

Q&A: Cost Engineering Support for SMART Planning Webinar

SMART Planning Webinar Series

April 3, 2014

The April 3rd webinar, part of a series of information-sharing webinars hosted by the Planning Community of Practice, presented an update on ongoing collaboration between the Cost Mandatory Center of Expertise (MCX) and Planning Community of Practice (PCoP) to outline cost engineering products and their integration in the feasibility study process.

Kim Callan, Chief of the Cost Engineering MCX from the Walla Walla District, was joined by Brian Harper (IWR / PCoP) for the presentation and questions from the field. Jim Neubauer and Mike Jacobs also participated providing real-time answers to questions submitted during the webinar.

For more information on Cost Engineering, including tools and practice, please visit: <http://www.nww.usace.army.mil/Missions/CostEngineering.aspx> or contact the MCX or your local Cost branch.

The questions and responses below are not a direct transcript; they have been reordered and edited for clarity. Additional questions and feedback are always welcome via the Planning Community Toolbox's SMART Guide comment form online at:

<http://planning.usace.army.mil/toolbox/smart.cfm?Section=10&Step=1>

Corrections / Clarification

Regarding availability of the Abbreviated Risk Analysis tool online at the MCX website (<http://www.nww.usace.army.mil/Missions/CostEngineering.aspx>) (first mentioned at slide 12 and followed up with slides 36-39, ACE-IT no longer allows the MCX to place the abbreviated risk analysis on our website. POC for current form is James Neubauer or William Bolte.

Resources / Shared Information

NWK has observed that a policy and technical risk that we wished we included: New NOAA National Weather Service Atlas 14 precipitation frequency estimates (<http://dipper.nws.noaa.gov/hdsc/pfds/>).



Developing Cost Information and Cost Risk Analysis: Timing and Scope throughout the Study Process


Prior to the Alternatives Milestone, when there are around 30 to 40 Alternatives, how should the Cost Branch be involved?

Cost engineering is a key member of the PDT, and should be able to provide valuable input for potential reduction of alternatives. Any estimate development would still include Cost Branch involvement as required by the Cost Engineering regulations regarding responsibilities (ref. ER 1110-2-1302, Engineering and Design – Civil Works Cost Engineering).

Many of those early alternatives will fall out, not due to cost but due to other variables such as real estate, sponsor objections, technical impossibilities, intuitively too costly. Others might require cost estimates. Cost will be just one factor.

Planning Study Process Risk

- Planning Decision Risk Analysis
 - Identify uncertainties in critical decision information
 - Benefits; costs; environmental, social or cultural impacts; residual risks
 - Identify those that have greatest impact on decision quality
- Focus on areas that are critical in achieving the objective. This may be alternative designs or the TSP.


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How do you handle developing estimates for array of alternatives if you don't have any good comparable projects/parametric data?

Reach out to the Construction folks; can you pull any information from their records? Can you look regionally or historically for that kind of work? If you don't have anything historical or any parametric data, you may have to develop an estimate from the ground up for the screening level estimate.

Can you still do the abbreviated risk model prior to TSP for projects >\$40M and then the detailed risk model for the final feasibility report?

Yes, you can apply the abbreviated for the alternatives even if over \$40M because it is for comparison purposes. The Oracle "Crystal Ball" Cost Study Risk Analysis (CSRA) program/evaluation is for the recommended plan >\$40M – this will be done during the last phase of study before the final report is produced and transmitted to Headquarters.

When is the formal cost and schedule risk analysis is done?

The formal cost and schedule risk analysis (CSRA) is done after the Agency Decision Milestone and prior to Civil Works Review Board. You need to use Crystal Ball CSRA for any decision document going forward to HQ >\$40M; at less than \$40M, you can use the abbreviated risk analysis even at your authorization level estimate.

Can you explain the Estimate Levels and Class descriptions relative to the phase of study – what would you expect at the Alternatives Milestone? At the final recommendation?

Regarding Estimate Levels and Class descriptions (Slide 21), the Cost MCX is developing better definition of estimate level and class. Those definitions will be placed in the draft ER 1110-2-1302 under development.

Class 4 estimates are required for the final group of alternatives.

Class 4 estimates are appropriate for early concept designs. At this point, there is substantial lack of final technical detailed information and scope clarity resulting in major estimate assumptions in design and quantities, heavy reliance on cost book, parametrics, historical, and little specific crew-based costs. While certain construction elements can be estimated in detail, there is still a great deal of uncertainty relative to major construction components. The PDT must identify areas of risk and uncertainty in the project and describe them to determine the amount of contingency that must be added to a cost estimate to reduce the uncertainty to an acceptable level of cost confidence.

Class 3 estimates are used for requesting amount for authorization. The Corps will be held accountable for execution within final authorization amount.

Class 3 estimates are based on availability of technical information, including designs are approaching a 20-60% quality of project definition. There is greater confidence in project planning and scope, design, technical information, construction methods and quantity development. At this stage 100% of overall scope has been identified. The estimates rely less on generic cost book items, greater reliance on site-specific crew based details, recent historical information and quotes. Class 3 estimates are a reflection of improved scoping documents. The estimates must be supported by a scope discussion within the estimate and the uncertainties associated with each major cost item in the estimate. Special attention must be given to large construction elements and items that are sensitive to design change. Appropriate contingencies should be applied for each major construction element to account for information that is lacking.

To accomplish a Class 3 estimate, it is vital to identify those areas that significantly contribute to cost uncertainty. Based on the Pareto Principle, 80 percent of the cost of a project is contained in 20 percent of the estimated work elements. The 80 percent of costs should be fairly well developed to a confident degree with basis of estimate. A Class 3 estimate should include a PDT project evaluation to determine if additional investigations or studies are necessary to reduce the uncertainties and refine the cost estimate. It must be accomplished as a joint analysis between the cost engineer and the designers or appropriate PDT members that have specific knowledge and expertise on all possible project risks. The object is to focus on the uncertainties associated with these so-called 20 percent “critical” elements that

Table 1. ASTM E 2516-06, Standard Classification for Cost Estimate Classification System*

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic			
	LEVEL OF PROJECT DEFINITION Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE INDEX Typical +/- range relative to best index of 1 [a]	PREPARATION EFFORT INDEX Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Screening or Feasibility	Stochastic or Judgment	4 to 20	1
Class 4	1% to 15%	Concept Study or Feasibility	Primarily Stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Mixed, but Primarily Stochastic	2 to 6	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Primarily Deterministic	1 to 3	5 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Deterministic	1	10 to 100

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reflect the 80 percent of costs in order to reduce the cost risk. Results of the risk analysis must be the basis for determining contingencies.

Cost QA/QC and Agency Technical Review: Timing and Scope throughout the Study Process

Is a Cost ATR required prior to the TSP milestone? How does that work while the team is still juggling alternatives and associated costs? I.e. the costs may still be changing while the ATR is being conducted.

Before you screen down your alternatives to the final array, involve your Cost people – and Cost folks, make yourselves available. The more you can screen down these alternatives with some informed information about cost, you can identify opportunities to screen out some alternatives early in the process and save yourself a lot of effort.

Districts often call and discuss methods at early development with the ATR lead – this is a good practice. In the planning study risk register and development of the PMP, the cost engineer should be involved to give the inputs on the time required etc. for the full ATR process.

A targeted Cost ATR is performed on the final group of alternatives that were used to establish the TSP prior to the TSP Milestone. This targeted Review during the identification of TSP is a more of a procedural review. As an example, are the alternatives developed in an appropriate manner to be used for comparison purposes? Has cost personnel been involved within the PDT? Has cost risk been appropriately incorporated into the formulation process? Typically this review is 1 to 2 day effort. Such a high level review (level 4/5 estimate class) generally costs \$2-3K and reduces the risk of changes to the selected plan after public review / during review of the draft plan.

Could you confirm that the diagram the Cost MCX does QA/QC on the Cost Level 4 estimate prior to the TSP Milestone meeting and then a complete ATR after draft and during public review?

The District is required to perform a QA/DQC on the alternative estimates, including the TSP. There will be a targeted technical review of the alternatives / screening prior to the TSP milestone (see previous question). There will be ATR / cost certification before the final report is transmitted to Headquarters - it is that estimate that is placed into the Chief's Report for authorization / funding request.

After the viable alternatives are screened and the Tentatively Selected Plan selected, Cost Effectiveness (CE) and Incremental Cost Analyses (ICA) may result in adding or deleting measures. Does a Cost Risk Analysis have to be re-run or can I use the same contingencies?

It depends on the changes; however, the risk analyses cost values should match the estimates. The contingencies would become apparent as a cost and risk byproduct.

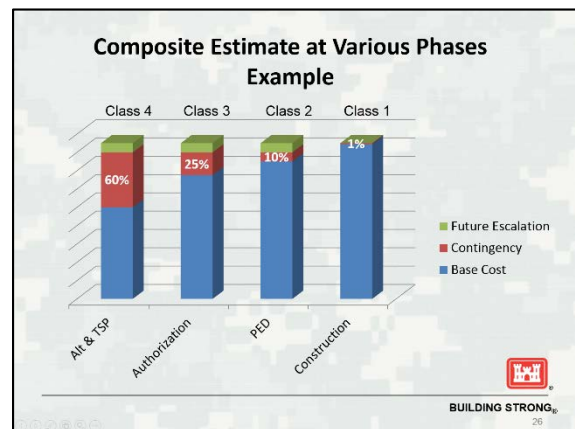
Contingencies

Earlier you stated that 80% contingency is considered too high; what is considered to be a "reasonable" contingency?

There may be confusion or misinterpretation here. The recommended contingency value reported from the Crystal Ball CSRA is at the 80% confidence level. Generally for alternative stage, one could expect contingencies ranging from 35-45%, though we have seen higher depending on complexity and uncertainties. For the recommended plan, a contingency approximating 25-35% would be the expected norm. If the recommended plan contingency is much greater than 40%, then the project should be revisited relative to scope clarification, estimate and risks.

How do you deal with others in the agency wanting to reduce contingency when you provide them with an estimate?

The District Cost Chief carries certain responsibilities relative to the Cost regulations. By regulation, the Cost Chief is required to formally sign off on the Total Project Cost summary sheet. The ATR was established to perform a non-biased review and that potential is considered. Often times, a higher contingency can be reduced via better scope clarification, base estimate adjustments and resulting reduced risks.



We're training and working to communicate to folks that a higher percentage contingency at the early phases is not dire. These are total cost / comparison level estimates, so hopefully that will help make the point that we cannot artificially lower contingency percentages. If the contingency levels are something that folks cannot live with, you can look at your assumptions and decide if there are any assumptions in the risk that could be looked at again. We do not want risk buried into the base cost and lose visibility; you want them to be there so you can acknowledge and mitigate that risk.

We recently went through a TSP Milestone in which the project contingency of 61% seemed to be right in line for a class 4 estimate as you explained it in this presentation. Yet that contingency raised a lot of concern with Headquarters.

The referenced 61% contingency project could have included a revised base estimate that would have decreased that contingency. That particular project did not have any Cost ATR prior to that milestone meeting.

Those high uncertainties are going to raise some eyebrows. But because they are driven by the uncertainties in that point in the process, it is important to document and acknowledge those uncertainties and decide whether or not:

- The uncertainties impact the screening / comparison decision.

- What factors drive the cost uncertainties.
- What is the effort necessary to mitigate that going forward.

Communicating / Understanding the Different Costs produced

When there are contingencies in cost estimates and no contingencies on benefits, this affects the Benefit – Cost Ratio (BCR) drastically. Can we expect clarification on this issue?

There are issues if you are using a full estimate with contingencies for your cost, but not for your benefits. Further, you can't use benefits with the same contingencies because it negatively impacts your BCR. It is very confusing and it's hard to get that apple-to-apple comparison.

This issue is being discussed at HQ level. The goal is to have a BCR which is a fair comparison. Currently the guidance is for cost engineering to provide the economist with the confidence level table which depicts project cost including contingencies at various levels. Further guidance will be issued in the near future concerning this.

How much detail is needed in the cost appendix between the screening process and TSP? Do we just discuss the Total Project Cost Summary and include all the tables associated with that alternative?

The Cost Appendix is critical; it highlights what your assumptions are and so much of your estimate now is built on those assumptions. The Cost Appendix is a technical engineering report. For the alternatives, the Cost Appendix will include: brief scope narratives, unique risk, a simple table comparison of the various alternatives, and feature costs and contingencies.

For the recommended plan, the Cost Appendix includes a scope narrative, key cost-schedule-risk assumptions, high level cost estimate (no quantities and no cost details because of FOUO), project schedule, risk analysis. Contact the Cost MCX for appendix template.

The upcoming release of ER 1110-2-1302 will better address those requirements.

Which cost numbers do you include in the final report?

The 2011 Memorandum, "Civil Works Cost Definitions and Applicability" defines and clarifies cost terminology to be used in Chief's Reports and other documents processed through the HQUSACE and or Office of the Assistant Secretary of the Army for Civil Works (ASA(CW)). Project first cost (middle column of Total Project Cost Summary) is the funding request for the Chief's Report (what gets authorized and you are measured against for the 902 limit). The fully funded (3rd column set) is more for the sponsor in planning funding needs over time and their contributions and useful in developing Project Partnership Agreements (PPAs). The memo is available online on the Planning Community Toolbox:

<http://planning.usace.army.mil/toolbox/library/MemosandLetters/11sep12-DCWCostMemo.pdf>

Update on ER 1110-2-1302

When will ER 1110-2-1302 be finalized?

ER 1110-2-1302, Civil Works Cost Engineering (2008), is being updated to include better assignment of responsibilities, cost product definition and update requirements, definition of estimate class, cost management controls, cost confidentiality information, Cost report requirements, Work Breakdown Structure definitions. Its revision basis was a result of the ATR lessons learned since 2008, other regulatory and internal policy changes such SMART Planning milestones, reviews by senior cost engineers and planning chiefs.

Policies scheduled for updates include ER 1110-1-1300, ER 1110-2-1302 and ETL 1110-2-573. We hope to complete all, hopefully, this FY. All are nearing completion.

Will the updated ER have input from the Districts?

A Draft update of ER 1110-2-1302 has been reviewed several times by MSCs and key senior cost estimators throughout the country. We are awaiting clarifications from HQ regarding some key issues and we hope to be done soon. Once resolved, we will post the ER for review and welcome your input.