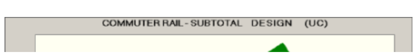
Assumption: COMMUTER RAIL - SUBTOTAL DESIGN (UC) Cell: E112

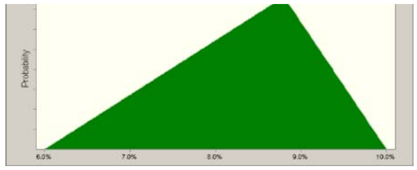
THREATS: BSNF design/review process

OPPORTUNITIES: BSNF design/review process

Triangular distribution with parameters:

Minimum	6.0%	(=$F$112)
Likeliest	8.8%	(=$E$112)
Maximum	10.0%	(=$G$112)




Probability
6.0%
7.0%
8.0%
9.0%
10.0%

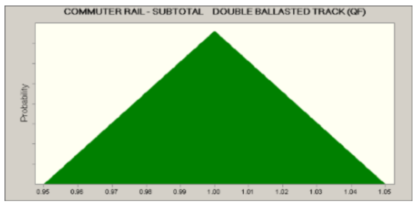
Assumption: COMMUTER RAIL - SUBTOTAL DOUBLE BALLASTED TRACK (QF) Cell: H87

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$87)
Likeliest	1.00	(=$H$87)
Maximum	1.05	(=$J$87)



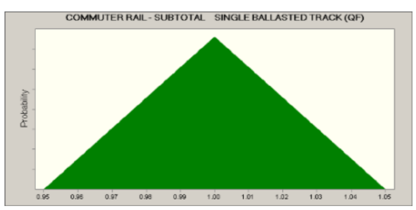
Assumption: COMMUTER RAIL - SUBTOTAL SINGLE BALLASTED TRACK (QF) Cell: H88

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, no final agreement with BNSF, ROW issues

Triangular distribution with parameters:

Minimum	0.95	(=$I$88)
Likeliest	1.00	(=$H$88)
Maximum	1.05	(=$J$88)



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (0-10') (QF) Cell: H83

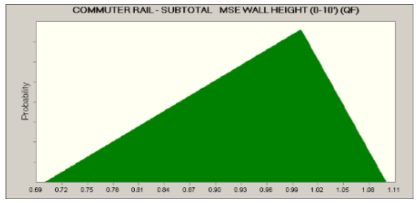
OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

Minimum	0.70	(=$I$83)
Likeliest	1.00	(=$H$83)
Maximum	1.10	(=$J$83)

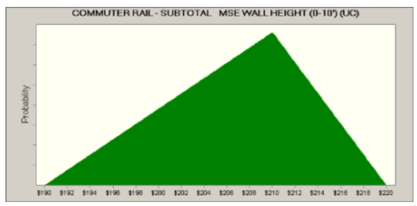
Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (0-10') (QF) (cont'd) Cell: H83



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (0-10') (UC) Cell: E83

Triangular distribution with parameters:

Minimum	$190	(=$F$83)
Likeliest	$210	(=$E$83)
Maximum	$220	(=$G$83)



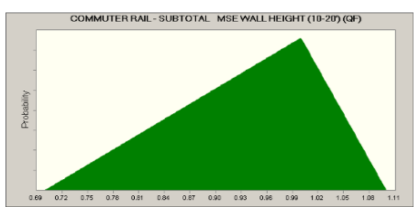
Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (10-20') (QF) Cell: H84

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

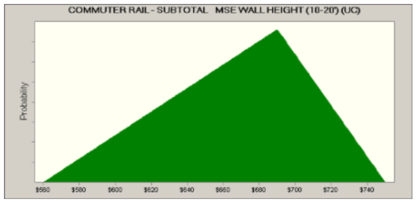
Minimum	0.70	(=$I$84)
Likeliest	1.00	(=$H$84)
Maximum	1.10	(=$J$84)



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (10-20') (UC) Cell: E84

Triangular distribution with parameters:

Minimum	$560	(=$F$84)
Likeliest	$690	(=$E$84)
Maximum	$750	(=$G$84)



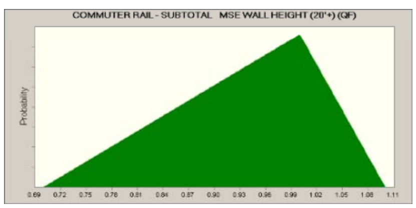
Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (20'+) (QF) Cell: H85

OPPORTUNITIES: design level, some historic properties may not be an issue in the future, quantities account for potential ponds along corridor, did not include tiered walls, quantities tied to opportunities to purchase ROW

THREATS: design level, development along corridor, drainage crossings

Triangular distribution with parameters:

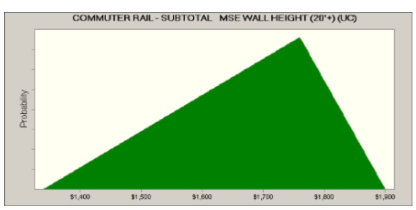
Minimum	0.70	(=$I$85)
Likeliest	1.00	(=$H$85)
Maximum	1.10	(=$J$85)



Assumption: COMMUTER RAIL - SUBTOTAL MSE WALL HEIGHT (20'+) (UC) Cell: E85

Triangular distribution with parameters:

Minimum	$1,340	(=$F$85)
Likeliest	$1,760	(=$E$85)
Maximum	$1,900	(=$G$85)



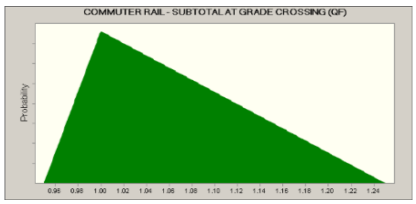
Assumption: COMMUTER RAIL - SUBTOTAL AT GRADE CROSSING (QF) **Cell: H97**

OPPORTUNITIES: 20-30% design level

THREATS: 20-30% design level, additional request from locals

Triangular distribution with parameters:

Minimum	0.95	(=$I$97)
Likeliest	1.00	(=$H$97)
Maximum	1.25	(=$J$97)



Assumption: COMMUTER RAIL - SUBTOTAL AT GRADE CROSSING (UC) **Cell: E97**

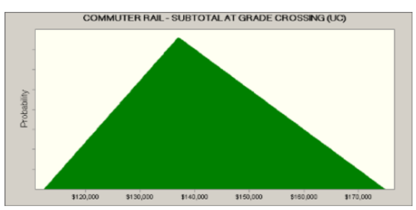
Average of different types of crossing

OPPORTUNITIES: quiet zones not implemented

THREATS: existing roadway widened

Triangular distribution with parameters:

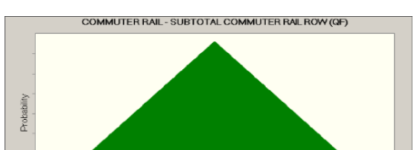
Minimum	$112,400	(=$F$97)
Likeliest	$137,000	(=$E$97)
Maximum	$174,840	(=$G$97)



Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL ROW (QF) **Cell: H114**

Triangular distribution with parameters:

Minimum	0.90	(=$I$114)
Likeliest	1.00	(=$H$114)
Maximum	1.10	(=$J$114)




0.90
0.92
0.94
0.96
0.98
1.00
1.02
1.04
1.06
1.08
1.10

Assumption: COMMUTER RAIL - SUBTOTAL COMMUTER RAIL STATIONS (UC) **Cell: E104**

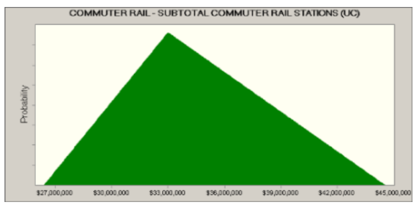
Average of cost of different types/sized stations
Based on RTD West corridor/Southwest Corridor extension projects and RTD 2010 Program Review cost

OPPORTUNITIES: market conditions, lower bid prices, cost sharing with local agencies, ROW available for larger surface lots

THREATS: level of security, increased ridership, timeframe of ridership model (only modeled to 2035)

Triangular distribution with parameters:

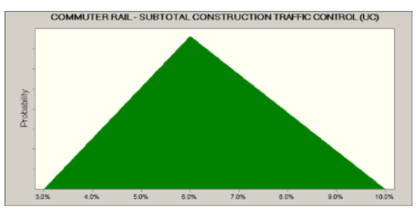
Minimum	$26,400,000	(=$F$104)
Likeliest	$33,000,000	(=$E$104)
Maximum	$44,550,000	(=$G$104)



Assumption: COMMUTER RAIL - SUBTOTAL CONSTRUCTION TRAFFIC CONTROL (UC) **Cell: E101**

Triangular distribution with parameters:

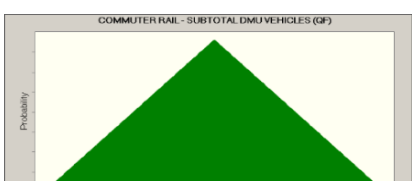
Minimum	3.0%	(=$F$101)
Likeliest	6.0%	(=$E$101)
Maximum	10.0%	(=$G$101)



Assumption: COMMUTER RAIL - SUBTOTAL DMU VEHICLES (QF) **Cell: H116**

Triangular distribution with parameters:

Minimum	0.90	(=$I$116)
Likeliest	1.00	(=$H$116)
Maximum	1.10	(=$J$116)




0.90
0.92
0.94
0.96
0.98
1.00
1.02
1.04
1.06
1.08
1.10

Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) **Cell: E78**

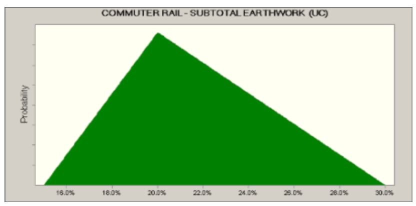
-Assumes cost of single track and maintenance road; based on alignment for trackline
-Percentage of trackwork cost

OPPORTUNITIES: 15-20% design level, soft soils - proximity to major rivers, haul distances, material suitability, unknown borrow sources

THREATS: 15-20% design level, changes in BNSF requirements, no final agreements in place with BNSF, material suitability, major aggregates supplies in project area

Triangular distribution with parameters:

Minimum	15.0%	(=$F$78)
Likeliest	20.0%	(=$E$78)
Maximum	30.0%	(=$G$78)



Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) (E87) **Cell: E87**

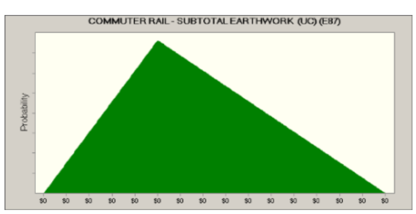
-Based on RTD 2010 Program review
-Includes cost for all track items from subgrade

OPPORTUNITIES: changes to FTA/FRA requirements, market conditions - steel/concrete prices

THREATS: changes to FTA/FRA requirements, market conditions - steel/concrete prices

Triangular distribution with parameters:

Minimum	$0	(=$F$78)
Likeliest	$0	(=$E$78)
Maximum	$0	(=$G$78)



Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) (E88) **Cell: E88**

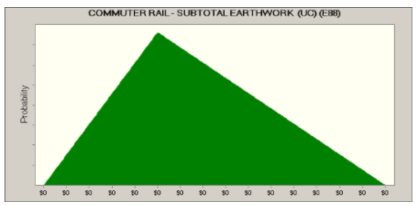
-Based on RTD 2010 Program review
-Includes cost for all track items from subgrade

OPPORTUNITIES: changes to FTA/FRA requirements, market conditions - steel/concrete prices

THREATS: changes to FTA/FRA requirements, market conditions - steel/concrete prices

Triangular distribution with parameters:

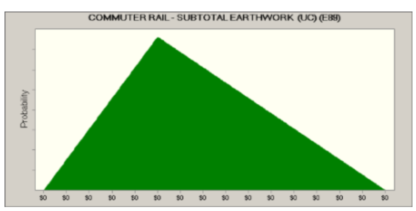
Minimum	$0	(=$F$78)
Likeliest	$0	(=$E$78)
Maximum	$0	(=$G$78)



Assumption: COMMUTER RAIL - SUBTOTAL EARTHWORK (UC) (E89) **Cell: E89**

Triangular distribution with parameters:

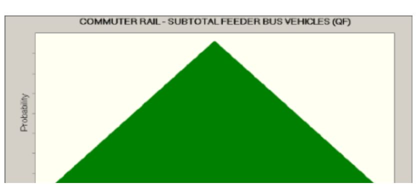
Minimum	$0	(=$F$78)
Likeliest	$0	(=$E$78)
Maximum	$0	(=$G$78)

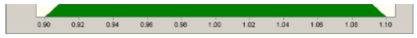


Assumption: COMMUTER RAIL - SUBTOTAL FEEDER BUS VEHICLES (QF) **Cell: H115**

Triangular distribution with parameters:

Minimum	0.90	(=$I$115)
Likeliest	1.00	(=$H$115)
Maximum	1.10	(=$J$115)




0.90
0.92
0.94
0.96
0.98
1.00
1.02
1.04
1.06
1.08
1.10

Assumption: COMMUTER RAIL - SUBTOTAL INSURANCE LEGAL (UC) **Cell: E107**

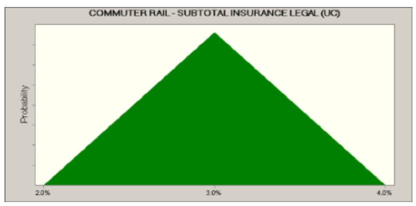
Includes contractor's bonding and legal cost
Based on West Corridor project cost
Owner Controlled Insurance (OCIP)

OPPORTUNITIES: contractor's bonding ratings, type of procurement

THREATS: contractor's bonding ratings, type of procurement

Triangular distribution with parameters:

Minimum	2.0%	(=$F$107)
Likeliest	3.0%	(=$E$107)
Maximum	4.0%	(=$G$107)



Assumption: COMMUTER RAIL - SUBTOTAL MAINTENANCE & OPERATIONS FACILITY (UC) **Cell: E105**

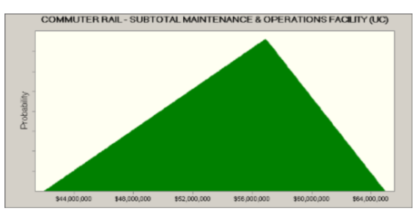
Used estimate M&O facility in California as a template
Min/Max based on including different characteristics of facility

OPPORTUNITIES: design level, estimate does not use local cost

THREATS: design level, estimate does not use local cost

Triangular distribution with parameters:

Minimum	$41,963,200	(=$F$105)
Likeliest	$56,900,000	(=$E$105)
Maximum	$64,946,300	(=$G$105)



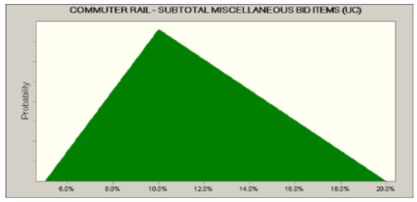
Assumption: COMMUTER RAIL - SUBTOTAL MISCELLANEOUS BID ITEMS (UC) **Cell: E103**

Includes structural fill, electrical conduit, public information, landscaping

Triangular distribution with parameters:

Minimum	5.0%	(=$F$103)
Likeliest	10.0%	(=$E$103)
Maximum	20.0%	(=$G$103)

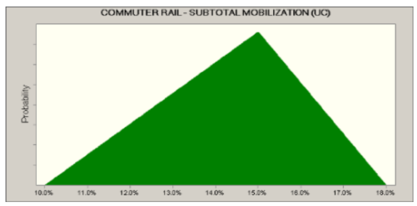
Assumption: COMMUTER RAIL - SUBTOTAL MISCELLANEOUS BID ITEMS (UC) (cont'd) **Cell: E103**



Assumption: COMMUTER RAIL - SUBTOTAL MOBILIZATION (UC) **Cell: E102**

Triangular distribution with parameters:

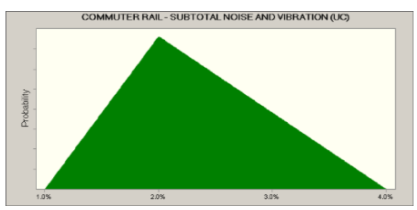
Minimum	10.0%	(=$F$102)
Likeliest	15.0%	(=$E$102)
Maximum	18.0%	(=$G$102)



Assumption: COMMUTER RAIL - SUBTOTAL NOISE AND VIBRATION (UC) **Cell: E99**

Triangular distribution with parameters:

Minimum	1.0%	(=$F$99)
Likeliest	2.0%	(=$E$99)
Maximum	4.0%	(=$G$99)

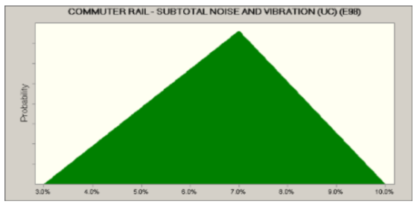


Assumption: COMMUTER RAIL - SUBTOTAL NOISE AND VIBRATION (UC) (E98) **Cell: E98**

-Based on RTD cost for Northwest Corridor
-Percentage of quantified commuter rail construction cost

Triangular distribution with parameters:

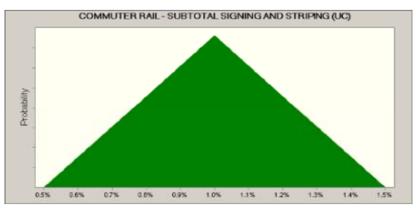
Minimum	3.0%	(=$F$98)
Likeliest	7.0%	(=$E$98)
Maximum	10.0%	(=$G$98)



Assumption: COMMUTER RAIL - SUBTOTAL SIGNING AND STRIPING (UC) **Cell: E100**

Triangular distribution with parameters:

Minimum	0.5%	(=$F$100)
Likeliest	1.0%	(=$E$100)
Maximum	1.5%	(=$G$100)



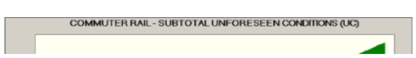
Assumption: COMMUTER RAIL - SUBTOTAL UNFORESEEN CONDITIONS (UC) **Cell: E106**

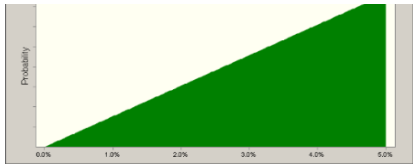
OPPORTUNITIES: Lessons learned from current RTD projects, unknown operator/owner (RTD?)

THREATS: No final agreements with BSNF, coordination issues with BSNF and existing RTD commuter rail, unknown operator/owner (RTD?), less tolerance in rail construction, subsurface issues/conditions, hazardous materials on existing rail line, 60-year horizon for construction of commuter rail (30 years until 1st project starts construction), abondoned mines

Triangular distribution with parameters:

Minimum	0.0%	(=$F$106)
Likeliest	5.0%	(=$E$106)
Maximum	5.0%	(=$G$106)




Probability
0.0%
1.0%
2.0%
3.0%
4.0%
5.0%

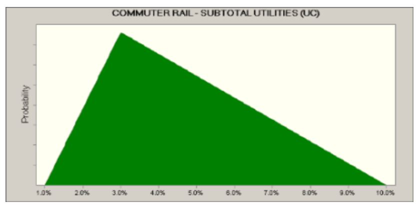
Assumption: COMMUTER RAIL - SUBTOTAL UTILITIES (UC) **Cell: E108**

Based on Northwest Corridor project
Percentage of commuter rail construction cost
OPPORTUNITIES: portions on existing alignment

THREATS: portions of new alignment, possibly parallel utilites in existing RR ROW

Triangular distribution with parameters:

Minimum	1.0%	(=$F$108)
Likeliest	3.0%	(=$E$108)
Maximum	10.0%	(=$G$108)



Assumption: CONSTRUCTION TRAFFIC CONTROL (UC) **Cell: E37**

Includes detour pavement, flagging, traffic control management, temporary signing, TCD, temporary concrete barrier

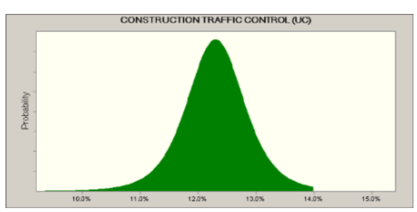
OPPORTUNITIES: contract phasing, larger projects w/ less crossovers, complete closures of interchanges with vertical alignment changes

THREATS: contract phasing, smaller projects with more crossovers, separating mainline and interchange contracts

Student's t distribution with parameters:

Midpoint	12.3%	(=$E$37)
Scale	0.5%	
Deg. Freedom	5	

Selected range is from 5.0% to 14.0%



Assumption: DRAINAGE (UC) **Cell: E34**

Includes all crossing items, water quality ponds, pipe, culverts, riprap, manholes, inlets, trash guards

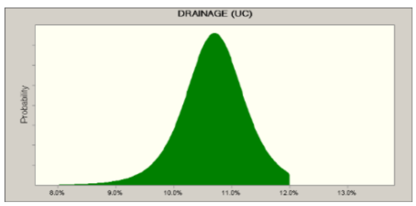
OPPORTUNITIES: very low level complexity (typical project), 20-30% design level, new technology such as stormwater vault systems, less ROW with vault systems

THREATS: 20-30% design level, no utility information, areas in Region 4 will become MS4 areas in future

Student's t distribution with parameters:

Midpoint	10.7%	(=$E$34)
Scale	0.5%	
Deg. Freedom	5	

Selected range is from 8.0% to 12.0%



Assumption: EROSION CONTROL (UC) **Cell: E35**

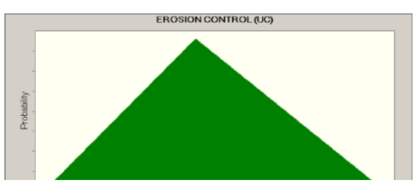
-Includes items such as topsoil, silt fence, sediment basins, seeding, mulching, soil retention blankets, erosion control supervisor
-Percentage of quantified items
-Historical projects were prior to consent decree

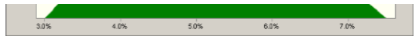
THREATS: Additional EPA regulations

OPPORTUNITIES: New direction at CDOT Environmental Programs Branch (EPB), BMP improvements/advances

Triangular distribution with parameters:

Minimum	3.0%	(=$F$35)
Likeliest	5.0%	(=$E$35)
Maximum	7.5%	(=$G$35)




3.0%
4.0%
5.0%
6.0%
7.0%

Assumption: EXPRESS BUS STATIONS (UC) **Cell: E57**

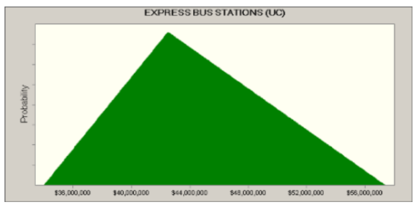
Average of cost of different types/sized stations
Based on RTD West corridor/Southwest Corridor extension projects and RTD 2010 Program Review cost

OPPORTUNITIES: market conditions, lower bid prices, cost sharing with local agencies, ROW available for larger surface lots

THREATS: level of security, increased ridership, timeframe of ridership model (only modeled to 2035)

Triangular distribution with parameters:

Minimum	$34,000,000	(=$F$57)
Likeliest	$42,500,000	(=$E$57)
Maximum	$57,375,000	(=$G$57)



Assumption: EXPRESS BUS VEHICLES (QF) **Cell: H74**

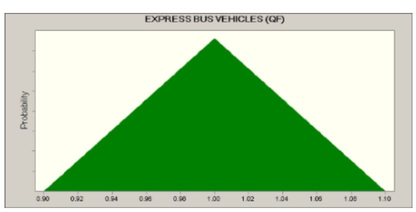
Ridership based on 2035

OPPORTUNITIES:

THREATS: development/growth in corridor

Triangular distribution with parameters:

Minimum	0.90	(=$I$74)
Likeliest	1.00	(=$H$74)
Maximum	1.10	(=$J$74)



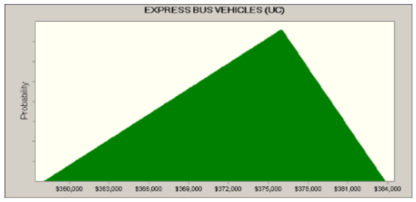
Assumption: EXPRESS BUS VEHICLES (UC) **Cell: E74**

-Assumed 40' coach style bus
-Cost based on RTD Annual Program Review
-Assumes 3-5% range; High range based on APTA report of average bus costs

Triangular distribution with parameters:

Minimum	$358,100	(=$F$74)
Likeliest	$376,000	(=$E$74)
Maximum	$383,800	(=$G$74)

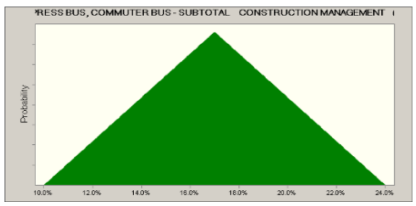
Assumption: EXPRESS BUS VEHICLES (UC) (cont'd) **Cell: E74**



Assumption: EXPRESS BUS, COMMUTER BUS - SUBTOTAL CONSTRUCTION MANAGEME Cell: E70

Triangular distribution with parameters:

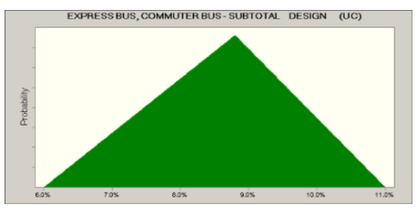
Minimum	10.0%	(=$F$70)
Likeliest	17.0%	(=$E$70)
Maximum	24.0%	(=$G$70)



Assumption: EXPRESS BUS, COMMUTER BUS - SUBTOTAL DESIGN (UC) **Cell: E69**

Triangular distribution with parameters:

Minimum	6.0%	(=$F$69)
Likeliest	8.8%	(=$E$69)
Maximum	11.0%	(=$G$69)



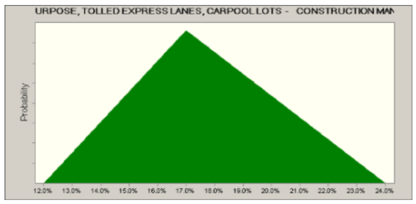
Assumption: I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS - CON Cell: E52

OPPORTUNITIES: using CDOT forces, D-B contracting, larger projects may be CE exemption

THREATS:

Triangular distribution with parameters:

Minimum	12.0%	(=$F$52)
Likeliest	17.0%	(=$E$52)
Maximum	24.0%	(=$G$52)



Assumption: I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS - DESI Cell: E51

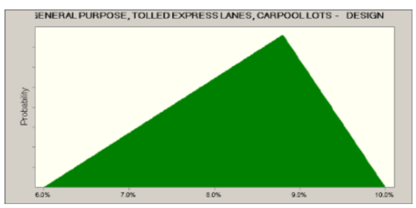
Includes phased ROD updates

OPPORTUNITIES: D-B contracting

THREATS: reorganization of project phasing, construction management, funding availability/schedule delay

Triangular distribution with parameters:

Minimum	6.0%	(=$F$51)
Likeliest	8.8%	(=$E$51)
Maximum	10.0%	(=$G$51)



Assumption: INTELLIGENT TRANSPORTATION SYSTEM ELEMENTS (UC) Cell: E44

Includes LED VMS, CCTV, weather station

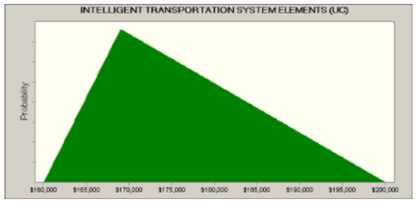
THREATS: new technology, decreased spacing of signs

OPPORTUNITIES: new technology

Triangular distribution with parameters:

Minimum	$160,000	(=$F$44)
Likeliest	$169,000	(=$E$44)
Maximum	$200,000	(=$G$44)

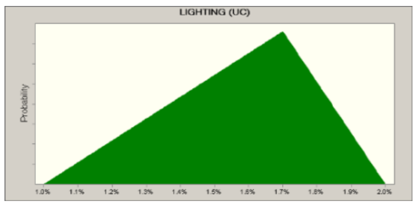
Assumption: INTELLIGENT TRANSPORTATION SYSTEM ELEMENTS (UC) (cont'd) **Cell: E44**



Assumption: LIGHTING (UC) **Cell: E30**

Triangular distribution with parameters:

Minimum	1.0%	(=$F$30)
Likeliest	1.7%	(=$E$30)
Maximum	2.0%	(=$G$30)



Assumption: MANAGED LANE SYSTEM (UC) **Cell: E45**

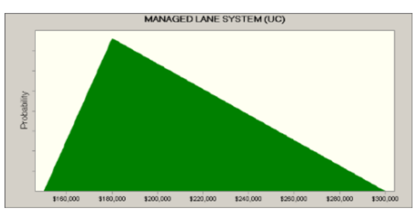
-Includes items such as electronic equipment, cabinets, power supply, cameras related to the managed lane system
-Based on historical national data from Wilbur Smith

OPPORTUNITIES: new technology

THREATS: costs based mainly on East Coast projects, new technology

Triangular distribution with parameters:

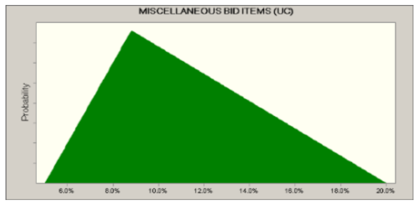
Minimum	$150,000	(=$F$45)
Likeliest	$180,000	(=$E$45)
Maximum	$300,000	(=$G$45)



Assumption: MISCELLANEOUS BID ITEMS (UC) **Cell: E61**

Triangular distribution with parameters:

Minimum	5.0%	(=$F$61)
Likeliest	8.8%	(=$E$61)
Maximum	20.0%	(=$G$61)



Assumption: MISCELLANEOUS BID ITEMS (UC) **Cell: E42**

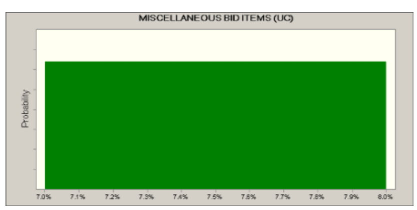
Includes items such as sandblasting, blading, resetting items, health and safety officers, solid waste disposal, geotextile items, fencing, curb and gutter, electrical conduit, rumble strips, traffic attenuators, field office, surveying, public information

THREATS: 5-20% design level, character of work could change and cause increase to miscellaneous items

OPPORTUNITIES: 5-20% design level, cost already included in estimate

Uniform distribution with parameters:

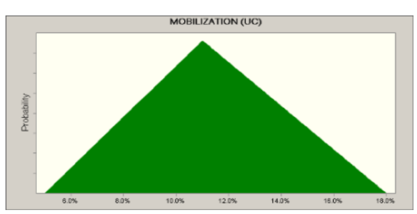
Minimum	7.0%	(=$F$42)
Maximum	8.0%	(=$G$42)



Assumption: MOBILIZATION (UC) **Cell: E60**

Triangular distribution with parameters:

Minimum	5.0%	(=$F$60)
Likeliest	11.0%	(=$E$60)
Maximum	18.0%	(=$G$60)

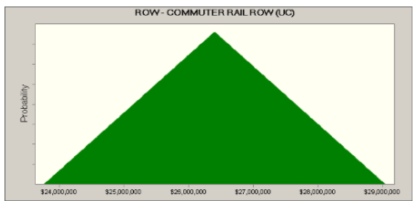


Assumption: ROW - COMMUTER RAIL ROW (UC) **Cell: E114**

Includes cost for removal of structures

Triangular distribution with parameters:

Minimum	$23,760,000	(=$F$114)
Likeliest	$26,400,000	(=$E$114)
Maximum	$29,040,000	(=$G$114)



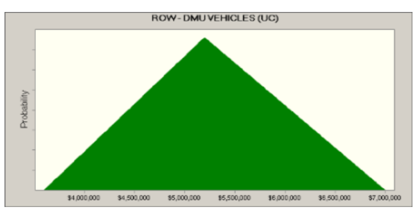
Assumption: ROW - DMU VEHICLES (UC) **Cell: E116**

Based on RTD Annual Program Review
Range based on Nationwide review of costs (Jacobs)

THREATS: Current design has not received FRA approval, Changes in FRA regulations
OPPORTUNITIES:

Triangular distribution with parameters:

Minimum	$3,600,000	(=$F$116)
Likeliest	$5,200,000	(=$E$116)
Maximum	$7,000,000	(=$G$116)



Assumption: ROW - FEEDER BUS VEHICLES (UC) **Cell: E115**

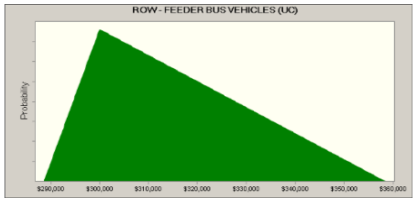
Cost based on RTD Program Review
Maximum is based on nationwide (APTA) cost of buses

Triangular distribution with parameters:

Minimum	$288,600	(=$F$115)
Likeliest	$300,000	(=$E$115)

Maximum	$358,400	(=$G$115)

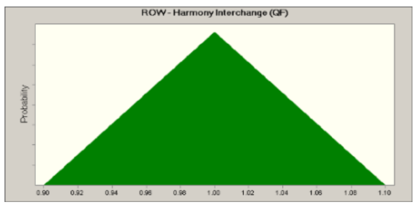
Assumption: ROW - FEEDER BUS VEHICLES (UC) (cont'd) **Cell: E115**



Assumption: ROW - Harmony Interchange (QF) **Cell: H134**

Triangular distribution with parameters:

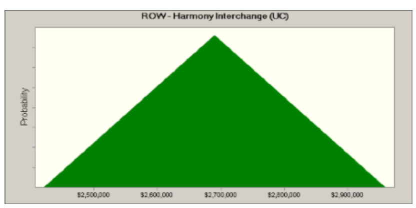
Minimum	0.90	(=$I$134)
Likeliest	1.00	(=$H$134)
Maximum	1.10	(=$J$134)



Assumption: ROW - Harmony Interchange (UC) **Cell: E134**

Triangular distribution with parameters:

Minimum	$2,421,000	(=$F$134)
Likeliest	$2,690,000	(=$E$134)
Maximum	$2,959,000	(=$G$134)

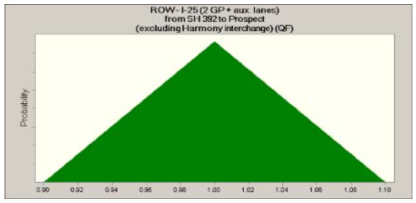


Assumption: ROW - I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony **Cell: H128**

Triangular distribution with parameters:

Minimum	0.90	(=$I$128)
Likeliest	1.00	(=$H$128)
Maximum	1.10	(=$J$128)

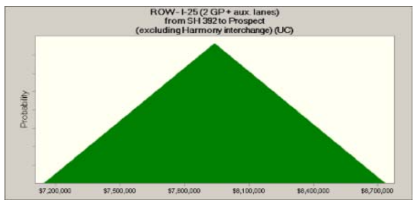
Assumption: ROW - I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony **Cell: H128**



Assumption: ROW - I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony **Cell: E128**

Triangular distribution with parameters:

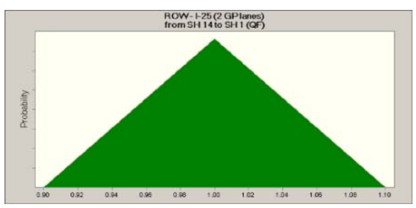
Minimum	$7,146,000	(=$F$128)
Likeliest	$7,940,000	(=$E$128)
Maximum	$8,734,000	(=$G$128)



Assumption: ROW - I-25 (2 GP lanes) from SH 14 to SH 1 (QF) **Cell: H133**

Triangular distribution with parameters:

Minimum	0.90	(=$I$133)
Likeliest	1.00	(=$H$133)
Maximum	1.10	(=$J$133)

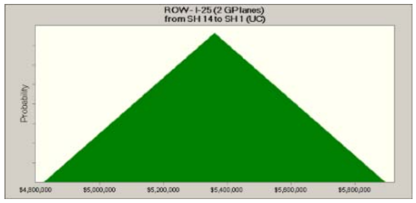


Assumption: ROW - I-25 (2 GP lanes) from SH 14 to SH 1 (UC) **Cell: E133**

Triangular distribution with parameters:

Minimum	$4,824,000	(=$F$133)
Likeliest	$5,360,000	(=$E$133)
Maximum	$5,896,000	(=$G$133)

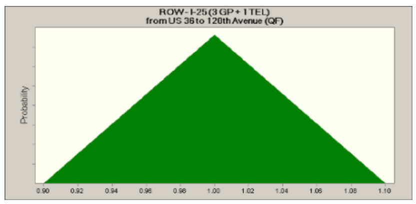
Assumption: ROW - I-25 (2 GP lanes) from SH 14 to SH 1 (UC) (cont'd) **Cell: E133**



Assumption: ROW - I-25 (3 GP + 1 TEL) from US 36 to 120th Avenue (QF) **Cell: H123**

Triangular distribution with parameters:

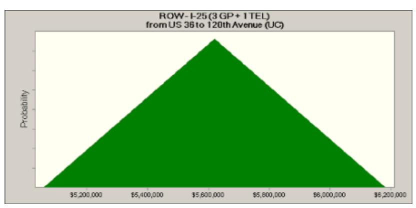
Minimum	0.90	(=$I$123)
Likeliest	1.00	(=$H$123)
Maximum	1.10	(=$J$123)



Assumption: ROW - I-25 (3 GP + 1 TEL) from US 36 to 120th Avenue (UC) **Cell: E123**

Triangular distribution with parameters:

Minimum	$5,058,000	(=$F$123)
Likeliest	$5,620,000	(=$E$123)
Maximum	$6,182,000	(=$G$123)

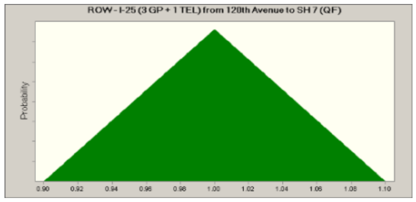


Assumption: ROW - I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7 (QF) **Cell: H131**

Triangular distribution with parameters:

Minimum	0.90	(=$I$131)
Likeliest	1.00	(=$H$131)
Maximum	1.10	(=$J$131)

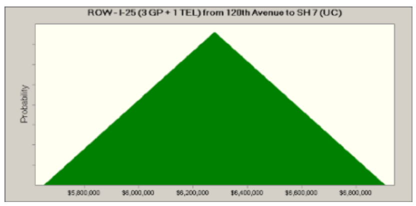
Assumption: ROW - I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7 (QF) (cont'd) **Cell: H131**



Assumption: ROW - I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7 (UC) **Cell: E131**

Triangular distribution with parameters:

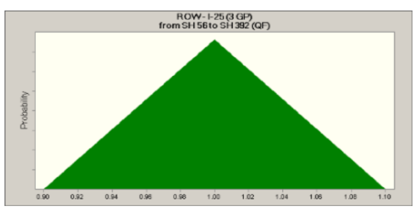
Minimum	$5,652,000	(=$F$131)
Likeliest	$6,280,000	(=$E$131)
Maximum	$6,908,000	(=$G$131)



Assumption: ROW - I-25 (3 GP) from SH 56 to SH 392 (QF) **Cell: H132**

Triangular distribution with parameters:

Minimum	0.90	(=$I$132)
Likeliest	1.00	(=$H$132)
Maximum	1.10	(=$J$132)

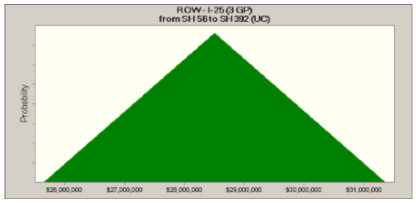


Assumption: ROW - I-25 (3 GP) from SH 56 to SH 392 (UC) **Cell: E132**

Triangular distribution with parameters:

Minimum	$25,650,000	(=$F$132)
Likeliest	$28,500,000	(=$E$132)
Maximum	$31,350,000	(=$G$132)

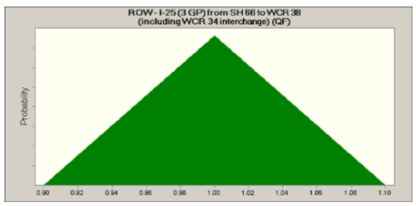
Assumption: ROW - I-25 (3 GP) from SH 56 to SH 392 (UC) (cont'd) **Cell: E132**



Assumption: ROW - I-25 (3 GP) from SH 66 to WCR 38 (including WCR 34 interchange) (QF) **Cell: H125**

Triangular distribution with parameters:

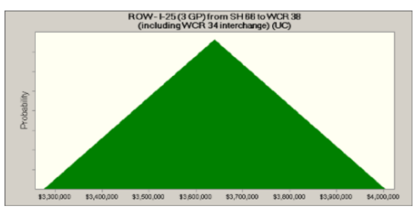
Minimum	0.90	(=$I$125)
Likeliest	1.00	(=$H$125)
Maximum	1.10	(=$J$125)



Assumption: ROW - I-25 (3 GP) from SH 66 to WCR 38 (including WCR 34 interchange) (UC) **Cell: E125**

Triangular distribution with parameters:

Minimum	$3,276,000	(=$F$125)
Likeliest	$3,640,000	(=$E$125)
Maximum	$4,004,000	(=$G$125)

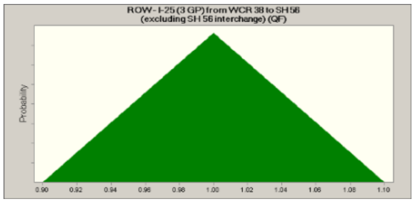


Assumption: ROW - I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange) (QF) **Cell: H126**

Triangular distribution with parameters:

Minimum	0.90	(=$I$126)
Likeliest	1.00	(=$H$126)
Maximum	1.10	(=$J$126)

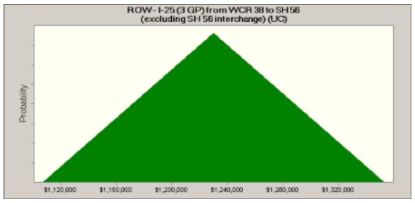
Assumption: ROW - I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange) (QF) **Cell: H126**



Assumption: ROW - I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange) (UC) **Cell: E126**

Triangular distribution with parameters:

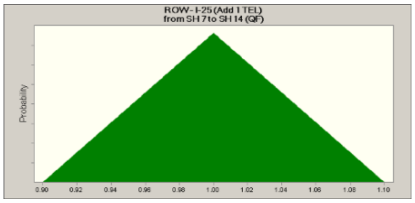
Minimum	$1,107,000	(=$F$126)
Likeliest	$1,230,000	(=$E$126)
Maximum	$1,353,000	(=$G$126)



Assumption: ROW - I-25 (Add 1 TEL) from SH 7 to SH 14 (QF) **Cell: H136**

Triangular distribution with parameters:

Minimum	0.90	(=$I$136)
Likeliest	1.00	(=$H$136)
Maximum	1.10	(=$J$136)

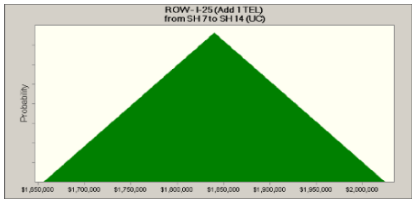


Assumption: ROW - I-25 (Add 1 TEL) from SH 7 to SH 14 (UC) **Cell: E136**

Triangular distribution with parameters:

Minimum	$1,656,000	(=$F$136)
Likeliest	$1,840,000	(=$E$136)
Maximum	$2,024,000	(=$G$136)

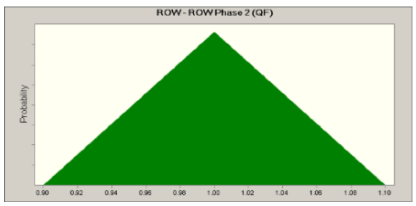
Assumption: ROW - I-25 (Add 1 TEL) from SH 7 to SH 14 (UC) (cont'd) **Cell: E136**



Assumption: ROW - ROW Phase 2 (QF) **Cell: H130**

Triangular distribution with parameters:

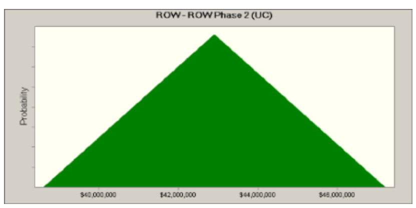
Minimum	0.90	(=$I$130)
Likeliest	1.00	(=$H$130)
Maximum	1.10	(=$J$130)



Assumption: ROW - ROW Phase 2 (UC) **Cell: E130**

Triangular distribution with parameters:

Minimum	$38,610,000	(=$F$130)
Likeliest	$42,900,000	(=$E$130)
Maximum	$47,190,000	(=$G$130)

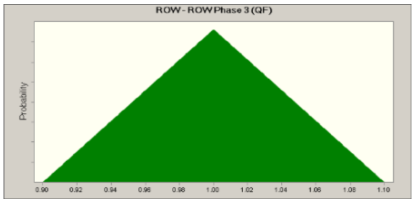


Assumption: ROW - ROW Phase 3 (QF) **Cell: H135**

Triangular distribution with parameters:

Minimum	0.90	(=$I$135)
Likeliest	1.00	(=$H$135)
Maximum	1.10	(=$J$135)

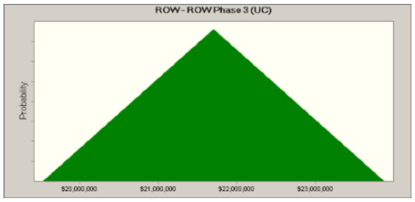
Assumption: ROW - ROW Phase 3 (QF) (cont'd) **Cell: H135**



Assumption: ROW - ROW Phase 3 (UC) **Cell: E135**

Triangular distribution with parameters:

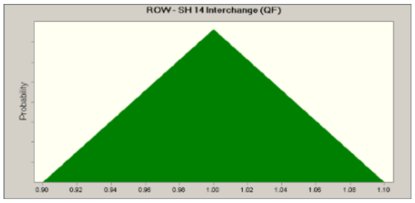
Minimum	$19,530,000	(=$F$135)
Likeliest	$21,700,000	(=$E$135)
Maximum	$23,870,000	(=$G$135)



Assumption: ROW - SH 14 Interchange (QF) **Cell: H129**

Triangular distribution with parameters:

Minimum	0.90	(=$I$129)
Likeliest	1.00	(=$H$129)
Maximum	1.10	(=$J$129)

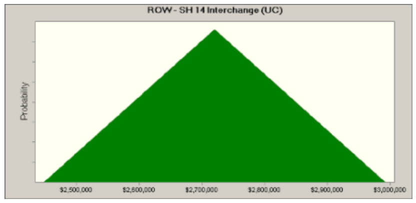


Assumption: ROW - SH 14 Interchange (UC) **Cell: E129**

Triangular distribution with parameters:

Minimum	$2,448,000	(=$F$129)
Likeliest	$2,720,000	(=$E$129)
Maximum	$2,992,000	(=$G$129)

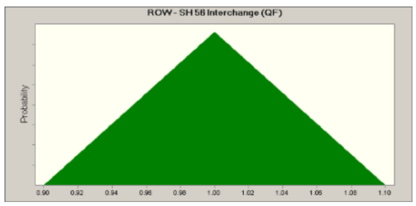
Assumption: ROW - SH 14 Interchange (UC) (cont'd) **Cell: E129**



Assumption: ROW - SH 56 Interchange (QF) **Cell: H127**

Triangular distribution with parameters:

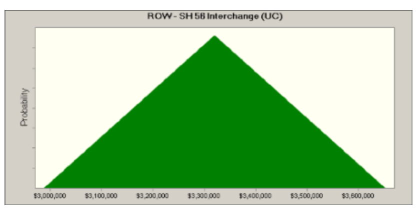
Minimum	0.90	(=$I$127)
Likeliest	1.00	(=$H$127)
Maximum	1.10	(=$J$127)



Assumption: ROW - SH 56 Interchange (UC) **Cell: E127**

Triangular distribution with parameters:

Minimum	$2,988,000	(=$F$127)
Likeliest	$3,320,000	(=$E$127)
Maximum	$3,652,000	(=$G$127)

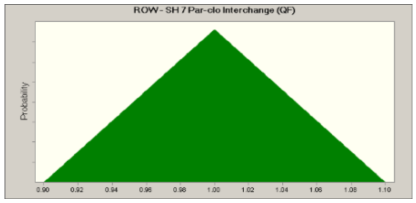


Assumption: ROW - SH 7 Par-clo Interchange (QF) **Cell: H124**

Triangular distribution with parameters:

Minimum	0.90	(=$I$124)
Likeliest	1.00	(=$H$124)
Maximum	1.10	(=$J$124)

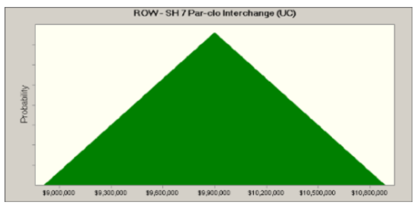
Assumption: ROW - SH 7 Par-clo Interchange (QF) (cont'd) **Cell: H124**



Assumption: ROW - SH 7 Par-clo Interchange (UC) **Cell: E124**

Triangular distribution with parameters:

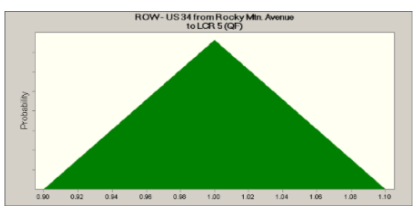
Minimum	$8,910,000	(=$F$124)
Likeliest	$9,900,000	(=$E$124)
Maximum	$10,890,000	(=$G$124)



Assumption: ROW - US 34 from Rocky Mtn. Avenue to LCR 5 (QF) **Cell: H137**

Triangular distribution with parameters:

Minimum	0.90	(=$I$137)
Likeliest	1.00	(=$H$137)
Maximum	1.10	(=$J$137)

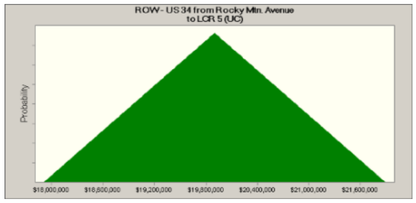


Assumption: ROW - US 34 from Rocky Mtn. Avenue to LCR 5 (UC) **Cell: E137**

Triangular distribution with parameters:

Minimum	$17,910,000	(=$F$137)
Likeliest	$19,900,000	(=$E$137)
Maximum	$21,890,000	(=$G$137)

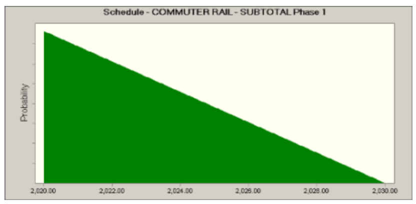
Assumption: ROW - US 34 from Rocky Mtn. Avenue to LCR 5 (UC) (cont'd) **Cell: E137**



Assumption: Schedule - COMMUTER RAIL - SUBTOTAL Phase 1 **Cell: D147**

Triangular distribution with parameters:

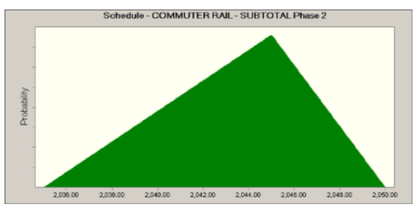
Minimum	2,020.00	(=$E$147)
Likeliest	2,020.00	(=$D$147)
Maximum	2,030.00	(=$F$147)



Assumption: Schedule - COMMUTER RAIL - SUBTOTAL Phase 2 **Cell: D148**

Triangular distribution with parameters:

Minimum	2,035.00	(=$E$148)
Likeliest	2,045.00	(=$D$148)
Maximum	2,050.00	(=$F$148)

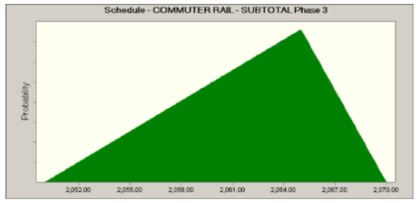


Assumption: Schedule - COMMUTER RAIL - SUBTOTAL Phase 3 **Cell: D149**

Triangular distribution with parameters:

Minimum	2,050.00	(=$E$149)
Likeliest	2,065.00	(=$D$149)
Maximum	2,070.00	(=$F$149)

Assumption: Schedule - COMMUTER RAIL - SUBTOTAL Phase 3 (cont'd) **Cell: D149**

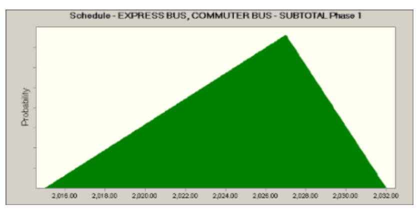


Assumption: Schedule - EXPRESS BUS, COMMUTER BUS - SUBTOTAL Phase 1 **Cell: D143**

THREATS: ROW preservation most likely will occur at the end of Phase I - Highway improvements are higher priority

Triangular distribution with parameters:

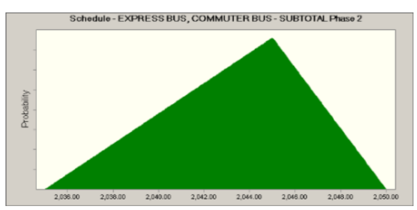
Minimum	2,015.00	(=$E$143)
Likeliest	2,027.00	(=$D$143)
Maximum	2,032.00	(=$F$143)



Assumption: Schedule - EXPRESS BUS, COMMUTER BUS - SUBTOTAL Phase 2 **Cell: D144**

Triangular distribution with parameters:

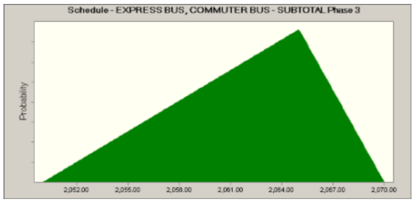
Minimum	2,035.00	(=$E$144)
Likeliest	2,045.00	(=$D$144)
Maximum	2,050.00	(=$F$144)



Assumption: Schedule - EXPRESS BUS, COMMUTER BUS - SUBTOTAL Phase 3 **Cell: D145**

Triangular distribution with parameters:

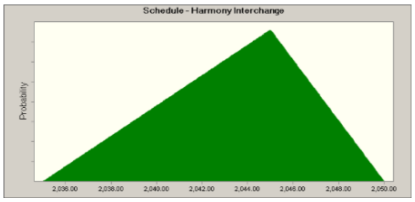
Minimum	2,050.00	(=$E$145)
Likeliest	2,065.00	(=$D$145)
Maximum	2,070.00	(=$F$145)



Assumption: Schedule - Harmony Interchange **Cell: K134**

Triangular distribution with parameters:

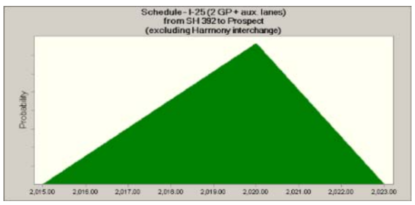
Minimum	2,035.00	(=$L$134)
Likeliest	2,045.00	(=$K$134)
Maximum	2,050.00	(=$M$134)



Assumption: Schedule - I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Har **Cell: K128**

Triangular distribution with parameters:

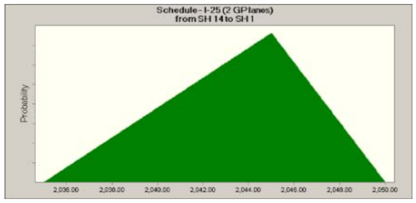
Minimum	2,015.00	(=$L$128)
Likeliest	2,020.00	(=$K$128)
Maximum	2,023.00	(=$M$128)



Assumption: Schedule - I-25 (2 GP lanes) from SH 14 to SH 1 **Cell: K133**

Triangular distribution with parameters:

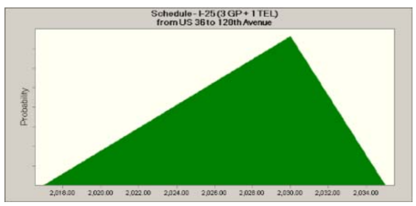
Minimum	2,035.00	(=$L$133)
Likeliest	2,045.00	(=$K$133)
Maximum	2,050.00	(=$M$133)



Assumption: Schedule - I-25 (3 GP + 1 TEL) from US 36 to 120th Avenue **Cell: K123**

Triangular distribution with parameters:

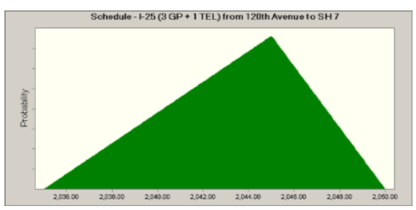
Minimum	2,017.00	(=$L$123)
Likeliest	2,030.00	(=$K$123)
Maximum	2,035.00	(=$M$123)



Assumption: Schedule - I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7 **Cell: K131**

Triangular distribution with parameters:

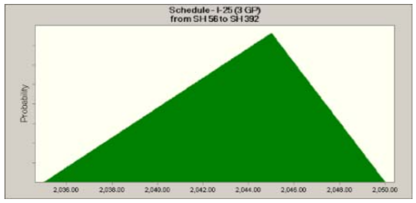
Minimum	2,035.00	(=$L$131)
Likeliest	2,045.00	(=$K$131)
Maximum	2,050.00	(=$M$131)



Assumption: Schedule - I-25 (3 GP) from SH 56 to SH 392 **Cell: K132**

Triangular distribution with parameters:

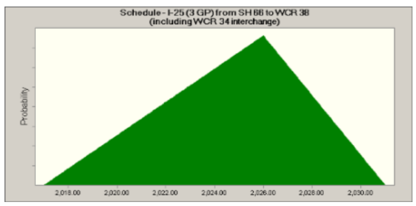
Minimum	2,035.00	(=$L$132)
Likeliest	2,045.00	(=$K$132)
Maximum	2,050.00	(=$M$132)



Assumption: Schedule - I-25 (3 GP) from SH 66 to WCR 38 (including WCR 34 interchange) **Cell: K125**

Triangular distribution with parameters:

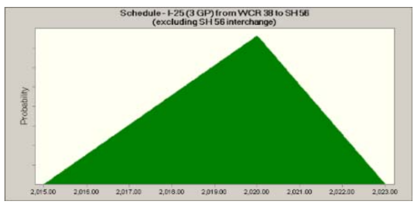
Minimum	2,017.00	(=$L$125)
Likeliest	2,026.00	(=$K$125)
Maximum	2,031.00	(=$M$125)



Assumption: Schedule - I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange) **Cell: K126**

Triangular distribution with parameters:

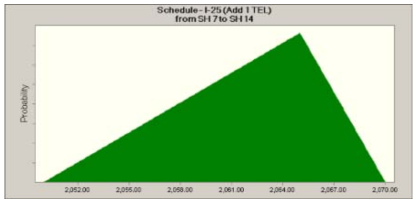
Minimum	2,015.00	(=$L$126)
Likeliest	2,020.00	(=$K$126)
Maximum	2,023.00	(=$M$126)



Assumption: Schedule - I-25 (Add 1 TEL) from SH 7 to SH 14 **Cell: K136**

Triangular distribution with parameters:

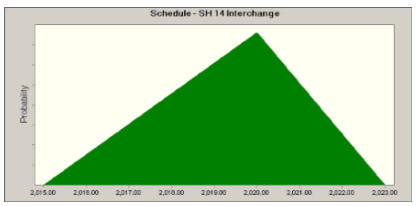
Minimum	2,050.00	(=$L$136)
Likeliest	2,065.00	(=$K$136)
Maximum	2,070.00	(=$M$136)



Assumption: Schedule - SH 14 Interchange **Cell: K129**

Triangular distribution with parameters:

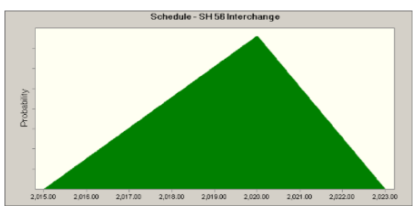
Minimum	2,015.00	(=$L$129)
Likeliest	2,020.00	(=$K$129)
Maximum	2,023.00	(=$M$129)



Assumption: Schedule - SH 56 Interchange **Cell: K127**

Triangular distribution with parameters:

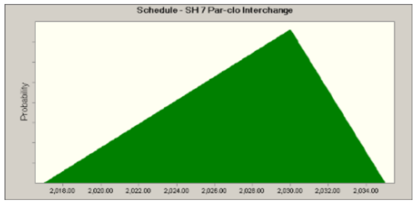
Minimum	2,015.00	(=$L$127)
Likeliest	2,020.00	(=$K$127)
Maximum	2,023.00	(=$M$127)



Assumption: Schedule - SH 7 Par-clo Interchange **Cell: K124**

Triangular distribution with parameters:

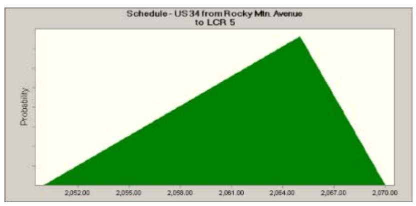
Minimum	2,017.00	(=$L$124)
Likeliest	2,030.00	(=$K$124)
Maximum	2,035.00	(=$M$124)



Assumption: Schedule - US 34 from Rocky Mtn. Avenue to LCR 5 **Cell: K137**

Triangular distribution with parameters:

Minimum	2,050.00	(=$L$137)
Likeliest	2,065.00	(=$K$137)
Maximum	2,070.00	(=$M$137)

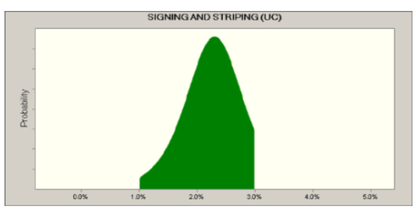


Assumption: SIGNING AND STRIPING (UC) **Cell: E36**

Student's t distribution with parameters:

Midpoint	2.3%	(=$E$36)
Scale	0.5%	
Deg. Freedom	5	

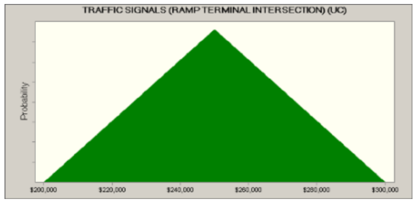
Selected range is from 1.0% to 3.0%



Assumption: TRAFFIC SIGNALS (RAMP TERMINAL INTERSECTION) (UC) **Cell: E46**

Triangular distribution with parameters:

Minimum	$200,000	(=$F$46)
Likeliest	$250,000	(=$E$46)
Maximum	$300,000	(=$G$46)



Assumption: UNFORESEEN CONDITIONS (UC) **Cell: E48**

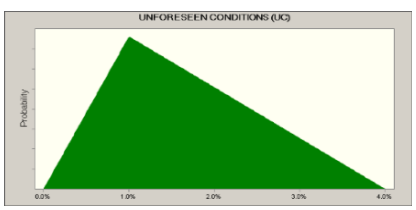
Includes cost of unknown unknowns
Percentage of construction cost

THREATS: potential for coal mine subsidence, 60-year horizon of project (scope creep)

OPPORTUNITIES: existing roadway, very low complexity project, no major issues with hazardous materials/historic properties anticipated due to completed studies, low chance of increasing scope of project, projects recently completed along corridor

Triangular distribution with parameters:

Minimum	0.0%	(=$F$48)
Likeliest	1.0%	(=$E$48)
Maximum	4.0%	(=$G$48)



Assumption: UNFORESEEN CONDITIONS (UC) **Cell: E66**

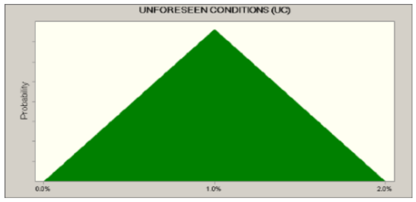
THREATS: requirements of operating agency, requirements of locals, subsurface conditions, hazardous materials

OPPORTUNITIES: requirements of operating agency, construction in localized areas for queue jumps

Triangular distribution with parameters:

Minimum	0.0%	(=$F$66)

Likeliest	1.0%	(=$E$66)
Maximum	2.0%	(=$G$66)

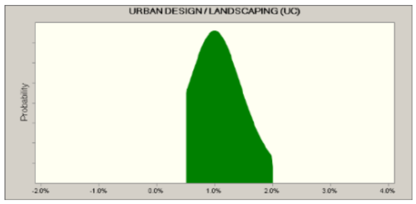


Assumption: URBAN DESIGN / LANDSCAPING (UC) **Cell: E38**

Student's t distribution with parameters:

Midpoint	1.0%	(=$E$38)
Scale	0.5%	
Deg. Freedom	5	

Selected range is from 0.5% to 2.0%

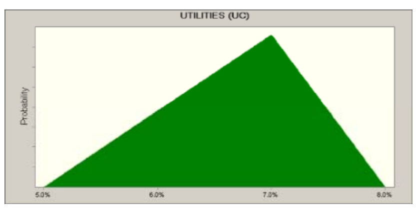


Assumption: UTILITIES (UC) **Cell: E67**

Based on construction in urban areas

Triangular distribution with parameters:

Minimum	5.0%	(=$F$67)
Likeliest	7.0%	(=$E$67)
Maximum	8.0%	(=$G$67)



Assumption: UTILITIES (UC) **Cell: E49**

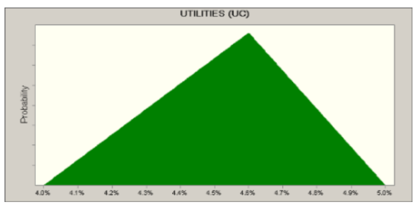
-Percentage of total construction cost
-Includes cost for relocations, design

OPPORTUNITIES: no parallel utilities in ROW, most crossing utilities at interchanges, 5-20% design level, access control limits the amount of utilities in interstate ROW

THREATS: 5-20% design level, potentially more cost in urban sections of project, additonal utilities in the future

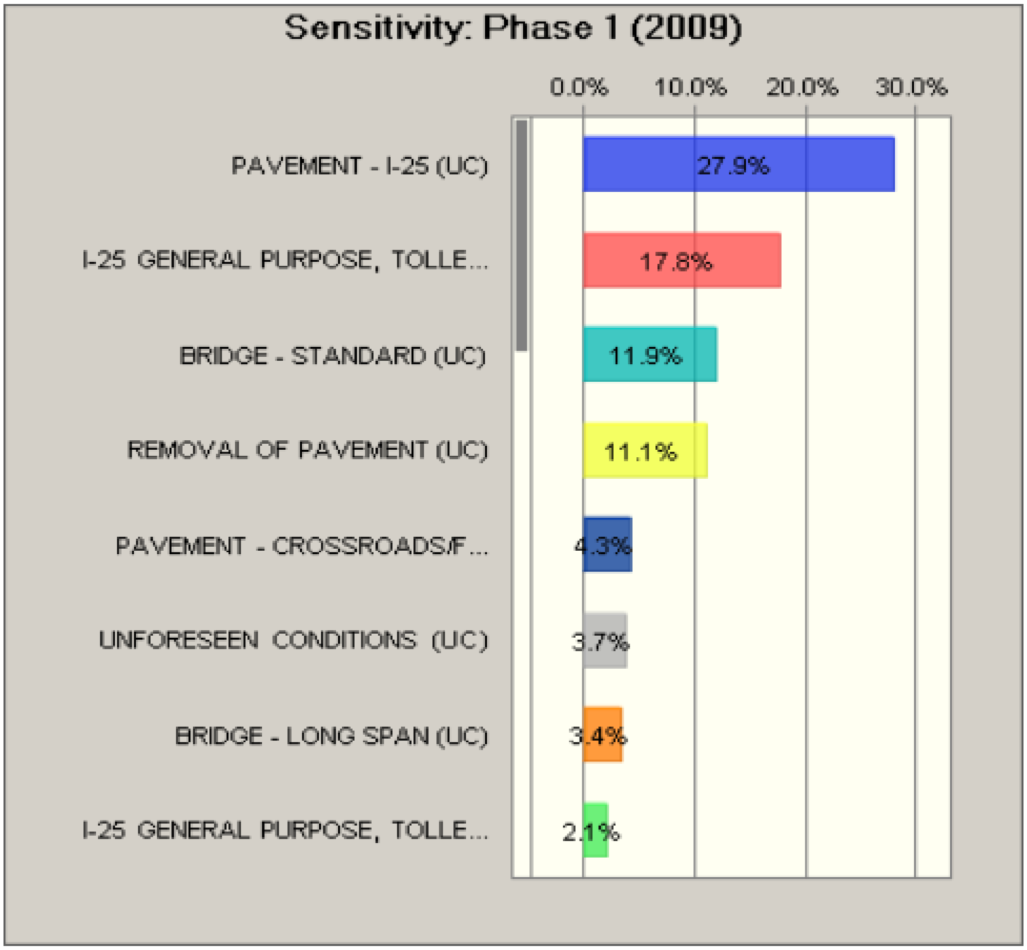
Triangular distribution with parameters:

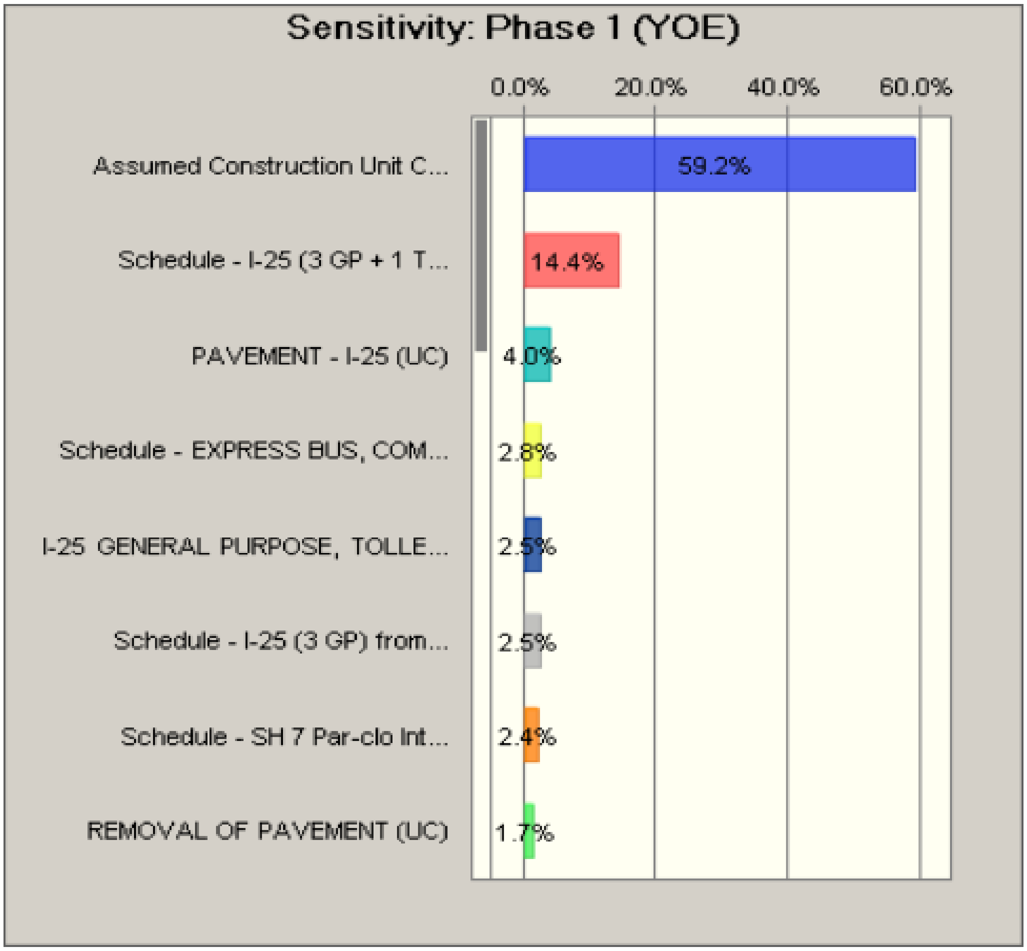
Minimum	4.0%	(=$F$49)
Likeliest	4.6%	(=$E$49)
Maximum	5.0%	(=$G$49)



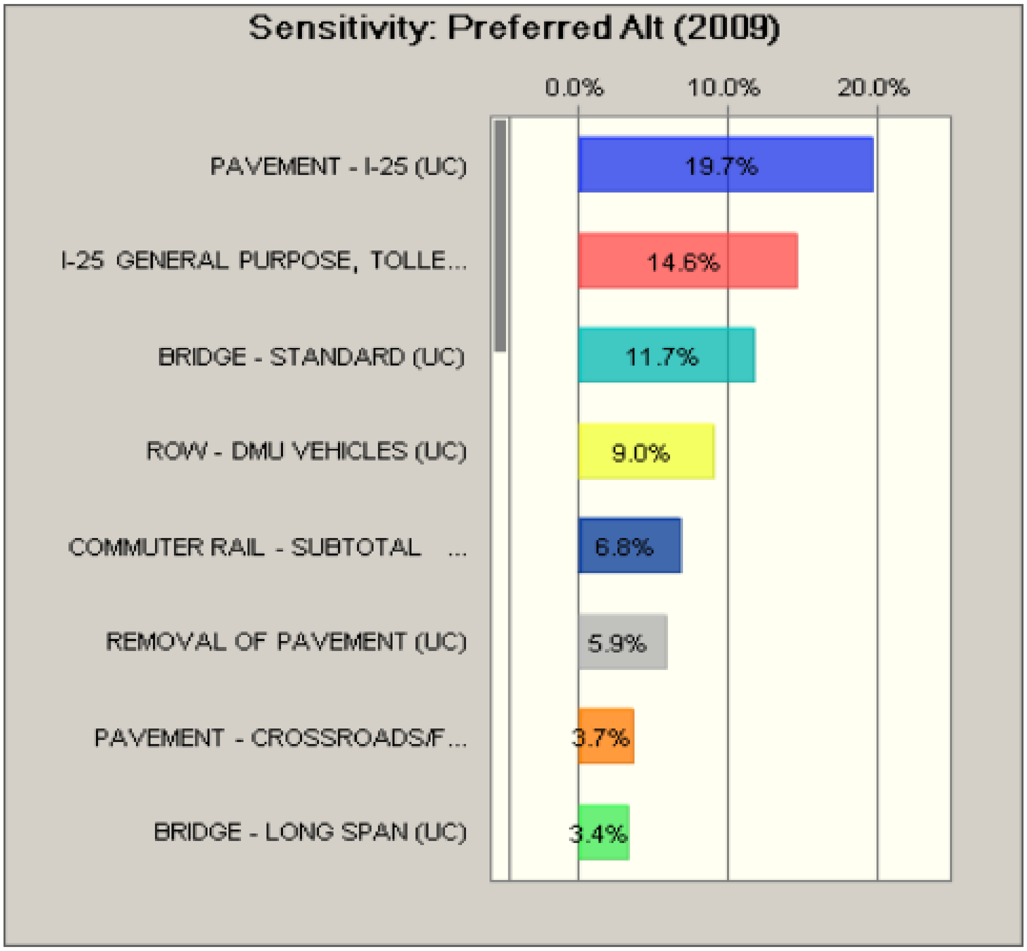
End of Assumptions

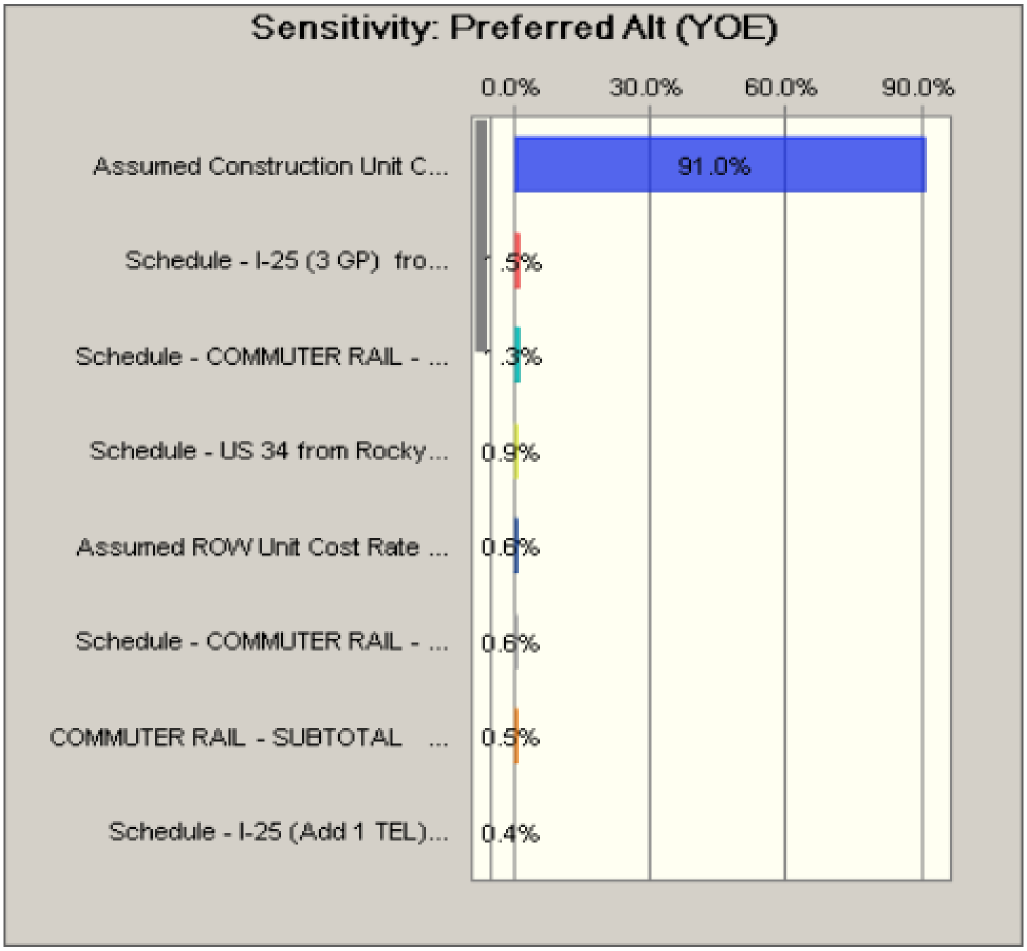
Sensitivity Charts





Sensitivity: Phase 1 (YOE)
0.0%
20.0%
40.0%
60.0%
Assumed Construction Unit C...
59.2%
Schedule - I-25 (3 GP + 1 T...
14.4%
PAVEMENT - I-25 (UC)
4.0%
Schedule - EXPRESS BUS, COM...
2.8%
I-25 GENERAL PURPOSE, TOLLE...
2.5%
Schedule - I-25 (3 GP) from...
2.5%
Schedule - SH 7 Par-clo Int...
2.4%
REMOVAL OF PAVEMENT (UC)
1.7%


Sensitivity: Preferred Alt (2009)
0.0%
10.0%
20.0%
PAVEMENT - I-25 (UC)
19.7%
I-25 GENERAL PURPOSE, TOLLE...
14.6%
BRIDGE - STANDARD (UC)
11.7%
ROW - DMU VEHICLES (UC)
9.0%
COMMUTER RAIL - SUBTOTAL ...
6.8%
REMOVAL OF PAVEMENT (UC)
5.9%
PAVEMENT - CROSSROADS/F...
3.7%
BRIDGE - LONG SPAN (UC)
3.4%



End of Sensitivity Charts

Appendix E

CER Closeout Presentation

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North I-25 Project

July 12-15, 2010

Denver, CO

Cost Estimate Review Closeout

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NORTH I-25 EIS

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Cost Estimate Review Objective

Conduct an unbiased risk-based review to verify the accuracy and reasonableness of the current total cost estimate to complete ***North I-25 project*** and to develop a probability range for the cost estimate that represents the project's current stage of design.

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Cost Estimate Review
Financial Plans (SAFETEA-LU)

Financial Plans required at the following thresholds:

Consider all costs - Engineering, Construction, ROW, Utilities…
in Year of Expenditure (YOE) Dollars

- **Over $500 Million**
  Major Project – Requires concurrence from FHWA's HQ
- **$100 to $500 Million**
  Required, however review is at FHWA Division's discretion

"Cost to complete estimates based on reasonable assumptions as determined by the Secretary (FHWA)"

Reasonable assumptions = Risk based analysis

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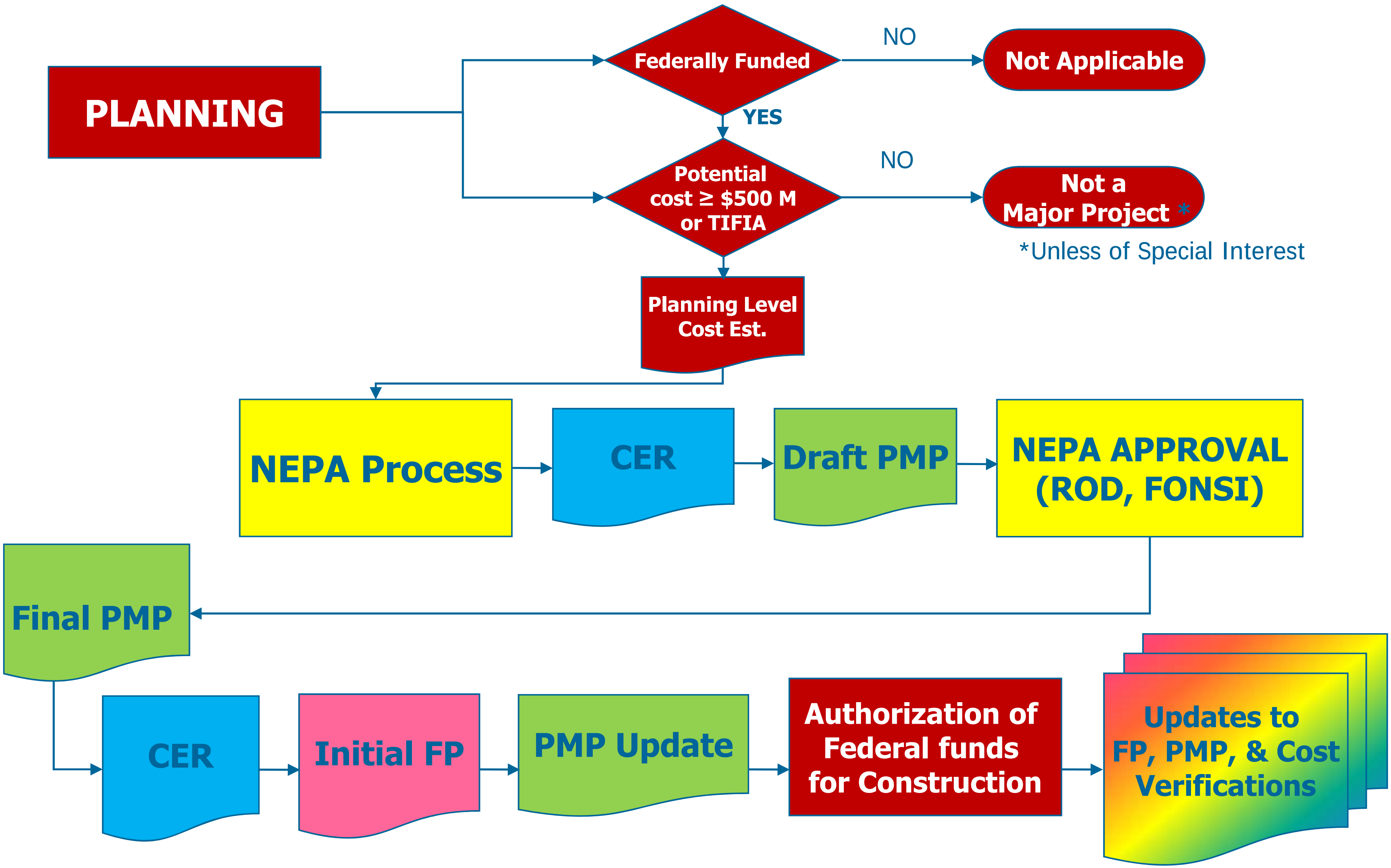
Major Project Process



Review Participants

- FHWA Division Office, Resource Center and HQ Major Project Technical Experts
- Colorado DOT (CDOT)
- North I-25 Project Consultants (Felsburg Holt & Ullevig, Jacobs)

Review Agenda

MONDAY, July 12

Field Visit, Project Overview by Project Personnel
CER Introduction by FHWA
Define Escalation, Threats/Opportunities
Escalation
Removals (demolition)
Miscellaneous Bid Items

TUESDAY, July 13

Roadway Base and Surface Treatments
Earthwork, Landscaping, Roadside Features, Erosion Control
Bridges, Retaining Walls, Sound Walls
Unforeseen Conditions
Utilities, Right of Way
Mobilization, Design, Construction Engineering

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Review Agenda

WEDNESDAY, July 14

Express and Commuter Bus
Carpool Lots
Commuter Rail
Lighting, Signals, Signs, Pavement Markings
ITS, Managed Lanes System
Construction Traffic Control
Drainage

THURSDAY, July 15

Begin findings and close out Presentation preparation
Dry Run of close out presentation
Closeout Presentation

Documentation Provided

- Project Cost Estimate and Schedule, History and Basis
- Draft Environmental Impact Statement
- Project Schematics and Aerial Layouts
- Comparable Project Data
- Inflation Data (CCI, MPOs, RTD, etc.)

Review Methodology

- **Review Team Input**
  - ❖FHWA
  - ❖State DOT and Regional Transportation District
  - ❖Project Consultants
- **Estimate Review**
  - ❖Understanding of estimate development process
  - ❖Threats and Opportunities for various items
  - ❖Contingencies and Projected Escalation Rates

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Review Methodology (continued)

- Threats and Opportunities Analysis
  - Reviewed major cost elements
  - Developed impacts and probabilities for significant project threats and opportunities
  - Developed probability assumption curves

- Performed Monte Carlo simulation to generate a project estimate forecast as a range

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Basis of Review

- Review based on estimates provided by the Team in advance with revisions made during the review
- Review to determine the reasonableness of assumptions used in the estimate
- Not an independent FHWA estimate
- Did not verify quantities and unit prices

Review Findings

Good Estimating Practices

- Use of unit prices and historical percentages from recent similar projects in the I-25 corridor
- More detailed estimate than typical at this stage of a project
- Up front consideration of variation in prices and quantities
- Used lessons learned from previous CERs
- Involvement of CDOT executive/region management

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Base Estimate Results

	Phase 1	Preferred Alt
Adjusted Estimate (2009)	$640.9m	$2,178.5m
Post-Review (2009 – 70%)	$677.3m	$2,144.5m
Post-Review YOE (70%)	**$1,271.2m**	$9,474.9m

Estimate Adjustments

- **Inflation Factor**
  - Lowered to 3.3% (from 4.35%)
    - Assumption curve from 2.7% to 5.3%
  - Separate factor for ROW (5%)
    - Assumption curve from 4% to 6%

- **Reviewed and Adjusted Unit prices, e.g.**
  - Concrete pavement lowered, $41/sy to $38.50/sy
  - Type 7 guardrail lowered from $90/lf to $75/lf
  - Cable guardrail raised, $10/lf to $20/lf
  - Erosion control (highway) allowance from 3.1% to 5%
  - Mobilization (highway - R4) from 15.7% to 11.0%
  - Retaining Wall 10'-20' (rail) from $700/lf to $690/lf
  - Unforeseen Condition (rail) from 1% to 5%
  - ROW (rail) from $24.8m to $26.4m

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Estimate Allowances

- Unforeseen Conditions
  - 1% roadway, 5% commuter rail, 1% express bus
- Miscellaneous Bid Items
  - 7.7% roadway, 10% rail, 8.8% bus

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Threats

- Funding availability
  - Letting delay (increase in inflation)
- Market conditions
  - ❖ Material prices (i.e. steel, fuel)
  - ❖ Unknown future inflation
- Environmental permit delays
  - ❖ Regulation changes
- Design, criteria changes, soils
- Uncertainty on owner/operator of rail and bus
- Rail line on new alignment
- Railroad agreements, payments, design reviews
- Land use changes (ROW, ridership)
- Project timeframe (65 years)
- Unknown procurement method

Opportunities

- Market conditions
  - ❖ Material prices (i.e. steel, fuel)
  - ❖ Potential reduction in inflation
  - ❖ Better pricing through competition
- Technology
  - – Bridges, ITS
- Retaining Wall/ROW trade-off
- Final Design
- Schedule Acceleration – Funding availability
- Innovative Procurement
- More Commuter Rail Experience
- Not overly complex

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Threats and Opportunities incorporated into the estimate

- Developed assumption curves for quantities and unit prices that model the cost and probability impact of the threat/opportunity
- Developed assumption curves for high cost items – 150 curves
- Crystal Ball software
    - 10,000 Monte Carlo iterations

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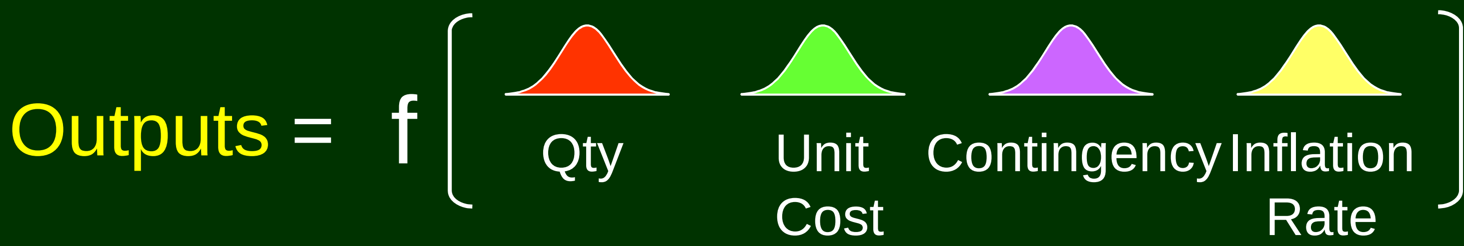
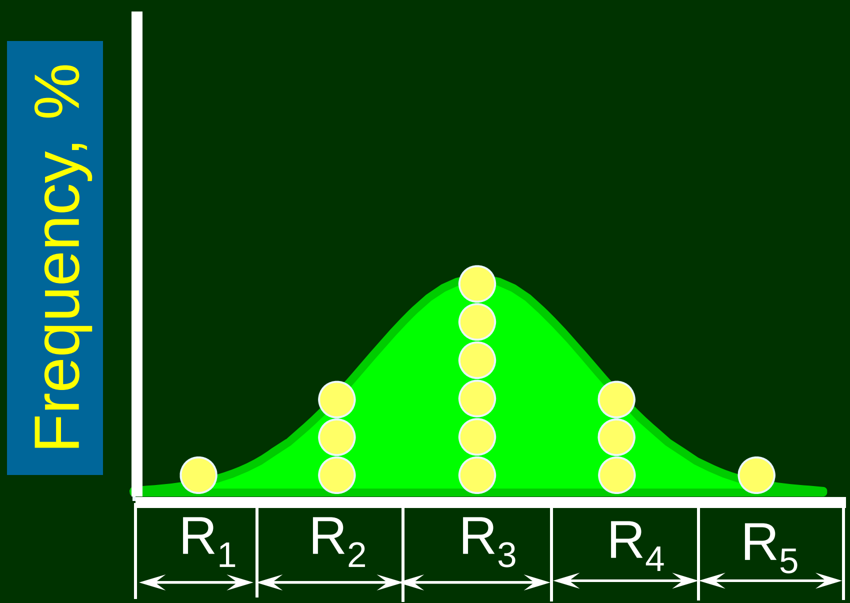
Monte-Carlo Simulation

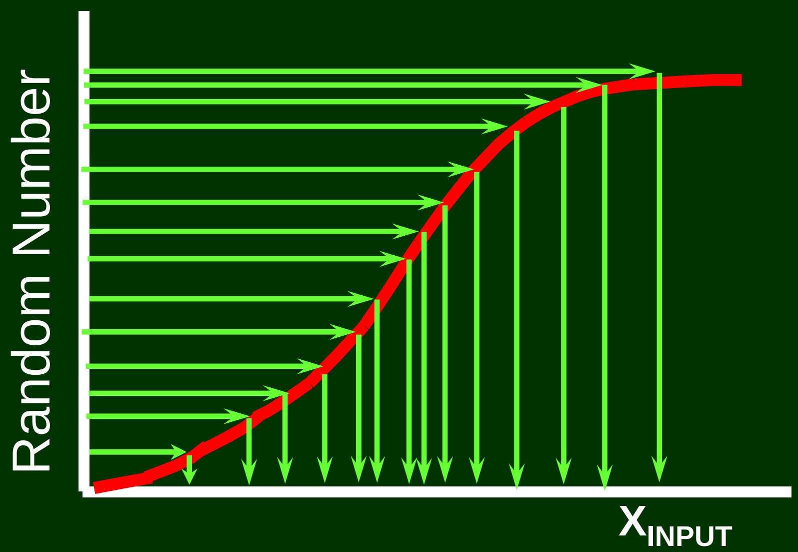
Random Numbers and Outputs

y = f(x) *or* y is a function of x



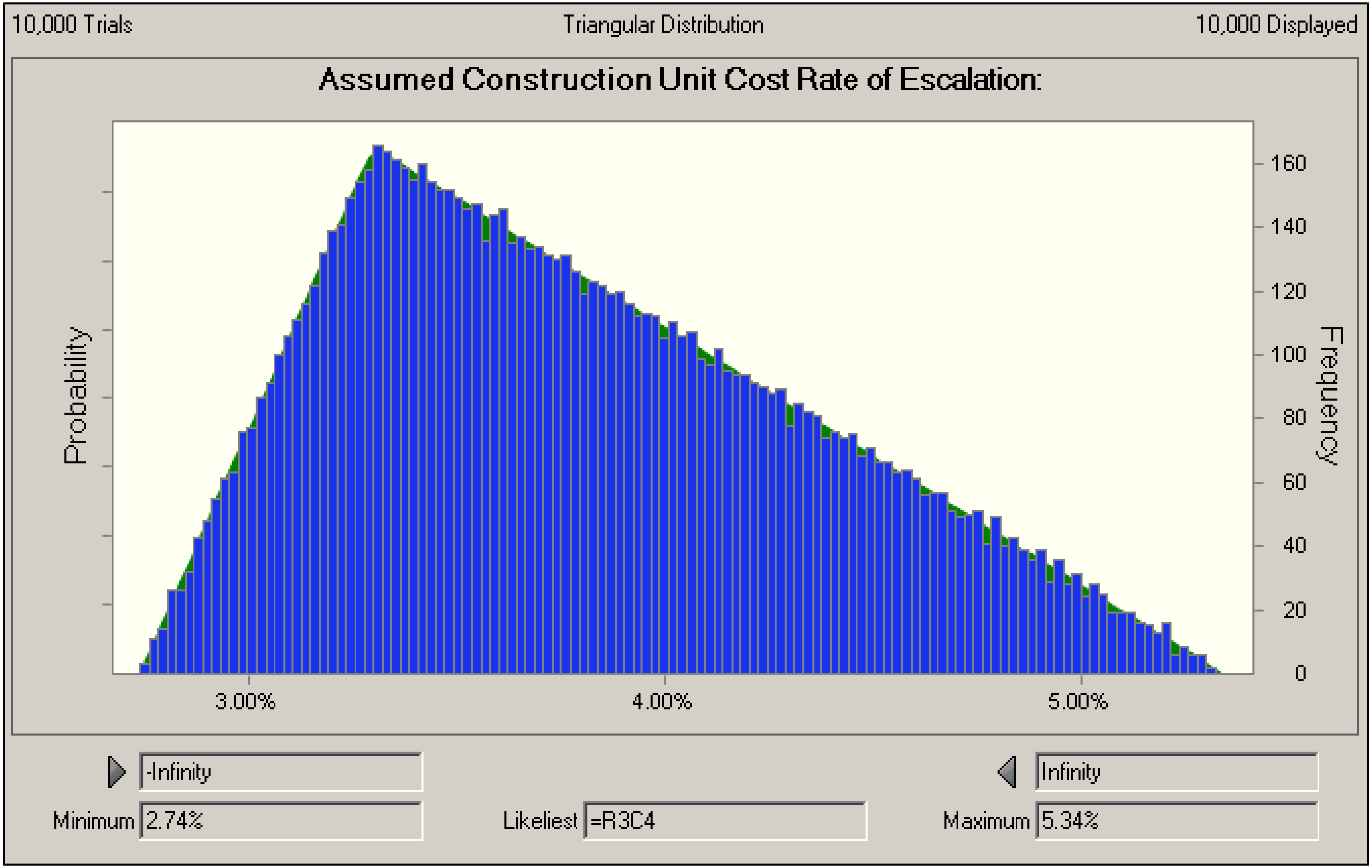


Outputs: Binned Results



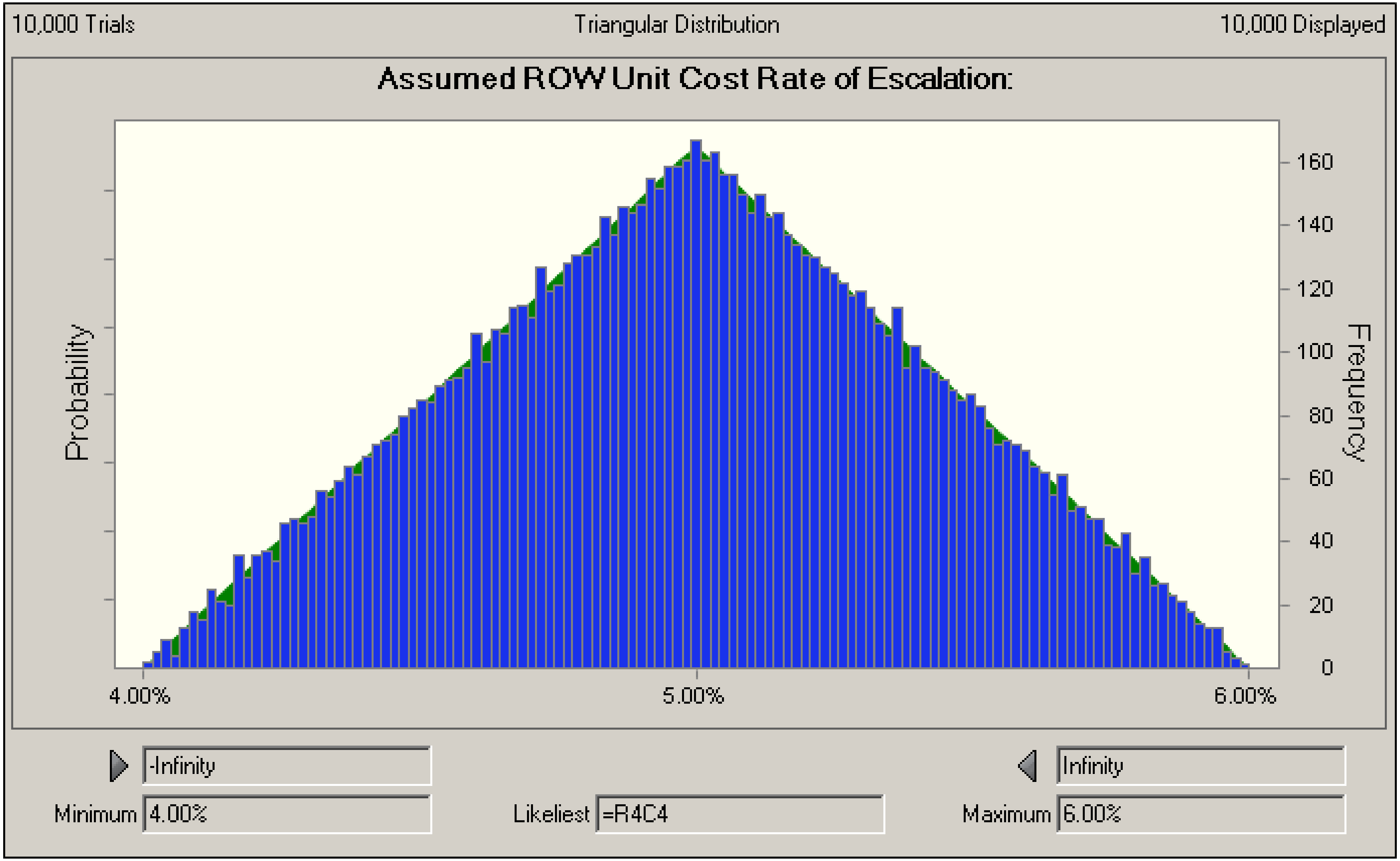
Inputs: Sampled Values

Risk Analysis - Sample Assumption Curve



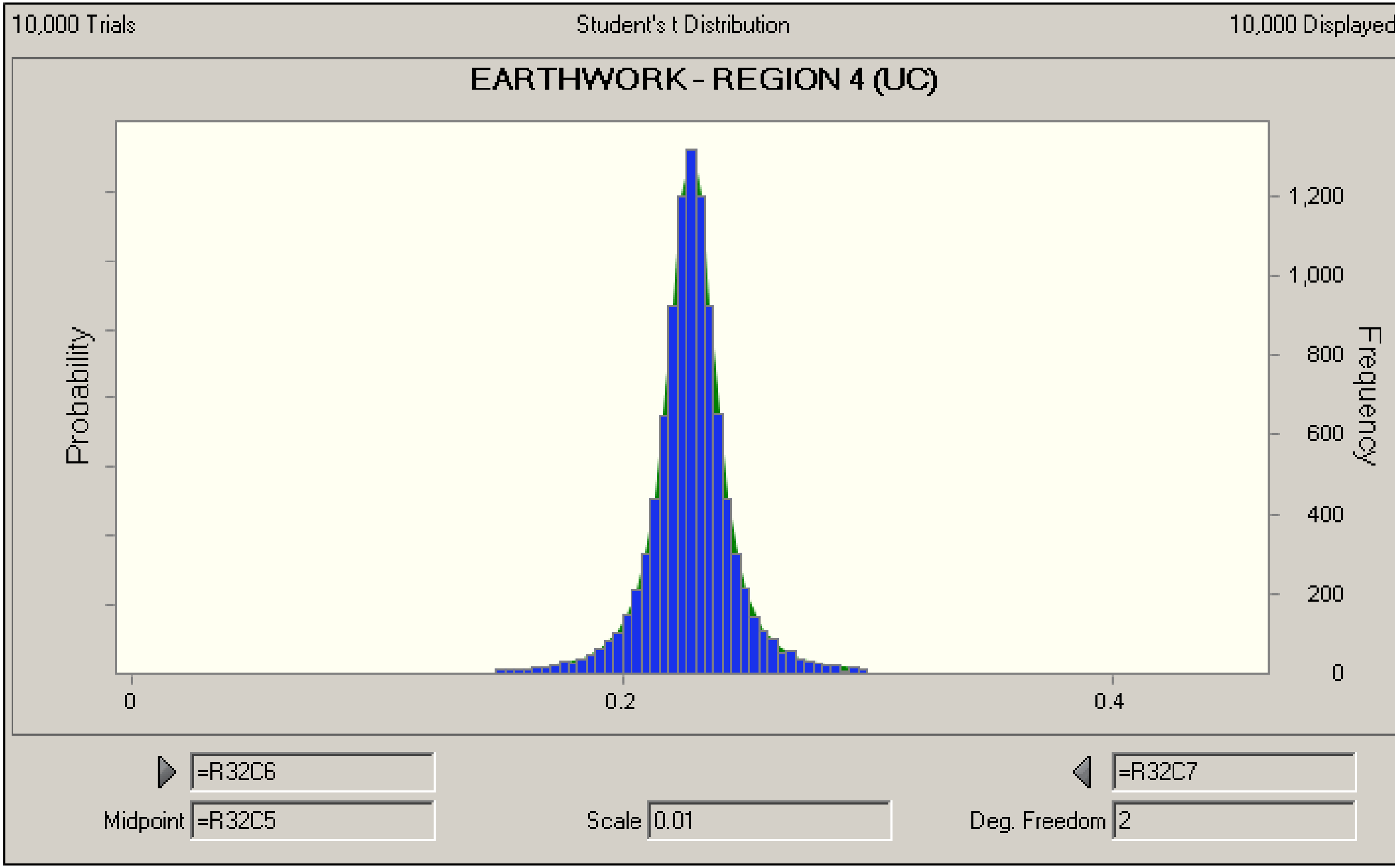
Min= 2.74% Most likely = 3.3% Max = 5.34%

Risk Analysis - Sample Assumption Curve



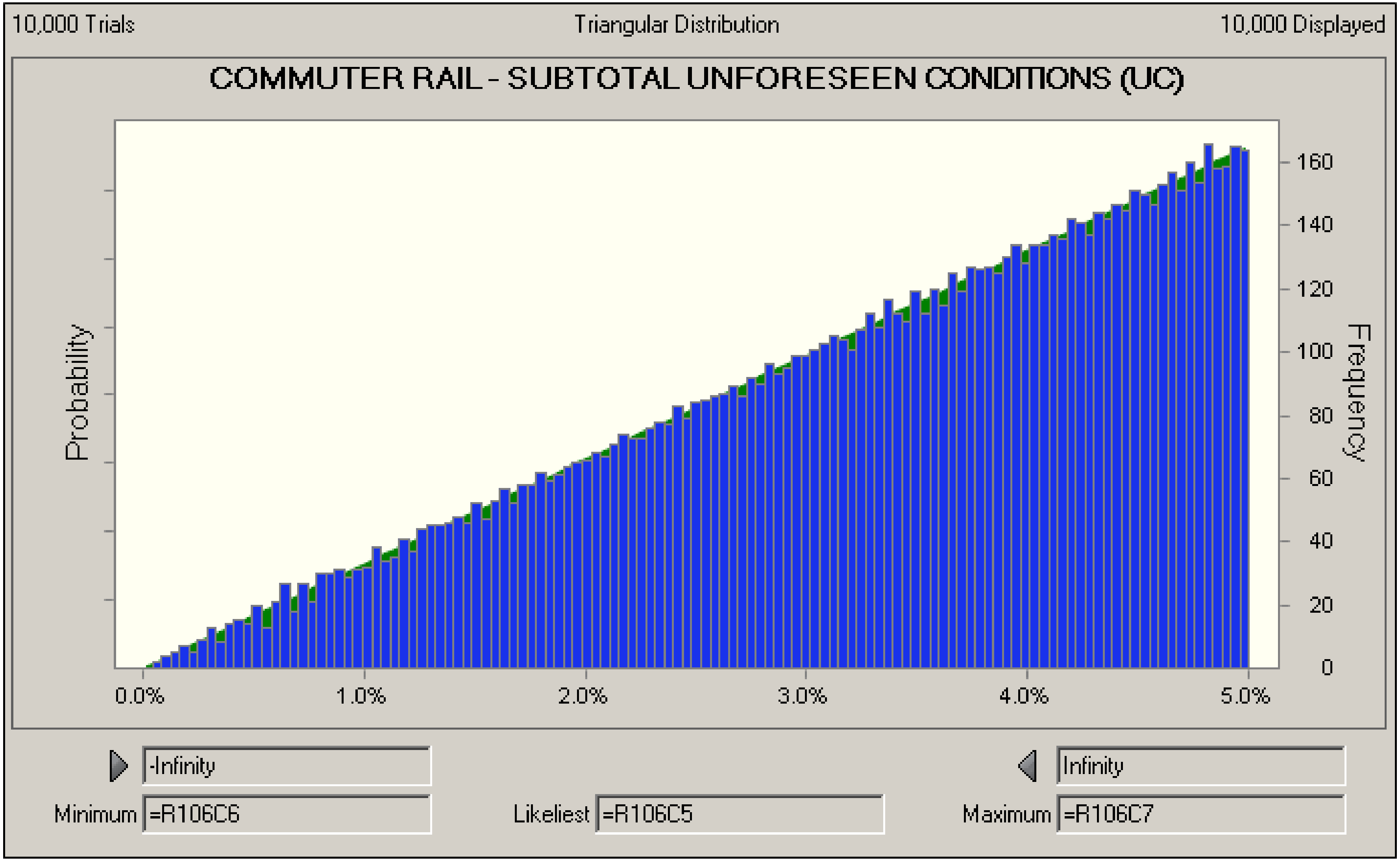
Min = 4% Most Likely = 5% Max = 6%

Risk Analysis - Sample Assumption Curve



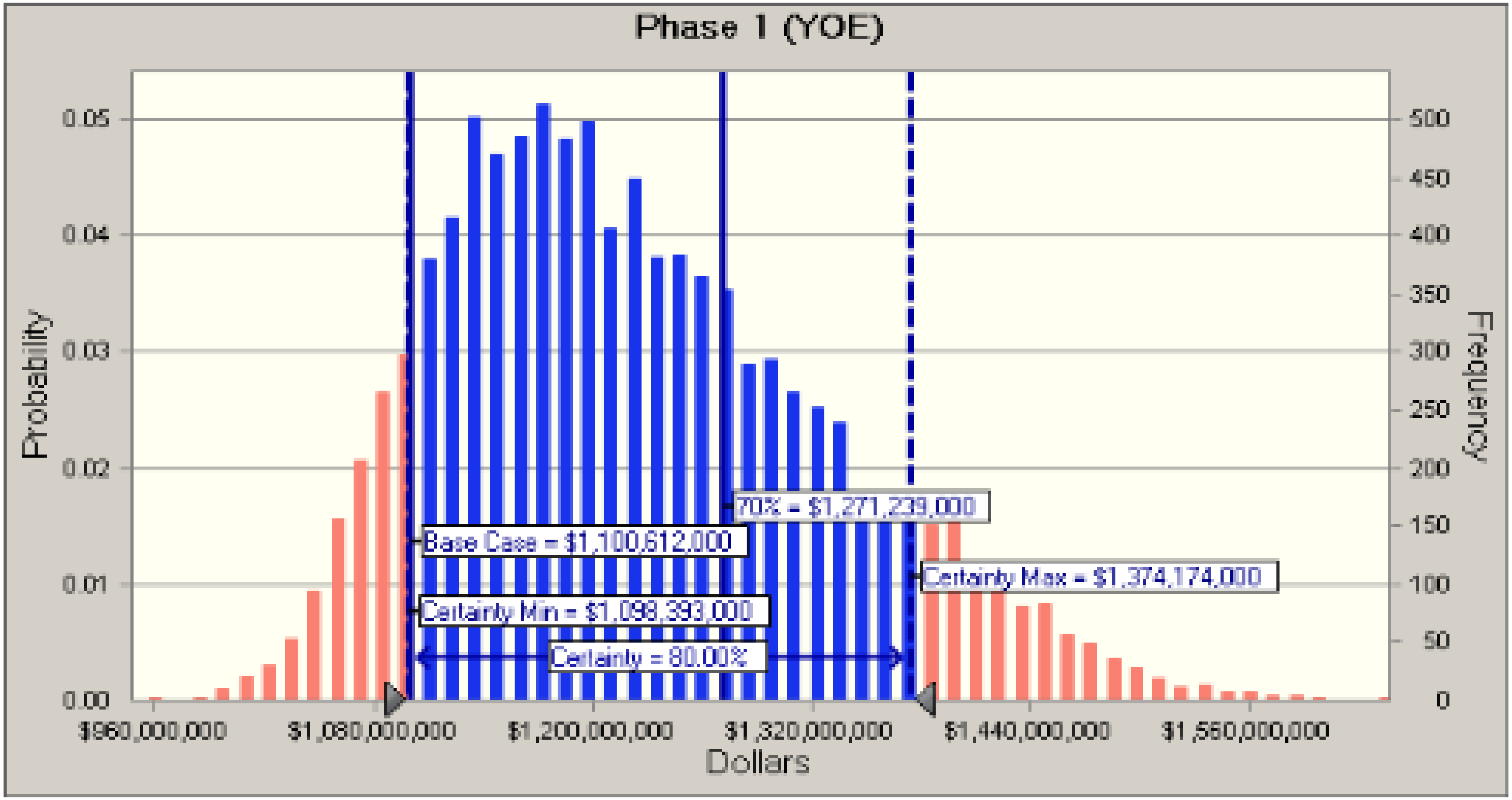
Min = 15% Midpoint = 22.8% Max = 30%

Risk Analysis - Sample Assumption Curve

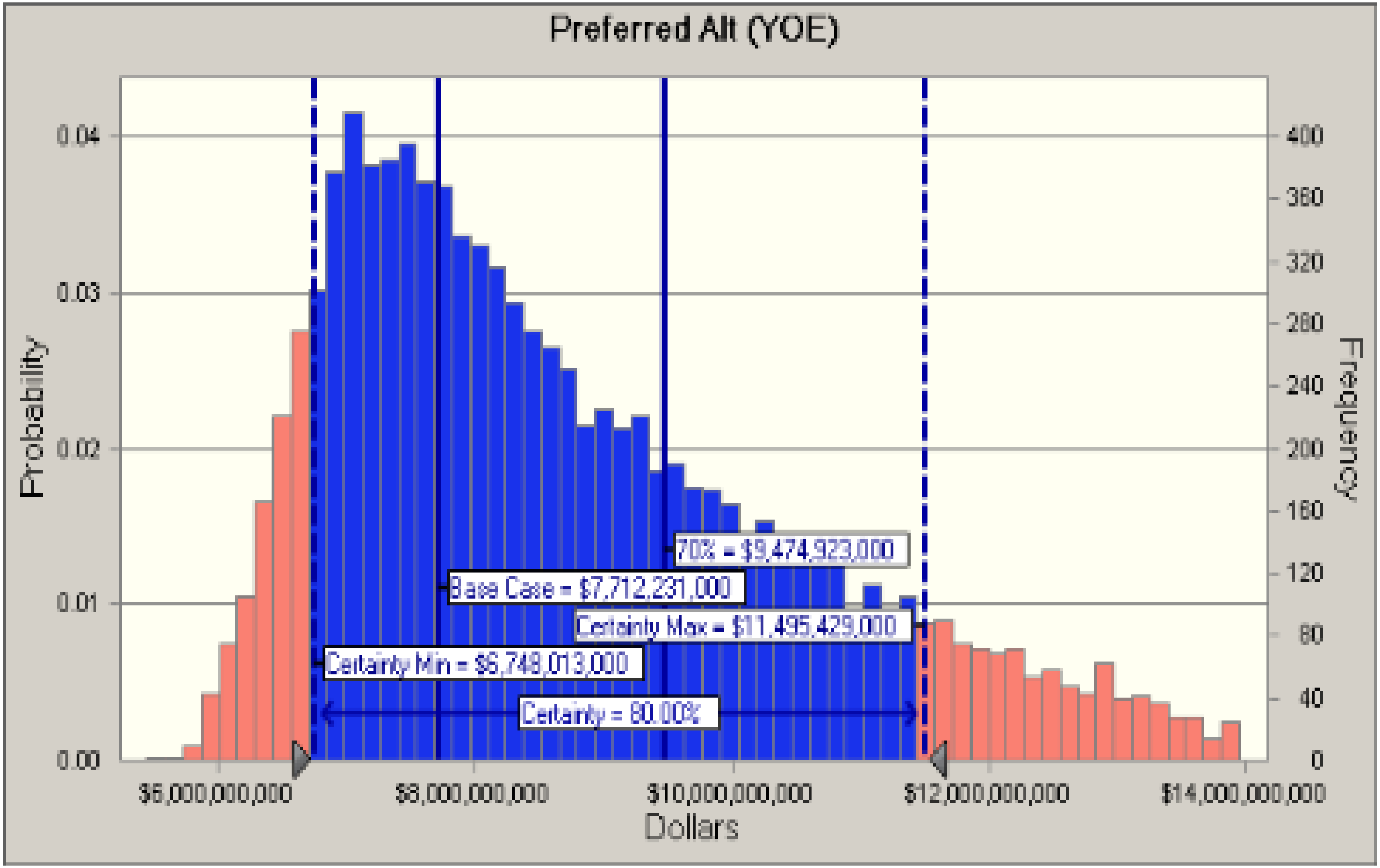


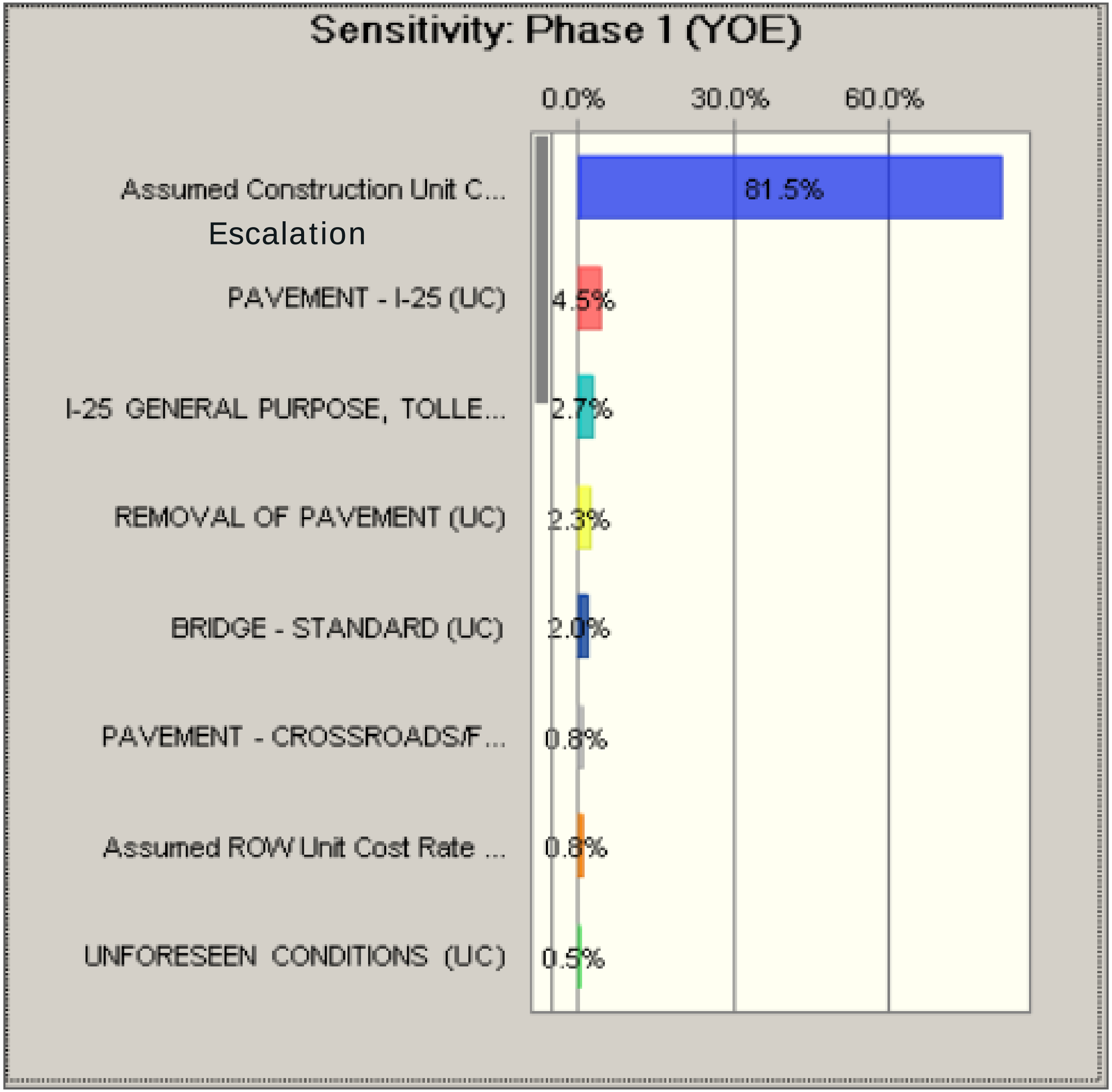
Min = 0% Most Likely = 5% Max = 5%

Simulation Results



Simulation Results




Sensitivity: Phase 1 (YOE)
0.0%
30.0%
60.0%
Assumed Construction Unit C...
Escalation
81.5%
PAVEMENT - I-25 (UC)
4.5%
I-25 GENERAL PURPOSE, TOLLE...
2.7%
REMOVAL OF PAVEMENT (UC)
2.3%
BRIDGE - STANDARD (UC)
2.0%
PAVEMENT - CROSSROADS/F...
0.8%
Assumed ROW Unit Cost Rate ...
0.8%
UNFORESEEN CONDITIONS (UC)
0.5%

Total Project Costs (YOE)

Percentile	Phase 1	Preferred Alt
0%	$953,461,000	$5,449,159,000
10%	$1,098,393,000	$6,748,013,000
20%	$1,130,345,000	$7,125,178,000
30%	$1,156,061,000	$7,482,515,000
40%	$1,181,538,000	$7,856,255,000
50%	$1,207,181,000	$8,290,487,000
60%	$1,237,705,000	$8,817,202,000
70%	**$1,271,239,000**	**$9,474,923,000**
80%	$1,312,975,000	$10,305,317,000
90%	$1,374,174,000	$11,495,429,000
100%	$1,629,202,000	$16,346,966,000

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Effect of Inflation

- 1 Year Delay in Phase 1= $48.4m
- 1 Year Delay in Preferred Alt = $385.1m

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Schedule Variability

- Assigning ranges to mid-year of construction

		Forecast	
		No Schedule Variability	Schedule Variability
Preferred Alternative	70% (YOE)	$9,474,923,000	$8,877,822,000
	Baseline (YOE)	$7,712,231,000	$7,712,231,000
	70% (2009)	$2,144,469,000	$2,144,113,000
	Baseline (2009)	$2,178,470,000	$2,178,470,000
Phase I	70% (YOE)	$1,271,239,000	$1,211,703,000
	Baseline (YOE)	$1,100,612,000	$1,100,612,000
	70% (2009)	$677,280,000	$677,424,000
	Baseline (2009)	$640,997,000	$640,997,000

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Cost Estimate Review
Draft Recommendations

- Finalize and submit NEPA, PMP, FP
- Refine and Manage Project Schedule and Budget
- Manage threats and opportunities through a risk management plan
- Look for opportunities to accelerate schedule to take advantage of current market conditions and inflation savings
- Develop consistent CDOT escalation rate

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Cost Estimate Review

Next steps:

- FHWA will prepare a final report documenting review findings.
  - ❖ Draft report for review within 30 days
  - ❖ Division Office will review and circulate the draft
  - ❖ Final report within 30 days after receipt of comments
- FHWA uses the report for the review of the Initial Financial Plan
- Review is a snapshot of the current estimate
- Request FMIS Major Project Identifier
- Change classification to active major project

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Questions?

Appendix F

North I-25 CER Information Packet

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North I-25 Environmental Impact Statement

Colorado Department of Transportation
Review Package Submittal
FHWA Cost Estimate Review

June 2010

Table of Contents

Introduction

The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA), in cooperation with the Colorado Department of Transportation (CDOT), initiated preparation of an Environmental Impact Statement (EIS) to identify and evaluate multi-modal transportation improvements along approximately 61 miles of the I-25 corridor from the Fort Collins-Wellington area to Denver. The improvements being considered in this Draft EIS will address regional and inter-regional movement of people, goods, and services in the I-25 corridor.

Project Purpose

The purpose of the project is to meet long-term travel needs between the Fort Collins-Wellington area, the rapidly growing population centers along the I-25 corridor, and south to the Denver Metro Area. To meet long-term travel needs, the project must improve safety, mobility and accessibility, and provide modal alternatives and interrelationships.

Need for the Project

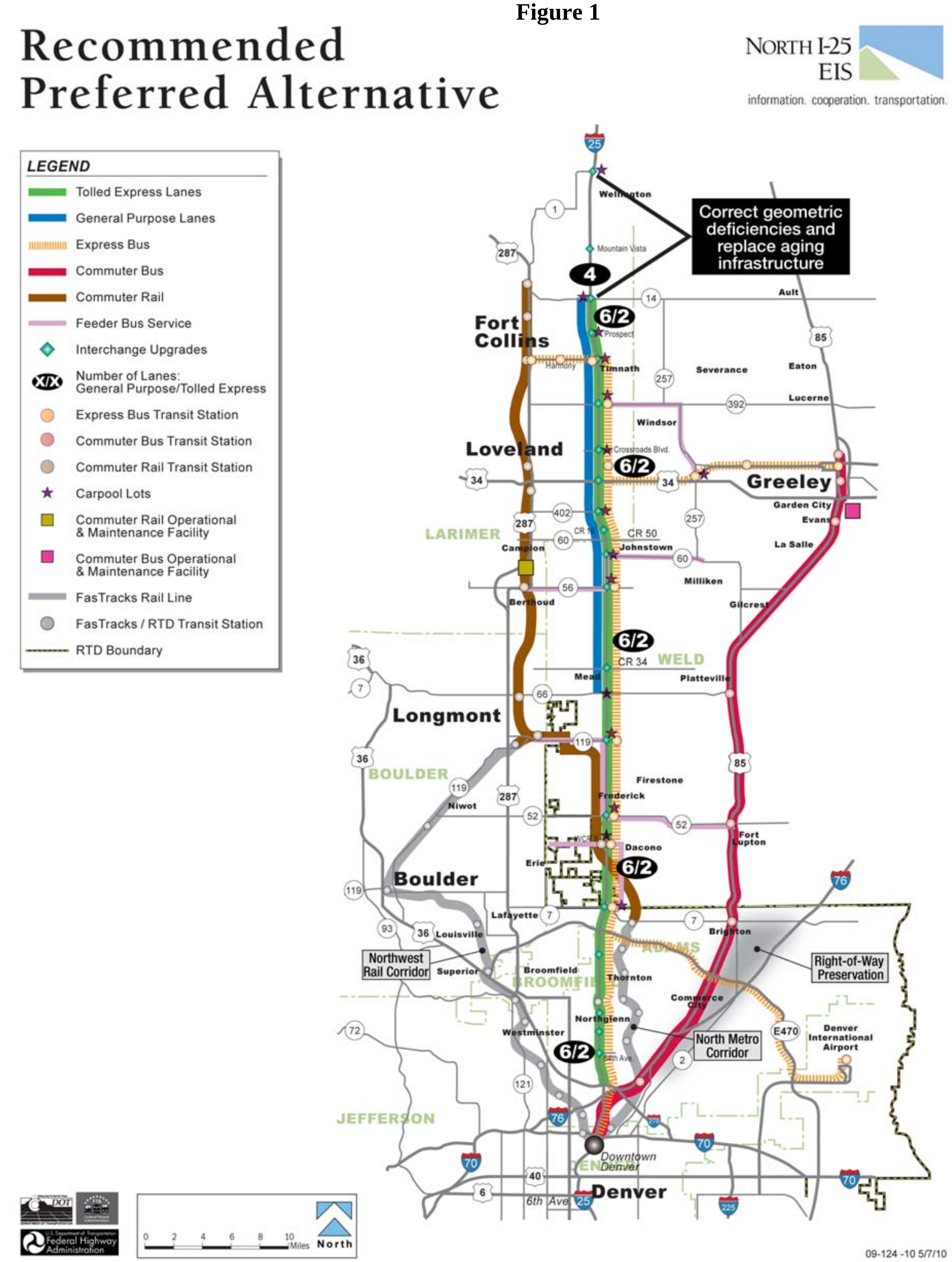
The need for the project can be summarized in the following four categories:

- Increased frequency and severity of crashes
- Increasing traffic congestion leading to mobility and accessibility problems
- Aging and functionally obsolete infrastructure
- Lack of modal alternatives

Preferred Alternative

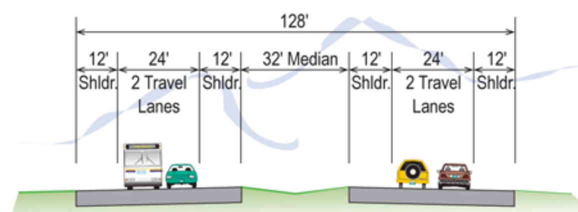
The Draft Recommended Preferred Alternative (PA) is a combination of transit and highway components along multiple corridors. The PA is illustrated on **Figure 1** and described below.

Figure 1

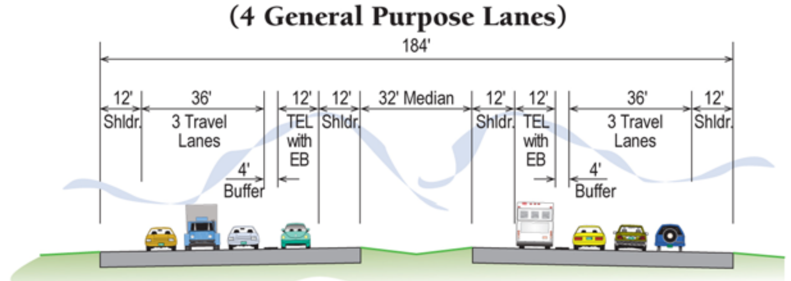


I-25 Improvements

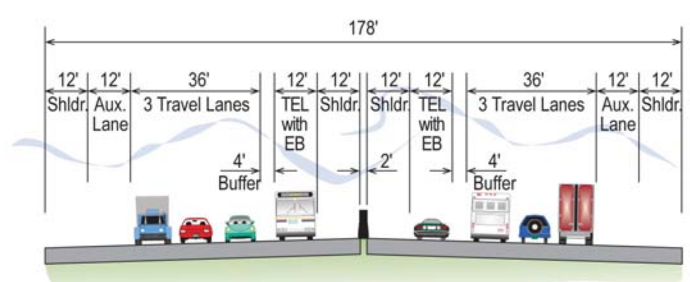
The Preferred Alternative would widen I-25 with general purpose lanes between SH 14 and SH 66. It would also add Tolled Express Lanes (lanes restricted to high-occupant vehicles and tolled single occupant vehicles) between SH 14 and US 36 for a total of eight lanes between SH 14 and US 36. Between SH 1 and SH 14 I-25 would be reconstructed to current design standards but would remain four lanes. I-25 cross sections are illustrated below:



SH 1 to SH 14
(4 General Purpose Lanes)



SH 14 to SH 7
(Tolled Express Lanes - Buffer Separated)



SH 7 to US 36
(Tolled Express Lanes -
Buffer Separated with Auxiliary Lanes)

Interchanges

The PA would fully reconstruct 14 interchanges, widen bridges at two interchanges and modify ramp terminals and ties at another nine interchanges to accommodate future travel needs.

Carpool Lots

Carpool lots would be located near many interchanges along the I-25 corridor to serve HOV users of the TEL. There are five new or expanded carpool lots planned. Eight additional carpool lots would be combined with Express Bus stations. The existing carpool lots at SH 66/I-25 and US 34/SH 257 would remain in place.

Express Bus Service

Express Bus services would connect northern Colorado communities to downtown Denver and to DIA, utilizing the tolled express lanes along I-25. Ten Express Bus stations would be constructed as part of this service. Two of the 10 stations would provide an intermodal connection between the planned commuter rail line and the planned express bus. An existing carpool lot located at US 34/SH 257 would be upgraded for use by the express bus. Five stations located adjacent to I-25 would provide the bus with bus-only slip ramps to improve travel time and reliability.

US 85 Commuter Bus

The Preferred Alternative includes commuter bus service along US 85 connecting Greeley to downtown Denver. It would include five new bus stations along the corridor and queue jumps and/or signal priority, allowing buses to bypass queued traffic at 17 intersections to help achieve reliable speeds for bus services.

Commuter Rail Transit

The Recommended Preferred Alternative includes commuter rail transit service from Fort Collins to the anticipated FasTracks North Metro end-of-line. Service to Denver would travel through Longmont and along the FasTracks North Metro Corridor; a transfer would not be necessary. To reach Boulder, northern Colorado riders would transfer to the Northwest Rail Corridor at the Sugar Mill station in Longmont. The service is assumed to operate with diesel multiple unit vehicles, similar to those assumed in the FasTracks plan to maintain interoperability.

The rail line would be largely single-track with passing tracks in four locations. RTD has recently purchased the rail ROW from north of the North Metro Corridor end-of-line to approximately CR 8 at I-25.

The plan includes construction of nine commuter rail stations eight of which have parking associated with them.

Four new grade separated crossings would be provided for the commuter rail service. Other intersection treatments would include gates or four-quadrant gates with median.

The following locations would be provided grade-separated railroad crossings of roadways:

- I-25 south of CR 8 (replaces a previous crossing)
- SH 52 and Wyndham Hill, west of I-25
- SH 119 near 3rd Avenue in Longmont
- US 287 north of Berthoud
- US 34 in Loveland (existing crossing)

Maintenance Facilities

A bus maintenance facility serving both the I-25 express bus and the US 85 commuter bus would be located at 31st Street and 1st Avenue in Greeley. The bus maintenance facility would include staff for the maintenance and operation of buses for the US 85 commuter bus service, I-25 bus service, and the feeder bus routes.

A commuter rail maintenance facility would include facilities for vehicle maintenance, cleaning, fueling and storage; track maintenance; parts storage; and vehicle operator facilities. The commuter rail maintenance facility would employ an estimated 90 workers. The recommended 30-acre site included in the Preferred Alternative is located at CR 46 and US 287 in Berthoud.

Feeder Bus

Local bus service would be provided to enable local riders to access the commuter rail and express bus regional services. Four feeder bus routes would operate hourly, timed to meet the regional services.

Congestion Management Features

Several congestion management measures are included with the Preferred Alternative. These serve to enhance the Preferred Alternative to improve the efficiency of the transportation system:

- Incident Management: Courtesy patrol service would serve the I-25 corridor between SH 14 and SH7
- Signal Coordination: Signal timing at interchanges along I-25 would be optimized.
- Ramp Metering: Ramp meters would be installed when warranted by interchange volumes
- Real-Time Transportation Information: Variable message signs would be installed along the I-25 corridor.
- Bicycle/Pedestrian Facilities: Transit station areas would be designed to provide bicycle and pedestrian links to the nearest local road.
- Travel Demand Measures: Use of alternative modes would be encouraged during construction.

Other Preferred Alternative Features

The Preferred Alternative would also include retaining walls, water quality ponds, and drainage structures.

Phasing

The project's Purpose and Need statement identifies a need to replace aging infrastructure on I-25, address safety concerns on I-25, improve mobility and provide modal options.

In addition, the two North I-25 committees representing the municipalities and agencies in the corridor identified the following guiding principles for development of Phase 1:

- Address concerns(safety, infrastructure and capacity) on I-25 north of SH 66
- Include bus transit
- Include a commitment to Commuter Rail

A review of current interchange safety rates, sufficiency ratings for structures, anticipated volumes in 2035 and remaining service life for pavement resulted in the following key findings:

- Pavement between SH 66 and Prospect has no practical remaining service life.
- Interchange structures at SH 1, SH 14, Prospect, US 34, and SH 56 all have sufficiency ratings below 75.
- Pavement and structures south of SH 66 are relatively new with a long remaining service life.
- Accident rates are higher than average at the SH 14, US 34, and SH 60 interchanges with I-25.

Phase 1

The effort described above resulted in the Phase 1 shown in **Figure 2**. As shown, this alternative includes the following elements.

- Widening I-25 between SH 66 and SH 56 with one tolled express lane in each direction. Widening would include noise and sound walls, water quality ponds, and median barrier features as well as the right of way purchase associated with the ultimate Preferred Alternative cross section.
- Widening I-25 between SH 392 and Prospect - would initially be used as continuous accel/decel lanes but would ultimately become part of the six-lane cross section. Widening would include noise and sound walls, water quality ponds, and median barrier features necessary in to accommodate this improvement. Right of way purchase associated with the ultimate Preferred Alternative cross section is also included.
- Widening I-25 between 120th Avenue and approximately US 36 – one buffer-separated tolled express lane in each direction. Widening would include noise and sound walls, water quality ponds, and median barrier features as well as the right of way purchase associated with the ultimate Preferred Alternative cross section.
- Interchange replacement and upgrades – SH 14, Prospect, SH 56, CR 34, SH 7, 104th Avenue, Thornton Parkway and 84th Avenue would be constructed to their ultimate configurations. SH 392 would be completed as part of a separate project.
- Six carpool lots at upgraded replaced or upgraded I-25 interchanges.
- Commuter Rail right of way preservation – All ROW necessary to construct the ultimate commuter rail configuration would be purchased as part of Phase 1.

- Initial I-25 Bus – Regional bus service connecting Fort Collins and Greeley to downtown Denver and DIA would be initiated. Four transit stations would be constructed as part of Phase 1 and 27 buses would be purchased.
- Commuter Bus – Commuter bus along US 85 connecting Greeley to downtown Denver would be implemented in Phase 1. This would include construction of five stations, 17 queue jumps/transit signal priority intersections and the purchase of five buses.
- Funding to upgrade one or more of the existing bus maintenance facilities in northern Colorado is included in Phase 1.

Figure 2 also illustrates the breakdown of funding and projects by planning region.

Phases 2 and 3

Projects identified in Phases 2 and 3 could be implemented sooner than anticipated if funding is identified earlier. However, for the purposes of this phasing discussion the following elements are anticipated to be constructed in phases 2 and 3.

Phase 2:

- Completion of express bus service on I-25
- Commuter rail service would begin on an initial corridor segment between Longmont and Loveland
- Construct bus maintenance facility
- Construction of commuter rail maintenance facility
- Tolled Express Lanes from SH 56 to SH 14
- Tolled Express Lanes from 120th Avenue to E-470
- Interchange replacement and upgrades – CR 16, SH 60, SH 402, Crossroads, Harmony, Mountain Vista, and SH 1 would be constructed to their ultimate configurations. A first phase of improvements to the US 34 interchange would be completed.

Phase 3:

- Completion of commuter rail service
- Tolled Express Lanes from E-470 to SH 66 and the associated interchange upgrade required (1 new buffer-separated tolled express lane in each direction)
- General purpose lanes from SH 66 to SH 14 (1 new lane in each direction)
- Completion of the US 34 interchange

Figure 2

Phase 1 Capital Improvement Projects

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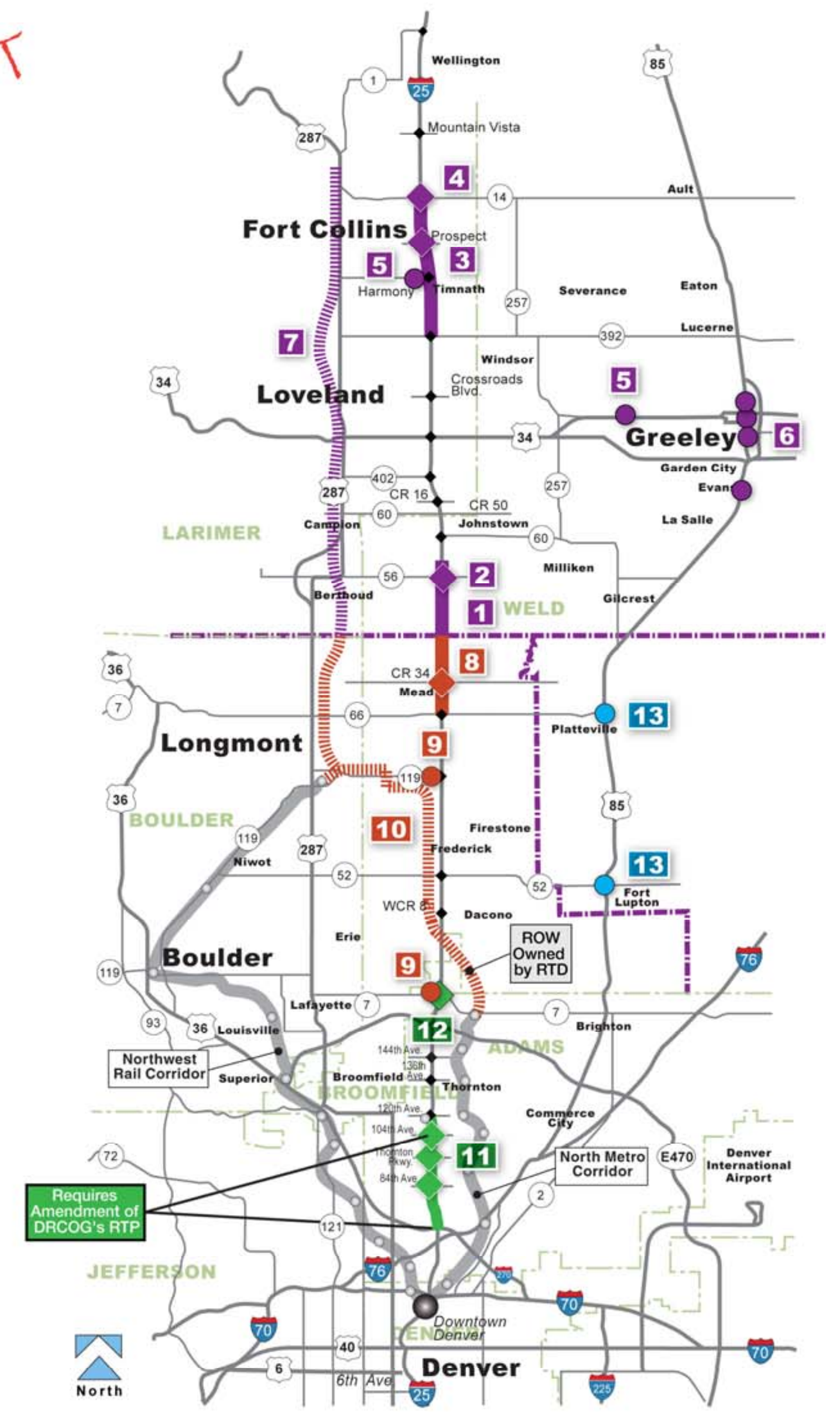

09-124-10 6/4/10

NFRMPO PROJECTS

	NFRMPO ROADWAY PROJECTS	DESCRIPTION	LENGTH (miles)	LANES	CURRENT COST ESTIMATE (in millions)	FUNDING SOURCE
1	I-25: WCR 38 to SH 56, (no interchange	Add tolled express lanes and reconstruct interchange	1.8	2	$36	Post 7th Pot
2	I-25: SH 56 interchange	Diamond interchange	2.0		$49	Post 7th Pot
3	I-25: SH 392 to Prospect/ Prospect interchange	Add auxiliary lanes (would accommodate eventual use as TELs), interchange upgrade	7.7	2	$139	Post 7th Pot
4	I-25: SH 14 interchange	Diamond interchange & mainline reconstruction	1.4		$63	Post 7th Pot
	SUBTOTAL ROADWAY				$287	

	NFRMPO RAPID TRANSIT PROJECTS	DESCRIPTION	CURRENT COST ESTIMATE (in millions)	FUNDING SOURCE
5	I-25/US 34 initial bus stations	I-25/Harmony, US 34/83rd Ave. park and rides	$33	Post 7th Pot
6	Commuter bus stations	US 85 park and rides and transit priority features	$10	Post 7th Pot
7	Commuter rail	Right-of-way preservation	$12	Post 7th Pot
	SUBTOTAL TRANSIT		$55	
	TOTAL NFRMPO PROJECTS		$342	
	AVAILABLE FUNDS		$325	

DRCOG REGION 4 PROJECTS

	DRCOG R4 ROADWAY PROJECTS	DESCRIPTION	LENGTH (miles)	LANES	CURRENT COST ESTIMATE (in millions)	FUNDING SOURCE
8	I-25: SH 66 to WCR 38/WCR 34 interchange reconstruction	Add tolled express lanes	4.0	2	$87	Post 7th Pot and congestion relief
	SUBTOTAL ROADWAY				$87	

	DRCOG R4 RAPID TRANSIT PROJECTS	DESCRIPTION	CURRENT COST ESTIMATE (in millions)	FUNDING SOURCE
9	I-25 initial bus stations	Rapid transit stations SH 7, SH 119 park and rides	$15	Post 7th Pot and CMAQ
10	US 287/BNSF: Commuter rail	Right-of-way preservation	$13	Post 7th Pot
	SUBTOTAL TRANSIT		$28	
	TOTAL DRCOG REGION 4 PROJECTS		$115	
	AVAILABLE FUNDS		$100	

DRCOG REGION 6 PROJECTS

	DRCOG R6 ROADWAY PROJECTS	DESCRIPTION	LENGTH (miles)	LANES	CURRENT COST ESTIMATE (in millions)	FUNDING SOURCE
11	I-25: US 36 to 120th Avenue	Amend RTP to specify tolled express lanes instead of general purpose lanes. Extend terminus to 120th Ave., upgrade interchanges	4.2	2	$140	DRCOG RTP
12	I-25: SH 7 interchange reconstruction	Interchange reconstruction			$50	DRCOG RTP
	TOTAL DRCOG REGION 6 PROJECTS				$190	
	AVAILABLE FUNDS				$213	

UPPER FRONT RANGE PROJECTS

	UPPER FRONT RANGE RAPID TRANSIT PROJECTS	DESCRIPTION	CURRENT COST ESTIMATE (in millions)	FUNDING SOURCE
13	Commuter bus stations	US 85 park and rides and transit priority features	$6	Post 7th Pot
	TOTAL UPPER FRONT RANGE PROJECTS		$6	
	AVAILABLE FUNDS		$6	

TOTAL PROJECT COST	$653	
TOTAL AVAILABLE FUNDS	$644	

FEIS - Package PA
PHASE 1 - HIGHWAY IMPROVEMENTS, TRANSIT STATIONS, AND COMMUTER RAIL ROW PRESERVATION
OPINION OF PROBABLE COST

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PHASE 1 **Project Description -** Phase 1 (2009 to 2035), Phase 2 (2036 to 2055), Phase 3 (2056 to 2075), Phase 4 - Total Preferred Alternative

= This color shaded cells can be updated

Mid-Year of Construction 2009

I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS (GP-TEL-CL)

Draft

	ITEM	UNIT COST	UNIT	Region 4											Region 6				
				I-25 (3 GP) from SH 66 to WCR 38 (including WCR 34 interchange)		I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange)		SH 56 Interchange		I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony interchange)		SH 14 Interchange			I-25 (3 GP + 1 TEL) from US 36 to 120th Avenue		SH 7 Par-clo Interchange		PROJECT TOTALS
		Phase		1		1		1		1		1			1		1		
1	***REMOVALS / RELOCATIONS***			Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost		Quantity	Cost	Quantity	Cost	
1-A	REMOVAL OF PAVEMENT	$ 3.00	S.Y.	271,100	$ 813,000	145,700	$ 437,000	251,800	$ 755,000	598,300	$ 1,795,000	187,300	$ 562,000		524,000	$ 1,572,000	196,300	$ 589,000	**$ 6,523,000**
1-B	REMOVAL OF BRIDGES	$ 72,000	EACH	6	$ 432,000	6	$ 432,000	2	$ 144,000	8	$ 576,000	4	$ 288,000		1	$ 72,000	1	$ 72,000	**$ 2,016,000**
1-C	REMOVAL OF BUILDINGS	$ 40,000	EACH	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -		1	$ 40,000	1	$ 40,000	**$ 80,000**
2	***ROADWAY/CONSTRUCTION***																		
2-A	PAVEMENT - I-25	$ 41	S.Y.	305,800	$ 12,415,000	131,400	$ 5,335,000	150,200	$ 6,098,000	444,900	$ 18,063,000	87,400	$ 3,548,000		539,000	$ 21,883,000	157,000	$ 6,374,000	**$ 73,716,000**
2-B	PAVEMENT - RAMPS	$ 33	S.Y.	43,200	$ 1,404,000	0	$ -	41,500	$ 1,349,000	27,700	$ 900,000	29,400	$ 956,000		65,900	$ 2,142,000	51,900	$ 1,687,000	**$ 8,438,000**
2-C	PAVEMENT - CROSSROADS/FRONTAGE ROADS	$ 33	S.Y.	114,900	$ 3,734,000	98,400	$ 3,198,000	76,600	$ 2,490,000	200,700	$ 6,523,000	153,400	$ 4,986,000		54,400	$ 1,768,000	62,300	$ 2,025,000	**$ 24,724,000**
2-D	AGGREGATE BASE COURSE (CLASS 6)	$ 22	C.Y.	77,300	$ 1,693,000	38,300	$ 839,000	44,700	$ 979,000	112,200	$ 2,457,000	45,000	$ 986,000		109,900	$ 2,407,000	45,200	$ 990,000	**$ 10,351,000**
2-E	GUARDRAIL TYPE 7	$ 90	L.F.	800	$ 72,000	0	$ -	0	$ -	1,900	$ 171,000	4,800	$ 432,000		41,100	$ 3,699,000	5,200	$ 468,000	**$ 4,842,000**
2-F	TENSIONED CABLE BARRIER	$ 10	L.F.	21,600	$ 214,000	9,100	$ 90,000	10,600	$ 105,000	22,400	$ 222,000	7,000	$ 69,000		0	$ -	3,000	$ 30,000	**$ 730,000**
3	***BRIDGES/STRUCTURES***																		
3-A	BRIDGE - STANDARD	$ 105	S.F.	34,700	$ 3,644,000	17,400	$ 1,827,000	56,100	$ 5,891,000	91,800	$ 9,639,000	20,000	$ 2,100,000		24,500	$ 2,573,000	44,300	$ 4,652,000	**$ 30,326,000**
3-B	BRIDGE - LONG SPAN	$ 115	S.F.	30,700	$ 3,531,000	0	$ -	0	$ -	41,100	$ 4,727,000	31,300	$ 3,600,000		11,400	$ 1,311,000	0	$ -	**$ 13,169,000**
3-C	BRIDGE - PEDESTRIAN OVERPASS	$ 910	S.F.	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -		8,600	$ 7,826,000	0	$ -	**$ 7,826,000**
3-D	BRIDGE - FLYOVER	$ 121	S.F.	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -		0	$ -	0	$ -	**$ -**
4	***RETAINING WALLS***																		
4-A	MSE WALL HEIGHT (0-10')	$ 210	LF	2,100	$ 441,000	200	$ 42,000	800	$ 168,000	4,900	$ 1,029,000	2,200	$ 462,000		24,800	$ 5,208,000	4,500	$ 945,000	**$ 8,295,000**
4-B	MSE WALL HEIGHT (10-20')	$ 690	LF	2,600	$ 1,794,000	600	$ 414,000	800	$ 552,000	4,100	$ 2,829,000	4,400	$ 3,036,000		14,000	$ 9,660,000	1,600	$ 1,104,000	**$ 19,389,000**
4-C	MSE WALL HEIGHT (20'+)	$ 1,760	LF	2,500	$ 4,400,000	700	$ 1,232,000	100	$ 176,000	2,200	$ 3,872,000	1,900	$ 3,344,000		2,100	$ 3,696,000	200	$ 352,000	**$ 17,072,000**
5	***SOUND WALLS***	$ 22	SF	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -		82,100	$ 1,826,000	0	$ -	**$ 1,826,000**
	SUBTOTAL (A) =				**$ 34,587,000**		**$ 13,846,000**		**$ 18,707,000**		**$ 52,803,000**		**$ 24,369,000**			**$ 65,683,000**		**$ 19,328,000**	**$ 229,323,000**
6	***LIGHTING***	1.7%	OF (A)		$ 588,000		$ 235,000		$ 318,000		$ 898,000		$ 414,000			$ 1,117,000		$ 329,000	**$ 3,899,000**
7	***EARTHWORK***	22.8%	OF (A)		$ 7,886,000		$ 3,157,000		$ 4,265,000		$ 12,039,000		$ 5,556,000	5.1%		$ 3,350,000		$ 986,000	**$ 37,239,000**
8	***DRAINAGE***	10.7%	OF (A)		$ 3,701,000		$ 1,482,000		$ 2,002,000		$ 5,650,000		$ 2,607,000			$ 7,028,000		$ 2,068,000	**$ 24,538,000**
9	***EROSION CONTROL***	3.1%	OF (A)		$ 1,072,000		$ 429,000		$ 580,000		$ 1,637,000		$ 755,000			$ 2,036,000		$ 599,000	**$ 7,108,000**
10	***SIGNING AND STRIPING***	2.3%	OF (A)		$ 796,000		$ 318,000		$ 430,000		$ 1,214,000		$ 560,000			$ 1,511,000		$ 445,000	**$ 5,274,000**
11	***CONSTRUCTION TRAFFIC CONTROL***	12.3%	OF (A)		$ 4,254,000		$ 1,703,000		$ 2,301,000		$ 6,495,000		$ 2,997,000			$ 8,079,000		$ 2,377,000	**$ 28,206,000**
12	***URBAN DESIGN / LANDSCAPING***	1.0%	OF (A)		$ 346,000		$ 138,000		$ 187,000		$ 528,000		$ 244,000			$ 657,000		$ 193,000	**$ 2,293,000**
13	***MOBILIZATION***	15.7%	OF (A)		$ 5,430,000		$ 2,174,000		$ 2,937,000		$ 8,290,000		$ 3,826,000	7.1%		$ 4,663,000		$ 1,372,000	**$ 28,692,000**
14	***MISCELLANEOUS BID ITEMS***	7.7%	OF (A)		$ 2,663,000		$ 1,066,000		$ 1,440,000		$ 4,066,000		$ 1,876,000			$ 5,058,000		$ 1,488,000	**$ 17,657,000**
15	***CARPOOL PARKING***	$ 4,460,000	L.S.	0.00	$ -	0.13	$ 591,000	0.00	$ -	0.16	$ 734,000	0.22	$ 981,000		0.00	$ -	0.00	$ -	**$ 2,306,000**
16	***INTELLIGENT TRANSPORTATION SYSTEM ELEMENTS***	$ 169,000	MI	4.0	$ 676,000	1.8	$ 296,000	2.0	$ 338,000	7.7	$ 1,301,000	1.4	$ 237,000		5.5	$ 930,000	1.0	$ 169,000	**$ 3,947,000**
17	***MANAGED LANE SYSTEM***	$ 180,000	MI	4.0	$ 720,000	1.8	$ 324,000	2.0	$ 360,000	0.0	$ -	0.0	$ -		5.5	$ 990,000	0.0	$ -	**$ 2,394,000**
18	***TRAFFIC SIGNALS*** (RAMP TERMINAL INTERSECTION)	$ 250,000	EACH	3	$ 750,000	3	$ 750,000	3	$ 750,000	8	$ 2,000,000	3	$ 750,000		4	$ 1,000,000	3	$ 750,000	**$ 6,750,000**
19	***PORT OF ENTRY*** (BUILDING AND PIT SCALES)	$ 410,000	EACH	0	$ -	0	$ -	0	$ -	2	$ 820,000	0	$ -		0	$ -	0	$ -	**$ 820,000**
	TOTAL CONSTRUCTION BID ITEMS (CBI)				**$ 63,469,000**		**$26,509,000**		**$34,615,000**		**$ 98,475,000**		**$45,172,000**			**$102,102,000**		**$30,104,000**	**$ 400,446,000**
20	***UNFORESEEN CONDITIONS***	2.0%	OF (CBI)		$ 1,269,000		$ 530,000		$ 692,000		$ 1,970,000		$ 903,000			$ 2,042,000		$ 602,000	**$ 8,008,000**
	TOTAL CONSTRUCTION ITEMS (CI)				**$ 64,738,000**		**$27,039,000**		**$35,307,000**		**$100,445,000**		**$46,075,000**			**$104,144,000**		**$30,706,000**	**$ 408,454,000**
21	***UTILITIES***	4.6%	OF (CI)		$ 2,978,000		$ 1,244,000		$ 1,624,000		$ 4,620,000		$ 2,119,000			$ 4,791,000		$ 1,412,000	**$ 18,788,000**
22	***PLANNING AND ENGINEERING***																		
22-A	DESIGN	8.8%	OF (CI)		$ 5,697,000		$ 2,379,000		$ 3,107,000		$ 8,839,000		$ 4,055,000			$ 9,165,000		$ 2,702,000	**$ 35,944,000**
22-B	CONSTRUCTION MANAGEMENT	17.0%	OF (CI)		$ 11,005,000		$ 4,597,000		$ 6,002,000		$ 17,076,000		$ 7,833,000			$ 17,704,000		$ 5,220,000	**$ 69,437,000**
23	***RIGHT-OF-WAY*** (HIGHWAY-CP)				$ 3,641,000		$ 1,234,000		$ 3,320,000		$ 7,943,000		$ 2,715,000			$ 5,616,000		$ 9,903,000	**$ 34,372,000**
	I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS - SUBTOTAL				***$ 88,059,000***		***$ 36,493,000***		***$ 49,360,000***		***$ 138,923,000***		***$ 62,797,000***			***$ 141,420,000***		***$ 49,943,000***	***$ 566,995,000***

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EXPRESS BUS, COMMUTER BUS (EB-CB)

	ITEM	Cost/Unit	UNIT	Quantity	Cost	Quantity	Cost	Quantity	Cost
			Phase	1		2		3	
1	*ROADWAY/CONSTRUCTION*								
1-A	PAVEMENT - QUEUE JUMPS	$ 57	S.Y.	220.000	$ 13,000	0.00	$ -	0.00	$ -
2	*EXPRESS BUS STATIONS*	$ 42,490,000	L.S.	0.460	$ 19,545,000	0.00	$ -	0.00	$ -
3	*COMMUTER BUS STATIONS*	$ 4,160,000	L.S.	1.000	$ 4,160,000	0.00	$ -	0.00	$ -
	SUBTOTAL (B) =				**$ 23,718,000**		**$ -**		**$ -**
4	*MOBILIZATION*	11.0%	OF (B)		$ 2,609,000		$ -	0.00	$ -
5	*MISCELLANEOUS BID ITEMS*	8.8%	OF (B)		$ 2,087,000		$ -	0.00	$ -
6	*BUS MAINTENANCE FACILITY*	$ 16,864,000	EACH	0.000	$ -	0.00	$ -	0.00	$ -
7	*TRAFFIC SIGNALS*								
7-A	QUEUE JUMP SIGNALS	$ 250,000	Each	1.250	$ 313,000	0.00	$ -	0.00	$ -
7-B	OTHER EXISTING SIGNAL MODIFICATIONS	$ 50,000	Each	9.000	$ 450,000	0.00	$ -	0.00	$ -
	TOTAL CONSTRUCTION BID ITEMS (CBI)				**$ 29,177,000**		**$ -**		**$ -**
8	*UNFORESEEN CONDITIONS*	2.0%	OF (CBI)		$ 584,000		$ -		$ -
	TOTAL CONSTRUCTION ITEMS (CI)				**$ 29,761,000**		**$ -**		**$ -**
9	*UTILITIES*	7.0%	OF (CI)		$ 2,083,000		$ -		$ -
10	*PLANNING AND ENGINEERING*								
10-A	ENVIRONMENTAL IMPACT STATEMENT								
10-B	DESIGN	8.8%	OF (CI)		$ 2,619,000		$ -		$ -
10-C	CONSTRUCTION MANAGEMENT	17.0%	OF (CI)		$ 5,059,000		$ -		$ -
11	*RIGHT-OF-WAY* (EB-CP-CB)								
11-A	ROW - EXPRESS BUS	$ 11,690,000	L.S.	0.67	$ 7,832,000	0.00	$ -	0.00	$ -
11-B	ROW - COMMUTER BUS	$ 4,068,000	L.S.	1.0	$ 4,068,000	0.00	$ -	0.00	$ -
12	*EXPRESS BUS VEHICLES*	$ 376,000	EACH	27	$ 10,152,000	0.00	$ -	0.00	$ -
13	*COMMUTER BUS VEHICLES*	$ 376,000	EACH	5	$ 1,880,000	0.00	$ -	0.00	$ -
	EXPRESS BUS, COMMUTER BUS - SUBTOTAL								***$ 63,454,000***

FEIS - Package PA
PHASE 1 - HIGHWAY IMPROVEMENTS, TRANSIT STATIONS, AND COMMUTER RAIL ROW PRESERVATION
OPINION OF PROBABLE COST

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COMMUTER RAIL (CR)

	ITEM	Cost/Unit	UNIT	Quantity	Cost	Quantity	Cost	Quantity	Cost
			Phase	1		2		3	
1	***EARTHWORK***	20%	OF (TRACKWORK)		$ -		$ -		$ -
2	***BRIDGES/STRUCTURES/TUNNELS***								
2-A	COMMUTER RAIL BRIDGE - span <140' (no curvature)	$ 180	S.F.	0	$ -	0	$ -	0	$ -
2-B	COMMUTER RAIL BRIDGE - span >140' (or with curvature)	$ 220	S.F.	0	$ -	0	$ -	0	$ -
3	***RETAINING WALLS***								
3-A	MSE WALL HEIGHT (0-10')	$ 210	L.F.	0	$ -	0	$ -	0	$ -
3-B	MSE WALL HEIGHT (10-20')	$ 690	L.F.	0	$ -	0	$ -	0	$ -
3-C	MSE WALL HEIGHT (20'+)	$ 1,760	L.F.	0	$ -	0	$ -	0	$ -
4	***TRACKWORK***								
4-A	DOUBLE BALLASTED TRACK	$ 599	L.F.	0	$ -	0	$ -	0	$ -
4-B	SINGLE BALLASTED TRACK	$ 332	T.F.	0	$ -	0	$ -	0	$ -
4-C	SPECIAL TRACK: NO. 11 TURNOUT	$ 133,500	EACH	0	$ -	0	$ -	0	$ -
5	***ACCESS ROAD***								
5-A	13' GRAVEL ACCESS ROAD	$ 20	TON	0	$ -	0	$ -	0	$ -
6	***SIGNALS***								
6-A	BASE COMMUNICATION SYSTEM	$ 1,500,000	ROUTE MILE	0	$ -	0	$ -	0	$ -
7	***SYSTEM WIDE ELEMENTS***								
7-A	COMMUTER RAIL ACTIVATION & TESTING	$ 2,000,000	EACH	0	$ -	0	$ -	0	$ -
7-B	RURAL FENCE	$ 5.30	L.F.	0	$ -	0	$ -	0	$ -
8	***AT GRADE CROSSING***	$ 136,700	EACH	0	$ -	0	$ -	0	$ -
	SUBTOTAL (C) =				**$ -**		**$ -**		**$ -**
9	***DRAINAGE***	7.0%	OF (C)		$ -		$ -		$ -
10	***NOISE AND VIBRATION***	2.0%	OF (C)		$ -		$ -		$ -
11	***SIGNING AND STRIPING***	1.0%	OF (C)		$ -		$ -		$ -
12	***CONSTRUCTION TRAFFIC CONTROL***	6.0%	OF (C)		$ -		$ -		$ -
13	***MOBILIZATION***	15.0%	OF (C)		$ -		$ -		$ -
14	***MISCELLANEOUS BID ITEMS***	10.0%	OF (C)		$ -		$ -		$ -
15	***COMMUTER RAIL STATIONS***	$ 32,845,000	L.S.	0	$ -	0	$ -	0	$ -
16	***MAINTENANCE & OPERATIONS FACILITY***	$ 56,886,000	EACH	0	$ -	0	$ -	0	$ -
	TOTAL CONSTRUCTION BID ITEMS (CBI)				**$ -**		**$ -**		**$ -**
17	***UNFORESEEN CONDITIONS***	5.0%	OF (CBI)		$ -		$ -		$ -
	TOTAL CONSTRUCTION ITEMS (CI)				**$ -**		**$ -**		**$ -**
18	***INSURANCE LEGAL***	3.0%	OF (CI)		$ -		$ -		$ -
19	***UTILITIES***	3.0%	OF (CI)		$ -		$ -		$ -
20	***PLANNING AND ENGINEERING***								
20-A	ENVIRONMENTAL IMPACT STATEMENT	$ -			$ -		$ -		$ -
20-B	DESIGN	8.8%	OF (CI)		$ -		$ -		$ -
20-C	CONSTRUCTION MANAGEMENT	24.0%	OF (CI)		$ -		$ -		$ -
21	***COMMUTER RAIL ROW***	$ 24,818,000	L.S.	1	$ 24,818,000	0	$ -	0	$ -
22	***FEEDER BUS VEHICLES***	$ 303,000	EACH	0	$ -	0	$ -	0	$ -
23	***DMU VEHICLES***	$ 5,200,000	EACH	0	$ -	0	$ -	0	$ -
	COMMUTER RAIL - SUBTOTAL							***$***	***24,818,000***

PHASE 4

Project Description - Phase 1 (2009 to 2035), Phase 2 (2036 to 2055), Phase 3 (2056 to 2075), Phase 4 - Total Preferred Alternative Costs are in 2009 dollars.

= This color shaded cells can be updated

Mid-Year of Construction 2009

Region 4

I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS (GP-TEL-CL)

	ITEM	UNIT COST	UNIT	I-25 (3 GP) from SH 66 to WCR 38 (including WCR 34 interchange)		I-25 (3 GP) from WCR 38 to SH 56 (excluding SH 56 interchange)		SH 56 Interchange		I-25 (2 GP + aux. lanes) from SH 392 to Prospect (excluding Harmony interchange)		SH 14 Interchange		I-25 (3 GP) from SH 56 to SH 392		Harmony Interchange		I-25 (2 GP lanes) from SH 14 to SH 1		I-25 (Add 1 TEL) from SH 7 to SH 14		US 34 from Rocky Mtn. Avenue to LCR 5	
1	***REMOVALS / RELOCATIONS***			Quantity	Cost																		
1-A	REMOVAL OF PAVEMENT	$ 3.00	S.Y.	271,100	$ 813,000	145,700	$ 437,000	251,800	$ 755,000	598,300	$ 1,795,000	187,300	$ 562,000	859,300	$ 2,578,000	71,100	$ 213,000	647,800	$ 1,943,000	27,900	$ 84,000	146,200	$ 439,000
1-B	REMOVAL OF BRIDGES	$ 72,000	EACH	6	$ 432,000	6	$ 432,000	2	$ 144,000	8	$ 576,000	4	$ 288,000	15	$ 1,080,000	5	$ 360,000	5	$ 360,000	0	$ -	2	$ 144,000
1-C	REMOVAL OF BUILDINGS	$ 40,000	EACH	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	4	$ 160,000	0	$ -	2	$ 80,000	0	$ -	0	$ -
2	***ROADWAY/CONSTRUCTION***																						
2-A	PAVEMENT - I-25	$ 41	S.Y.	305,800	$ 12,415,000	131,400	$ 5,335,000	150,200	$ 6,098,000	444,900	$ 18,063,000	87,400	$ 3,548,000	694,600	$ 28,201,000	0	$ -	482,900	$ 19,606,000	680,100	$ 27,612,000	0	$ -
2-B	PAVEMENT - RAMPS	$ 33	S.Y.	43,200	$ 1,404,000	0	$ -	41,500	$ 1,349,000	27,700	$ 900,000	29,400	$ 956,000	223,400	$ 7,261,000	42,300	$ 1,375,000	54,500	$ 1,771,000	0	$ -	50,900	$ 1,654,000
2-C	PAVEMENT - CROSSROADS/FRONTAGE ROADS	$ 33	S.Y.	114,900	$ 3,734,000	98,400	$ 3,198,000	76,600	$ 2,490,000	200,700	$ 6,523,000	153,400	$ 4,986,000	443,600	$ 14,417,000	86,500	$ 2,811,000	404,600	$ 13,150,000	19,100	$ 621,000	230,100	$ 7,478,000
2-D	AGGREGATE BASE COURSE (CLASS 6)	$ 22	C.Y.	77,300	$ 1,693,000	38,300	$ 839,000	44,700	$ 979,000	112,200	$ 2,457,000	45,000	$ 986,000	226,900	$ 4,969,000	21,500	$ 471,000	157,000	$ 3,438,000	116,500	$ 2,551,000	46,800	$ 1,025,000
2-E	GUARDRAIL TYPE 7	$ 90	L.F.	800	$ 72,000	0	$ -	0	$ -	1,900	$ 171,000	4,800	$ 432,000	4,900	$ 441,000	0	$ -	7,000	$ 630,000	0	$ -	24,100	$ 2,169,000
2-F	TENSIONED CABLE BARRIER	$ 10	L.F.	21,600	$ 214,000	9,100	$ 90,000	10,600	$ 105,000	22,400	$ 222,000	7,000	$ 69,000	58,900	$ 583,000	0	$ -	45,100	$ 446,000	72,200	$ 715,000	0	$ -
3	***BRIDGES/STRUCTURES***																						
3-A	BRIDGE - STANDARD	$ 105	S.F.	34,700	$ 3,644,000	17,400	$ 1,827,000	56,100	$ 5,891,000	91,800	$ 9,639,000	20,000	$ 2,100,000	227,300	$ 23,867,000	52,500	$ 5,513,000	115,400	$ 12,117,000	27,200	$ 2,856,000	0	$ -
3-B	BRIDGE - LONG SPAN	$ 115	S.F.	30,700	$ 3,531,000	0	$ -	0	$ -	41,100	$ 4,727,000	31,300	$ 3,600,000	87,900	$ 10,109,000	33,500	$ 3,853,000	0	$ -	6,100	$ 702,000	77,900	$ 8,959,000
3-C	BRIDGE - PEDESTRIAN OVERPASS	$ 910	S.F.	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
3-D	BRIDGE - FLYOVER	$ 121	S.F.	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	192,400	$ 23,280,000	0	$ -	0	$ -	0	$ -	0	$ -
4	***RETAINING WALLS***																						
4-A	MSE WALL HEIGHT (0-10')	$ 210	LF	2,100	$ 441,000	200	$ 42,000	800	$ 168,000	4,900	$ 1,029,000	2,200	$ 462,000	16,800	$ 3,528,000	500	$ 105,000	6,200	$ 1,302,000	5,900	$ 1,239,000	2,700	$ 567,000
4-B	MSE WALL HEIGHT (10-20')	$ 690	LF	2,600	$ 1,794,000	600	$ 414,000	800	$ 552,000	4,100	$ 2,829,000	4,400	$ 3,036,000	13,000	$ 8,970,000	0	$ -	1,400	$ 966,000	4,400	$ 3,036,000	2,500	$ 1,725,000
4-C	MSE WALL HEIGHT (20'+)	$ 1,760	LF	2,500	$ 4,400,000	700	$ 1,232,000	100	$ 176,000	2,200	$ 3,872,000	1,900	$ 3,344,000	13,200	$ 23,232,000	0	$ -	500	$ 880,000	2,800	$ 4,928,000	2,100	$ 3,696,000
5	***SOUND WALLS***	$ 22	SF	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	42,600	$ 947,000	100	$ 2,000	0	$ -
	SUBTOTAL (A) =				**$ 34,587,000**		**$ 13,846,000**		**$ 18,707,000**		**$ 52,803,000**		**$ 24,369,000**		**$ 152,676,000**		**$ 14,701,000**		**$ 57,636,000**		**$ 44,346,000**		**$ 27,856,000**
6	***LIGHTING***	1.7%	OF (A)		$ 588,000		$ 235,000		$ 318,000		$ 898,000		$ 414,000		$ 2,595,000		$ 250,000		$ 980,000		$ 754,000		$ 474,000
7	***EARTHWORK***	22.8%	OF (A)		$ 7,886,000		$ 3,157,000		$ 4,265,000		$ 12,039,000		$ 5,556,000		$ 34,810,000		$ 3,352,000		$ 13,141,000		$ 10,111,000		$ 6,351,000
8	***DRAINAGE***	10.7%	OF (A)		$ 3,701,000		$ 1,482,000		$ 2,002,000		$ 5,650,000		$ 2,607,000		$ 16,336,000		$ 1,573,000		$ 6,167,000		$ 4,745,000		$ 2,981,000
9	***EROSION CONTROL***	3.1%	OF (A)		$ 1,072,000		$ 429,000		$ 580,000		$ 1,637,000		$ 755,000		$ 4,733,000		$ 456,000		$ 1,787,000		$ 1,375,000		$ 864,000
10	***SIGNING AND STRIPING***	2.3%	OF (A)		$ 796,000		$ 318,000		$ 430,000		$ 1,214,000		$ 560,000		$ 3,512,000		$ 338,000		$ 1,326,000		$ 1,020,000		$ 641,000
11	***CONSTRUCTION TRAFFIC CONTROL***	12.3%	OF (A)		$ 4,254,000		$ 1,703,000		$ 2,301,000		$ 6,495,000		$ 2,997,000		$ 18,779,000		$ 1,808,000		$ 7,089,000		$ 5,455,000		$ 3,426,000
12	***URBAN DESIGN / LANDSCAPING***	1.0%	OF (A)		$ 346,000		$ 138,000		$ 187,000		$ 528,000		$ 244,000		$ 1,527,000		$ 147,000		$ 576,000		$ 443,000		$ 279,000
13	***MOBILIZATION***	15.7%	OF (A)		$ 5,430,000		$ 2,174,000		$ 2,937,000		$ 8,290,000		$ 3,826,000		$ 23,970,000		$ 2,308,000		$ 9,049,000		$ 6,962,000		$ 4,373,000
14	***MISCELLANEOUS BID ITEMS***	7.7%	OF (A)		$ 2,663,000		$ 1,066,000		$ 1,440,000		$ 4,066,000		$ 1,876,000		$ 11,756,000		$ 1,132,000		$ 4,438,000		$ 3,415,000		$ 2,145,000
15	***CARPOOL PARKING***	$ 4,460,000	L.S.	0.00	$ -	0.13	$ 591,000	0.00	$ -	0.16	$ 734,000	0.22	$ 981,000	0.42	$ 1,889,000	0.00	$ -	0.06	$ 266,000	0.00	$ -	0.00	$ -
16	***INTELLIGENT TRANSPORTATION SYSTEM ELEMENTS***	$ 169,000	MI	4.0	$ 676,000	1.8	$ 296,000	2.0	$ 338,000	7.7	$ 1,301,000	1.4	$ 237,000	9.0	$ 1,516,000	2.0	$ 338,000	8.4	$ 1,427,000	9.5	$ 1,606,000	0.0	$ -
17	***MANAGED LANE SYSTEM***	$ 180,000	MI	4.0	$ 720,000	1.8	$ 324,000	2.0	$ 360,000	0.0	$ -	0.0	$ -	9.0	$ 1,620,000	2.0	$ 360,000	0.0	$ -	21.1	$ 3,798,000	0.0	$ -
17	***TRAFFIC SIGNALS*** (RAMP TERMINAL INTERSECTION)	$ 250,000	EACH	3	$ 750,000	3	$ 750,000	3	$ 750,000	8	$ 2,000,000	3	$ 750,000	13	$ 3,250,000	4	$ 1,000,000	8	$ 2,000,000	0	$ -	2	$ 500,000
18	***PORT OF ENTRY*** (BUILDING AND PIT SCALES)	$ 410,000	EACH	0	$ -	0	$ -	0	$ -	2	$ 820,000	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
	TOTAL CONSTRUCTION BID ITEMS (CBI)				**$ 63,469,000**		**$ 26,509,000**		**$ 34,615,000**		**$ 98,475,000**		**$ 45,172,000**		**$ 278,969,000**		**$ 27,763,000**		**$ 105,882,000**		**$ 84,030,000**		**$ 49,890,000**
19	***UNFORESEEN CONDITIONS***	2.0%	OF (CBI)		$ 1,269,000		$ 530,000		$ 692,000		$ 1,970,000		$ 903,000		$ 5,579,000		$ 555,000		$ 2,118,000		$ 1,681,000		$ 998,000
	TOTAL CONSTRUCTION ITEMS (CI)				**$ 64,738,000**		**$ 27,039,000**		**$ 35,307,000**		**$ 100,445,000**		**$ 46,075,000**		**$ 284,548,000**		**$ 28,318,000**		**$ 108,000,000**		**$ 85,711,000**		**$ 50,888,000**
20	***UTILITIES***	4.6%	OF (CI)		$ 2,978,000		$ 1,244,000		$ 1,624,000		$ 4,620,000		$ 2,119,000		$ 13,089,000		$ 1,303,000		$ 4,968,000		$ 3,943,000		$ 2,341,000
21	***PLANNING AND ENGINEERING***																						
21-A	DESIGN	8.8%	OF (CI)		$ 5,697,000		$ 2,379,000		$ 3,107,000		$ 8,839,000		$ 4,055,000		$ 25,040,000		$ 2,492,000		$ 9,504,000		$ 7,543,000		$ 4,478,000
21-B	CONSTRUCTION MANAGEMENT	17.0%	OF (CI)		$ 11,005,000		$ 4,597,000		$ 6,002,000		$ 17,076,000		$ 7,833,000		$ 48,373,000		$ 4,814,000		$ 18,360,000		$ 14,571,000		$ 8,651,000
22	***RIGHT-OF-WAY*** (HIGHWAY-CP)				$ 3,641,000		$ 1,234,000		$ 3,320,000		$ 7,943,000		$ 2,715,000		$ 28,538,000		$ 2,688,000		$ 5,357,000		$ 1,841,000		$ 19,868,000
	I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS - SUBTOTAL				***$ 88,059,000***		***$ 36,493,000***		***$ 49,360,000***		***$ 138,923,000***		***$ 62,797,000***		***$ 399,588,000***		***$ 39,615,000***		***$ 146,189,000***		***$ 113,609,000***		***$ 86,226,000***

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PHASE 4

= This color shaded cells can be updated

Project Description - **Phase 1 (2009 to 2035), Phase 2 (2036 to 2055), Phase 3 (2056 to 2075), Phase 4 - Total Preferred Alternative**
Costs are in 2009 dollars.

Mid-Year of Construction 2009

I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS (GP-TEL-CL)

	ITEM	UNIT COST	UNIT		Region 6						PROJECT TOTALS
					I-25 (3 GP + 1 TEL) from US 36 to 120th Avenue		SH 7 Par-clo Interchange		I-25 (3 GP + 1 TEL) from 120th Avenue to SH 7		
1	***REMOVALS / RELOCATIONS***										
1-A	REMOVAL OF PAVEMENT	$ 3.00	S.Y.		524,000	$ 1,572,000	196,300	$ 589,000	398,400	$ 1,195,000	**$ 12,975,000**
1-B	REMOVAL OF BRIDGES	$ 72,000	EACH		1	$ 72,000	1	$ 72,000	0	$ -	**$ 3,960,000**
1-C	REMOVAL OF BUILDINGS	$ 40,000	EACH		1	$ 40,000	1	$ 40,000	0	$ -	**$ 320,000**
2	***ROADWAY/CONSTRUCTION***										
2-A	PAVEMENT - I-25	$ 41	S.Y.		539,000	$ 21,883,000	157,000	$ 6,374,000	484,600	$ 19,675,000	**$ 168,810,000**
2-B	PAVEMENT - RAMPS	$ 33	S.Y.		65,900	$ 2,142,000	51,900	$ 1,687,000	37,600	$ 1,222,000	**$ 21,721,000**
2-C	PAVEMENT - CROSSROADS/FRONTAGE ROADS	$ 33	S.Y.		54,400	$ 1,768,000	62,300	$ 2,025,000	0	$ -	**$ 63,201,000**
2-D	AGGREGATE BASE COURSE (CLASS 6)	$ 22	C.Y.		109,900	$ 2,407,000	45,200	$ 990,000	87,000	$ 1,905,000	**$ 24,710,000**
2-E	GUARDRAIL TYPE 7	$ 90	L.F.		41,100	$ 3,699,000	5,200	$ 468,000	29,500	$ 2,655,000	**$ 10,737,000**
2-F	TENSIONED CABLE BARRIER	$ 10	L.F.		0	$ -	3,000	$ 30,000	0	$ -	**$ 2,474,000**
3	***BRIDGES/STRUCTURES***										
3-A	BRIDGE - STANDARD	$ 105	S.F.		24,500	$ 2,573,000	44,300	$ 4,652,000	67,100	$ 7,046,000	**$ 81,725,000**
3-B	BRIDGE - LONG SPAN	$ 115	S.F.		11,400	$ 1,311,000	0	$ -	0	$ -	**$ 36,792,000**
3-C	BRIDGE - PEDESTRIAN OVERPASS	$ 910	S.F.		8,600	$ 7,826,000	0	$ -	0	$ -	**$ 7,826,000**
3-D	BRIDGE - FLYOVER	$ 121	S.F.		0	$ -	0	$ -	0	$ -	**$ 23,280,000**
4	***RETAINING WALLS***										
4-A	MSE WALL HEIGHT (0-10')	$ 210	LF		24,800	$ 5,208,000	4,500	$ 945,000	7,900	$ 1,659,000	**$ 16,695,000**
4-B	MSE WALL HEIGHT (10-20')	$ 690	LF		14,000	$ 9,660,000	1,600	$ 1,104,000	1,600	$ 1,104,000	**$ 35,190,000**
4-C	MSE WALL HEIGHT (20'+)	$ 1,760	LF		2,100	$ 3,696,000	200	$ 352,000	500	$ 880,000	**$ 50,688,000**
5	***SOUND WALLS***	$ 22	SF		82,100	$ 1,826,000	0	$ -	172,400	$ 3,834,000	**$ 6,609,000**
	SUBTOTAL (A) =					**$ 65,683,000**		**$ 19,328,000**		**$ 41,175,000**	**$ 567,713,000**
6	***LIGHTING***	1.7%	OF (A)			$ 1,117,000		$ 329,000		$ 700,000	**$ 9,652,000**
7	***EARTHWORK***	22.8%	OF (A)	5.1%		$ 3,350,000		$ 986,000		$ 2,100,000	**$ 107,104,000**
8	***DRAINAGE***	10.7%	OF (A)			$ 7,028,000		$ 2,068,000		$ 4,406,000	**$ 60,746,000**
9	***EROSION CONTROL***	3.1%	OF (A)			$ 2,036,000		$ 599,000		$ 1,276,000	**$ 17,599,000**
10	***SIGNING AND STRIPING***	2.3%	OF (A)			$ 1,511,000		$ 445,000		$ 947,000	**$ 13,058,000**
11	***CONSTRUCTION TRAFFIC CONTROL***	12.3%	OF (A)			$ 8,079,000		$ 2,377,000		$ 5,065,000	**$ 69,828,000**
12	***URBAN DESIGN / LANDSCAPING***	1.0%	OF (A)			$ 657,000		$ 193,000		$ 412,000	**$ 5,677,000**
13	***MOBILIZATION***	15.7%	OF (A)	7.1%		$ 4,663,000		$ 1,372,000		$ 2,923,000	**$ 78,277,000**
14	***MISCELLANEOUS BID ITEMS***	7.7%	OF (A)			$ 5,058,000		$ 1,488,000		$ 3,170,000	**$ 43,713,000**
15	***CARPOOL PARKING***	$ 4,460,000	L.S.		0.00	$ -	0.00	$ -	0.00	$ -	**$ 4,461,000**
16	***INTELLIGENT TRANSPORTATION SYSTEM ELEMENTS***	$ 169,000	MI		5.5	$ 930,000	1.0	$ 169,000	5.3	$ 891,000	**$ 9,725,000**
17	***MANAGED LANE SYSTEM***	$ 180,000	MI		5.5	$ 990,000	0.0	$ -	6.3	$ 1,134,000	**$ 9,306,000**
17	***TRAFFIC SIGNALS*** (RAMP TERMINAL INTERSECTION)	$ 250,000	EACH		4	$ 1,000,000	3	$ 750,000	0	$ -	**$ 13,500,000**
18	***PORT OF ENTRY*** (BUILDING AND PIT SCALES)	$ 410,000	EACH		0	$ -	0	$ -	0	$ -	**$ 820,000**
	TOTAL CONSTRUCTION BID ITEMS (CBI)					**$102,102,000**		**$30,104,000**		**$ 71,676,000**	**$ 1,018,656,000**
19	***UNFORESEEN CONDITIONS***	2.0%	OF (CBI)			$ 2,042,000		$ 602,000		$ 1,434,000	**$ 20,373,000**
	TOTAL CONSTRUCTION ITEMS (CI)					**$104,144,000**		**$30,706,000**		**$ 73,110,000**	**$ 1,039,029,000**
20	***UTILITIES***	4.6%	OF (CI)			$ 4,791,000		$ 1,412,000		$ 3,363,000	**$ 47,795,000**
21	***PLANNING AND ENGINEERING***										
21-A	DESIGN	8.8%	OF (CI)			$ 9,165,000		$ 2,702,000		$ 6,434,000	**$ 91,435,000**
21-B	CONSTRUCTION MANAGEMENT	17.0%	OF (CI)			$ 17,704,000		$ 5,220,000		$ 12,429,000	**$ 176,635,000**
22	***RIGHT-OF-WAY*** (HIGHWAY-CP)					$ 5,616,000		$ 9,903,000		$ 6,278,000	**$ 98,942,000**
	I-25 GENERAL PURPOSE, TOLLED EXPRESS LANES, CARPOOL LOTS - SUBTOTAL					***$ 141,420,000***		***$ 49,943,000***		***$ 101,614,000***	***$ 1,453,836,000***

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EXPRESS BUS, COMMUTER BUS (EB-CB)

	ITEM	Cost/Unit	UNIT	Quantity	Cost
1	***ROADWAY/CONSTRUCTION***				
1-A	PAVEMENT - QUEUE JUMPS	$ 57	S.Y.	220	$ 13,000
2	***EXPRESS BUS STATIONS***	$ 42,490,000	L.S.	1	$ 42,490,000
3	***COMMUTER BUS STATIONS***	$ 4,160,000	L.S.	1	$ 4,160,000
	SUBTOTAL (B) =				**$ 46,663,000**
4	***MOBILIZATION***	11.0%	OF (B)		$ 5,133,000
5	***MISCELLANEOUS BID ITEMS***	8.8%	OF (B)		$ 4,106,000
6	***BUS MAINTENANCE FACILITY***	$ 16,864,000	EACH	1	$ 16,864,000
7	***TRAFFIC SIGNALS***				
7-A	QUEUE JUMP SIGNALS	$ 250,000	Each	1.25	$ 313,000
7-B	OTHER EXISTING SIGNAL MODIFICATIONS	$ 50,000	Each	9	$ 450,000
	TOTAL CONSTRUCTION BID ITEMS (CBI)				**$ 73,529,000**
8	***UNFORESEEN CONDITIONS***	2.0%	OF (CBI)		$ 1,471,000
	TOTAL CONSTRUCTION ITEMS (CI)				**$ 75,000,000**
9	***UTILITIES***	7.0%	OF (CI)		$ 5,250,000
10	***PLANNING AND ENGINEERING***				
10-A	ENVIRONMENTAL IMPACT STATEMENT				
10-B	DESIGN	8.8%	OF (CI)		$ 6,600,000
10-C	CONSTRUCTION MANAGEMENT	17.0%	OF (CI)		$ 12,750,000
11	***RIGHT-OF-WAY*** (EB-CP-CB)				
11-A	ROW - EXPRESS BUS	$ 11,690,000	L.S.	1	$ 11,690,000
11-B	ROW - COMMUTER BUS	$ 4,068,000	L.S.	1	$ 4,068,000
12	***EXPRESS BUS VEHICLES***	$ 376,000	EACH	27	$ 10,152,000
13	***COMMUTER BUS VEHICLES***	$ 376,000	EACH	5	$ 1,880,000
	EXPRESS BUS, COMMUTER BUS - SUBTOTAL				***$ 127,390,000***

FEIS - Package PA
Preferred Alternative HIGHWAY IMPROVEMENTS, TRANSIT STATIONS, AND COMMUTER RAIL ROW PRESERVATION
OPINION OF PROBABLE COST

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COMMUTER RAIL (CR)

	ITEM	Cost/Unit	UNIT	Quantity	Cost
1	***EARTHWORK***	20%	OF (TRACKWORK)		$ 10,856,000
2	***BRIDGES/STRUCTURES/TUNNELS***				
2-A	COMMUTER RAIL BRIDGE - span <140' (no curvature)	$ 180	S.F.	17,800	$ 3,204,000
2-B	COMMUTER RAIL BRIDGE - span >140' (or with curvature)	$ 220	S.F.	37,200	$ 8,184,000
3	***RETAINING WALLS***				
3-A	MSE WALL HEIGHT (0-10')	$ 210	L.F.	23,750	$ 4,988,000
3-B	MSE WALL HEIGHT (10-20')	$ 690	L.F.	6,590	$ 4,547,000
3-C	MSE WALL HEIGHT (20'+)	$ 1,760	L.F.	4,330	$ 7,621,000
4	***TRACKWORK***				
4-A	DOUBLE BALLASTED TRACK	$ 599	L.F.	35,150	$ 21,055,000
4-B	SINGLE BALLASTED TRACK	$ 332	T.F.	95,245	$ 31,621,000
4-C	SPECIAL TRACK: NO. 11 TURNOUT	$ 133,500	EACH	12	$ 1,602,000
5	***ACCESS ROAD***				
5-A	13' GRAVEL ACCESS ROAD	$ 20	TON	97,330	$ 1,947,000
6	***SIGNALS***				
6-A	BASE COMMUNICATION SYSTEM	$ 1,500,000	ROUTE MILE	49	$ 73,350,000
7	***SYSTEM WIDE ELEMENTS***				
7-A	COMMUTER RAIL ACTIVATION & TESTING	$ 2,000,000	EACH	2	$ 4,000,000
7-B	RURAL FENCE	$ 5.30	L.F.	410,300	$ 2,175,000
8	***AT GRADE CROSSING***	$ 136,700	EACH	39	$ 5,331,000
	SUBTOTAL (C) =				**$ 180,481,000**
9	***DRAINAGE***	7.0%	OF (C)		12,634,000
10	***NOISE AND VIBRATION***	2.0%	OF (C)		3,610,000
11	***SIGNING AND STRIPING***	1.0%	OF (C)		1,805,000
12	***CONSTRUCTION TRAFFIC CONTROL***	6.0%	OF (C)		$ 10,829,000
13	***MOBILIZATION***	15.0%	OF (C)		$ 27,072,000
14	***MISCELLANEOUS BID ITEMS***	10.0%	OF (C)		$ 18,048,000
15	***COMMUTER RAIL STATIONS***	$ 32,845,000	L.S.	1	$ 32,845,000
16	***MAINTENANCE & OPERATIONS FACILITY***	$ 56,886,000	EACH	1	$ 56,886,000
	TOTAL CONSTRUCTION BID ITEMS (CBI)				**$ 344,210,000**
17	***UNFORESEEN CONDITIONS***	5.0%	OF (CBI)		$ 17,211,000
	TOTAL CONSTRUCTION ITEMS (CI)				**$ 361,421,000**
18	***INSURANCE LEGAL***	3.0%	OF (CI)		$ 10,843,000
19	***UTILITIES***	3.0%	OF (CI)		$ 10,843,000
20	***PLANNING AND ENGINEERING***				
20-A	ENVIRONMENTAL IMPACT STATEMENT	$ 7,000,000	$		$ 7,000,000
20-B	DESIGN	8.8%	OF (CI)		$ 31,805,000
20-C	CONSTRUCTION MANAGEMENT	24.0%	OF (CI)		$ 86,741,000
21	***COMMUTER RAIL ROW***	$ 24,818,000	L.S.	1	$ 24,818,000
22	***FEEDER BUS VEHICLES***	$ 303,000	EACH	0	$ -
23	***DMU VEHICLES***	$ 5,200,000	EACH	29	$ 150,800,000
	COMMUTER RAIL - SUBTOTAL				***$ 684,270,000***

		Item Number & Description	Unit	Unit Cost Range Low	Unit Cost Range High	Most Probable Value	Percentage of Range	Assumptions
I-25 GENERAL PURPOSE + TOLLED EXPRESS LANES (GP-TEL)								
	1	**REMOVALS & RELOCATIONS**						
	1-A	Removal of Pavement	S.Y.	$2.00	$10.00	$3.00	13%	Assumes removal of concrete pavement and asphalt pavement have the same unit cost. High cost range assumes all pavement is hauled to a recycling center. Low cost range applicable to large projects with over 500,000 SY of removal. The unit cost applied reflects the size of anticipated project construction phases without recycling. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	1-B	Removal of Bridges	Each	$30,000	$250,000	$72,000	19%	Assumes removal and disposal of existing bridge structure, including concrete, reinforcing steel, girders, and bridge deck. CDOT cost data for 2009 identifies $72,000/bridge as an average. The low cost range is for a small single span bridge. The high cost range is typical of a large four-span bridge either over a water course or high volume traffic. The anticipated structure removals typical for this project include only a minor percentage that will require I-25 closure. The cost used is that average from the recent I-25 projects from SH 7 to SH 66. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	1-C	Removal of Buildings	Each	$25,000	$200,000	$40,000	9%	Assumes all environmental remediation and complete removal of the structure, and foundation. The low cost range is for a small structure and the high cost range is for a larger structure with greater environmental mitigation requirements. CDOT cost data average for 2008 is $105,000 per building and for 2009 is $50,000 per building. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	2	**ROADWAY**						
	2-A	Pavement - I-25 Mainline	S.Y.	$35.00	$60.00	$40.60	22%	Assumes concrete pavement at 11 – 13" thickness. The unit cost of $38/SY was developed using that average of recent I-25 projects from SH 7 to SH 66. CDOT cost data average for 2009 is $49/SY for 13-Inch Concrete Pavement (41,504 SY) and the 2007 average was $39/SY for the same (232,099 SY). The high cost range is typical for a small paving project less than 10,000 SY. The low cost range is typical for a large paving project over 200,000 SY. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	2-B	Pavement - I-25 Ramps	S.Y.	$25.00	$40.00	$32.50	50%	Assumes concrete pavement at 8" - 10" thickness. The unit cost of $32/SY was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $27.36/SY for 10 3/4" Concrete Pavement (212,084 SY), and the 2007 average was $33.10/SY for 10" Concrete Pavement (41,104 SY). The low cost range is typical for high volume paving projects greater than 200,000 SY and the high cost range is for low volume paving projects less than 10,000 SY. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	2-C	Pavement - Crossroads & Frontage Roads	S.Y.	$25.00	$40.00	$32.50	50%	Assumes concrete pavement at 10" thickness. The unit cost of $58/Ton was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $36.41 for Hot Bituminous Pavement (HBP) (Grading SX)(75) (305,962 Tons), and the 200X average was $51.47/Ton for HBP (Grading SX)(100)(PG 64-22)(129,500 Tons) . The low cost range is typical for high volume paving projects over 50,000 Tons and the high cost range is for low volume paving projects less than 1,000 Tons. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	2-D	Aggregate Base Course (Class 6)	C.Y.	$15.00	$40.00	$21.90	28%	Assumes Aggregate Base Course (ABC) (Class 6) at 6" thickness as part of a composite section for all bituminous and concrete pavements. The unit cost of $20/CY was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $32.00/CY for ABC (Class 6) (80,390 CY), and the 2008 average was $23.57/CY (58,658 CY). The low cost range is typical for high volume paving projects over 50,000 CY with a close source of aggregate and the high cost range is for low volume paving projects less than 1,000 CY and an aggregate source located at a greater distance from the project. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.

	Item Number & Description		Unit	Unit Cost Range		Most Probable Value	Percentage of Range	Assumptions
				Low	High			
	2-E	Guardrail Type 7	L.F.	$50.00	$100.00	$90.00	80%	Assumes concrete barrier in accordance with the CDOT M&S Standards. The unit cost of $58/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $67/LF for CDOT Standard Guardrail Type 7 (Style CA) (9,233 LF), and the 2008 average was $56/LF (29,639 LF). The low cost range is typical for a large quantity project over 10,000 LF and the high cost range is for a small quantity project with less than 1,000 LF. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	2-F	Tensioned Cable Barrier	L.F.	$9.00	$15.00	$9.90	15%	Assumes application of tensioned cable barrier in accordance with the CDOT M&S Standards continued along I-25 median similar to recent I-25 projects from SH 7 to SH 66. The unit cost of $10.49/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $12.29/LF for CDOT Standard Tensioned Cable Barrier (36,732 LF), and the 2008 average was $13.96/LF (37,415 LF). The low cost range is typical for a large quantity project over 10,000 LF and the high cost range is for a small quantity project with less than 1,000 LF. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	3	**BRIDGE STRUCTURES**						
	3-A	Bridge - Standard	S.F.	$85.00	$150.00	$105.00	31%	This bridge classification is intended to be comprised of the span lengths and structure types most commonly used for bridge construction in Colorado. Span lengths in this classification are generally less than 140' and include Precast Prestressed Girders (BT, Box, or U-Tub) and Concrete Slab (Precast Prestressed or Cast-In-Place) The unit cost of $105/SF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $90/SF for CDOT Standard Prestress Girder (Box Section) (65,663 SF), the 2008 average was $136/SF (15,418 SF) and the 2007 average was $86/SF (10,335 SF). The low cost range is typical for a large quantity project over 20,000 SF and the high cost range is for a small quantity project with less than 10,000 SF. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	3-B	Bridge - Long Span	S.F.	$85.00	$170.00	$115.00	35%	This bridge classification consists of structure types and span lengths that are outside the definition of a standard bridge. This bridge is typical of for crossroads over I-25 where a center median pier is not allowed. These structure types include a Post-Tensioned Precast Concrete U Girder, Cast-in-Place Post-Tensioned Box or U- Girder, Steel Plate Girder, Steel Box Girder, or Pedestrian Overpass Truss Arch Structure. The unit cost of $115/SF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $131/SF for Prestress/Post-Tensioned Concrete I-Girder (5,828 SF), and $110/SF for Fabricated Steel Girder (20,751 SF). The 2008 average was $123/SF for Rolled Steel GIrder (16,076 SF), and the 2006 average was $152/SF for Post-Tenstioned Box Girder (90,520 SF). CDOT Region 4 has accepted a two-span (Standard) type of structure for the recent No-Action project at the I-25/SH 392 interchange. As such, the possibilty that CDOT Region 4 will accept a two-span (Standard) structure in lieu of a Long Span structure at other interchange locations along I-25, the low cost range is extended to the same low cost for a Standard Bridge
	3-C	Bridge - Pedestrian Overpass	S.F.	$700.00	$1,000.00	$910.00	70%	This bridge classification is for highway pedestrian overpasses along I-25. However, the cost information source is derived from RTD FasTracks and TREX available cost data for similar type structures. The cost/s.f. assumes 1 elevator and tower, 1 set of stairs at each end of the pedestrian bridge, lighting, and security.

	Item Number & Description		Unit	Unit Cost Range Low	Unit Cost Range High	Most Probable Value	Percentage of Range	Assumptions
…LED EXPRESS LANES (GP-TEL)	**3-D**	Bridge - Flyover	S.F.	$102.00	$170.00	$121.00	28%	This bridge classification is soley for the flyovers required for the I-25/US 34 Interchange. The maximum span lenght was held to 275' in order to allow for alternative girder options, including Post-Tensioned Precast Concrete U Girders and Precast Segmental. The unit cost of $121/SF was developed using the average of flover structures E-17-QJ and E-17-QK. The CDOT cost data average for 2006 was $152/SF for Post Tensioned Box Girder (90,520 SF).. The low cost range is typical for a large quantity project over 20,000 SF and the high cost range is for a small quantity project with less than 5,000 SF. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	4	**RETAINING WALL STRUCTURES**						
	4-A	MSE Wall (0-10' Height)	L.F.	$190.00	$220.00	$210.00	67%	Assumes a mechanically stabilized earth retaining wall, including Structure Excavation, Structure Backfill (Class 1), Mechanical Reinforcement of Soil, lock Facing and Structural Concrete Coating. This item assumes an average wall height of 7.5'. The unit cost of $200/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $8.67/CY for Structure Excavation (92,674 LF), $16.79/CY for Structure Backfill (Class 1) (132,151 CY), $13.68/CY for Mechanical Reinforcement of Soil (72,752 CY), $12.66/SF for Block Facing (104,971 SF), and $1.07/SF for Structural Concrete Coating (15,464 SF). The low cost range is typical for a large quantity project over 1,000 LF and the high cost range is for a small quantity project with less than 100 LF. Separate unit costs are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	4-B	MSE Wall (10'-20' Height)	L.F.	$560.00	$750.00	$690.00	68%	Assumes a mechanically stabilized earth retaining wall, including Structure Excavation, Structure Backfill (Class 1), Mechanical Reinforcement of Soil, lock Facing and Structural Concrete Coating. This item assumes an average wall height of 15'. The unit cost of $660/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $8.67/CY for Structure Excavation (92,674 LF), $16.79/CY for Structure Backfill (Class 1) (132,151 CY), $13.68/CY for Mechanical Reinforcement of Soil (72,752 CY), $12.66/SF for Block Facing (104,971 SF), and $1.07/SF for Structural Concrete Coating (15,464 SF). The low cost range is typical for a large quantity project over 1,000 LF and the high cost range is for a small quantity project with less than 100 LF. Separate applied unit costs are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	4-C	MSE Wall (20'+ Height)	L.F.	$1,340.00	$1,900.00	$1,760.00	75%	Assumes a mechanically stabilized earth retaining wall, including Structure Excavation, Structure Backfill (Class 1), Mechanical Reinforcement of Soil, lock Facing and Structural Concrete Coating. This item assumes an average wall height of 25'. The unit cost of $1,680/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $8.67/CY for Structure Excavation (92,674 LF), $16.79/CY for Structure Backfill (Class 1) (132,151 CY), $13.68/CY for Mechanical Reinforcement of Soil (72,752 CY), $12.66/SF for Block Facing (104,971 SF), and $1.07/SF for Structural Concrete Coating (15,464 SF). The low cost range is typical for a large quantity project over 1,900 LF and the high cost range is for a small quantity project with less than 100 LF. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	5	**SOUND WALLS**	S.F.	$10.00	$35.00	$22.24	49%	Assumes a masonry fence with a height range from 10' to 16'. The unit cost of $13.13/SF was developed using the average of various Region 6 projects. The CDOT cost data average for 2007 was $33/SF for CDOT Fence Masonry (Sound Barrier) (3,300 SF). The low cost range is typical for a large quantity project over 20,000 SF and the high cost range is for a small quantity project with less than 1,000 SF. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.

	Item Number & Description		Unit	Unit Cost Range		Most Probable Value	Percentage of Range	Assumptions
				Low	High			
I-25 GENERAL PURPOSE + TOLL	6	**LIGHTING**	% of Quantified Items	1.0%	2.0%	1.7%	70%	This percentage total represents a compilation of lighting related items including the following: light standards, concrete foundations, lighting control center, luminaires, electrical conduit, wiring. Separate percentages are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	7	**EARTHWORK**						
		Earthwork - CDOT Region 4	% of Quantified Items	20.0%	30.0%	22.8%	28%	This percentage total represents a compilation of earthwork related items including the following: embankment material, unclassified excavation and muck excavation. Separate eartwork line items were identified for the two CDOT regions due to the relatively large disparity in percentage ranges between to the two regions for this item. The higher percentage range is typical for I-25 projects in Region 4 north of SH 66 wherein profile grade and horizontal alignment revisions are part of the project(s).
		Earthwork - CDOT Region 6	% of Quantified Items	3.0%	6.0%	5.1%	70%	This percentage total represents a compilation of earthwork related items including the following: embankment material, unclassified excavation and muck excavation. Separate earthwork line items for were identified for the two CDOT regions due to the relatively large disparity in percent ranges between the two regions for this item. The lower percentage range is typical for I-25 projects in Region 6 wherein no significant profile grade revisions or alignment revisions are part of the project(s).
	8	**DRAINAGE**	% of Quantified Items	8.0%	12.0%	10.7%	67.5%	This percentage total represents a compilatiion of drainage related items including the following: riprap, pipe (concrete, plastic, corrugated metal), inlets, manholes, drains (under, edge, sub-surface), trash guards, and box culverts. Separate applied percentages are included to reflect cost differentials between North Front Rage (Region 4) projects and Denver Metro (Region 6) projects.
	9	**EROSION CONTROL**	% of Quantified Items	2.0%	3.5%	3.1%	73.3%	This percentage total represents a compilation of erosion control related items including the following: topsoil, erosion bales, silt fence, sediment basins, erosion control supervisor, seeding, mulching, soil retention blankets, and herbicide treatments. It does not include ROW, earthwork, pipe, or structures for MS4 components. Separate applied percentages are included to reflect cost differentials for these items between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	10	**SIGNING AND STRIPING**	% of Quantified Items	1.0%	3.0%	2.3%	65.0%	This percentage total represents a compilation of signing and striping related items including the following: delineators, sign panels, sign posts, sign structures (cantilever, butterfly), preformed pavement marking, and paint. Separate applied percentages are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	11	**CONSTRUCTION TRAFFIC CONTROL**	% of Quantified Items	5.0%	14.0%	12.3%	81.1%	This percentage total represents a compilation of construction traffic control related items including the following: detour pavement, flagging, traffic control management and inspection, temporary signing, traffic control devices (barrier, barrels, cones, arrow panels), impact attenuators. Separate applied percentages are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	12	**URBAN DESIGN / LANDSCAPING**	% of Quantified Items	0.0%	2.0%	1.0%	50.0%	This percentage total represents a compilation of urban design and landscape related items including the following: sod, mulch, seeding, trees and irrigation. Separate applied percentages are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	13	**MOBILIZATION**						
		Mobilization - Region 4	% of Quantified Items	15.1%	16.2%	15.7%	54.5%	This percentage total includes all costs per the CDOT Specifications. Separate mobilization line items were identified for the two CDOT regions due to the relatively large disparity in percentage ranges between the two regions for this item. However, the cost range for this item in Region 4 is relatively narrow.
		Mobilization - Region 6	% of Quantified Items	4.9%	10.4%	7.1%	40.0%	This percentage total includes all costs per the CDOT Specifications. Separate mobilization line items were identified for the two CDOT regions due to the relatively large disparity in percentage ranges between the two regions for this item. The high end of the cost range represents more recent I-25 construction, which may be assumed to be of a higher probability than the lower end of the cost range.
	14	**MISCELLANEOUS BID ITEMS**	% of Quantified Items	7.0%	8.0%	7.7%	70.0%	This percentage includes costs for other known CDOT bid items not represented by either the quantifiable or percentage line items identified above.

	Item Number & Description		Unit	Unit Cost Range Low	Unit Cost Range High	Most Probable Value	Percentage of Range	Assumptions
	15	**CARPOOL PARKING**	LS	$3,600,000	$5,400,000	$4,460,000	47.8%	Unit cost data from RTD 2010 Annual Program Review, West Corridor and SWC Extension. Municipal requirements could vary causing the cost to be lower or higher. The cost range accounts for varying bid prices and carpool lot sizes, affecting ecomomies of scale. This lump sum item represents all costs associated with all of the carpool facilities along the I-25 corrridor, including ingress and egress facilities, bus turnaround paving, bike racks, etc.
	16	**INTELLIGENT TRANSPORTATION SYSTEM**	Mile	$160,000.00	$175,000.00	$169,000	60.0%	This unit cost represents a compilation of ITS related items including the following: LED Variable Message System, concrete foundation, closed circuit television cameras and poles, and weather station. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects. This item includes 1 VMS Board/Foundation every 2 miles in both directions, 1 Weather Station every 5 miles, 1 Communication Equipment Station every 2 miles in both directions, and 1 Closed Circuit Television every 2 miles in both directions.
	17	**MANAGED LANE SYSTEM**	Mile	$150,000.00	$300,000.00	$180,000	20.0%	This unit cost represents a compilation of managed lane system related items including the following: sing structures, electronic equipment, cabinets, power supply, cameras, testing, . The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	18	**TRAFFIC SIGNALS**	Each	$200,000.00	$300,000.00	$250,000	50.0%	This unit cost represents a compilation of traffic signal related items including the following: traffic signal poles with mast arms, electrical conduit, signal heads, controller, cabinet, and power supply. The appropriate applied unit cost is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	19	**PORT OF ENTRY** (BUILDING AND PIT SCALES)	Each	$370,000	$440,000	$410,000	57.1%	This unit cost represents a port of entry building and weighs scales for each location. The cost of pavement, barrier, signing, and advanced warning have not been included in the cost. The applied unit cost is appropriate for the North Front Range (Region 4) since there is only one project location for the Preferred Alternative.
	20	**UNFORESEEN CONDITIONS**	% Of (CBI)	0.0%	2.0%	1.0%	50%	This item accounts for any unforeseen conditions that are not covered under all of the other quantifiable or percentage bid items above. These unforeseen conditions generally may include any unknown removals or environmental conditions that require mitigation.
	21	**UTILITIES**	% Of (CBI)	4.0%	5.0%	4.6%	60%	This percentage total represents a compilation of utility related items including relocations and abandonments for gas, water, sanitary sewer, communication and electric services and mains not covered under relocation agreements. The appropriate applied percentage is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	22	**PLANNING & ENGINEERING**						This percentage total represents a compilation of utility related items including relocations and abandonments for gas, water, sanitary sewer and electric services and mains.
	22-A	Environmental Impact Statement	NA	NA	NA	NA	NA	The amount included in this item represents that portion of the actual costs associated with the environmental process that can reasonably be attributed to the I-25 General Purpose and Tolled Express Lanes for the Preferred Alternative. This cost is not included in any of the (future) project phases, but is included in the overall project cost.
	22-B	Design	% Of (CBI)	6.0%	10.0%	8.8%	70%	This percentage total represents a compilation of design related items including survey, geotechnical, preliminary and final design, and preparation of construction documents. The appropriate applied percentage is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	22-C	Construction Management	% Of (CBI)	12.0%	24.0%	17.0%	42%	This percentage total represents a compilation of construction management related items including: field office, materials testing, construction surveying, construction observation and management. The lower end of this percentage range represents larger PA implementation projects such as design/build projects greater than $100 million. The upper end of the percentage range represents with no exceptions from the CM CDOT policy/planning budget standard and a larger number of projects for PA implementation. The appropriate applied percentage is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.

	Item Number & Description		Unit	Unit Cost Range		Most Probable Value	Percentage of Range	Assumptions
				Low	High			
	22	RIGHT-OF-WAY (GP-TEL)		$95,974,000.00	$128,625,000.00	$ 98,942,000	9%	The right-of-way cost estimate was coordinated with personnel knowledgeable in the appraisal, acquisition and relocation disciplines. The costs associated with each type of ROW activity were estimated by using Tax assessor data, comparable sales, listings and appraisals performed for CDOT Region 4 projects along I-25. The comparable sales data was not verified with buyer, seller or agent. Field inspections were conducted to gather and consider pertinent information for preparation of the estimate. However, it should be noted, the estimate is not a formal appraisal. The estimate is based on the most probable worst case and highest cost assumptions. Since properties were not inspected individually, assumptions were made about the level of complexities involved in each of the relocation situations. The total includes the estimated value of the land to be acquired, the value of any improvements and relocation costs. Impact areas and aerial maps with an overlay of the proposed ROW footprint were used for the estimate. The Sales Comparison Approach was used, in which comparable sales in the area establish the base dollar value. Also, access to remainders is assumed to be reasonable in the after condition. The estimate is not intended to reflect subsequent material changes to properties or market conditions, up or down, after May, 2010. No adjustments for inflation, uncertainties (changes in future highest and best use of properties or subsequent development of properties), and risks associated with construction schedules have not been applied. The assessor's information and aerial maps provided by others, which were relied upon in this estimate, are accurate and the most current available. The properties are considered to be "free and clear" of liens and encumbrances. In addition, it is assumed there are no hidden or unapparent conditions of the properties, sub soils or structures that render them more or less valuable. This estimate does not include any oil/gas wells, drainage or irrigation structures, cell towers or billboards, if any. For the purpose of this estimate, subdivision out los, common areas and streets impacted/identified are estimated at full fee value. This estimate does not include any contingency costs for appraisals, acquisition, attorney's fees, settlements or court costs, etc. associated with the acquisition of the properties. This estimate does not include personal property move costs. No floodplain study was conducted. The properties were assumed not to be in a designated floodplain/floodway area. Damages to remainders and any situation where a cost to cure analysis would be required were not considered. Parkland, wetland, and properties owned by public agencies and historic property placement requirements, if any, have not been considered. Due in large part to the exclustions listed above, as well as to account for the additional cost of appraisals, the upper range for right-of-way costs has been extended to a maximum of 30% of the known property costs that have been identified in the technical report. Another factor contributing to the high end of the cost range considered for this item is the probability for property condemnation. Over 500 properties were evaluated for the ROW Technical Report, and CDOT Region 4 has noted a history of a 4%-5% condemnation rate, the cost of which is not included in the base ROW cost estimate. Finally, the group gave consideration to establishing a separate or supplemental inflation rate to property values, recognizing the volatility in the real estate market. Alll of these considerations contributed to establishing an upper cost range that is 30% greater than the direct ROW cost estimate provided in the Technical Report. The only known factor contributing to the lower end of the cost range is an estimated 3% reduction in property valuation in Northern Colorado from 2007 (the base year of the ROW cost valuation) and 2009 (the base year for the FEIS Preferred Alternative Cost Estimate.
	I-25 GENERAL PURPOSE + TOLLED EXPRESS LANES (GP-TEL)							
EXPRESS BUS, COMMUTER BUS & CARPOOL LOTS (EB-CB-CL)								
	1	ROADWAY						
	1-A	Pavement - Queue Jumps	S.Y.	$50	$60	$57	70%	Unit cost data from RTD 2010 Annual Program Review, West Corridor and SWC Extension. Cost could vary depending who is the operating agency and their design requirements .

	Item Number & Description		Unit	Unit Cost Range Low	Unit Cost Range High	Most Probable Value	Percentage of Range	Assumptions
(EB-CB)	2	**EXPRESS BUS STATIONS**	L.S.	$34,000,000	$51,000,000	$42,490,000	50%	Unit cost data from RTD 2010 Annual Program Review, West Corridor and SWC Extension. Cost could vary depending who is the operating agency and their design requirements . The cost were developed using RTD criteria, A new transit agency could have design requirements causing the cost to be lower or higher. Costs for improvements could also vary depending upon local and econcomic conditions.
	3	**COMMUTER BUS STATIONS**	L.S.	$3,600,000	$5,100,000	$4,160,000	37%	Unit cost data from RTD 2010 Annual Program Review, West Corridor and SWC Extension. Cost could vary depending who is the operating agency and what are their design requirements . The cost were developed using RTD criteria, A new transit agency could have design requirements causing the cost to be lower or higher. Costs for improvements could also vary depending upon local and econcomic conditions.
	4	**OPERATIONS & MAINTENANCE FACILITY**	Each	$14,205,200	$20,212,800	$16,864,000	44%	The preliminary estimate has been developed from a preliminary cost estimate for a new bus transit facility in Northern California. Essential utility services (such as electrical, telephone, water, natural gas, storm drainage, and sanitary systems) would be adjacent to the project site and can be easily tied into without updgrading the existing main systems.This line item does not directly account for the following: furntiture, fitting and equipment unless it is an integrated part of construction, support equipment, removal of toxic or hazardous waste/material, real estate/right-of-way acquisition, legal and finance fees, owner's administration costs, surveying, warranty and maintenance, and cost escalation. Construction is based on one continuous phase under one general contract. This preliminary cost estimate is based on all work to be performed during regular working hours and does not account for overtime, night work or weekend work. The unit costs used in the detailed estimates are composite construction unit costs, including costs for material, labor, equipment, and contractor markups for general conditions, overhead and profit. Items that could potentially affect the cost estimate include: modifications to the scope of work, unforeseen subsurface conditions, special phasing requirements, restrictive technical specifications or excessive contract conditions, any specified item that cannot be obtained from at least three different sources, and any other non-competitive bid situations. This preliminary cost estimate has been prepared using accepted practices, at represents our opinion of probable construction costs. Since we have no control over market conditions (such as surges in steel or cement prices) and other factors that may affect the actual prices, we cannot and do no warranty nor guaranty that the ultimate construction costs will not vary from this preliminary cost estimate. This cost estimate has been based on very preliminary and limited information. It only serves as a general guideline for more specific and detailed studies in the future. An updated estimate should be prepared when more specific and detailed design information is available. Specific bus facility configuration assumptions include the following. For **Transit Operations**, the Operations Manager's office is a private office, the Road Supervisors and Customer Representatives' offices are shared offices. Also, the dispatch copy/work room is within the dispatch suite, the Operators men's restrooms have 1 toilet for every 25 staff and one urinal for every 75 staff. The Operators women's restrooms have 1 toilet for every 25 staff. The Men's locker room includes half height lockers. For **Maintenance - Office and Support Areas**, the Maintenance Manager's office is a private office, the Maintenance Supervisors' office is a shared office, and Maintenance break room includes vending machines, refrigerator and kitchenette. For **Administrative Office and Support Areas**, the support area conference room accommodates 10 people, and the copy/supply storage/work room includes work table. For **Maintenance - Shop & Bay Area**, the running repair bay accommodates a 40' Motor Coach with a bus to bay ratio of 15:1, and the Standard PM/Inspection bay accommodates a standard 40' Motor Coach with a bus to bay ratio of 50:1. The Tire Bay accommodates a standard 40' Motor Coach with a bus to bay ratio of 150:1. The Battery Room is an enclosed room , the Lube/Compressor room is above ground fluid tanks, and the parts distributor is included under the parts counter.

	Item Number & Description		Unit	Unit Cost Range Low	Unit Cost Range High	Most Probable Value	Percentage of Range	Assumptions
EXPRESS BUS - COMMUTER BUS								For the **Service Island**, the Island Supervisor is a shared office adjacent to the Service Island, and the Fueling Lane/Fare Retrieval/Clean Lane accommodates a standard 40' Motor Coach with a bus per position ratio of 75:1. Also, the Vacuum Equipment room includes storage for detail supply, the service storage room accommodates forklift access, and the Lube/Compressor room is above ground fluid tanks. For **Exterior Areas**, the Diesel Fuel Tank is a 30,000 gallon above ground tank, and the Unleaded Fuel Tank is an 8,000 gallon above ground tank. A reduced construction cost adjustment of 5% is included to account for the difference between construction in Northern California and the Denver Metro Area. The Paint and Body Shop and equipment was eliminated as this was assumed to be contracted out. Also, the Eng/Trans - O/H is assumed to be contracted out.
	5	**MOBILIZATION**						
		Mobilization - Region 4	Of (B)	5.0%	9.0%	7.1%	53%	This percentage total includes all costs per the CDOT Specifications. Separate mobilization line items were identified for the two CDOT regions due to the relatively large disparity in percentage ranges between the two regions for this item.
		Mobilization - Region 6	Of (B)	8.0%	18.0%	15.7%	77%	This percentage total includes all costs per the CDOT Specifications. Separate mobilization line items were identified for the two CDOT regions due to the relatively large disparity in percentage ranges between the two regions for this item.
	6	**MISCELLANEOUS BID ITEMS**	% of Quantified Items	5.0%	20.0%	8.8%	25%	This percentage includes costs for other known bid items not representated by either the quantifiable or percentage line items above.
	7	**TRAFFIC SIGNALS**						
	7-A	Queue Jump Signals	Each	$176,000	$289,000	$250,000	65%	The unit cost assumes a signalized intersection using the following items: 4x traffic signal poles with mast arms, foundations, & signal heads, illumination, pedestrian countdown heads and pushbuttons for 4 crosswalks, vehicle detection for 4 approaches, preemption, electrical conduit, controller, cabinet, & power supply. Signal interconnection assumed to already exist since these will be installed at existing signals. Individual item high and low prices taken from CDOT Bid Price book averages for 2007 thru 2009. Some existing equipment may be able to be reused, depending on condition of existing hardware.
	7-B	Other Existing Signal Modifications	Each	$30,000	$60,000	$50,000	67%	Includes the costs associated with traffic signal modifications at locations other than queue jump signals.
	8	**UNFORESEEN CONDITIONS**	% of Quantified Items	0.0%	2.0%	1.0%	50%	This item accounts for any unforeseen conditions that are not covered under all of the other quantifiable or percentage bid items above. These unforeseen conditions generally may include any unknown removals or environmental conditions that require mitigation.
	9	**UTILITIES**	% of Quantified Items	5.0%	8.0%	7.0%	67%	This percentage total represents a compilation of utility related items including relocations and abandonments for gas, water, sanitary sewer, communication and electric services and mains not covered under relocation agreements.
	10	**PLANNING & ENGINEERING**						
	10-A	Environmental Impact Statement	NA	NA	NA	NA	NA	The amount included in this item represents that portion of the actual costs associated with the environmental process that can reasonably be attributed to the I-25 General Purpose and Tolled Express Lanes for the Preferred Alternative. This cost is not included in any of the (future) project phases, but is included in the overall project cost.
	10-B	Design	Of (CI)	6.0%	11.0%	8.8%	56%	This percentage total represents a compilation of design related items including survey, geotechnical, preliminary and final design, and preparation of construction documents. This item covers the cost for completion of final design from the current design status to completion of preparation of construction documents.

Item Number & Description		Unit	Unit Cost Range Low	Unit Cost Range High	Most Probable Value	Percentage of Range	Assumptions
10-C	Construction Management	Of (CI)	10.0%	24.0%	20.0%	71%	This percentage total represents a compilation of construction management related items including: field office, materials testing, construction surveying, construction observation and management. The lower end of this percentage range represents larger PA implementation projects such as design/build projects greater than $100 million. The upper end of the percentage range represents with no exceptions from the CM CDOT policy/planning budget standard and a larger number of projects for PA implementation. The appropriate applied percentage is the same for both North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
11	**RIGHT-OF-WAY (EB-CB)**						See General Purpose Lanes - Tolled Express Lanes Section Item 22 for additional pertinent details regarding assumptions for right-of-way. The lower end of the cost range represents an estimated 3% reduction in real estate values in Northern Colorado from 2007 (the base year for the ROW evaluation) and 2009 (the cost estimate base year).
11-A	ROW - Express Bus (EB)	LS	$11,300,000	$11,690,000	$11,690,000	100%	
11-B	ROW - Commuter Bus (CB)	LS	$3,946,000	$4,068,000	$4,068,000	100%	
12	**EXPRESS BUS VEHICLES**	Each	358,100	383,800	$376,000	70%	Vehicle assumed to be a 40' Coach style bus. Unit cost is per RTD. High and low costs assume a 3 to 5% range. High range is from APTA paper on average bus costs.
13	**COMMUTER BUS VEHICLES**	Each	358,100	383,800	$376,000	70%	Vehicle assumed to be a 40' Coach style bus. Unit cost is per RTD. High and low costs assume a 3 to 5% range. High range is from APTA paper on average bus costs.
EXPRESS BUS, COMMUTER BUS & CARPOOL LOTS (EB-CB-CL)							
COMMUTER RAIL (CR)							
1	**EARTHWORK**	% Of Trackwork	15.0%	30.0%	20.0%	33%	Earthwork during the DEIS was computed by modeling a double track section through the entire length of the project. Cost of earthwork was then calculated as a percentage of overall length of track to be 15%. Comparing the DEIS double track with the FEIS single track and passing track with the addition of a considerable length of maintenance road, the required earthwork was increased to 20%. Considering each phase will be broken into smaller projects that may be built over a longer period of time, this percentage could be higher due to availability and location of fill.
2	**BRIDGE & TUNNEL STRUCTURES**						
2-A	Railroad Bridge - Span <140' (no curvature)	S.F.	$90	$220	$180	69%	Unit cost data from RTD 2010 Annual Program Review. Range of costs vary dependent on type of construction. Bridges could be Prestressed Girder (Box Section) or Fabricated Steel Girder. Unit cost is based on CDOT costs with comparisons to RTD's bottom up estimate.
2-B	Railroad Bridge - Span >140' (or with curvature)	S.F.	$115	$285	$220	62%	Unit cost data from RTD 2010 Annual Program Review. Range of costs vary dependent on type of construction. Bridges could be Prestressed Girder (Box Section) or Fabricated Steel Girder. Unit cost is based on CDOT costs with comparisons to RTD's bottom up estimate.
3	**RETAINING WALL STRUCTURES**						
3-A	MSE Wall (0-10' Height)	L.F.	$190.00	$220.00	$210.00	67%	Assumes a mechanically stabilized earth retaining wall, including Structure Excavation, Structure Backfill (Class 1), Mechanical Reinforcement of Soil, lock Facing and Structural Concrete Coating. This item assumes an average wall height of 7.5'. The unit cost of $200/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $8.67/CY for Structure Excavation (92,674 LF), $16.79/CY for Structure Backfill (Class 1) (132,151 CY), $13.68/CY for Mechanical Reinforcement of Soil (72,752 CY), $12.66/SF for Block Facing (104,971 SF), and $1.07/SF for Structural Concrete Coating (15,464 SF). The low cost range is typical for a large quantity project over 1,000 LF and the high cost range is for a small quantity project with less than 100 LF. Separate unit costs are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.

	Item Number & Description		Unit	Unit Cost Range: Low	Unit Cost Range: High	Most Probable Value	Percentage of Range	Assumptions
UTER RAIL (CR)	3-B	MSE Wall (10'-20' Height)	L.F.	$560.00	$750.00	$690.00	68%	Assumes a mechanically stabilized earth retaining wall, including Structure Excavation, Structure Backfill (Class 1), Mechanical Reinforcement of Soil, lock Facing and Structural Concrete Coating. This item assumes an average wall height of 15'. The unit cost of $660/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $8.67/CY for Structure Excavation (92,674 LF), $16.79/CY for Structure Backfill (Class 1) (132,151 CY), $13.68/CY for Mechanical Reinforcement of Soil (72,752 CY), $12.66/SF for Block Facing (104,971 SF), and $1.07/SF for Structural Concrete Coating (15,464 SF). The low cost range is typical for a large quantity project over 1,000 LF and the high cost range is for a small quantity project with less than 100 LF. Separate applied unit costs are included to reflect cost differentials between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	3-C	MSE Wall (20'+ Height)	L.F.	$1,340.00	$1,900.00	$1,760.00	75%	Assumes a mechanically stabilized earth retaining wall, including Structure Excavation, Structure Backfill (Class 1), Mechanical Reinforcement of Soil, lock Facing and Structural Concrete Coating. This item assumes an average wall height of 25'. The unit cost of $1,680/LF was developed using the average of recent I-25 projects from SH 7 to SH 66. The CDOT cost data average for 2009 was $8.67/CY for Structure Excavation (92,674 LF), $16.79/CY for Structure Backfill (Class 1) (132,151 CY), $13.68/CY for Mechanical Reinforcement of Soil (72,752 CY), $12.66/SF for Block Facing (104,971 SF), and $1.07/SF for Structural Concrete Coating (15,464 SF). The low cost range is typical for a large quantity project over 1,900 LF and the high cost range is for a small quantity project with less than 100 LF. Separate applied unit costs are included to reflect differential between North Front Range (Region 4) projects and Denver Metro (Region 6) projects.
	4	**TRACKWORK**						
	4-A	Double Ballasted Track	L.F.	$540	$710	$599	35%	Unit cost data from RTD 2010 Annual Program Review. Includes all items for new track including rails, ties, ballast, subballast, welding and installation. Cost range is dependent on concrete or wood ties, size and thickness of ballast, condition of subgrade and need for sub drain system.
	4-B	Single Ballasted Track	T.F.	$260	$350	$332	80%	Unit cost data from RTD 2010 Annual Program Review. Includes all items for new track including rails, ties, ballast, subballast, welding and installation. This also includes all items associated with the removal and replacement of track in areas where existing track needs rehabilitation. Cost range is dependent on concrete or wood ties, size and thickness of ballast, condition of subgrade and need for sub drain system.
	4-C	Special Track - No. 11 Turnout	Each	$126,760	$170,115	$133,500	16%	Unit cost data from RTD 2010 Annual Program Review which is based on supplier quotes, includes all items and installation per BNSF specifications. Specific costs not found for #11, but used range of construction costs for #15 compared to RTD's estimate for Turnout #15 and extrapolated for a #11. Range of costs is dependent on location of installation. Turnouts are located in rural open railroad ROW and in downtown Ft. Collins.
	5	**MAINTENANCE ROAD**						
	5-A	Gravel Road (13' Wide)	Ton	$15	$40	$20	20%	Per BNSF standards, the gravel road is comprised of an extension of the railroad subballast. The quantity for this item was calculated using a 12" deep section with a 2:1 outside sideslope. The subballast can be material similar to roadway aggregate. The same assumptions for Aggregate Base Course Class 6 for roadway would be considered for this item.
	6	**SIGNALS**						
	6-A	Base Communications System	Route Mile	$892,000	$1,762,780	$1,500,000	70%	Assumes both signal system and communication system. This item includes centralized traffic control, block signals, power operated switch machines and at-grade crossing signal warning protection. It also includes all electrical equipment and equipment used to support communication between wayside equipment and the operations control center. Cost range accounts for work that may or may not be needed for stations, maintenance facility and connecting to existing systems.
	7	**SYSTEM WIDE ELEMENTS**						
	7-A	Commuter Rail Activation and Testing	Each	$1,500,000	$3,500,000	$2,000,000	25%	Unit cost data from RTD 2010 Annual Program Review. Assumes cost of commuter rail start-up and testing prior to public use. Cost range varies with estimates from other projects and could be affected by the number of stations and the maintenance facility.

	Item Number & Description		Unit	Unit Cost Range Low	Unit Cost Range High	Most Probable Value	Percentage of Range	Assumptions
COMMU	7-B	Rural Fence	L.F.	2.50	16.00	$5.30	21%	Assumes wire fence on ROW lines on both sides of rail corridor through non-urban areas. Fence was not considered in downtown Longmont, Loveland and Ft. Collins. Unit cost data from RTD Northwest Corridor. Cost range assumes chain link fencing would be required in some areas with wire fence throughout most of the corridor.
	8	AT GRADE CROSSING IMPROVEMENTS	Each	112,400	174,840	$136,730	39%	Assumes the reconstruction of signalized intersections to accommodate new track, reconstructed roadway pavement and re-signalization of traffic signals. Unit cost data from RTD Northwest Corridor. Cost range is based on the different size of crossings and the length of roadway reconstruction needed. Applied cost was arrived at by the number of each type of crossing divided by the total number of crossings.
	9	DRAINAGE	% Of (CI)	3.0%	10.0%	7%	57%	Based on RTD Northwest Corridor with a similar mix of urban and rural drainage. Assumes the cost of all items included in storm sewer systems, cross culverts and any necessary grading for ponds and ditches. The lower cost is from a more itemized estimate further into design and the higher cost is more consistent with a project at a conceptual level. Work in the BNSF ROW will match drainage patterns that exist. The majority of the work will be in the south half of the project placing track through undeveloped land.
	10	NOISE AND VIBRATION	% Of (CI)	1.0%	4.0%	2%	33%	Assumes the use of noise and vibration mitigation measures in urban areas only. Option would include continuous welded rails, resilient rail fasteners and ballast mats. Unit cost from RTD Northwest Corridor. Relatively short lengths of this will be needed compared to overall length of project. Even though trackwork is not included in Ft. Collins, percentage could be higher if mitigation is required. Lower percentage would apply if less expensive mitigation measures are used.
	11	SIGNING AND STRIPING	% Of (CI)	0.5%	1.5%	1%	50%	Signing and striping costs apply to roadways only and is limited to roads crossing new track. Percentage range is consistent with CDOT conceptual design
	12	CONSTRUCTION TRAFFIC CONTROL	% Of (CI)	3.0%	10.0%	6%	43%	Assumes 3 major components: crossings, corridor and stations. An average construction period for each was considered and varied by urban or rural location and included roadway traffic control and railroad flaggers. The cost of station construction traffic control was included with the cost of the station, but additional roadway or rail work near the stations was considered here. Higher percentage would apply for additional railroad flagging if required in BNSF corridor.
	13	MOBILIZATION	% Of (CI)	10.0%	18.0%	15.0%	63%	Assumes a single mobilization cost for the operations and maintenance facility is covered separately under that item. This item covers the costs assumed for mobilization of no more than two rail line/station projects (North Metro to Longmont and Longmont to Fort Collins).
	14	MISCELLANEOUS BID ITEMS	% Of (CI)	5.0%	20.0%	10.5%	37%	This percentage includes costs for other known bid items not representated by either the quantifiable or percentage line items above.
	15	COMMUTER RAIL STATIONS	L.S.	$22,200,000	$39,500,000	$32,845,000	62%	Unit cost data from RTD 2010 Annual Program Review, West Corridor, East Corridor and SWC Extension. Cost could vary depending who is the operating agency. The cost were developed using RTD criteria, a new transit agency could have requirements causing the cost to be lower or higher. One variance could be the requirement of a a grade separated crossing of the BNSF tracks.
	16	OPERATIONS & MAINTENANCE FACILITY	Each	$41,963,200	$64,946,300	$56,886,000	65%	Assumes the cost of construction for a railcar maintenance facility. Includes building, test track, main and secondary access points, spur tracks for rail parking and employee parking. Building furnishings as well as other support equipment is not included in unit cost. The low cost range assumes certain features would be contracted out, such as the shop area and the associated track. Also the elimination of the test track and reduced employee parking. The high cost range would include furniture and support equipment as well as overtime work. See Item 21 in Express Bus-Commuter Bus section above for further details on assumptions for operations and maintenance facilities in general.
	17	UNFORESEEN CONDITIONS	% Of (CBI)	0.0%	2.0%	1.0%	50%	This item accounts for any unforeseen conditions that are not covered under all of the other quantifiable or percentage bid items above. These unforeseen conditions generally may include any unknown removals or environmental conditions that require mitigation.
	18	INSURANCE & LEGAL	% Of (CI)	2.0%	4.0%	3.0%	50%	Includes contractor's bonding, insurance and legal cost needed for the project. RTD estimates ranged from 2% to 4% with the higher percentage for a design build project.

Final Review

NORTH I-25 EIS
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	Item Number & Description		Unit	Unit Cost Range		Most Probable Value	Percentage of Range	Assumptions
				Low	High			
	19	UTILITIES	% Of (CI)	1.0%	10.0%	3.0%	22%	Based on RTD Northwest Corridor that is similar in length and urban versus rural location. Cost range varies due to unknown utilities in new railroad ROW east and south of Longmont. The low percentage range indicates minor utility conflicts. The high range assumes that more upgrades to existing utilities would be necessary.
	20	PLANNING & ENGINEERING						
	20-A	Environmental Impact Statement	NA	NA	NA	NA	NA	The amount included in this item represents that portion of the actual costs associated with the environmental process that can reasonably be attributed to the I-25 General Purpose and Tolled Express Lanes for the Preferred Alternative. This cost is not included in any of the (future) project phases, but is included in the overall project cost.
	20-B	Design	9%	6%	10%	9.0%	75%	Assume project will be built as design , bid, build. Lower percentage is from similar size design/build project.
	20-C	Construction Management	24%	11%	30%	24.0%	68%	The construction management costs are based on historic CDOT percentages plus additional percentage for coordination of work in the BNSF ROW. Range of percentages are dependent on work being split into multiple phases, and if they are prepared as design, bid, build or design/build packages.
	21	RIGHT-OF-WAY (CR)	LS	$24,073,000	$24,818,000	$ 24,818,000	100%	See General Purpose Lanes - Tolled Express Lanes Section Item 22 for additional pertinent details regarding assumptions for right-of-way. The lower end of the cost range represents an estimated 3% reduction in real estate values in Northern Colorado from 2007 (the base year for the ROW cost estimate) to 2009 (the base year for the cost estimate).
	22	FEEDER BUS VEHICLES	Each	$288,600	$358,400	$303,000	21%	Vehicle assumed to be a 40' transit bus. Unit cost is per RTD. High and low costs dependent on number of vehicles purchased. Used 95% of unit cost for low range. High range is from APTA paper on average bus costs.
	23	DMU VEHICLES	Each	$3,600,000	$7,000,000	$5,200,000	47%	Based on an average cost of various DMU vehicles that are available at the time of this estimate. Cost also based on the number of vehicles purchased.
		COMMUTER RAIL (CR)						