KABATA KNIK ARM CROSSING DOT&PF

COST ESTIMATE REVIEW STUDY

June 2006

Prepared By

PBS&J

U.S. Department of Transportation
Federal Highway Administration

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Executive Summary

Introduction

The FHWA Major Projects Unit assembled a Project Review Team (Team) of FHWA, Knik Arm Bridge and Toll Authority (KABATA), Alaska DOT (ADOT) and Consultants. This team met from April 24 through 28, 2006 at the HDR Consulting offices in Anchorage, Alaska. The purpose of this workshop was to perform a cost review and probability analysis for the construction cost estimate for the Knik Arm Crossing project.

Objective of the Workshop

The objective of the Cost Estimate Review was to verify the accuracy and reasonableness of the current total cost estimate to complete each project and to develop a probability range for the cost estimate that represents the project's stage of design.

The Knik Arm Crossing cost estimate review included workshop team members from the following agencies and firms:

- FHWA Headquarters
- FHWA Alaska Division
- Alaska DOT
- Knik Arm Bridge and Toll Authority (KABATA)
- HDR Alaska, Inc. – Design Team
- PND, Inc. – Design Team
- RISE Alaska, LLC – Design Team
- Shannon & Wilson, Inc. – Geotechnical and Environmental Member of Design Team
- PBS&J – Facilitators and Cost/Risk Analysts

The Workshop Process

The workshop took place during the period April 24 – 28, starting with a site tour. In the afternoon of the first day the team assembled and began a four day review of the several cost and design issues contributing to the project make-up. Key components of this review included the need to integrate the two working estimates that were prepared by PND, Inc. and Rise Alaska. As the new working estimate was compiled together, the participants were able to begin their discussion of the cost line items and to identify the risks and opportunities associated with each of these items. This culminated in the running of a Monte Carlo simulation that clarified the construction cost ranges that were likely to happen and the associated levels of certainty associated with each studied range.

Results of the Workshop

The project being reviewed had several alignment options. For simplicity and to capture the most likely outcome of the alignment choice process, the review team settled on the Preferred Alternative (M2-C1-D/E), with an emphasis on the Erickson part of the D/E alignment. The workshop included a review of the November 2005 DEIS and April 2006 cost estimate(s), construction schedule, and the likely scenarios for eventual build-out of the future Phase 2. Discussions covered some of the likely methods that could be used for project delivery.

Some of the key results of the workshop included:

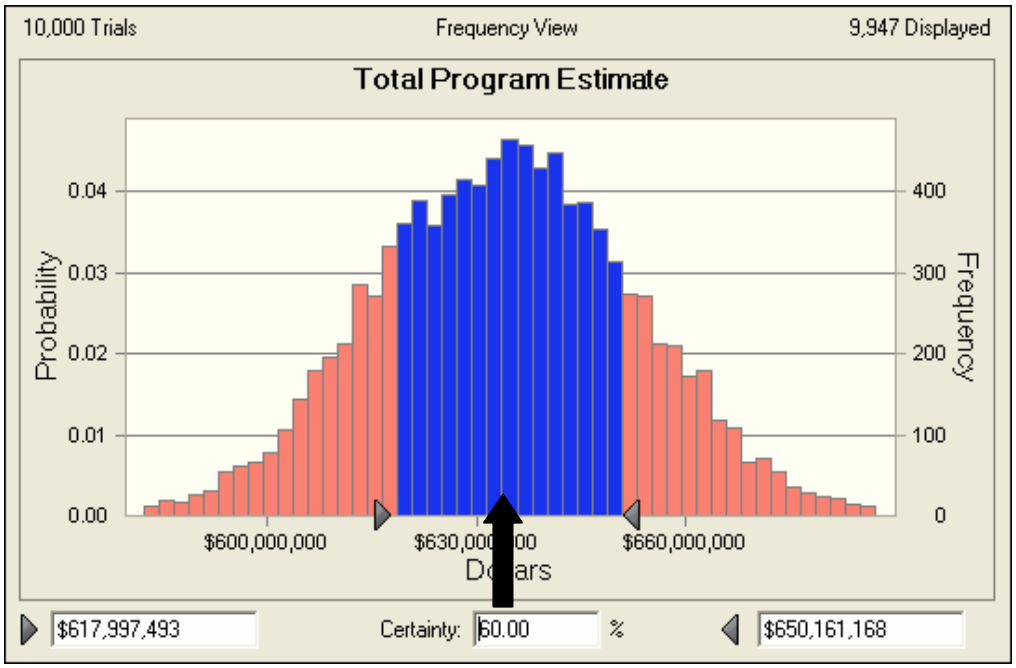
- The initial build-out for Phase 1 - Erickson Option was identified as being $599.4 million in the November 2005 DEIS estimate. When the cost estimates from the two consulting sources were integrated, it was found that the estimate was $639.4 – a $40 million increase. This cost increase was mostly the result of adding to the scope of the cut and cover tunnel at Government Hill (~ $20.00 million), right-of-way cost increases (~ $6.0 million) and Environmental/Mitigation cost increases (~ $6.3 million).
- Similarly, the final build-out for Phase 2 - Erickson Option was identified as being $586.7 million in the November 2005 DEIS estimate. The revised estimate that evolved during this workshop indicated that this build-out cost would be in the range of $504.0 million – this was an $82 million reduction. This was the result of advancing several construction items to Phase 1, e.g., it was decided to move all of the tunnel construction to Phase 1. Having the tunnel construction completed in Phase 1 would reduce the inconvenience to the local public.
- The overall estimate is consistent with the project's current stage of design
- The development of quantities and unit prices has been done in a manner consistent with industry standards.
- Appropriate contingencies and other mark-ups have been applied to the estimate.
- The following items could impose some significant risks on the eventual project cost:
    - Bidding conditions (number of responsive bidders)
    - Other projects competing for limited resources
    - Constructability issues (weather, whales, noise)
    - Cost of key construction components needed for the construction

The workshop team identified some miscellaneous items that could have major project impacts:

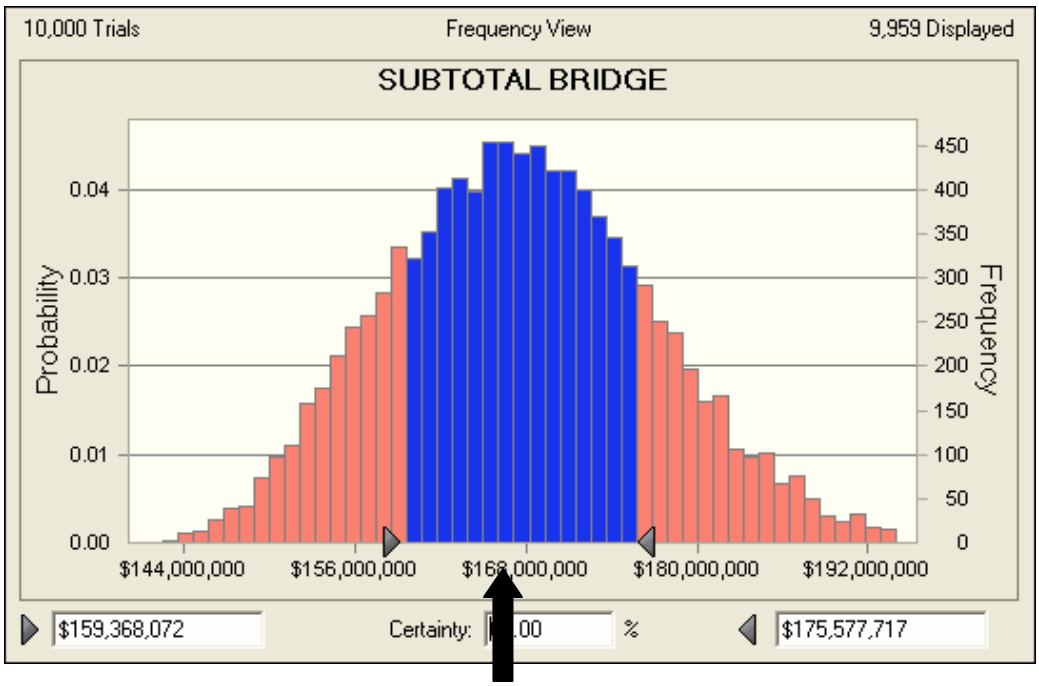
- If the project is delayed in its start-up, the cost of the delay could amount to approximately $25 million for one year of delay.
- The generally understood construction scenarios include award of several construction packages. There could be some difficulties if the projects are not let in a way that recognizes the sequential nature of the work and the need for coordination between the various contractors.
- The contract delivery method itself could impose some unexpected concerns for the manager of the projects.

The following observations emerged from the Monte Carlo simulations:

- The estimate compiled during the workshop (April 2006) indicated that the Total Program Construction Cost for Phase 1 would be $639.4 million. When the selected cost variables were submitted to Monte Carlo simulation, the model revealed that the expected cost for the project would range between $618 million and $650 million, with a 60% level of collective probability. This is illustrated in the probability distribution curve below:



- Similarly, the Total Bridge Direct Cost was estimated to be $167 million and the model revealed that there was a 60 percent level confidence in this part of the project costing between $159 and $176 million. The resulting model indicated the following:



- The Team was asked to analyze the cost data that was available for the future build-out of the project (Ph. 2). This build-out is expected to consist of bridge and roadway widening, and the construction of a new connector on the far south end of the project, that would tie in to the planned City transportation corridor master plan. The timeframe for this future construction would be expected to occur in the year 2023, depending on how fast traffic demands grow. The Team compiled a construction cost estimate expressed in April 2006 dollars. This estimate indicated that the Total Program Estimate for that future scope of work would be $504 million. The bridge component was to cost approximately $63 million and other leading elements had a cost of $226 million. A majority of the cost was inflation to the year 2023. Probability distributions were used and Monte Carlo simulations were run to provide additional cost guidance for the future project management team.

- KABATA management and their consultants noted that they wanted to have the current estimate findings compared, as closely as possible, with the construction estimate that was done at the time of the Draft Environmental Impact Statement (DEIS). This was done for both the Phase 1 and Phase 2 construction programs. The resulting analyses served mainly to highlight the growth in the Phase 1 and Phase 2 estimates, primarily reflecting the ambient market conditions that have prevailed since the DEIS estimate was performed in November of 2005.

In the briefing that took place on the last day of the workshop it was confirmed that these probabilities were cause for some concern. A 60 percent level of certainty about the cost outcomes, coupled with the fact that the cost estimates were higher than desired, signaled a need to work on cost control and the need to clarify some of the current “unknowns” about the project. The following were seen as some of the “Opportunities” that could help the project delivery team meet their cost and time objectives for the project:

- Value engineering could offer some cost reduction items that could help bring the Phase 1 project scope back into the $600 million target zone.

- There were some potentially very significant cost savings associated with getting permission to obtain critically needed fill materials from the nearby Air Force Base. This base is already providing fill stone to the Port of Anchorage and it was thought that the agreement between the Port and the Air Force might serve as a vehicle to make the same stone material available for use in construction of the Phase 1 facilities. This option and the associated terms need to be established to avoid the high cost of long hauls of this material from other, more distant sources.

- How the component contracts are packaged could represent an important boost to the prospects of delivering the project in a timely manner and close-to or under the required budget. The work needed to deliver the overall finish project lends itself to well thought-out sequencing. One of the most important examples is to have the approaches and the bridge construction done in a way that maximizes the linear nature of the work. For example, if the approaches to the bridge are done early-on this would expedite delivery of the bridge materials to the bridge site.

Recommendations:

The following recommendations emerged from the workshop and were presented in the final briefing:

- Consolidate the existing cost estimates, using consistent methodology and following guidelines that usually apply to government cost estimates.
- Define project sequencing as the program continues toward construction.
- Perform Value Engineering studies on the key construction components
- Identify upcoming project risks and develop contingency plans for dealing with these problems
- Continue to monitor overall project costs through project completion
- Consider owner-furnished materials (e.g., armor rock)
- Clarify tolling system to be used in the finished project
- Develop programs for incorporating Intelligent Traffic Systems and Geotechnical Instrumentation
- Incorporate security measures into the design and operational plan

Section I – Methodology, Findings and Conclusions

1.1 Project Background

The Knik Arm Crossing project includes the construction of a bridge across the Upper Cook Inlet above Anchorage, Alaska, to connect the Municipality of Anchorage (MOA) with the Matanuska-Susitna (Mat-Su) Borough. The crossing project will also include, on the eastern side of Knik Arm, the existing Anchorage road network connecting the Port of Anchorage/Ship Creek industrial area to the National Highway System (NHS) at the access to the A Street/C Street couplet and the Ingra Street/Gambell Street couplet. On the western side of Knik Arm, the Point MacKenzie Road connects Port MacKenzie to the Knik-Goose Bay Road. The project is expected to consist of the Initial Build-out in Phase 1 and a Future build-out in Phase 2. The current project is defined by the work necessary to improve Point MacKenzie Road from the western bridge approach northward to Burma Road, the west and east bridge approaches (constructed fill), the bridge, a constructed fill through the Port of Anchorage area (below the Cherry Hill bluff), a cut and cover tunnel through the Government Hill historic area, and road connection to the A and C couplet. This project has been supported in various ways including its inclusion in the Statewide Transportation Improvement Program (STIP) in 2001 and the establishment of the Knik Arm Bridge and Toll Authority (KABATA) within the Alaska Department of Transportation and Public Facilities (ADOT&PF). The bridge that is to be constructed is expected to be 8,200 feet in length.

The Federal Highway Administration (FHWA) Major Projects unit assembled a Project Review Team (Team) consisting of FHWA, ADOT&PF, KABATA, and technical experts to review the cost estimates on the Knik Arm Crossing Project. This team met at the office of the lead project design firm, HDR from April 24 – 28, 2006. This document summarizes and reports the results of this cost estimate review.

1.2 Objective of the Review:

The objective of this review was to verify the accuracy and reasonableness of the current total cost estimate to complete the Knik Arm Crossing project and to develop a probability range for the cost estimate that represents the level of uncertainty remaining at the project's current stage of design. The results of this probability analysis could then be used to determine if the risk/contingency factors in the estimate are reasonable based on the results of the probability analysis.

1.3 Review Team:

The project estimate review team (Team) was developed with the intent of having individuals with a strong knowledge of the project and/or of major project work. In this instance, the team was required to include expertise in specific disciplines of the project, such as bridge structures, roadway, right-of-way acquisition, cost consulting, etc. This core Team stayed together throughout the week. In addition, project delivery team members with specific expertise on various disciplines briefed the Team on the project's cost estimate development process for their respective disciplines. The Team was then able to interview the discipline presenters to further understand and clarify the development of the project cost estimate quantities, unit prices, assumptions, opportunities and risks. The Team was comprised of the following members:

- FHWA Headquarters and Alaska Division Staff
- Alaska DOT
- Knik Arm Bridge and Toll Authority
- HDR – Design Team
- PND, Inc. – Design Team
- RISE Alaska – Design Team
- Shannon & Wilson, Inc. – Geotechnical and Environmental Member of Design Team
- PBS&J – Facilitators and Cost/Risk Analysts

Appendix B includes a complete list of all the attendees as well as the Work Shop Sign-In sheets.

1.4 Review Clarifications / Qualifications:

Following are the basis, assumptions and qualifications of the Cost Estimate Review:

- Independent cost estimates were not developed
- Verification of quantities were not performed
- A cursory review of major cost items and unit prices was performed
- Review focused only on cost items with major impacts to cost
- Potential schedule delays due to inter-contract relationships were not qualified in the analysis
- Review focused largely on the Initial Build-out scope (Phase 1)
- Review accounted for April 2006 cost estimate update to the DEIS Estimate from November 2005

1.5 Methodology:

The workshop took place during the period April 24 – 28, starting with a site tour. In the afternoon of the first day the team assembled and began a four day review of the several cost and design issues contributing to the project make-up. Key components of this review included the need to integrate the two working estimates that were prepared by PND, Inc. and Rise Alaska. As the new working estimate was compiled, the participants were able to begin their discussion of the cost line items and

to identify the risks and opportunities associated with each of these items. This culminated in the running of a Monte Carlo simulation that clarified the construction cost ranges that were likely to happen and the associated levels of certainty associated with each studied range. A detailed Cost Estimate Review Agenda and Work Plan are included in Appendix B.

All categories of costs in the project estimate were reviewed during this time frame, including non-construction costs such as right-of-way, preliminary engineering, construction management, inflation and contingency. Based on the details of each project element, the Team assessed if the estimated costs adequately reflected the current scope and market conditions. At the conclusion of this component review, the Team had arrived at recommended adjustments to the current estimate. These adjustments are included in the recommendations that follow later in this document.

Two other desired outcomes were derived from this workshop, i.e., reconciling the April 2006 estimate to the November 2005, DEIS estimate, and determining an approximate cost associated with any one year of delay in delivering the project. The results were as follows:

- The key difference between the two estimates had to do with an increase in scope for the Phase 1 construction since the latest estimate indicates that all cut and cover tunnel work at Government Hill will be done in Phase 1, not distributed between the two phases. This added approximately $82 million up to Phase 1.
- It was determined that one year delay in the time to deliver the project would have an associated $25 million increase to the project cost estimate.

The Team's objective during the review was not to develop an independent cost estimates, but to perform a scope review and a summary cost estimate review, assess risks and assign contingencies, and provide recommendations on possible modifications to the cost estimates.

The following aspects were covered in the review's scope of the Preferred Alternative Cost Estimate:

- Overall Project Scope Review
- Review of the November 2005 and the April 2006 cost estimates
- Focus on Preferred Alternative (M2-C1-D/E) and Initial Build-out (Phase 1)
    - Northern Access, Southern Crossing, Degan/Erickson Options
- Focus on Bridge, Approaches, Cut and Cover Tunnel
    - Bridge Scope
        - Type of Bridge, Steel Price fluctuations
        - Constructability, Currents, Tide and other weather impacts
        - Whales and other natural species
        - Noise restrictions
        - Number of seasons of bridge construction
        - Competitive Bids and other competing projects
    - Government Hill Scope
        - Contamination
        - Historical
        - Right-of-Way

- Review other project scope (Mat-Su side, POA, etc.)
- Mobilization Costs
- Utilities, Right-of-Way, Environmental, etc.
- Application of Contingencies (Design, Program)
- Escalation application to cost estimates (mid-point of construction)
- Discussed project delivery methods (DBB, D-B, PPP, etc.)
- Develop consolidated/updated Cost Estimate for review
- Risks and Opportunities Analysis
    - Focused on major cost items
    - Evaluated the risks and opportunities associated with each cost item
    - Applied probability distribution curve for each cost item

Utilizing this methodology, the Team identified opportunities and risks within the cost estimate, established recommended current day values for the Preferred Alternative Package based on recommended adjustments to the current cost estimate, evaluated the impact of inflation and contingencies for changes during construction, and arrived at anticipated total project costs.

1.6 Recommended Estimate Adjustments:

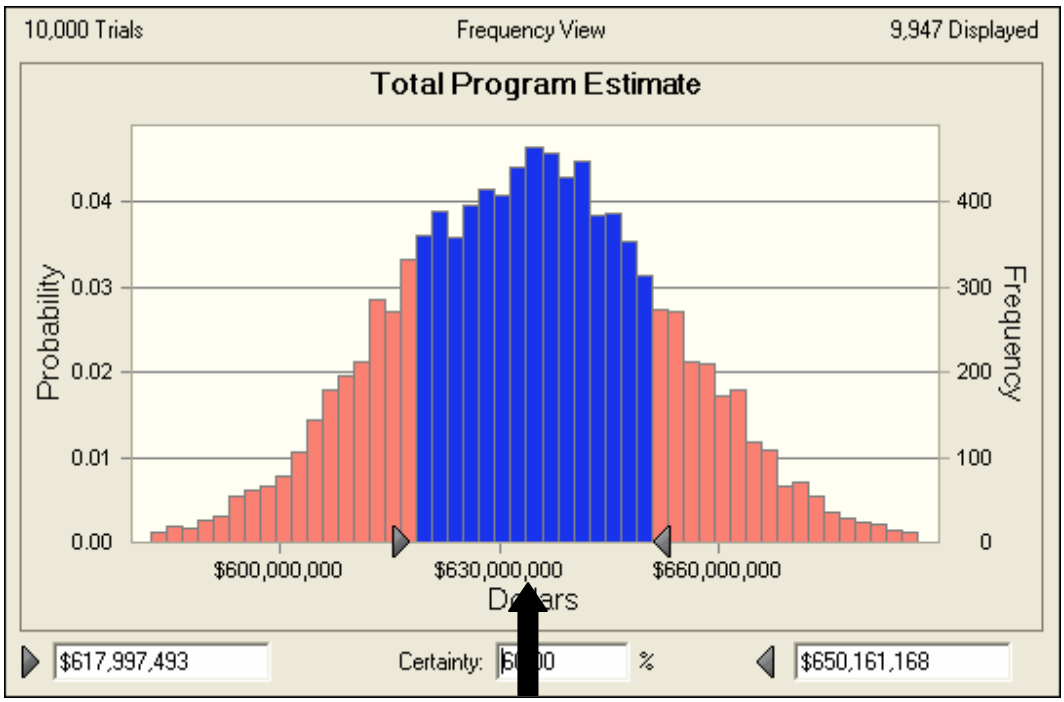
As noted earlier, at the beginning of the study, the Team reviewed the two contributing estimating components from PND and Rise Alaska. These components of the construction cost estimate had not yet been integrated. The Team worked together with HDR, PND, Rise Alaska, and FHWA to work out an agreed-upon construction cost estimate. The result was well over the stated budget for the project ($600 million). The participants then reviewed the estimate for items that might not reflect the most current understanding of the project. Several items were found to contain higher costs than necessary. These items were corrected, at the consent of all parties, and the result was found to be in the range of $639 million.

1.7 Review Probability Assessment:

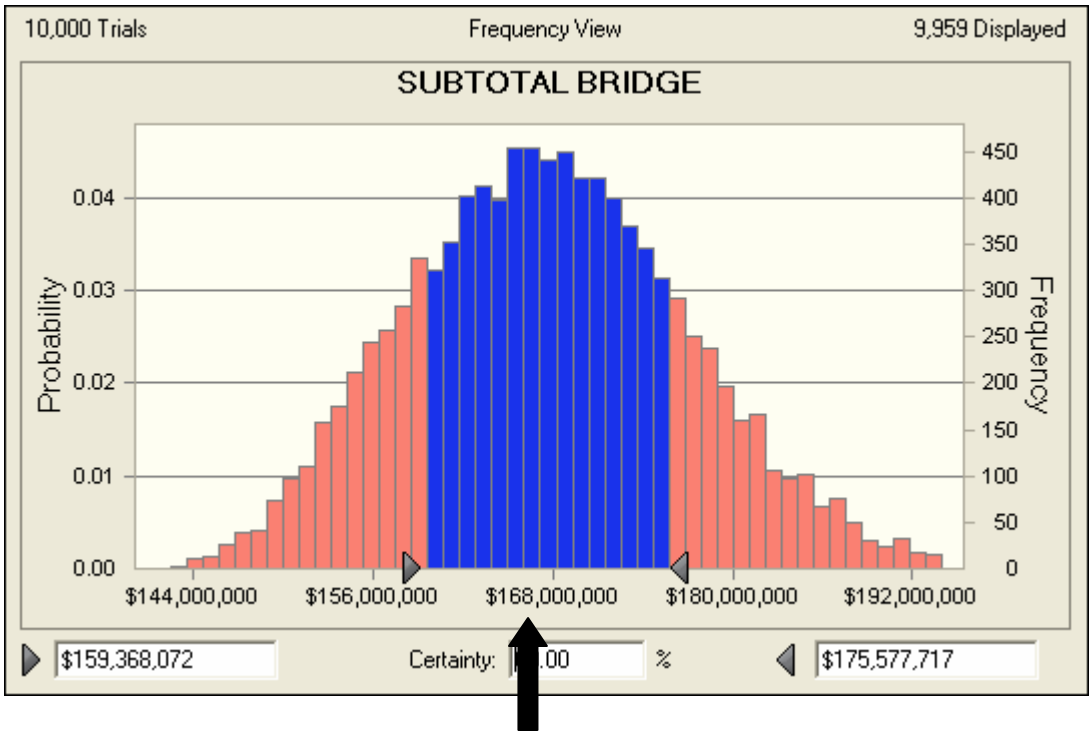
The following sections describe the probability assessment analysis for the April 2006 Project Estimates.

1.7.1 April 2006 Total Cost Estimate Review:

- The estimate that was integrated during the workshop (April 2006) indicated that the Total Program Construction Cost for Phase 1 would be $639.4 million. When the selected cost variables were submitted to Monte Carlo simulation, the model revealed that the expected cost for the project would range between $618 million and $650 million, with a 60% level of collective probability. This is illustrated in the resulting probability distribution curve as follows:



- Similarly, the Total Bridge Direct Cost was estimated to be $167 million and the model revealed that there was a 60 percent level confidence in this part of the project costing between $159 and $176 million. The resulting model indicated the following:



- The Team was asked to analyze the cost data that was available for the future build-out of the project. This build-out is expected to consist of bridge and roadway widening, and the construction of a new connector, on the far south end of the project, which would tie in to the planned City transportation corridor master plan. The timeframe for this future construction would be expected to occur in the year 2023, depending on how fast traffic demands grow. The Team developed a construction cost estimate expressed in April 2006 dollars. This estimate indicated that the Total Program Estimate for that future scope of work would be $504 million. The bridge component was to cost approximately $63 million and other leading elements had a cost of $226 million. Probability distributions were used and Monte Carlo simulations were run to provide additional cost guidance for the future project management team.

- KABATA management and their consultants noted that they wanted to have the current estimate findings compared, as closely as possible, with the construction estimate that was developed at the time of the Draft Environmental Impact Statement (DEIS). This was done for both the Phase 1 and Phase 2 construction programs. The resulting analyses served mainly to highlight the growth in the Phase 1 and Phase 2 estimates, primarily reflecting the ambient market conditions that have prevailed since the DEIS estimate was performed in November 2005.

In the briefing that took place on the last day of the workshop it was confirmed that these probabilities were cause for some concern. A 60 percent level of certainty about the cost outcomes, coupled with the fact that the cost estimates were higher than desired, signaled a need to work on cost control and the need to clarify some of the current “unknowns” about the project.

1.8 Review Findings:

The findings of the Review are summarized as follows:

- It was confirmed that the overall project estimate is consistent with the current stage of project design
- Quantities and unit prices development process are consistent with industry standards
- Appropriate contingencies and other markups have been applied to the estimate
- The following items could pose a major risk on the project cost:
    - Bidding conditions (number of responsive bidders)
    - Other competing projects
    - Constructability issues (weather, whales, noise)
    - Impact of key direct cost items/unit prices on bid
        - Super-Structure
        - 48” Piles
        - Cut and Cover/Government Hill Scope
        - Borrow (source, haul distance, quantity, etc.)
        - Armor Rock
        - Right-of-Way Acquisition
        - Contamination
        - Steel Price Fluctuation possibility
        - Availability of local materials
        - Scope Creep

1.9 Review Recommendations:

Based on the workshop findings, the Team made the following recommendations at its closing working session in Anchorage:

- The Team worked with the design consultants to develop a consolidated cost estimate. It is recommended that this general format be maintained since it has a consistent estimating methodology that can be used jointly by the two firms engaged in preparing project cost estimates. This estimating approach is also consistent with government project-required formats.
- There is a need to further define the expected project sequencing
- There should be a Value Engineering Study with the bridge substructure and the overall project as likely subjects of the study.
- Identify project risks, assign potential cost/schedule impacts and develop actions to mitigate any unacceptable impacts
- Continue to monitor overall project costs until project completion
- Initiate discussions with the Air Force to clarify some of the outstanding issues and to set the stage for taking advantage of some cost reduction opportunities (access to Air Force borrow material that is near the construction site, etc.)
- Consider owner-furnished materials (i.e., armor rock)

- Clarify the methodology and infrastructure requirements for the tolling facilities.
- Develop programs for incorporating Intelligent Traffic Systems and Geotechnical Instrumentation
- Incorporate security measures into the design and operational plan

Due to the recent national disasters related to Hurricanes Katrina, Rita and Wilma, there is wide spread speculation that the construction industry will be impacted with increasing prices, shortage of material, labor and equipment and also increasing bonding and insurance costs. It is recommended that for this project, the construction market be closely monitored to capture any such impacts as they relate to the project budget. The estimate work that was done during this workshop focused primarily on the cost of the project in today's dollars, escalated to the appropriate place in time. The assumptions surrounding escalation must be carefully reviewed as the sequencing of the project components are better defined.

Section II – Probabilities, Opportunities & Risks

2.1 Opportunities and Risks

Each opportunity and risk identified during the study was evaluated to estimate the potential impact that each might have on the total project costs. This evaluation is somewhat subjective, and based on the Team's impressions and knowledge of local construction conditions. The opportunities, risks and the category of the estimated impact on total project costs are noted by Project discipline in the following sections:

I. DAY OF OPENING (Phase 1)
- A. Earthwork
- B. Surfacing/Paving
- C. Structures
  1. Crossing Bridge Substructure
  2. Crossing Bridge Superstructure
  3. Cut and Cover Tunnel
- D. Miscellaneous Items
  1. Bridge Approaches
  2. North Tunnel Approach
  3. South Tunnel Approach
  4. Toll Station
  5. Lane Viaduct
- E. Drainage
- F. Traffic Services
- G. Miscellaneous Roads

II. FUTURE BUILD-OUT (Phase 2)
- A. Rough order of magnitude of the build-out costs
- B. Bridge crossing of the existing railroad switching yard

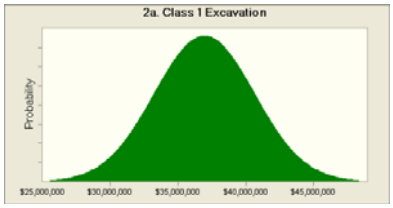
2.2 Selection of Probability Distribution Curves for Risk Analysis

The study team used a statistical tool called Crystal Ball® in order to establish a sense of perspective on the cost expectations for the Knik Arm Crossing project. This software selection is an add-in program for use with the Excel™ spreadsheet program. Crystal Ball® permitted the application of Monte Carlo simulation technology to analyze key components of the construction cost estimate prepared by HDR, PND and Rise Alaska. 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 involved supplying random numbers for selected cells identified as "assumption

cells", with these random numbers falling within the range of real-life possibilities defined by the study 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.

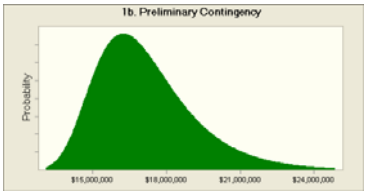
The outcome depicted in this final probability curve is typically stated in the following manner: "There is a 90% (or whatever percentage depicted) degree of certainty that the construction cost will be in a range from $x to $y, provided that our understandings and related assumptions do not change significantly between now and the end of the construction."

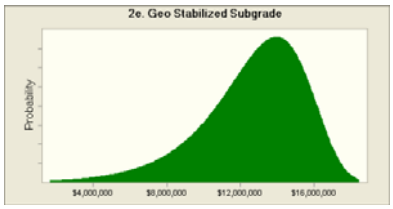
In order for this to work correctly the Team must supply the program with the probability range of construction cost for each assumption cell in the spreadsheet, and must supply an indicative characterization for the probability spread for each of these cells. This shows up in the form of probability distribution curves. In the case of this study workshop, the Team utilized multiple probability distributions about each of the assumption cells. The following are several of the most common probability distribution curves:

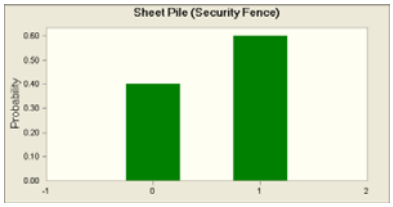


Normal Distribution – In this case, the range of construction costs for this particular cost item is expected to follow a "bell-shaped curve" pattern. The Team considers the cost will be within the nominal range indicated on the curve extremities, with the highest percentage of outcomes gathered about the middle ordinate. The Team selected the end-points of the nominal range of outcomes, based on their knowledge of the alignment and current market conditions in the area of the project. When this normal distribution curve has been selected by the team, it indicates a reasonable confidence in the current estimate value, with a probability that the cost could vary either higher or lower than the estimate to a reasonable degree.

Maximum Extreme Distribution – The Team considers the range of construction costs for this item will more than likely vary to be higher than the current estimate based on the opportunities, risks and trends with this item.







Minimum Extreme Distribution – The Team considers the range of construction costs for this item will more than likely vary to be lower than the current estimate based on the opportunities, risks and trends with this item.

The Team leadership also chose to use the Yes-No Distribution in order help to reflect the possibility that a sheet pile wall may or may not be built. It was seen in that instance that there was a 60 percent chance that the wall would be included in the project.

2.3 Detailed Probability Analysis
Day of Opening Costs (Phase 1)

The review Team utilized a synthesized cost tool to provide a platform for reviewing the costs of the project. The resulting table is titled "PRELIMINARY QUANTITIES AND COST ESTIMATE, MS2-C1-D or E OPTION". This table reflects the costs that are assumed to be required to construct the preferred alternative alignment:

MS2	Alignment on the west shore of Knik Arm (Mat-Su Borough side)
C1	Knik Arm Bridge crossing alignment
D or E Options	Two possible street alignments, Degan or Erickson leading to the southeastern-most terminus of the project.

The following is the basic information developed for each cost line item in the Table noted above. It is referenced by the headings and sub-headings in the Table.

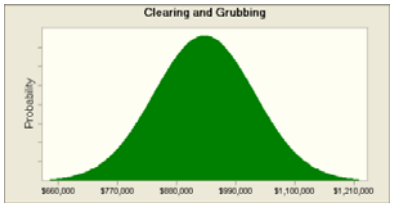
2.3.1 Assumption Cell: Clearing and Grubbing $5,000.00/Acre

Risks:

- Quantity is pretty well defined
- No historical or archaeological sites
- Due to linear layout of various construction elements, there could be several mobilization and demobilization locations involved

Opportunities:

- Possible unit price reduction
- Potential for early timber operations



Normal distribution with parameters:

Mean	**$931,650**
Std. Dev.	**$ 93,165**

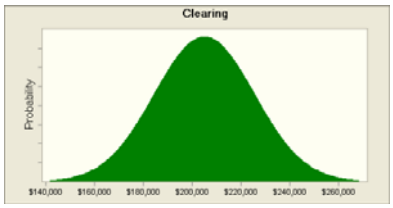
2.3.2 Assumption Cell: Clearing $3,000.00/Acre

Risks:

- No historical or archaeological sites

Opportunities:

- Possible unit price reduction
- Potential to reduce quantities
- Potential for early timber operations



Normal distribution with parameters:

Mean	**$205,040**
Std. Dev.	**$ 20,504**

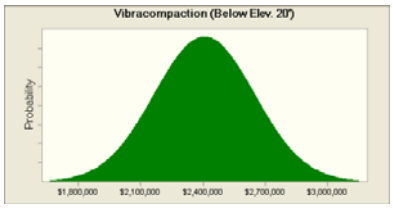
2.3.3 Assumption Cell: Vibracompaction (Below elev 20') $10.80/SY

Risks:

- Fill depths are deep
- Potential for some liquefaction

Opportunities:

- Good control – may be able to expedite construction
- Below 20' – use of self-compacting material could reduce time for the line item



Normal distribution with parameters:

Mean	**$2,406,481**
Std. Dev.	**$ 240,648**

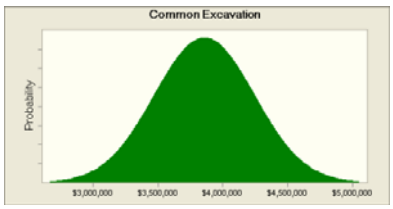
2.3.4 Assumption Cell: Common Excavation $5.00/CY

Risks:

- Unit price could increase based on fuel adjustments
- Soils risk, no known contamination
- Assumed that much of this soil would be usable - assumption may be off (early in design)
- Conditions not completely known – may be some unexploded shells from previous use as a gunnery practice range
- Design evolution might yield additional problems

Opportunities

- Being reused as Borrow A or C
- May have free disposal
- Design evolution could increase quantities



Normal distribution with parameters

Mean	**$3,858,426**
Std. Dev.	**$ 385,843**

2.3.5 Assumption Cell: Common Excavation $7.50/CY

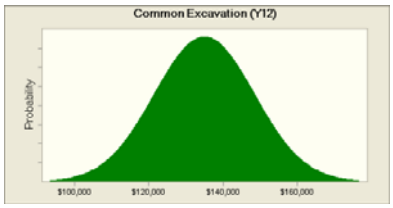
This is the material that must be excavated from the Government Hill cut.

Risks:

- Unit price could increase based on fuel adjustments
- Might have some contamination
- Assumptions on much of this soil is usable may be off (early in design)
- Design evolution might yield additional problems

Opportunities

- May have free disposal
- Design evolution could increase quantities



Normal distribution with parameters

Mean	**$135,000**
Std. Dev.	**$ 13,500**

2.3.6 Assumption Cell: Excavation (Stockpile) $5.00/CY

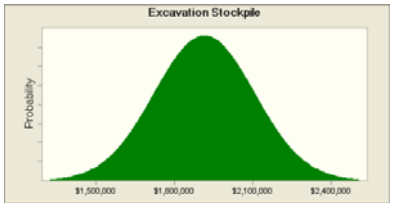
This excavated material is to come from the Port MacKenzie Industrial – North Route

Risk:

- Quantity may increase
- Make permanent use of some of the material (short term cost, long term savings)

Opportunities:

- Phasing changes may make it possible to reduce double handling
- Design evolution may reduce quantity



Normal distribution with parameters

Mean	**$1,914,285**
Std. Dev.	**$ 191,429**

2.3.7 Assumption Cell Excavation (Waste) $12.00/CY

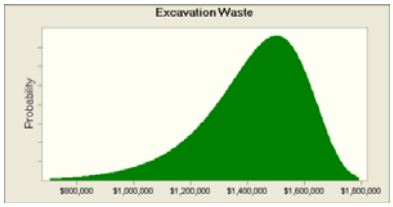
This is excavation related to construction of the security wall.

Risks:

- There could be a chance that this soil is contaminated
- Soil conditions could be quite variable at this location

Opportunities:

- There is the possibility that this wall might not be required



Minimum Extreme distribution with parameters:

Likeliest	**$1,500,000**
Scale	**$ 150,000**

2.3.8 Assumption Cell Excavation (Waste) $7.00/CY

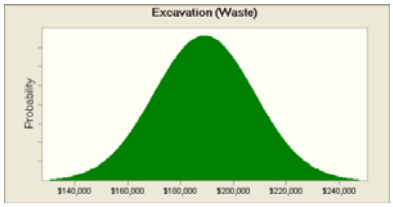
This is material from Government Hill tunnel that is likely to be wasted.

Risks:

- Disposal sites not identified
- Haul for disposal could be 2.5 to 3 miles from site
- Contaminated soils a possibility
- Contaminated groundwater a possibility

Opportunities:

- May be able to establish a disposal site on adjacent airbase or on the purchased site for this tunnel.



Normal distribution with parameters

Mean	**$ 189,000**
Std. Dev.	**$ 18,900**

2.3.9 Assumption Cell Excavation (Special) $15.00/CY

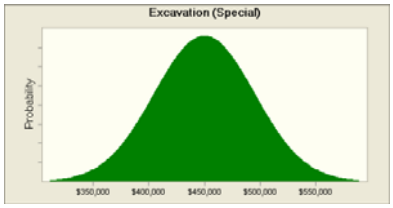
This is for the Government Hill tunnel location.

Risks:

- May have to deal with more volume
- Temporary walls, sheet pilings required for this work, not included
- Design risk
- Does not include hauling of waste
- May dictate higher unit cost due to difficulty of disposal (material handling)
- Clay interface location is unknown – will prove to be very important

Opportunities:

- None noted



Normal distribution with parameters

Mean	**$ 450,000**
Std. Dev.	**$ 45,000**

2.3.10 Assumption Cell Borrow Type A $10.00/CY

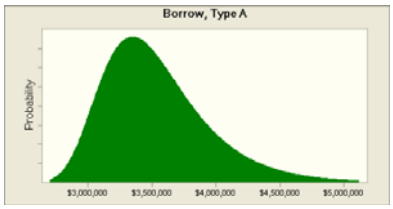
This borrow is to take place primarily on each of the roadway-type construction elements.

Risks:

- Quantity could be greater than currently expected
- Could be higher cost due to fuel cost increases
- Long haul plus royalties could apply

Opportunities

- Could possibly get this material from the Air Force Base, a local alternate source
- Could potentially locate unloading point at nearby railroad track.



Maximum Extreme distribution with parameters:

Likeliest	**$3,346,349**
Scale	**$ 334,635**

2.3.11 Assumption Cell Borrow Type A $13.00/CY

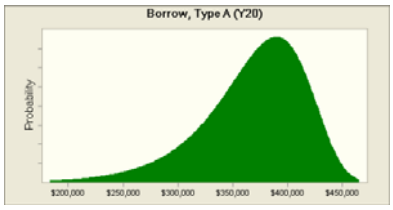
This borrow will be used in the MOA Future Port Expansion.

Risks:

- Quantities could be higher
- Definition of limits could be difficult

Opportunities:

- None noted



Minimum Extreme distribution with parameters:

Likeliest	**$ 389,571**
Scale	**$ 38,957**

2.3.12 Assumption Cell Borrow Type A $14.00/CY

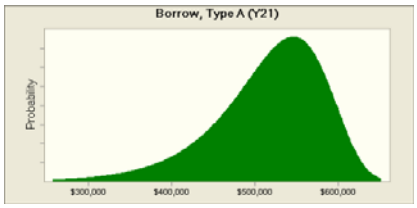
This borrow was be brought in to meet the needs of constructing the Government Hill cut.

Risks:

- Quantity required could be greater than currently expected
- Unit price could be higher due to fuel cost increases
- Long haul plus royalties

Opportunities:

- May be able to get this material from the nearby Air Force base
- May be able to bring material in by rail --- unloading in nearby yard



Minimum Extreme distribution with parameters:

Likeliest	**$ 546,000**
Scale	**$ 54,600**

2.3.13 Assumption Cell Borrow Type C $10.00/CY

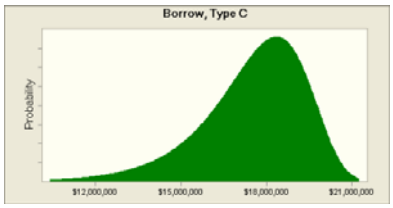
This borrow is to be used for the East and West Approaches and for construction below the Cherry Hill overlook.

Risks:

- Quantities may increase
- Limits of work hard to define at this time

Opportunities:

- None noted



Minimum Extreme distribution with parameters:

Likeliest	**$18,336,310**
Scale	**$ 1,500,000**

2.3.14 Assumption Cell: Borrow, Type C $13.00/CY

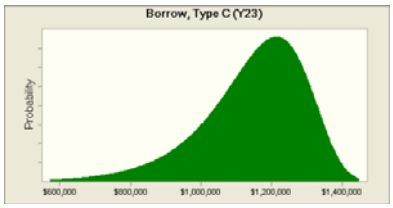
This borrow is part of the MOA Future Port Expansion.

Risks:

- Quantities may increase
- Limits of work hard to define at this time

Opportunities:

- None noted



Minimum Extreme distribution with parameters:

Likeliest	**$ 1,213,381**
Scale	**$ 121,338**

2.3.15 Assumption Cell: Borrow, Type C $10.00/CY

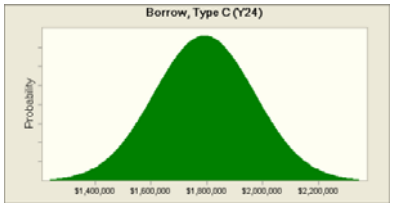
This borrow is part of the construction at Government Hill tunnel location.

Risks:

- Quantities may increase
- Limits of work hard to define at this time

Opportunities:

- None noted



Normal distribution with parameters:

Mean	**$1,791,400**
Std. Dev.	**$ 179,140**

2.3.16 Assumption Cell: Fill Below Elevation 20’ $15.00/CY

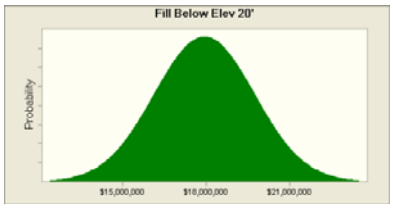
This is fill on the East and West approaches. This work would primarily be done during the low tide periods of each work day.

Risks:

- May have long haul distances
- Quantities could be higher
- Definition of limits is difficult

Opportunities:

- May be able to use Armor Rock Reject material below 20’



Normal distribution with parameters:

Mean	**$17,944,185**
Std. Dev.	**$ 1,794,419**

2.3.17 Assumption Cell: Muck Excavation $5.00/CY

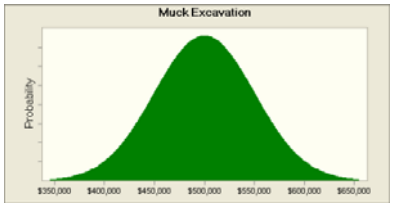
The Muck Excavation is expected to be encountered in some low points on the Point MacKenzie Road alignment. This work includes removal of peat and some saturated silts.

Risks:

- Unit cost may be higher
- Geotechnical information is preliminary and could increase quantity

Opportunities:

- May be able to use some of this material as topsoil
- Design evolution may reduce the quantity



Normal distribution with parameters:

Mean	**$500,000**
Std. Dev.	**$ 50,000**

2.3.18 Assumption Cell: Stone Mastic $48.00/Ton

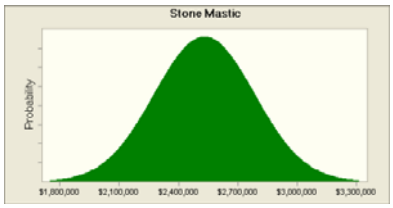
This material is to be incorporated into each of the roadway paving elements.

Risks:

- Oil prices could impact costs
- Finding stone with suitable hardness, close to the work site could be difficult
- Unit price may be low

Opportunities:

- Due to the low traffic volumes, may be able to replace the current design with a more standard pavement design



Normal distribution with parameters:

Mean	**$2,530,703**
Std. Dev.	**$ 253,070**

2.3.19 Assumption Cell: Asphalt $44.00/Ton

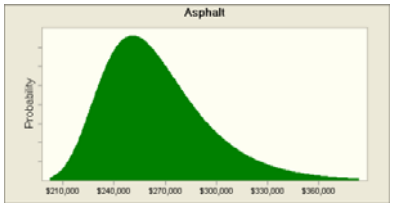
This material is to be incorporated into each of the roadway paving elements.

Risks:

- Unit price may be higher (~$70/ton)

Opportunities:

- Quantity reliable



Maximum Extreme distribution with parameters:

Likeliest	**$250,800**
Scale	**$ 25,080**

2.3.20 Assumption Cell: AC Pavement, Type II CI A $40.00/Ton

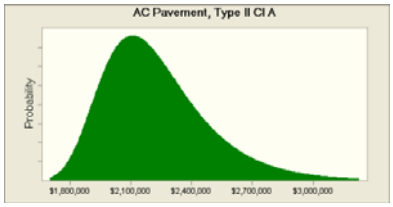
This material is to be incorporated into each of the roadway paving elements.

Risks:

- Fuel cost increase could increase unit costs
- For East and West Approaches pavement could increase by 20%
- Unit price may be low

Opportunities:

- Phasing could help reduce the cost



Maximum Extreme distribution with parameters:

Likeliest	**$2,108,919**
Scale	**$ 210,892**

2.3.21 Assumption Cell: Concrete Paving $400.00/CY

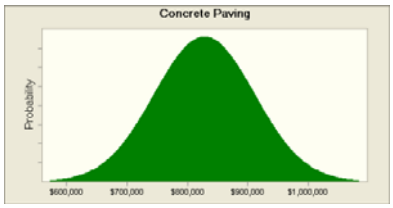
This material is to be incorporated into some of the roadway paving elements.

Risks:

- It is not clear how the unit price will be affected by upcoming energy trends

Opportunities:

- Design may positively affect outcome



Normal distribution with parameters:

Mean	**$828,000**
Std. Dev.	**$ 82,800**

2.3.22 Assumption Cell: Base Course $25.00/Ton

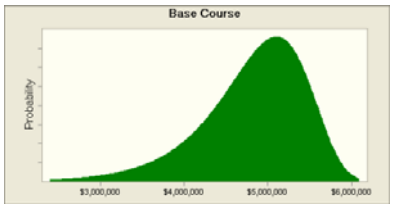
This material is to be incorporated into each of the roadway paving elements.

Risks:

- Haul distance is a large risk

Opportunities:

- Unit price could be lower if local source is negotiated
- May be able to reduce the quantity on the shoulders



Minimum Extreme distribution with parameters:

Likeliest	**$5,100,698**
Scale	**$ 510,070**

2.3.23 Assumption Cell: Base Course $33.50/Ton

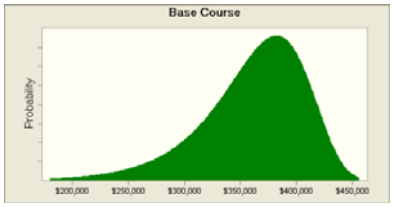
This material is to be incorporated into each of the roadway paving elements.

Risks:

- Minimal risk
- Unit price may be high

Opportunities:

- Higher unit cost possible



Minimum Extreme distribution with parameters:

Likeliest	**$381,900**
Scale	**$ 38,190**

2.3.24 Assumption Cell: Armor Rock $82.50/CY

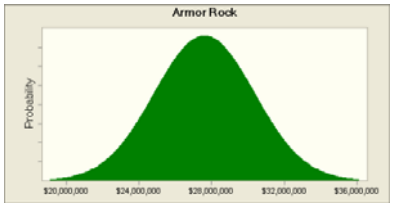
This material is to be incorporated into roadway slopes affected by the tidal variations.

Risks:

- The specific size of stone that is required may be difficult to find
- High quantity is required
- Quantity could increase by as much as 20% depending on indicators from updated geotechnical and design information

Opportunities:

- May be able to barge the material in at a lower cost
- Should get price competition since the quantities are so large.



Normal distribution with parameters:

Mean	**$27,593,280**
Std. Dev.	**$ 2,759,328**

2.3.25 Assumption Cell: Filter Rock $38.50/CY

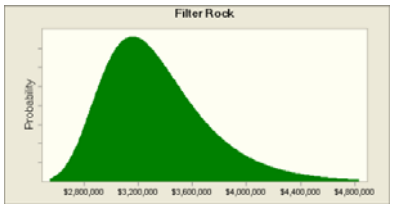
This material is the separator between the armor rock and the embankment material.

Risks:

- Quantity may increase

Opportunities:

- Large quantities may generate competitive pricing



Maximum extreme distribution with parameters:

Likeliest	**$3,158,656**
Scale	**$ 315,866**

2.3.26 Assumption Cell: Sheet Pile (Security Fence) $1,800.00/Ton

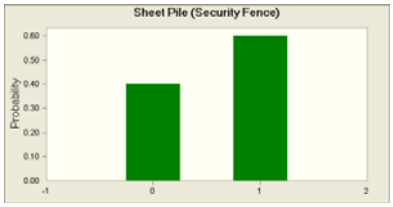
This material may or may not be required depending on upcoming design decisions. The Team was told that there is a 60% chance it will be needed, hence, the distribution curve selection noted below.

Risks:

- Steel price could impact costs
- Working toe of marginally stable slope
- Remnant

Opportunities:

- Design evolution savings
- Delete or shift costs of walls



Yes-No distribution with parameters:

Probability of Yes (1)	**0.6**

2.3.27 Assumption Cell: Sheet Pile (Open Cell) $1,785.00/Ton

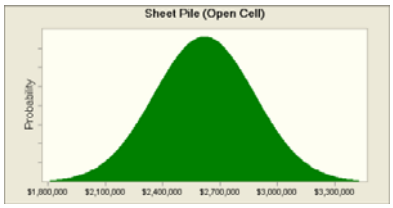
This material is to be used at MOA future expansion and at the Cherry Hill wall.

Risks:

- Steel price could impact costs
- Working toe of marginally stable slope

Opportunities:

- Design evolution savings
- Delete or shift costs of walls



Normal distribution with parameters:

Mean	**$2,618,595**
Std. Dev.	**$ 261,860**

2.3.28 Assumption Cell: Sheet Pile (Cantilevered) $1,600.00/Ton

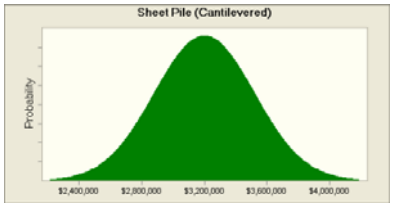
This is a cost related to a wall.

Risks:

- Steel prices could impact costs

Opportunities:

- Design evolution savings



Normal distribution with parameters:

Mean	**$3,200,000**
Std. Dev.	**$ 320,000**

2.3.29 Assumption Cell: Topsoil and Seed $370.00/MSF

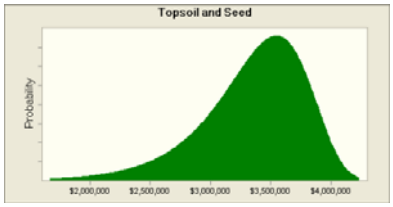
This material is to be incorporated into roadway slope stabilization areas.

Risks:

- May need slope stabilization on the back slopes prior to seeding

Opportunities:

- Possibility to use muck/peat on shoulders
- Entire cut and fill limits, may be excessive
- Possibly high unit price
- Back slopes may not need seeding and top soil



Minimum Extreme distribution with parameters:

Likeliest	**$3,546,943**
Scale	**$ 354,694**

2.3.30 Assumption Cell: Guardrail $35.00/LF

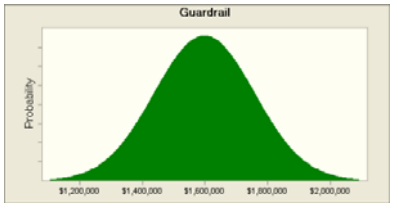
This material is to be incorporated into roadway slope areas, where needed to protect the driving public.

Risks:

- Lesser quantity, lower unit price

Opportunities:

- Potential for lower prices solution



Normal distribution with parameters:

Mean	**$1,598,016**
Std. Dev.	**$ 159,802**

2.3.31 Assumption Cell: Cut & Cover Tunnel (6 Lanes) $35,000,000/LS

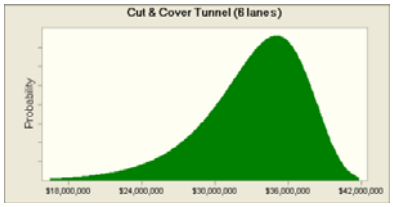
This tunnel is to be located in the Government Hill area.

Risks:

- Contaminated soils possibility
- Design concerns with tie backs
- Utility runs within structure

Opportunities:

- Costs could be lower
- Top down construction potential



Minimum Extreme distribution with parameters:

Likeliest	**$35,000,000**
Scale	**$ 3,500,000**

2.3.32 Assumption Cell: Retaining Walls $8,300,000/LS

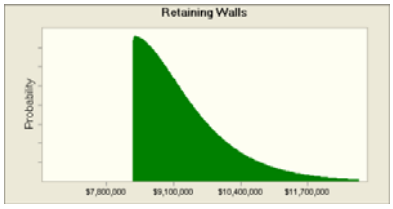
These retaining walls are part of the construction at Government Hill.

Risks:

- Unit cost may be very low, could be 3 time estimated cost
- Range could way from $8.3 to $24 million
- Profile dependent, particularly on the South approach
- Possible claims?

Opportunities:

- Potential to eliminate some walls and reduce retaining wall scope



Maximum Extreme distribution with parameters:

Likeliest	**$8,300,000**
Scale	**$ 830,000**

Selected range is from $8,300,000 to Infinity

2.3.33 Assumption Cell: Reconstruct Intersection $1,000,000/LS

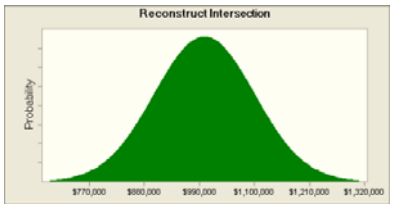
This allowance covers reconstruction and improvements necessary as part of the Government Hill construction.

Risks:

- Traffic controls are typically high (as high as 30% for urban work)
- Temporary crossings

Opportunities:

- Signalization, lighted



Normal distribution with parameters:

Mean	**$1,000,000**
Std. Dev.	**$ 100,000**

2.3.34 Assumption Cell: Connect to A-C Couplet $1,000,000/LS

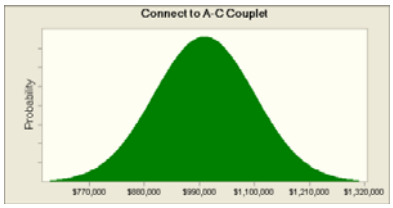
This work is part of the south termini construction for Phase 1.

Risks:

- Allowance could be low

Opportunities:

- No issues noted



Normal distribution with parameters:

Mean	**$1,000,000**
Std. Dev.	**$ 100,000**

2.3.35 Assumption Cell: Miscellaneous $1,500,000/LS

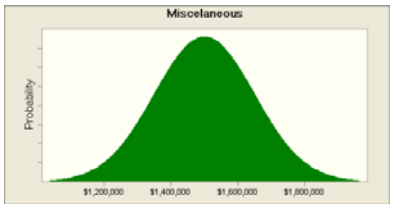
This allowance covers miscellaneous construction elements at Government Hill.

Risks:

- None identified

Opportunities:

- None identified



Normal distribution with parameters:

Mean	**$1,500,000**
Std. Dev.	**$ 150,000**

2.3.36 Assumption Cell: Concrete Barrier $100.00/LF

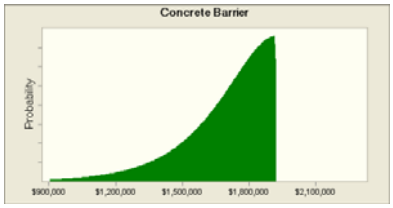
This material is to be incorporated into the east and west approaches and at Cherry Hill.

Risks:

- Unit price may be low

Opportunities:

- Concrete barrier might selectively be eliminated



Minimum Extreme distribution with parameters:

Likeliest	**$1,921,920**
Scale	**$ 192,192**

Selected range is from –Infinity to $1,921,000

2.3.37 Assumption Cell: Security Fencing (Chain Link) $60.00/LF

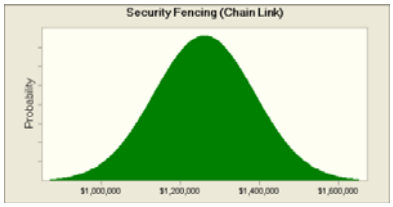
This fencing is to be part of the construction of the east approach, the future port expansion and Cherry Hill site.

Risks:

- Unit price may be low

Opportunities:

- Design evolution may negate the use of some of this fencing.



Normal distribution with parameters:

Mean	**$1,260,864**
Std. Dev.	**$ 126,086**

2.3.38 Assumption Cell: Curb and Gutter $35.00/LF

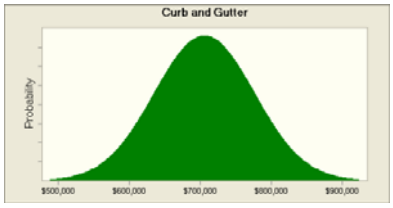
This curb and gutter is planned as part of the Cherry Hill construction.

Risks:

- Unit price may be low

Opportunities:

- The quantity of curb and gutter might be reduced as part of the design evolution or as a result of a VE work session.



Normal distribution with parameters:

Mean	**$705,810**
Std. Dev.	**$ 70,581**

2.3.39 Assumption Cell: Military Underpass $3,000,000/LS

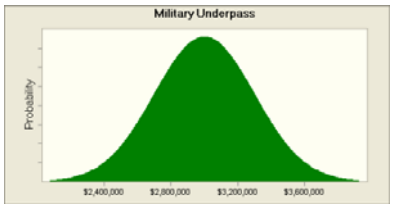
This underpass is to be provided to give the military direct access, under the south roadway segments of this project, to the port. In effect, this would be emergency access in the event of a general mobilization. It will also serve the military's needs for routine port access.

Risks:

- The attendant risks are those noted earlier for construction at Cherry and Government Hills, i.e., contaminated soils, unstable slopes, etc.

Opportunities:

- It may be possible to simplify or eliminate this connection point as the design continues to be developed.



Normal distribution with parameters:

Mean	**$3,000,000**
Std. Dev.	**$ 300,000**

2.3.40 Assumption Cell: Port Egress Intersection $1,000,000/LS

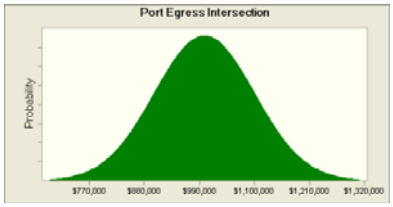
This work would consist of constructing an access ramp between the port operations area and the new, elevated roadway below the Government and Cherry Hills bluff.

Risks:

- Similar to the note above, i.e., contamination and unstable slopes.

Opportunities:

- This ramp may be negotiated out of the construction program.



Normal distribution with parameters:

Mean	**$1,000,000**
Std. Dev.	**$ 100,000**

2.3.41 Assumption Cell: 48” Diameter Pipe Piles $2,000.00/Ton

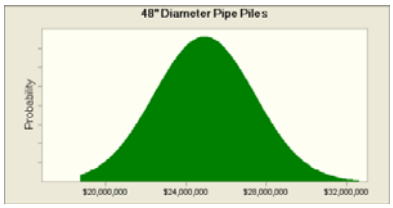
These are the steel pipes that are to be used as the non-driven piling to support the bridge across Knik Arm.

Risks:

- Steel prices are currently rather volatile

Opportunities:

- None reported.



Normal distribution with parameters:

Mean	**$24,908,000**
Std. Dev.	**$ 2,490,800**

Selected range is from $18,681,000 to Infinity

2.3.42 Assumption Cell: 48” Diameter Pipe Piles (Driven) $120,000.00/EA

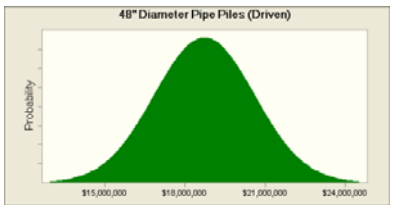
This is the part of the pilings that will be driven.

Risks:

- Template issues
- Currents, tides and weather delays
- Equipment availability – scheduling barges
- Delays due to Whale migration
- Possible range $16M to $19M

Opportunities:

- Some piles could be driven for less than $120K (at least 16 of them)



Normal distribution with parameters:

Mean	**$18,720,000**
Std. Dev.	**$ 1,872,000**

2.3.43 Assumption Cell: 48” Diameter Pipe Field Splices $10,000.00/EA

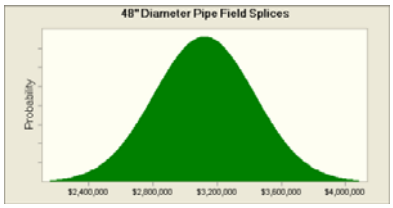
These splices are primarily between the driven and non-driven pile sections.

Risks:

- Time consuming, labor intensive
- Difficult operations – requires construction planning
- Potential weather delays
- Testing, Quality Assurance costs
- $4 to $8M possibility

Opportunities:

- Potential to reduce wall thickness, will reduce weld size
- Unit cost of $20K can be lower
- $4 to $8M possibility



Normal distribution with parameters:

Mean	**$3,120,000**
Std. Dev.	**$ 312,000**

2.3.44 Assumption Cell: Steel Pile Caps $5,000.00/Tons

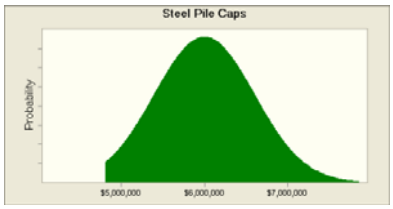
The pile caps will be steel structural shapes. They will most likely be fabricated off site and brought in on barges.

Risks:

- Labor costs could increase
- Customized connections

Opportunities:

- Design build may reduce customization
- Opportunity for optimization of design (plate steel use)



Normal distribution with parameters:

Mean	**$6,000,000**
Std. Dev.	**$ 600,000**

2.3.45 Assumption Cell: Concrete Pile Fill $400.00/CY

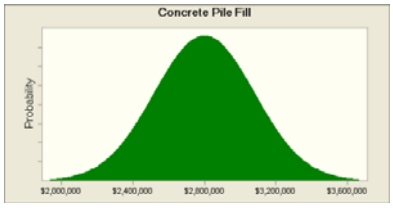
This will be a low grade concrete used mainly to stiffen the piles and help them absorb the energy of a barge collision.

Risks:

- No major risks
- Possibly increase in concrete costs

Opportunities:

- Possible 50% price reduction by replacing with gravel
- Significant cost reduction



Normal distribution with parameters:

Mean	**$2,800,000**
Std. Dev.	**$ 280,000**

2.3.46 Assumption Cell: Abutment Concrete $1,500.00/CY

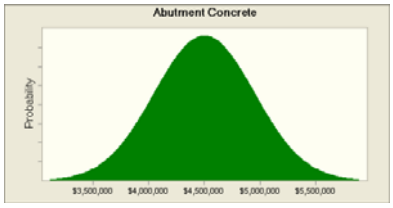
This material is to be incorporated into end sections of the approach roadways.

Risks:

- Low risk element
- $5M to $8M range

Opportunities:

- $2500/CY – very high unit price



Normal distribution with parameters:

Mean	**$4,500,000**
Std. Dev.	**$ 450,000**

2.3.47 Assumption Cell: Abutment Concrete Reinforcing $2,000.00/Ton

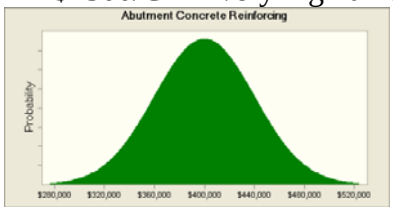
Location and use is self-explanatory.

Risks:

- Low risk element
- $5M to $8M range

Opportunities:

- $2500/CY – very high unit price



Normal distribution with parameters:

Mean	**$400,000**
Std. Dev.	**$ 40,000**

2.3.48 Assumption Cell: Super Structure – Structural Steel $5,000.00/Ton

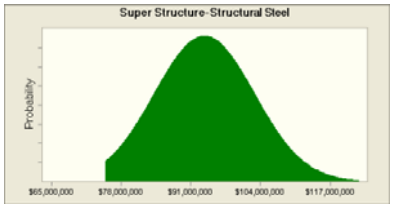
Self-explanatory.

Risks:

- Steel costs
- Welding and details is the largest risk
- Speed of fabrication
- Weather
- Competing projects
- Domestic steel price
- Corrosion risks
- $100M - $112M range

Opportunities:

- Availability not a problem
- $3.00/LB on the high side. Could be $2.50/LB
- $100M - $112M range



Normal distribution with parameters:

Mean	**$93,500,000**
Std. Dev.	**$ 9,350,000**

Selected range is from $74,800,000 to Infinity

2.3.49 Assumption Cell: Curb Reinforced Concrete $1,500.00/CY

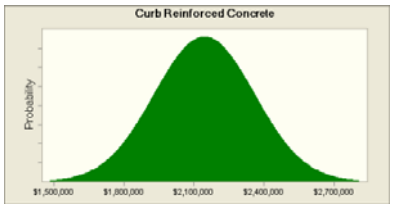
This material is the curbing on the bridge.

Risks:

- Unit price may be affected by energy costs.

Opportunities:

- None reported.



Normal distribution with parameters:

Mean	**$2,145,000**
Std. Dev.	**$ 214,500**

2.3.50 Assumption Cell: Curb Reinforcing Steel $2,000.00/Ton

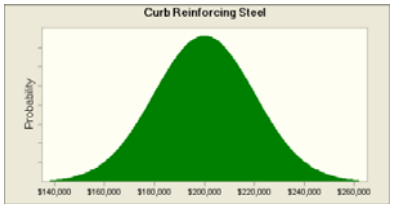
Self-explanatory.

Risks:

- Unit price may be low

Opportunities:

- None reported.



Normal distribution with parameters:

Mean	**$200,000**
Std. Dev.	**$ 20,000**

2.3.51 Assumption Cell: Bridge Rail $6,000.00/Ton

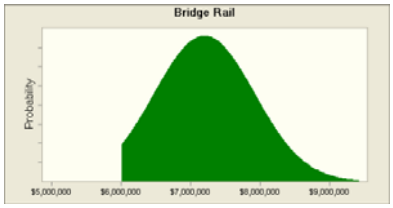
This is steel railing.

Risks:

- Steel prices

Opportunities:

- $3.00/LB could be high



Normal distribution with parameters:

Mean	**$7,200,000**
Std. Dev.	**$ 720,000**

2.3.52 Assumption Cell: Deck Metalizing $90.00/SY

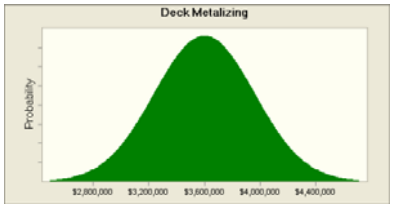
Self-explanatory.

Risks:

- No issues

Opportunities:

- No issues



Normal distribution with parameters:

Mean	**$3,600,000**
Std. Dev.	**$ 360,000**

2.3.53 Assumption Cell: Rubberized Asphalt Paving $120.00/Tons

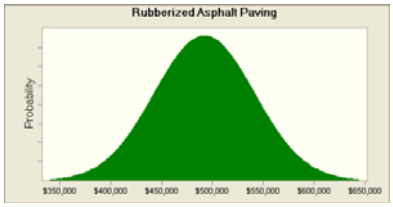
This material is to be incorporated into each of the roadway paving elements.

Risks:

- Oil prices could impact costs

Opportunities:

- Due to the low traffic volumes, may be able to replace the current design with a more standard pavement design



Normal distribution with parameters:

Mean	**$492,000**
Std. Dev.	**$ 49,200**

2.3.54 Assumption Cell: Asphalt Paving $80.00/Tons

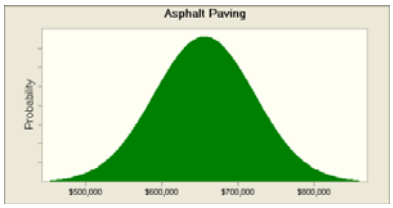
This material is to be incorporated into each of the roadway paving elements.

Risks:

- Oil prices could impact costs
- Unit price may be low

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$656,000**
Std. Dev.	**$ 65,600**

2.3.55 Assumption Cell: Lighting $200.00/LF

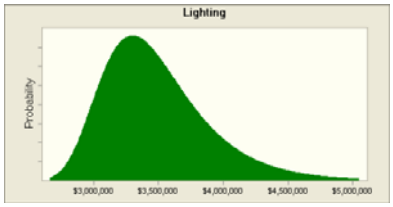
This is lighting on the bridge. It will be low level to help see through fog. May have to add lighting to the approach roadways.

Risks:

- No issues

Opportunities:

- No issues



Maximum Extreme distribution with parameters:

Likeliest	**$3,300,000**
Scale	**$ 330,000**

2.3.56 Assumption Cell: Signs & Miscellaneous $500,000/All

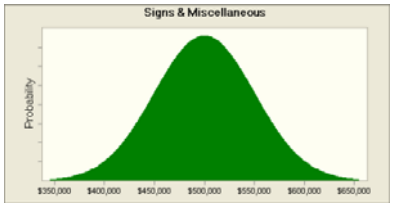
Self-explanatory.

Risks:

- No issues

Opportunities:

- No issues



Normal distribution with parameters:

Mean	**$500,000**
Std. Dev.	**$ 50,000**

2.3.57 Assumption Cell: 10’ Diameter Energy Absorbers $20,000.00/EA

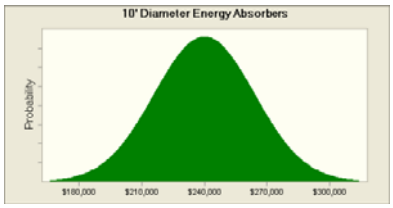
This is protection for the bridge.

Risks:

- Unit price may be low

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$240,000**
Std. Dev.	**$ 24,000**

2.3.58 Assumption Cell: Small Rubber Energy Absorbers $100,000.00/All

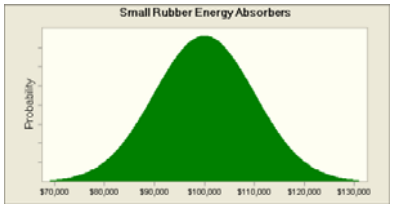
This is protection for the bridge.

Risks:

- Unit price may be low

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$100,000**
Std. Dev.	**$ 10,000**

2.3.59 Assumption Cell: Toll Facility $3,000,000.00/All

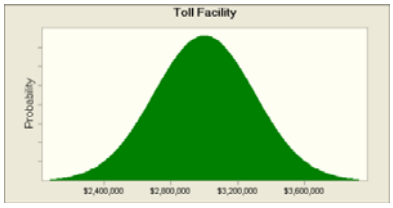
This cost element represents a "placeholder" until the toll operations are better defined.

Risks:

- Cost will be at risk until the toll operations are better defined

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$3,000,000**
Std. Dev.	**$ 300,000**

2.3.60 Assumption Cell: Intersection $200,000.00/LS

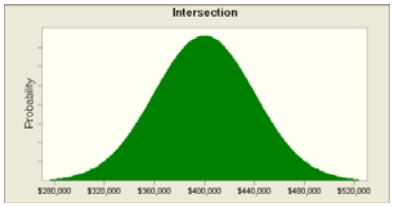
This funding is for two intersections to be reconstructed on the west shore.

Risks:

- None reported

Opportunities:

- The ultimate design may make it possible to reduce these costs.



Normal distribution with parameters:

Mean	**$400,000**
Std. Dev.	**$ 40,000**

2.3.61 Assumption Cell: Maintenance Facility $1,500,000.00/LS

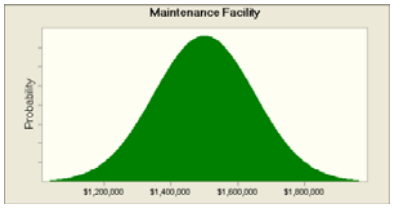
This is a placeholder costs for a facility that has not yet been defined.

Risks:

- None reported

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$1,500,000**
Std. Dev.	**$ 150,000**

2.3.62 Assumption Cell: Striping $0.90/LF

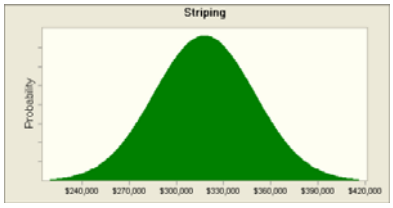
Self-explanatory

Risks:

- None reported

Opportunities:

- None reported



Normal distribution with parameters:

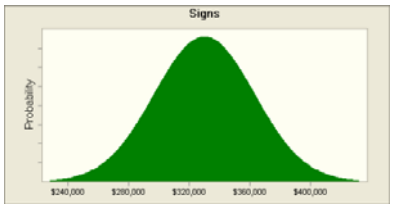
Mean	**$317,814**
Std. Dev.	**$ 31,781**

2.3.63 Assumption Cell: Signs $100.00/SF

Self-explanatory

Risks:
- None reported

Opportunities:
- None reported



Normal distribution with parameters:

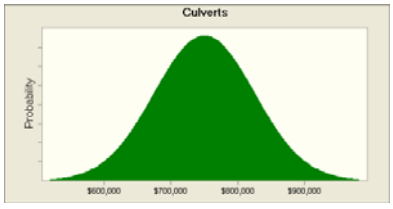
Mean	**$330,000**
Std. Dev.	**$ 33,000**

2.3.64 Assumption Cell: Culverts $100.00/LF

Drainage is not well defined at this time.

Risks:
- Since drainage is not well defined, costs will be a concern.

Opportunities:
- None reported



Normal distribution with parameters:

Mean	**$750,000**
Std. Dev.	**$ 75,000**

2.3.65 Assumption Cell: Drainage System – East Approach $500,000.00/LS

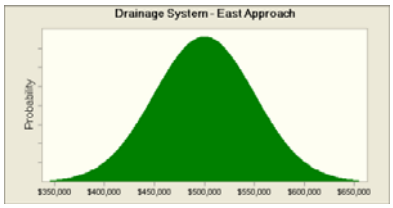
Drainage is not well defined at this time.

Risks:

- Since drainage is not well defined, costs will be a concern.

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$500,000**
Std. Dev.	**$ 50,000**

2.3.66 Assumption Cell: Drainage System – MOA Future Port Expansion $1,500,000.00

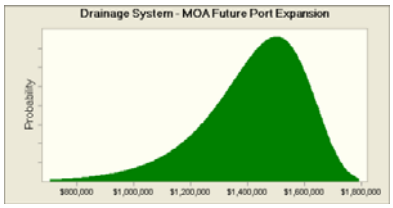
Drainage is not well defined at this time.

Risks:

- Since drainage is not well defined, costs will be a concern.

Opportunities:

- None reported



Minimum Extreme distribution with parameters:

Mean	**$1,500,000**
Std. Dev.	**$ 150,000**

2.3.67 Assumption Cell: Drainage System – Security Wall $1,000,000.00

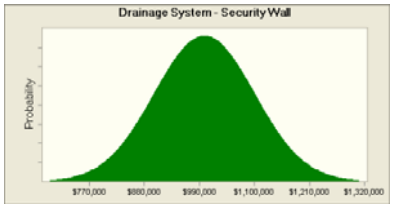
Drainage is not well defined at this time.

Risks:

- Since drainage is not well defined, costs will be a concern.

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$1,000,000**
Std. Dev.	**$ 100,000**

2.3.68 Assumption Cell: Drainage System – Cherry Hill $842,000.00

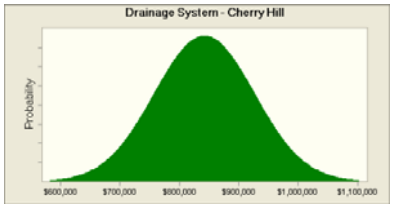
Drainage is not well defined at this time.

Risks:

- Since drainage is not well defined, costs will be a concern.

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$842,000**
Std. Dev.	**$ 84,200**

2.3.69 Assumption Cell: Surveying - All $100,000.00/LS

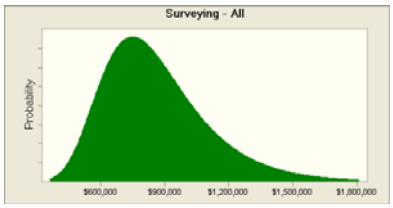
Allowance for surveying during construction.

Risks:

- Allowance is very likely low

Opportunities:

- None reported



Maximum Extreme distribution with parameters:

Mean	**$750,000**
Std. Dev.	**$200,000**

2.3.70 Assumption Cell: Demolition $100,000.00/LS

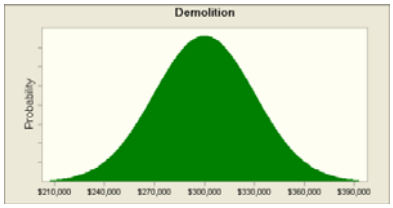
This is an allowance.

Risks:

- Unit price may be low

Opportunities:

- None reported



Normal distribution with parameters:

Mean	**$300,000**
Std. Dev.	**$ 30,000**

2.3.71 Assumption Cell: Traffic Control $100,000.00/LS

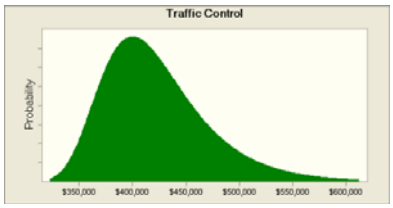
This is an allowance.

Risks:

- Unit price may be low

Opportunities:

- None reported



Maximum Extreme distribution with parameters:

Mean	**$400,000**
Std. Dev.	**$ 40,000**

2.3.72 Assumption Cell: Silt Fence/ Erosion Protection $1,000,000.00/LS

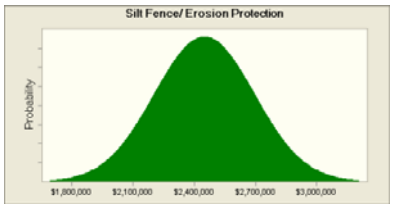
This is an allowance to cover this cost throughout the project area.

Risks:

- Unit price may be low

Opportunities:

- None reported.



Normal distribution with parameters:

Mean	**$2,450,000**
Std. Dev.	**$ 245,000**

2.3.73 Assumption Cell: Utility Crossings $1,200,000.00/LS

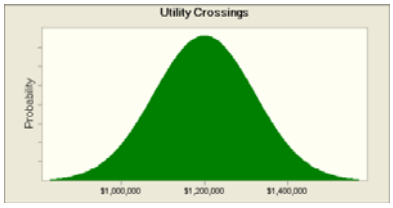
This is an allowance to cover the cost of handling the utilities that cross the roadway alignment. Most of this work will be done in the Government Hill area.

Risks:

- Work is not well defined at this point

Opportunities:

- If the scope of the tunnel work is reduced, the cost of handling utilities in Phase 1 could be significantly reduced.
-



Normal distribution with parameters:

Mean	**$1,200,000**
Std. Dev.	**$ 120,000**

APPENDICES

APPENDIX A

Review Estimates

KNIK ARM CROSSING
APRIL 2006 COMPILED ESTIMATE

Item	Unit	Cost/ Unit	Program Totals Total Cost
INITIAL BUILD OUT (Ph. 1)			
Overall length	Miles		
Clearing and Grubbing	Acre	$5,000.00	$ 931,650
Clearing	Acre	$3,000.00	$ 205,040
Vibracompaction (Below elev 20')	SY	$10.80	$ 2,406,481
Common Excavation	CY	$5.00	$ 3,858,426
Common Excavation	CY	$7.50	$ 135,000
Excavation (Stockpile)	CY	$5.00	$ 1,914,285
Excav. (as borrow elsewhere)	CY	$0.00	$ -
Excavation (Waste)	CY	$10.00	$ -
Excavation (Waste)	CY	$12.00	$ 1,500,000
Excavation (Waste)	CY	$7.00	$ 189,000
Excavation (Special)	CY	$15.00	$ 450,000
Borrrow, Type A	CY	$10.00	$ 3,346,349
Borrow, Type A	CY	$13.00	$ 389,571
Borrrow, Type A	CY	$14.00	$ 546,000
Borrrow, Type C	CY	$10.00	$ 18,336,310
Borrrow, Type C	CY	$13.00	$ 1,213,381
Borrrow, Type C	CY	$10.60	$ 1,791,400
Fill Below elev 20'	CY	$15.00	$ 17,944,185
Muck Excavation	CY	$5.00	$ 500,000
Stone Mastic	TN	$48.00	$ 2,530,703
Asphalt	TN	$44.00	$ 250,800
AC Pavement, Type II Cl A	TN	$40.00	$ 2,108,919
Concrete Paving	CY	$400.00	$ 828,000
Base Course	TN	$25.00	$ 5,100,698
Base Course	TN	$33.50	$ 381,900
Armor Rock	CY	$82.50	$ 27,593,280
Filter Rock	CY	$38.50	$ 3,158,656
Sheet Pile (Security Fence)	Tons	$1,800.00	$ 5,698,800
Sheet Pile (Open Cell)	Tons	$1,785.00	$ 2,618,595
Sheet Pile (Cantilevered)	LF	$1,600.00	$ 3,200,000
Topsoil and Seed	MSF	$370.00	$ 3,546,943
Guardrail	LF	$35.00	$ 1,598,016
Cut & Cover Tunnel (6 lanes)	LS	$35,000,000.00	$ 35,000,000
Retaining Walls	LS	$8,300,000.00	$ 8,300,000
Reconstruct Intersection	LS	$1,000,000.00	$ 1,000,000
Connect to A-C Couplet	LS	$1,000,000.00	$ 1,000,000
Miscelaneous	LS	$1,500,000.00	$ 1,500,000
Concrete Barrier	LF	$100.00	$ 1,921,920
Security Fencing (Chain Link)	LF	$60.00	$ 1,260,864
Trail Rail	LF	$100.00	$ -
Bridge Rail	LF	$365.00	$ -
Curb and Gutter	LF	$35.00	$ 705,810
Military Underpass	LS	$3,000,000.00	$ 3,000,000
Port Egress Intersection	LS	$1,000,000.00	$ 1,000,000
48" Diameter Pipe Piles	Tons	$2,000	$ 24,908,000
48" Diameter Pipe Piles (Driven)	EA	$120,000	$ 18,720,000
48" Diameter Pipe Field Splices	EA	$10,000	$ 3,120,000
Steel Pile Caps	Tons	$5,000.00	$ 6,000,000
Concrete Pile Fill	CY	$400.00	$ 2,800,000
Abutment Concrete	CY	$1,500.00	$ 4,500,000
Abutment Concrete Reinforcing	Tons	$2,000.00	$ 400,000
Super Structure-Structural Steel	Tons	$5,000.00	$ 93,500,000
Curb Reinforced Concrete	CY	$1,500.00	$ 2,145,000
Curb Reinforcing Steel	Tons	$2,000.00	$ 200,000
Bridge Rail	Tons	$6,000.00	$ 7,200,000
Deck Metalizing	SY	$90.00	$ 3,600,000
SUBTOTAL BRIDGE			**$ 167,093,000**
Rubberized Asphalt Paving	Tons	$120.00	$ 492,000
Asphalt Paving	Tons	$80.00	$ 656,000
Lighting	LF	$200.00	$ 3,300,000
Signs & Miscellaneous	All	$500,000.00	$ 500,000
10' Diameter Energy Absorbers	EA	$20,000.00	$ 240,000
Small Rubber Energy Absorbers	All	$100,000.00	$ 100,000
Toll Facility	All	$3,000,000.00	$ 3,000,000

KNIK ARM CROSSING
APRIL 2006 COMPILED ESTIMATE

Item	Unit	Cost/ Unit	Program Totals Total Cost
2 Lane Bridge Expansion	LF	$10,000	$ -
Shared Use Path At Crossing	LF	$3,500	$ -
Toll Plaza	LS	$4,000,000	$ -
Frontage Roads (both sides)	LS	$5,000,000	$ -
Frontage Roads (One side only)	LS	$2,500,000	$ -
Intersection	LS	$200,000	$ 400,000
Maintenance Facility		$1,500,000.00	$ 1,500,000
Lighting	LF	$40.00	$ -
Striping	LF	$0.90	$ 317,814
Signs	SF	$100.00	$ 330,000
Culverts	LF	$100.00	$ 750,000
Drainage System - East Approach	LS	$500,000.00	$ 500,000
Drainage System - MOA Future Port Expansion		$1,500,000.00	$ 1,500,000
Drainage System - Security Wall		$1,000,000.00	$ 1,000,000
Drainage System - Cherry Hill		$842,000.00	$ 842,000
Surveying - All	LS	$100,000	$ 750,000
Demolition	LS	$100,000	$ 300,000
Traffic Control	LS	$100,000	$ 400,000
Silt Fence/ Erosion Protection	LS	$1,000,000	$ 2,450,000
Utility Crossings	LS	1200000	$ 1,200,000
TOTAL DIRECT CONST. ESTIMATE			**$ 356,581,795**
Design Contigency @ 15%			$ 53,487,269
Total DIRECT CONST. EST. with Contingency			**$ 410,069,064**
		Mobilization @ 5%	$ 20,503,453
		Environmental	$ 10,000,000
		Total Const. Est.	**$ 440,572,518**
		Design/Engr.	$ 30,840,076
		Constn. Mgmt	$ 33,042,939
		Total Hard Cost Est	**$ 504,455,533**
		Private Land Purch.	**$ 12,300,000**
		Subtotal Project Est.	**$ 516,755,533**
		Escalation	$ 64,524,163
		Subtotal Program Est.	$ 581,279,696
		Program Contingency	$ 58,127,970
		Total Program Estimate	**$ 639,407,665**

KNIK ARM CROSSING
APRIL 2006 COMPILED ESTIMATE

Item	Unit	Cost/ Unit	Program Totals Total Cost
FUTURE BUILD OUT (Ph. 2)			
Rough Order of Magnitude Build out Costs			
Additional roadway construction			32,450,957
Additional 2 lanes of bridge deck			98,160,000
Depressed roadway connection			16,200,000
Raised Viaduct			93,600,000
I/G interchange			33,600,000
Erickson Paving over Ph 1 Earthwork			8,400,000
Geotechnical Risk			
Contaminated Soil Risk			
Subtotal Build out Costs incl. 20% Design Cont.			$282,410,957
MOBILIZATION (5% of Line Item Y)			$14,120,548
MITIGATION (2% of Line Item Y, Bridge at 1%)			$4,666,619
Subtotal HARD COSTS			$301,198,124
ENGINEERING / ADMINISTRATION (7% of line Z)			$21,083,869
CONSTRUCTION MANAGEMENT (7.5% of line Z)			$22,589,859
Subtotal SOFT COSTS			$43,673,728
Private Land			
Right of Way			$4,984,944
Subtotal PROJECT COSTS			$349,856,796
ESCALATION (3% for 15 years of line BB)			$195,208,692
Subtotal PROGRAM COSTS			$545,065,488
PROGRAM CONTINGENCY (25% of line BB)			$136,266,372
TOTAL BUILD OUT INCREMENT			**$681,331,860**

KNIK ARM CROSSING INITIAL CONSTRUCTION COST ESTIMATE - 35% DESIGN UPDATE

Item	Unit	Cost/ Unit	Program Totals	
			Total Qnty	Total Cost
DEIS Estimate				
Overall length	Miles			
Clearing and Grubbing	Acre	$5,000.00	186	$ 931,650
Clearing	Acre	$3,000.00	68	$ 205,040
Vibracompaction (Below elev 20')	SY	$10.80	222,822	$ 2,406,481
Common Excavation	CY	$5.00	771,685	$ 3,858,426
Common Excavation	CY	$7.50	18,000	$ 135,000
Excavation (Stockpile)	CY	$5.00	382,857	$ 1,914,285
Excav. (as borrow elsewhere)	CY	$0.00	425,291	$ -
Excavation (Waste)	CY	$10.00	0	$ -
Excavation (Waste)	CY	$12.00	125,000	$ 1,500,000
Excavation (Waste)	CY	$7.00	27,000	$ 189,000
Excavation (Special)	CY	$15.00	30,000	$ 450,000
Borrrow, Type A	CY	$10.00	334,635	$ 3,346,349
Borrow, Type A	CY	$13.00	29,967	$ 389,571
Borrrow, Type A	CY	$14.00	39,000	$ 546,000
Borrrow, Type C	CY	$10.00	1,833,631	$ 18,336,310
Borrrow, Type C	CY	$13.00	93,337	$ 1,213,381
Borrrow, Type C	CY	$10.60	169,000	$ 1,791,400
Fill Below elev 20'	CY	$15.00	1,196,279	$ 17,944,185
Muck Excavation	CY	$5.00	100,000	$ 500,000
Stone Mastic	TN	$48.00	52,723	$ 2,530,703
Asphalt	TN	$44.00	5,700	$ 250,800
AC Pavement, Type II Cl A	TN	$40.00	52,723	$ 2,108,919
AC Pavement, Type II for DEIS Adjustment				$ 2,000,000
Concrete Paving	CY	$400.00	2,070	$ 828,000
Base Course	TN	$25.00	204,028	$ 5,100,698
Base Course	TN	$33.50	11,400	$ 381,900
Armor Rock	CY	$82.50	334,464	$ 27,593,280
Filter Rock	CY	$38.50	82,043	$ 3,158,656
Sheet Pile (Security Fence)	Tons	$1,800.00	3,166	$ 5,698,800
Sheet Pile (Open Cell)	Tons	$1,785.00	1,467	$ 2,618,595
Sheet Pile (Cantilevered)	LF	$1,600.00	2,000	$ 3,200,000
Topsoil and Seed	MSF	$370.00	9,586	$ 3,546,943
Guardrail	LF	$35.00	45,658	$ 1,598,016
Cut & Cover Tunnel (2 lanes)	LS	$15,000,000.00	1	$ 15,000,000
Retaining Walls	LS	$8,300,000.00	1	$ 8,300,000
Reconstruct Intersection	LS	$1,000,000.00	1	$ 1,000,000
Connect to A-C Couplet	LS	$1,000,000.00	1	$ 1,000,000
Miscelaneous	LS	$1,500,000.00	1	$ 1,500,000
Concrete Barrier	LF	$100.00	19,219	$ 1,921,920
Security Fencing (Chain Link)	LF	$60.00	21,014	$ 1,260,864

KNIK ARM CROSSING INITIAL CONSTRUCTION COST ESTIMATE - 35% DESIGN UPDATE

Item	Unit	Cost/ Unit	Program Totals	
			Total Qnty	Total Cost
Trail Rail	LF	$100.00	0	$ -
Bridge Rail	LF	$365.00	0	$ -
Curb and Gutter	LF	$35.00	20,166	$ 705,810
Military Underpass	LS	$3,000,000.00	1	$ 3,000,000
Port Egress Intersection	LS	$0.00	1	$ -
48" Diameter Pipe Piles	Tons	$2,000	12,454	$ 24,908,000
48" Diameter Pipe Piles (Driven)	EA	$120,000	156	$ 18,720,000
48" Diameter Pipe Field Splices	EA	$10,000	312	$ 3,120,000
Steel Pile Caps	Tons	$5,000.00	1,200	$ 6,000,000
Concrete Pile Fill	CY	$400.00	7,000	$ 2,800,000
Abutment Concrete	CY	$1,500.00	3,000	$ 4,500,000
Abutment Concrete Reinforcing	Tons	$2,000.00	200	$ 400,000
Super Structure-Structural Steel	Tons	$5,000.00	18,700	$ 93,500,000
Curb Reinforced Concrete	CY	$1,500.00	1,430	$ 2,145,000
Curb Reinforcing Steel	Tons	$2,000.00	100	$ 200,000
Bridge Rail	Tons	$6,000.00	1,200	$ 7,200,000
Deck Metalizing	SY	$90.00	40,000	$ 3,600,000
SUBTOTAL BRIDGE				**$ 167,093,000**
Rubberized Asphalt Paving	Tons	$120.00	4,100	$ 492,000
Asphalt Paving	Tons	$80.00	8,200	$ 656,000
Lighting	LF	$200.00	16,500	$ 3,300,000
Signs & Miscellaneous	All	$500,000.00	1	$ 500,000
10' Diameter Energy Absorbers	EA	$20,000.00	12	$ 240,000
Small Rubber Energy Absorbers	All	$100,000.00	1	$ 100,000
Toll Facility	All	$3,000,000.00	1	$ 3,000,000
2 Lane Bridge Expansion	LF	$10,000	0	$ -
Shared Use Path At Crossing	LF	$3,500	0	$ -
Toll Plaza	LS	$4,000,000	0	$ -
Frontage Roads (both sides)	LS	$5,000,000	0	$ -
Frontage Roads (One side only)	LS	$2,500,000	0	$ -
Intersection	LS	$200,000	2	$ 400,000
Maintenance Facility	LS	$1,500,000.00	0	$ -
Lighting	LF	$40.00	0	$ -
Striping	LF	$0.90	353,126	$ 317,814
Signs	SF	$100.00	3,300	$ 330,000
Culverts	LF	$100.00	7,500	$ 750,000
Drainage System - East Approach	LS	$500,000.00	1	$ 500,000
Drainage System - MOA Future Port Expansion		$1,500,000.00	1	$ 1,500,000
Drainage System - Security Wall		$1,000,000.00	1	$ 1,000,000
Drainage System - Cherry Hill		$842,000.00	1	$ 842,000

KNIK ARM CROSSING INITIAL CONSTRUCTION COST ESTIMATE - 35% DESIGN UPDATE

Item	Unit	Cost/ Unit	Program Totals	
			Total Qnty	Total Cost
Surveying - All	LS	$100,000	8	$ 750,000
Demolition	LS	$100,000	3	$ 300,000
Traffic Control	LS	$100,000	4	$ 400,000
Silt Fence/ Erosion Protection	LS	$1,000,000	2	$ 2,450,000
Utility Crossings	LS	1200000	1	$ 1,200,000
TOTAL DIR CONST. EST. W/O CONTINGENCY			**Total:**	**$ 336,081,795**
Design Contigency @ 15%				$ 50,412,269
Total DIRECT CONST. EST. with Contingency			**Total w/ 15% Contingency:**	**$ 386,494,064**

Mobilization @ 5%	5.0%	$	19,324,703
Environmental	2.59%	$	10,000,000
Total Const. Est.(Bid Stage)		**$**	**415,818,768**
Design/Engr.	7.0%	$	29,107,314
Constn. Mgmt	7.5%	$	31,186,408
Total Hard Cost Est		**$**	**476,112,489**
Private Land Purch.		**$**	**6,300,000**
Subtotal Project Est.		**$**	**482,412,489**
Escalation	12.5%	$	60,235,953
Subtotal Program Est.		$	542,648,442
Program Contingency	10.0%	$	54,264,844
Total Program Estimate		**$**	**596,913,286**

APPENDIX B

Agenda and Sign-In Sheets

COST ESTIMATE REVIEW Agenda

Objective: The objective of the Cost Estimate Review is 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 project's stage of design.

DATE	TIME	ACTIVITY
Mon 4/24	8 – 12	Site Tour
	Noon	Lunch at HDR, 4th Floor Conference Room Introduction of Project to Team by KABATA
	1 - 5	Participants Introductions, Review Project Status Review Cost Estimates, Overview, and Process
Tues 4/25	8 – 9:30	Bridge Structures Cost Estimate Overview Structures Task Force Identified
	9:30 – 12	*Structures Task Force* Breakout Session - Bridge Non-Construction Costs Review (PE,CEI,PM) *(other Team members)*
	1 – 3	Discuss *Structures Task Force* Review Results
	3 – 5	Cut and Cover Structures
Wed 4/25	8 - 10	Roadways Cost Estimate Review incl. Drainage
	10 – 12	Anchorage Approach Roadways
	1 – 2	Utilities Cost Estimate Review
	2 – 3	Environmental Mitigation / Stewardship Cost Estimate Review
	3 – 4	Right-of-Way Cost Estimate Review
	4 – 5	MOT / Congestion Management System Costs Review
Thurs 4/26	8 -10	Inflation and Contingencies Review
	10 -12	Discuss Project Schedule Risks and Delivery Methods
	1- 5	Finalize Review & Begin Preparation of Presentation
Fri 4/28	8 – 12	Finalize & Rehearse Presentation
	1 – 3	Presentation & Wrap - Up

PBS&J

KNIK ARM CROSSING

U.S. Department of Transportation
Federal Highway Administration

KNIK ARM CROSSING PROJECT
COST ESTIMATE REVIEW

Sign-In Sheet
Date: Apr. 24, 2006

Name	Agency	Discipline	Ph. No.	E-mail
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Dennis Nottingham	PND	C.S	561-1011	—
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Duane Hippe	HDR	Principal	907.644.2000	duane.hippe@hdrinc.com

KNIK ARM CROSSING

U.S. Department of Transportation
Federal Highway Administration

KNIK ARM CROSSING PROJECT
COST ESTIMATE REVIEW

Sign-In Sheet

Date: Apr. 25, 2006

Name	Agency	Discipline	Ph. No.	E-mail
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KNIK ARM CROSSING

U.S. Department of Transportation
Federal Highway Administration

KNIK ARM CROSSING PROJECT
COST ESTIMATE REVIEW

Sign-In Sheet

Date: Apr. 26, 2006

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KNIK ARM CROSSING

U.S. Department of Transportation
Federal Highway Administration

KNIK ARM CROSSING PROJECT
COST ESTIMATE REVIEW

Sign-In Sheet

Date: Apr. 27, 2006

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KNIK ARM CROSSING

U.S. Department of Transportation
Federal Highway Administration

KNIK ARM CROSSING PROJECT
COST ESTIMATE REVIEW

Sign-In Sheet
Date: Apr. 28, 2006

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KNIK ARM CROSSING

U.S. Department of Transportation
Federal Highway Administration

KNIK ARM CROSSING PROJECT
COST ESTIMATE REVIEW

Sign-In Sheet

Date: Apr. 28, 2006

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APPENDIX C

Estimate Review Summary Presentation

Knik Arm Crossing
Cost Estimate Review

Apr. 2006

U.S. Department of Transportation
Federal Highway Administration

KNIK ARM CROSSING

Knik Arm Crossing
Cost Estimate Review

Objective

The objective of the Cost Estimate Review is 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 project's current stage of design.

Knik Arm Crossing
Cost Estimate Review
Workshop Team Members

- FHWA Staff
- KABATA Staff and Consultants
- ADOT
- PBS&J (Consultant)

Knik Arm Crossing
Cost Estimate Review
Other similar projects

- St. Croix River Crossing Project, MN
- San Fran.-Oakland Bay Bridge Project, CA
- Utah Legacy Project
- Mississippi River Bridge
- Maryland Intercounty Connector, MD
- Ohio River Bridge

Knik Arm Crossing
Cost Estimate Review
Agenda

- **Monday, Apr. 24**
  - Site Tour
  - Introduction of the Project by KABATA
  - Review Project Scope
  - Review Project Cost Estimate and Cost Estimate development process
- **Tuesday, Apr. 25**
  - Bridge Structures Cost Estimate Review
  - Cut and Cover Structures Cost Estimate Review
  - Review Non-Construction Costs (PE, CM, Inflation, Contingencies)
- **Wednesday, Apr. 26**
  - Roadway incl. Drainage and Lighting Cost Estimate Reviews
  - Approach Roadways Cost Estimate Review
  - Utilities, Environmental, Right-of-Way, Project Phasing
  - Review Final Build-out Cost Estimate
- **Thursday, Apr. 27**
  - Finalize Review of Project Cost Estimate
  - Perform Risk Analysis on Cost Estimate utilizing Risks and Opportunities
- **Friday, Apr. 28**
  - Prepare Presentation
  - Presentation of findings

Knik Arm Crossing
Cost Estimate Review
Methodology

- Overall Project Scope Review
- Review DEIS Nov. 2005 and April 2006 Cost Estimates
- Focus on Preferred Alternative (M2-C1-D/E) and Initial Build-out
  - Northern Access, Southern Crossing, Degan / Erickson Options
  - Review based on Erickson Option
- Focus on Bridge, Approaches, Cut and Cover
  - **Bridge Scope**
    - Type of Bridge, Steel Price fluctuations
    - Constructability, Currents, Tide and other weather impacts
    - Whales and other natural species
    - Noise Restrictions
    - Number of seasons of bridge construction
    - Competitive Bids and other competing projects
  - **Government Hill Scope**
    - Contamination
    - Historical
    - ROW

Knik Arm Crossing
Cost Estimate Review
Methodology (continued)

- Review other project scope (Mat-Su side, POA, etc.)
- Mobilization Costs
- Utilities, Right of Way, Environmental, etc.
- Application of contingencies (Design, Program)
- Inflation application to cost estimates (mid-point of construction)
- Discussed Project Delivery Methods (DBB, D-B, PPP, etc.)
- Develop consolidated/updated Cost Estimate for review
- Risks and Opportunities Analysis
  - Focused on major cost items
  - Evaluate the risks and opportunities associated with each item
  - Applied probability curve for each item
  - Total Bridge, Bid level cost and Total Program Cost Analysis

Knik Arm Crossing
Cost Estimate Review
Review Qualifications

- Independent cost estimates not developed
- Verification of quantities not performed
- Cursory review of major cost items unit prices
- Review emphasized cost items with *major* impacts to cost
- Potential schedule delays due to inter-contract relationships were not quantified in analysis
- Impact due to type of contract delivery method not quantified in analysis
- Review focused largely on the *Initial Build-out* (Ph. 1)
- Review based on a Steel Design for Bridge
- Review based on the April 2006 update and DEIS Estimate from Nov. 2005

Knik Arm Crossing Cost

Overall Cost Estimate Summary

Initial Build-out (Erickson Opt.)	Total Estimate	Change
DEIS Estimate (Nov. 2005)	$599.4M	
Revised Estimate (Apr. 2006)	$639.4M	$40M

TOT. EST. PRIOR TO CONTINGENCIES	**$ 356.5M**
DESIGN CONTINGENCY (15%)	**$ 53.5M**
MOBILIZATION (5%)	**$ 20.5M**
MITIGATION	**$ 10.0M**
DESIGN / CM (7.0 / 7.5%)	**$ 63.9M**
RIGHT OF WAY	**$ 12.3M**
INFLATION (4% per year for 3 years)	**$ 64.5M**
PROGRAM CONTINGENCY (10%)	**$ 58.1M**

Final Build-out (Erickson Opt.)	Total Estimate	Change
DEIS Estimate (Nov. 2005)	$586.7M	
Revised Estimate (Apr. 2006)	$504.0M	(-$82M)

Knik Arm Crossing Cost Estimate Review

Overall Cost Estimate Summary

Initial Build-out (Erickson Opt.)	Total Estimate	Change
DEIS Estimate (Nov. 2005)	$599.4M	
Revised Estimate (Apr. 2006)	$639.4M	$40M

TOT. EST. PRIOR TO CONTINGENCIES **$356.5M**

Borrow	**$43.6M**	**12% of $356.5M**
Armor Rock	**$27.6M**	**8%**
Cut and Cover	**$35.0M**	**10%**
48" Piles (installed)	**$46.7M**	**13%**
Super-Structure	**$93.5M**	**27%**
		70%
Total Bridge	**$167M**	**47%**

Knik Arm Crossing Cost Estimate Review

Overall Cost Estimate Summary

Initial Build-out (Erickson Opt.)	Total Estimate	Change
DEIS Estimate (Nov. 2005)	$599.4M	
Revised Estimate (Apr. 2006)	$639.4M	$40M

Major Changes between Estimates:	Change
Cut and Cover Tunnel from 2 to 6 Lanes	~ $20.0 M
Right-of-Way Cost Increase	~ $6.0 M
Environmental / Mitigation Cost Increase	~ $6.3 M
Other miscellaneous changes (increases and decreases)	
Modify Contingencies Calculation methods	

Knik Arm Crossing
Cost Estimate Review
Summary of Review Findings

- Overall Estimate is consistent with project's current stage of design
- Quantities and unit prices development process is consistent with industry standards
- Appropriate contingencies and other markups applied to estimate
- Following items could have major risk on project cost
  - Bidding Conditions (number of responsive bidders)
  - Other competing projects
  - Constructibility Issues (weather, whales, noise)
  - Impact of key direct cost items / unit prices on bid
    - Super-Structure
    - 48" Piles
    - Cut and Cover / Gov. Hill scope
    - Borrow
    - Armor Rock
    - Right of Way Acquisition
    - Contamination
    - Steel price fluctuation possibility
    - Availability of local resources
    - Scope Creep

Knik Arm Crossing
Cost Estimate Review
Summary of Review Findings

Other Major Project Impacts

- Impact of delay to project start

  Additional Escalation **$25 M for one year delay**

- Number of contracts
  - Impact of coordination between contractors
  - Delays to project due to one contract potentially delaying others

- Contract Delivery Method
  - Traditional, Design-Build, Best Value, PPP

Knik Arm Crossing

Probability Analysis

Initial Build-out (Phase 1)

April 2006 Estimate * Costs in Millions	Apr. 2006 Estimate	Probability	
		20%	80%
Total Bridge Direct Cost	$167 M	$159 M	$176 M
Total Bid Stage Estimate (2005)	$440.6 M	$425 M	$447 M
Total Program Estimate (incl. Mit, ROW, Infl, Prog. Contingency)	$639.4 M	$618 M	$650 M

DEIS Estimate * Costs in Millions	DEIS Estimate	Probability	
		20%	80%
Total Bridge Direct Cost	$167 M	$159 M	$176 M
Total Estimate w/ Design Contingency	$416 M	$404 M	$426 M
Total Program Estimate (incl. Mit, ROW, Infl, Prog. Contingency)	$597 M	$580 M	$611 M

Knik Arm Crossing

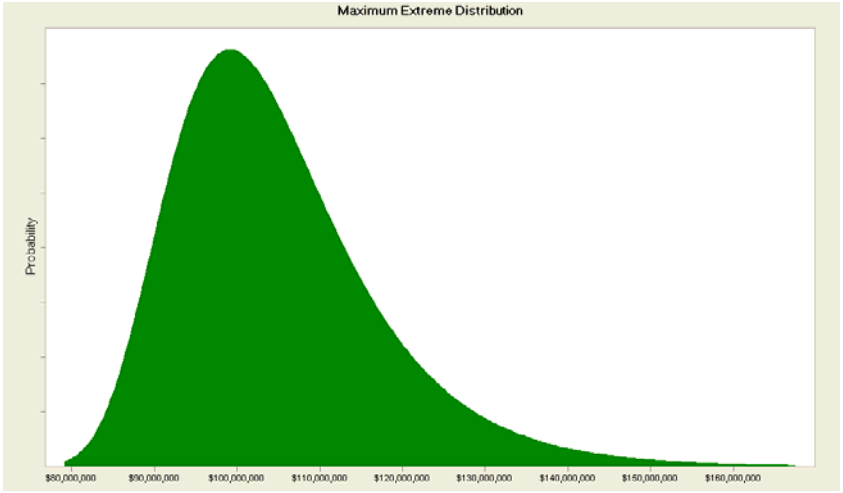
Probability Analysis

FINAL Build-out (Phase 2)

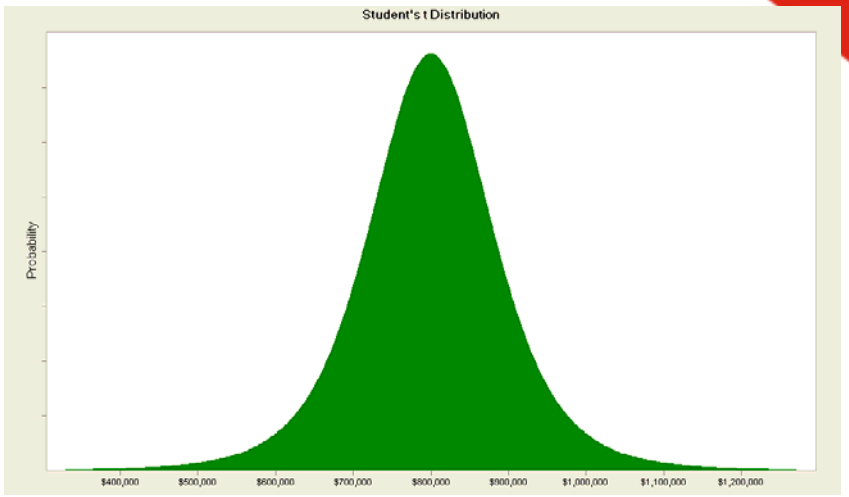
April 2006 Estimate * Costs in Millions	Apr. 2006 Estimate	Probability	
		20%	80%
Total Bridge Direct Cost	$63 M	$55 M	$72 M
Total Estimate w/ Des. Contin. (2005)	$226 M	$212 M	$237.5 M
Total Program Estimate (incl. Mit, ROW, Infl, Prog. Contingency)	$504 M	$473 M	$530 M

DEIS Estimate * Costs in Millions	DEIS Estimate	Probability	
		20%	80%
Total Bridge Direct Cost	$63 M	$55 M	$71.5 M
Total Estimate w/ Design Contin.(2005)	$231 M	$220 M	$244 M
Total Program Estimate (incl. Mit, ROW, Infl, Prog. Contingency)	$564 M	$538 M	$595 M

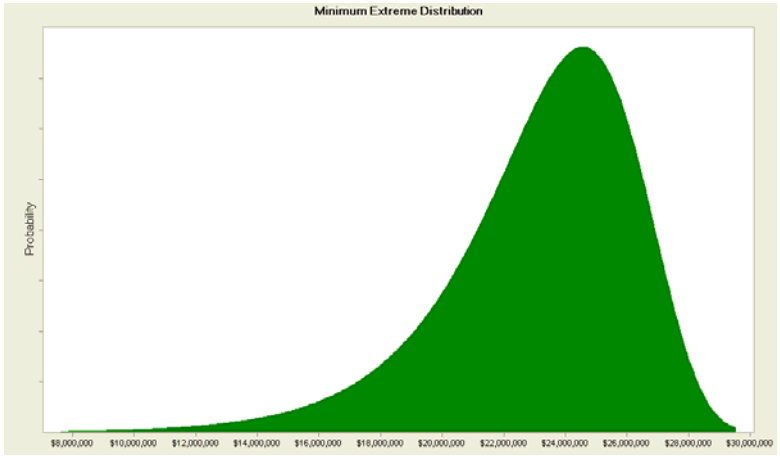
Knik Arm Crossing
Cost Estimate Review
Risk Analysis



Maximum Extreme Distribution



Student's t Distribution

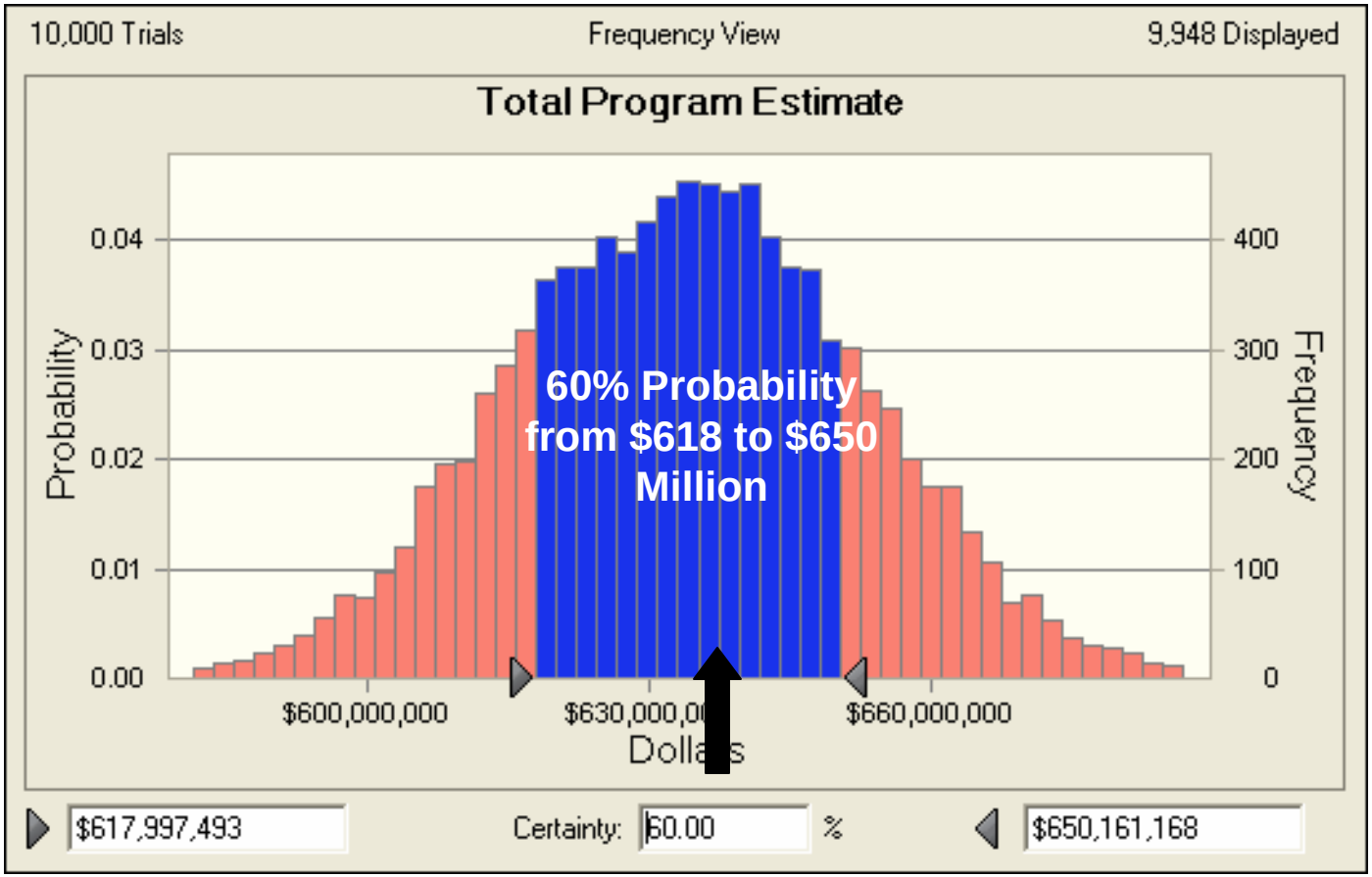


Minimum Extreme Distribution

Knik Arm Crossing

Initial Build-out, Apr. 2006 Est.

TOTAL PROGRAM ESTIMATE



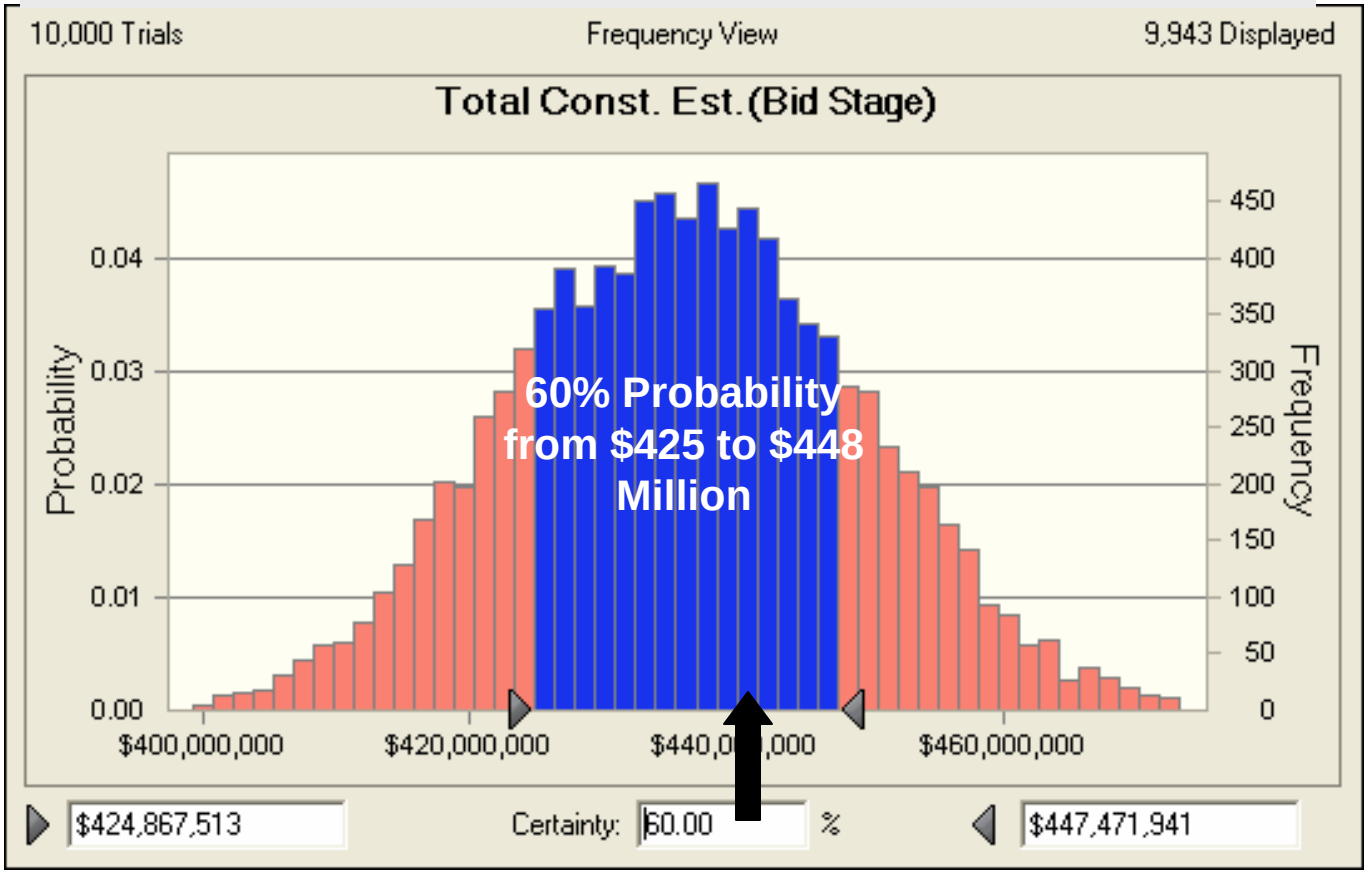
April 2006 Total Program Estimate = $639.4 Million (61% probability)

Knik Arm Crossing

Initial Build-out, Apr. 2006 Est.

TOTAL BID LEVEL ESTIMATE

(2005 costs)

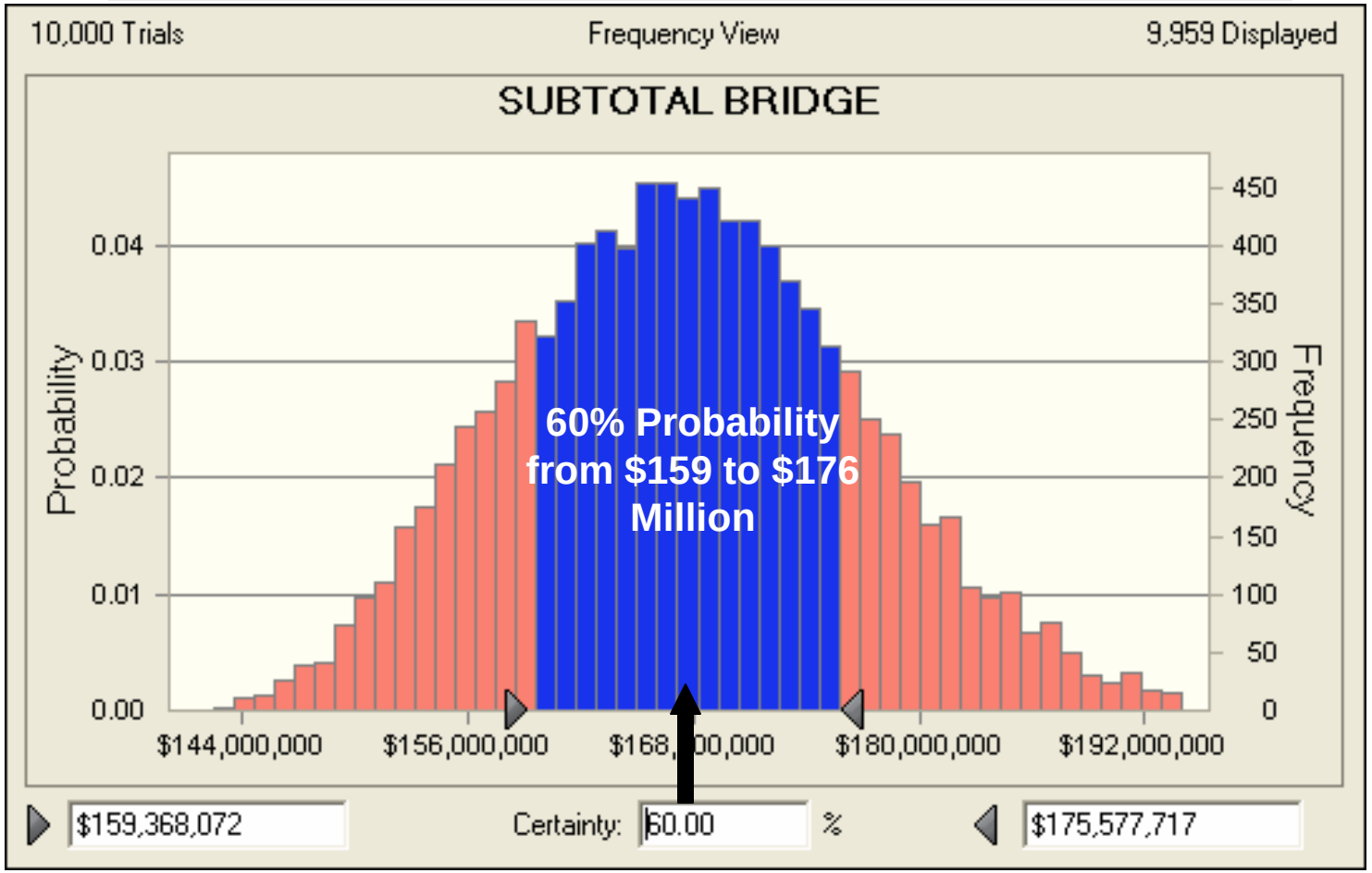


Total Bid Estimate (2005) = $440.6 Million (63% probability)

Knik Arm Crossing

Initial Build-out, Apr. 2006 Est.

Total Bridge Direct Cost Estimate

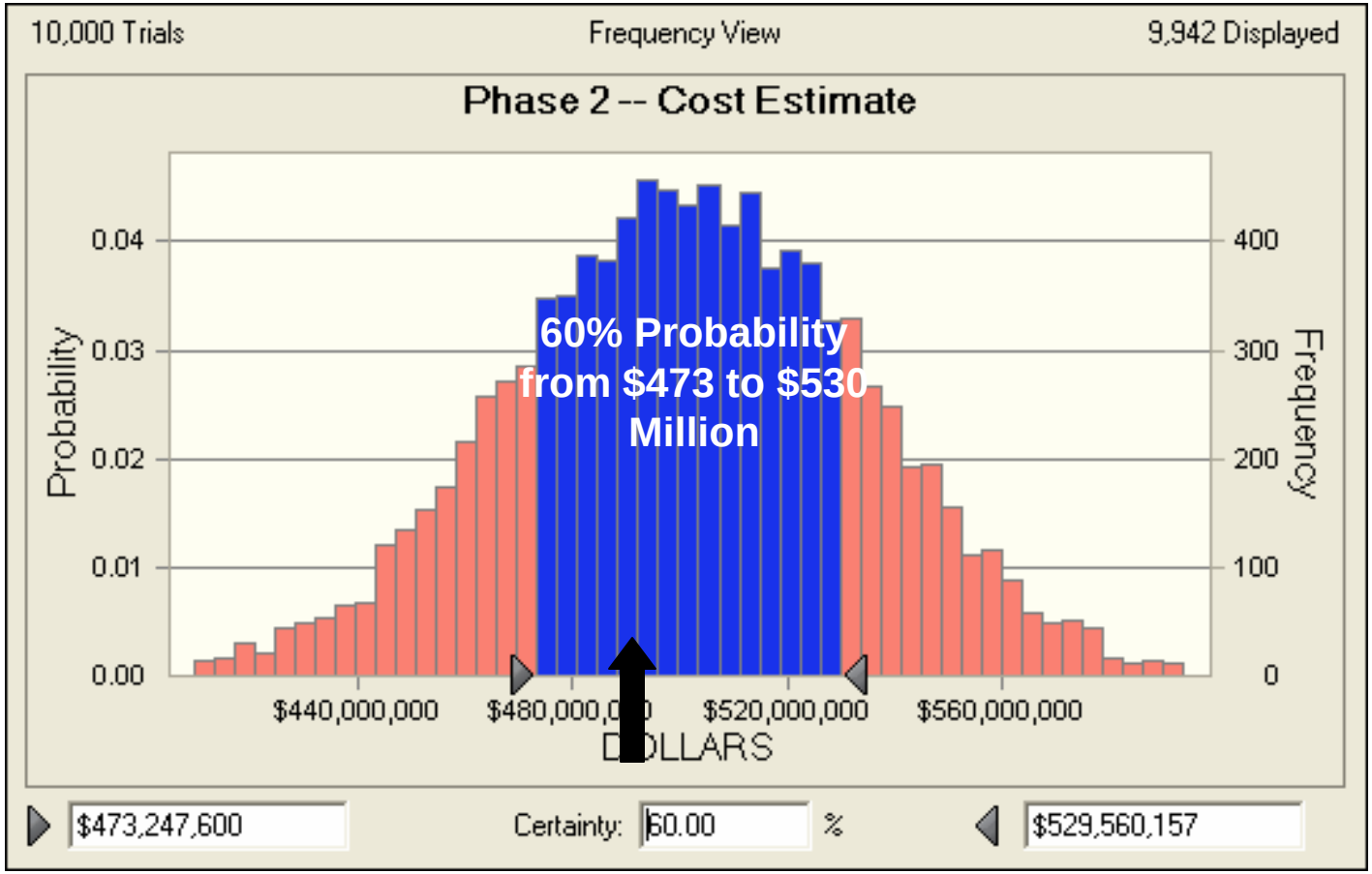


Total Bridge Estimate = $167 Million (48% probability)

Knik Arm Crossing

FINAL Build-out, Apr. 2006 Est.

TOTAL PROGRAM ESTIMATE



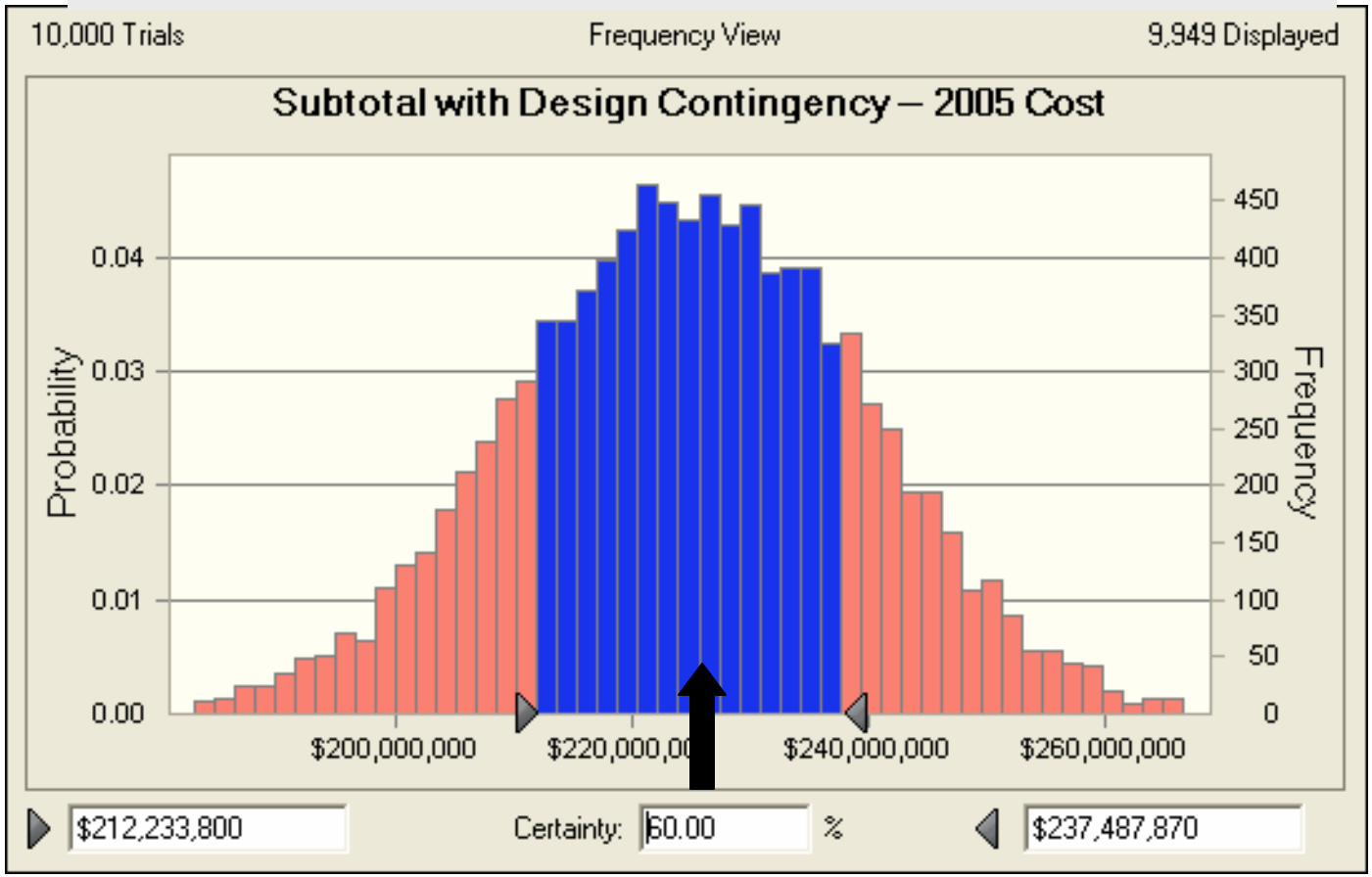
April 2006 Total Program Estimate = $504 Million (53% probability)

Knik Arm Crossing

FINAL Build-out, Apr. 2006 Est.

TOTAL BID LEVEL ESTIMATE

(2005 costs)

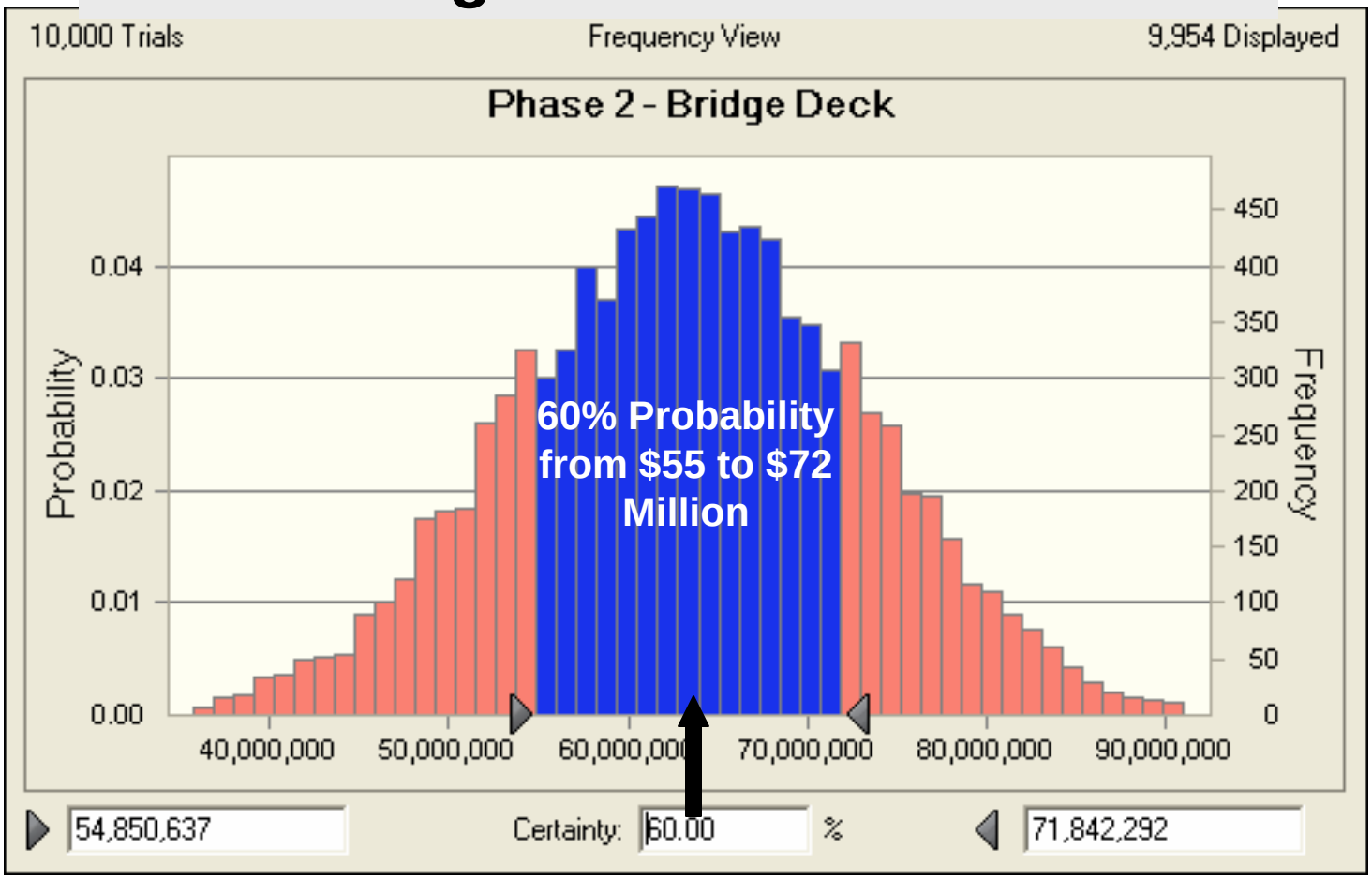


Total Bid Estimate (2005) = $226 Million (53% probability)

Knik Arm Crossing

FINAL Build-out, Apr. 2006 Est.

Total Bridge Direct Cost Estimate



Total Bridge Estimate = $63.2 Million (50% probability)

Knik Arm Crossing
Cost Estimate Review
Recommendations

- Consolidate cost estimates
  - Use consistent methodology, government project
- Define project sequencing
- Perform VE study (substructure, overall project, etc.)
- Identify project risks
  - Assign potential cost/schedule impacts
  - Develop contingency plans
- Continue to monitor overall project costs throughout project completion
- Initiate dialog with Air Force
- Consider owner-furnished materials (ie. armor rock)
- Tolling control of system (Clarify toll methodology)
- ITS and Geotechnical Instrumentation Program
- Security Considerations

Knik Arm Crossing
Cost Estimate Review
Conclusion

The Current Project Estimate is consistent with the scope of the project and pricing is reasonable considering available information; however, there is significant risk with marine construction activity, availability of gravels and armor rock, excavation disposal, and steel, concrete & fuel pricing. Cost of one year delay (~$25M/year) should be considered during scheduling and financing.

Knik Arm Crossing
Cost Estimate Review

Questions?