

WEBINAR

COST ENGINEERING IN PLANNING STUDIES

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US Army Corps
of Engineers®





OBJECTIVES



Better Understand

When and What level of detail of cost products in support of the SMART Planning process.

Correlation between Planning Risk and CSRA Risk and how each can help each other.

Cost ATR requirements -when and as to what level.

Lessons Learned



COST ENGINEERING MISSION



“to focus USACE leadership on effective development, management, and control of cost estimates to
program
phases
quality
support
successful

to ensure funds are adequately programmed, authorized and appropriated in all phases of the project

Source: ER 1110-1-1300 Engineering and Design Cost Engineering Policy and General Requirements, 3 – 26 - 1993



KEY DRIVERS FOR CIVIL WORKS COST INCREASES





ER 1110-2-1302



Project Phase	Project Definition Scope	Risk Level	Minimum Estimate Class
Pre-Budget Development	Extremely Limited	Extremely High	5
Pre-Authorization			
Reconnaissance Alternatives	Very Limited	Very High	4
Feasibility Alternatives	Very Limited	High	4
Feasibility – Federally Recommended Plan	Limited-Fair	Moderate	3
Feasibility Locally Preferred Plan	Limited-Fair	Moderate	3
Funding Request Decision Documents	Limited-Fair	Moderate	3
Post Authorization			
Continuing Authorities Program	Limited	Moderate to High	3-4
Civil Emergency Management Program	Limited	Moderate to High	3-4
Alternative Studies	Limited	Moderate to High	3-4
Post Authorization Change Reports	Fair	Moderate	2-3
Funding Decision Documents	Limited-Fair	Moderate	3
Preconstruction, Engineering & Design (working estimates)			
PED 30%	Fair	Moderate	3
PED 60%	Fair-Good	Moderate to Low	2
PED 90%	Very Good	Low	1
IGE <100% Design	Fair-Good	Moderate to Low	2
IGE 100% Design	Very Good	Low	1
Construction / Post Award			
Budgets (modifications / claims)	Fair-Good	Moderate to Low	2
IGEs (modifications / claims)	Very Good	Low	1



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

* Reprinted, with permission, from the Annual Book of ASTM Standards, copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM, www.astm.org.



TYPES OF COST ESTIMATES

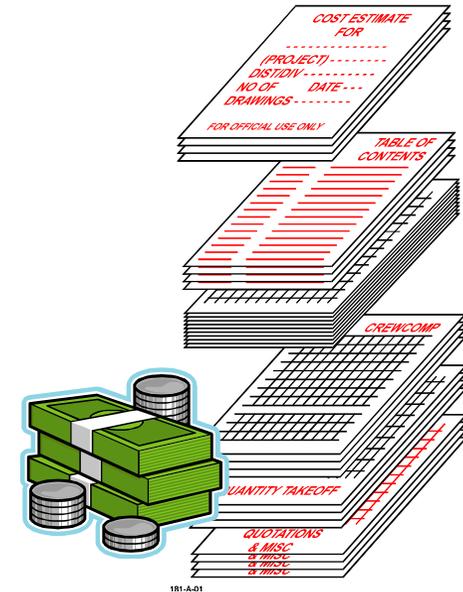
ER 1110-2-1302, CIVIL WORKS COST ENGINEERING

Alternative Formulation Level (Class 4 and 5)

Baseline/Programming Estimate (Class 3)

Current Working Estimates (CWE) (Class 2)

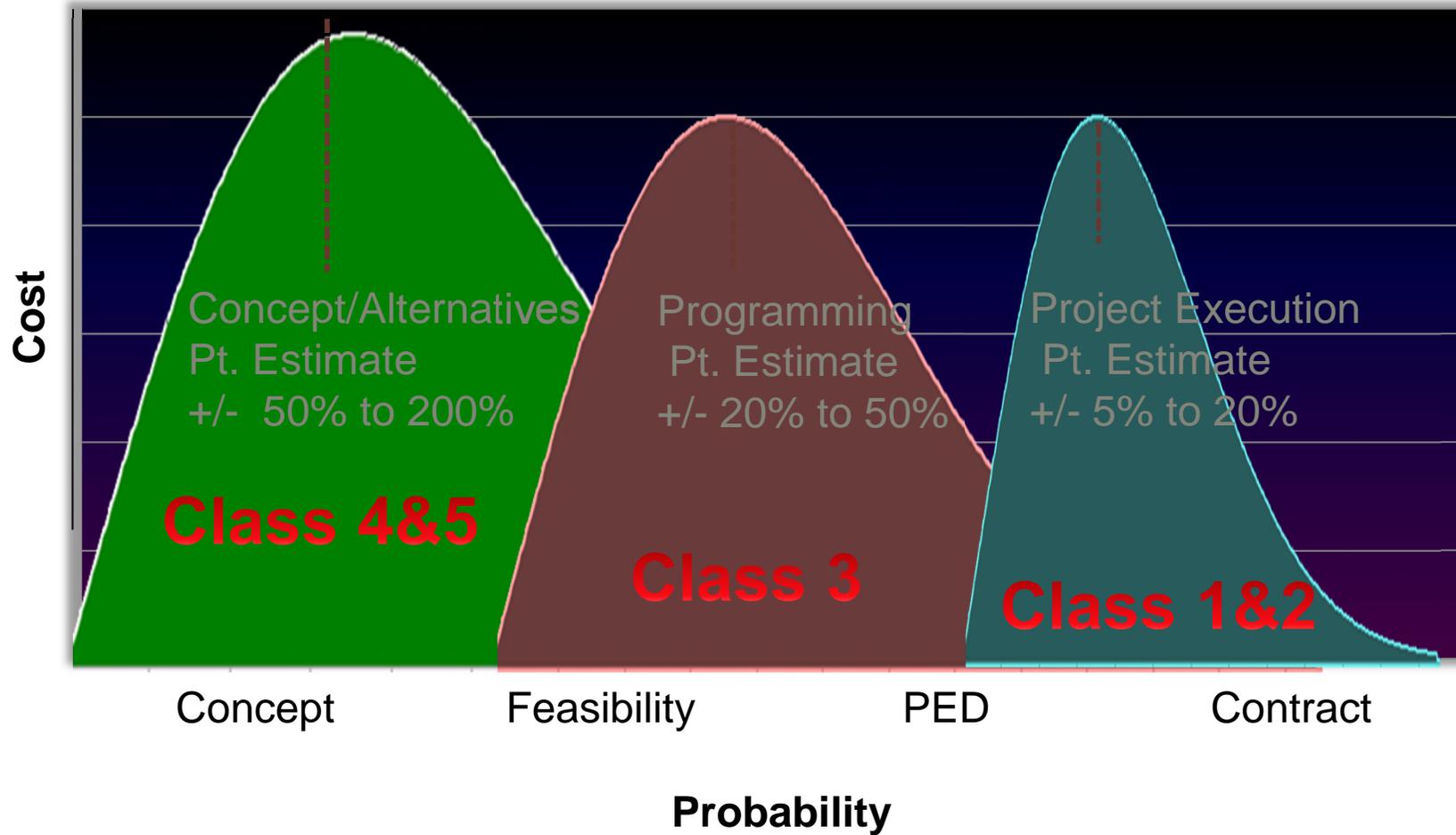
Independent Government Estimate (Class 1)





TYPES OF ESTIMATES

ACQUISITION LIFE CYCLE COST UNCERTAINTY





EFFECTS FROM SMART PLANNING



Identify Solution (Chief's Report) MS#5

- Sufficient Technical Scope/Basis of Design
- Identify sufficient funds to complete project for funding decision

Potential for Decisions based on Reduced Technical Information

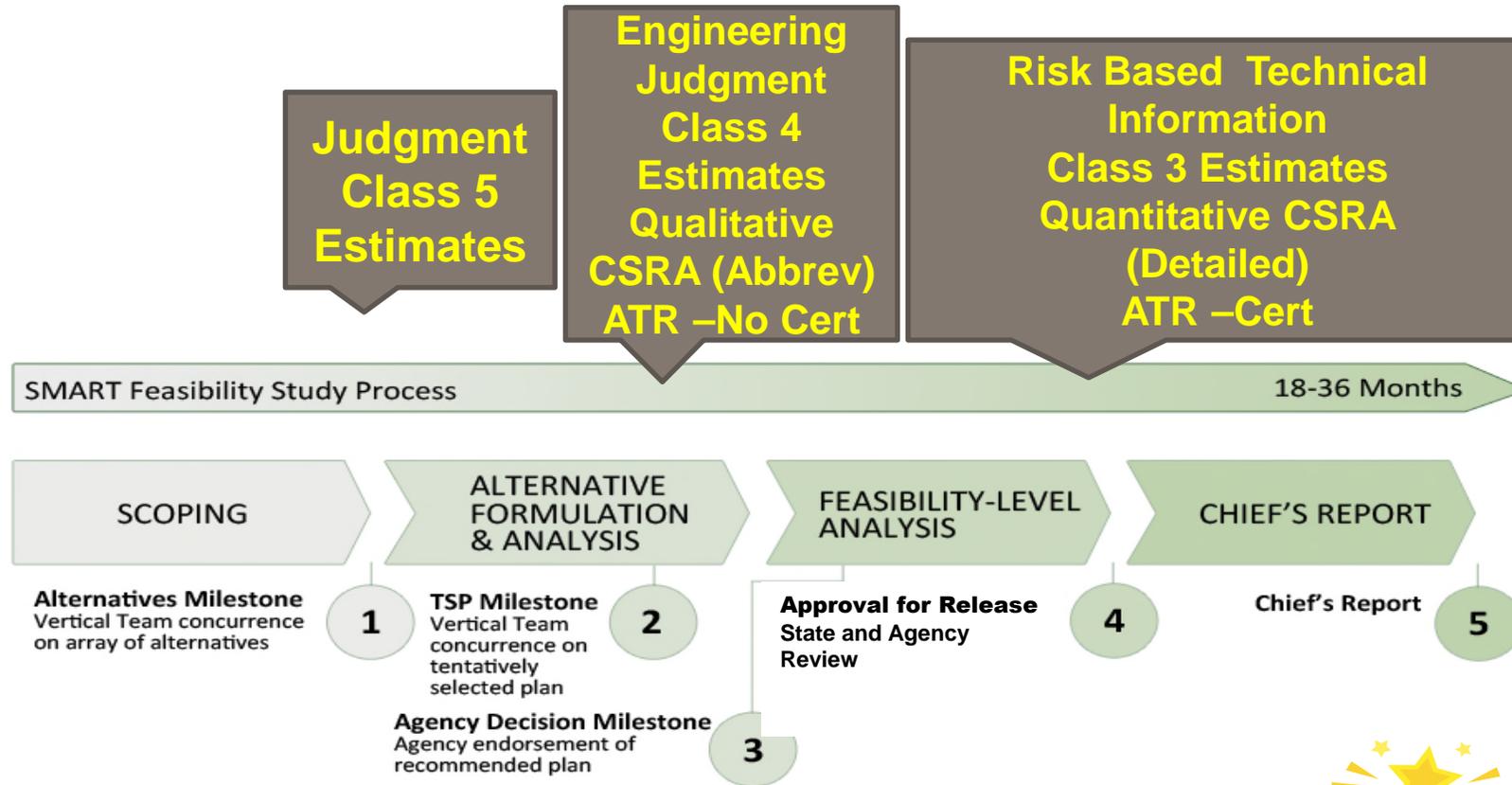
Relies on Properly Identifying Risks of the Decision

B/C Ratio Impacts to cost

Can the Decision Withstand Scrutiny?



ESTIMATES/COST RISK IN PLANNING CYCLE





SCOPE AND TECHNICAL INFORMATION



Get the right people on the PDT

Spend the time...Nail down scope

Assure all parties are on same page

Define Options, Schedules, and Restrictions

MAKE SURE YOU HAVE A COMPLETE, EXECUTABLE PLAN!!





ARE YOU ABLE TO INVOLVE SME TO HELP SHAPE THE TECHNICAL SOLUTION?



**Little or No
Interaction**

Moderate

Extensive



PLANNING MODERNIZATION

3X3X3- DIFFERENT RISK REGISTERS FOR DIFFERENT PURPOSES



Planning Risk Register

- Evaluates the planning process for risk elements
 - study costs & schedule
 - benefits, costs, env & social impacts of alternatives
- Helps identify areas of high risk and lower risk
- Lower Risk Events are evaluated to be moved to later stages (i.e. detailed design aspects)

Cost and Schedule Risk Register

- Evaluates the Project for risk elements which may cause a variance to cost, schedule, or both.
- Helps identify areas to mitigate in order to lower risk
- Establishes Project Contingencies at Certain Confidence Levels





ARE YOU USING RISK REGISTERS TO ACTIVELY MANAGE THE STUDY?

Little or none

Moderate

Extensive



HOW MUCH % CONTINGENCY IS APPROPRIATE?



ER1110-2-1150, ENGINEERING AND DESIGN FOR CIVIL WORKS PROJECTS , 31 August 1999

Contingencies for engineering costs during the feasibility phase shall be limited to the maximum extent possible; however, good engineering judgment shall be used in developing these contingencies.



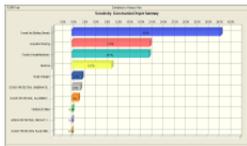
COST & SCHEDULE RISK ANALYSIS (CSRA)

Tool used to communicate potential risk early in project development.

Used to identify key areas for potential risk mitigation efforts and for development of project contingency.

Formal analysis is required on all projects seeking authorization, anticipated to be \$40 Million or more in total project cost. An abbreviated version is available for projects less than \$40 Million.

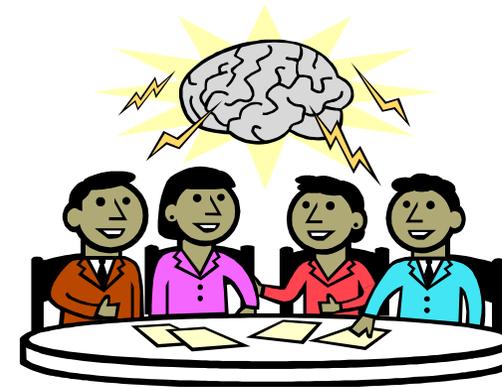
Analyzes at both cost and schedule of a project.





RISK CONSIDERATIONS

Organizational
Project Management
Contract Acquisition
Technical Risks
Estimates and Schedules
Lands and Damages
Regulatory
Environmental
Construction
External Impacts





DO I CARRY THE COST IN BASE COST VS RISK



Will it most likely occur? – Base Cost

Does it need risk mitigation efforts?

Do we have the time or will we need additional time and \$

Pros to Risk Assignment

- Identify for PDT Risk Mitigation Efforts

Con's to Risk Assignment

- High % Contingency



...				Project Cost			Project Schedule		
Ref #	Risk/Opportunity Event	Description	PDT Discussions	Likelihood ©	Impact ©	Risk Level ©	Likelihood (S)	Impact (S)	Risk Level (S)
Contract Acquisition (CA)									
38	Undefined acquisition strategy	Acquisition strategy is undefined to date	PDT is confident project will be solicited for maximum competition.	Unlikely	Negligible	Low	Unlikely	Negligible	Low
44	Contract Modifications	Typ risk for contract mod's	Assume typical risk for potential contract modifications, since this is dredging in areas that have not been previously dredged.	Likely	Marginal	Moderate	Likely	Marginal	Moderate
Technical Design (TD)									
47	Risk from Remaining Architectural Design	Confidence in scope, investigations, design, critical quantities	Through initial screening of potential risk, PDT has determined this Risk Element is not a factor for this Project	Unlikely	Negligible	Low	Unlikely	Negligible	Low
48	Risk from Remaining Geotechnical Design	Confidence in scope, investigations, design, critical quantities	Through initial screening of potential risk, PDT has determined this Risk Element is not a factor for this Project	Unlikely	Negligible	Low	Unlikely	Negligible	Low
49	Risk from Remaining Civil Design	Confidence in scope, investigations, design, critical quantities	Tight schedules, Little float in design schedule, high risk to meeting design milestones	Unlikely	Negligible	Low	Very Likely	Significant	High
50	Risk from Remaining Electrical Design	Confidence in scope, investigations, design, critical quantities	Through initial screening of potential risk, PDT has determined this Risk Element is not a factor for this Project	Unlikely	Negligible	Low	Unlikely	Negligible	Low
51	Risk from Remaining Mechanical Design	Confidence in scope, investigations, design, critical quantities	Through initial screening of potential risk, PDT has determined this Risk Element is not a factor for this Project	Unlikely	Negligible	Low	Unlikely	Negligible	Low
52	Risk from Remaining Structural Design	Confidence in scope, investigations, design, critical quantities	Through initial screening of potential risk, PDT has determined this Risk Element is not a factor for this Project	Unlikely	Negligible	Low	Unlikely	Negligible	Low
53	Risk from Remaining Environmental Design	Confidence in scope, investigations, design, critical quantities	Predredge Survey - Placements are ongoing. Potential for finding species which could halt project. If this occurs project is halted and therefore not modeled for contingency development	Very Likely	Significant	High	Very Likely	Significant	High
54	Risk from Remaining Controls Design	Confidence in scope, investigations, design, critical quantities	Benchmarks are being reestablished, as a result the overall qty of material could be effected.	Unlikely	Negligible	Low	Unlikely	Negligible	Low
55	Risk from Remaining Other Specialized Disciplines	Confidence in scope, investigations, design, critical quantities	Through initial screening of potential risk, PDT has determined this Risk Element is not a factor for this Project	Unlikely	Negligible	Low	Unlikely	Negligible	Low
69	Right-of-way analysis in question	Access to site through right of way	Access right of ways have not been granted. Lack of right away access would cause issues to disposal sites	Unlikely	Crisis	High	Unlikely	Crisis	High



RESULTS OF FORMAL CSRA PROCESS

Report

Risk Register and Monte Carlo Model

Cost Contingency by Confidence Interval

Schedule Contingency by Confidence Interval

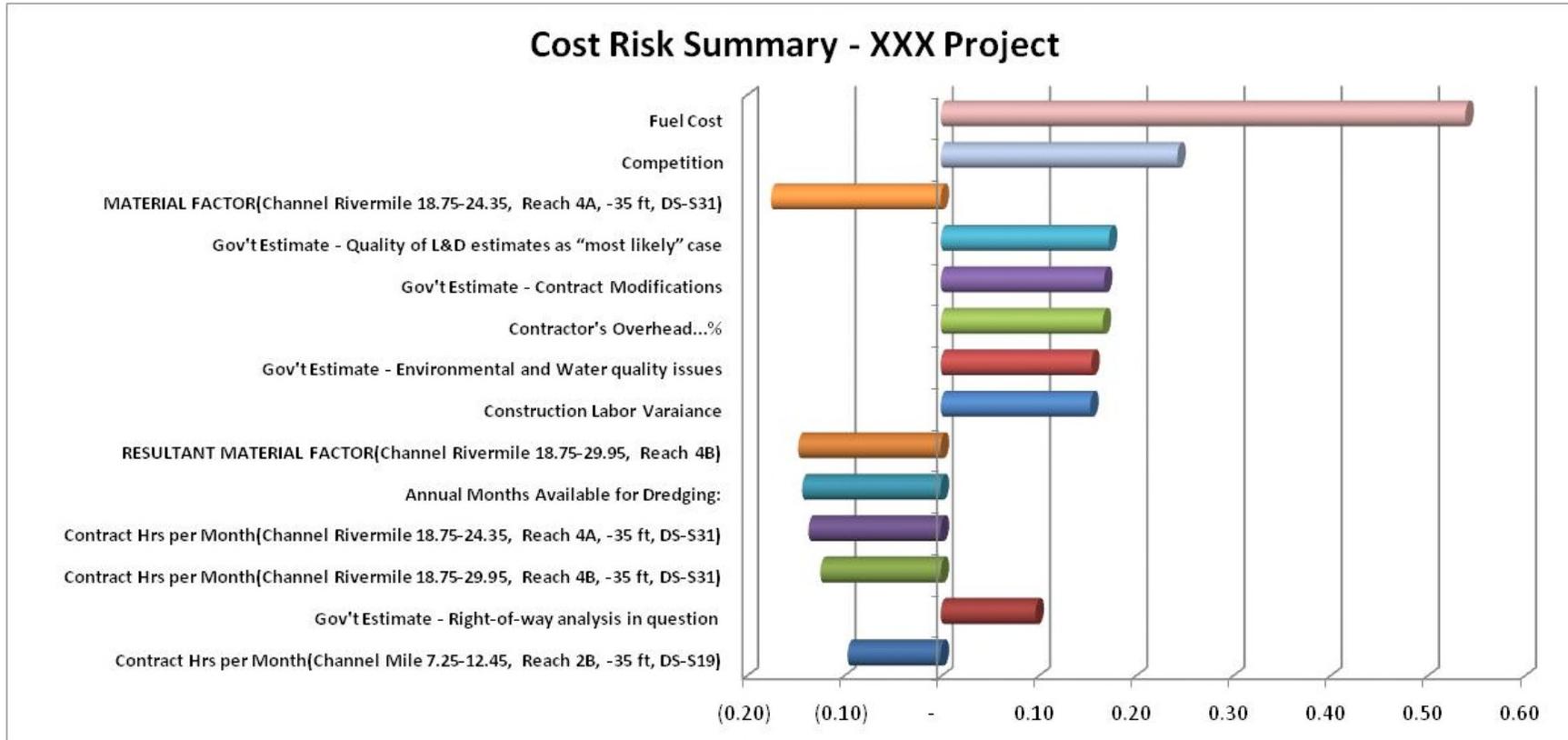
Recommended Contingency for Total Project Cost
Summary

Sensitivity Analysis (similar to Tornado Chart)

Recommended Mitigation Areas



IDENTIFY SENSITIVITY OF RISK ELEMENTS





AGENCY TECHNICAL REVIEW & COST CERTIFICATION



AGENCY TECHNICAL REVIEW CERTIFICATION REQUIRED FOR:

- USACE Civil Works Decision Documents
- Annual Budget Submission
- HQ/Division Request
- DVA Program (EGPMP)

COST: \$3-15K
TIME: ~1-4 Weeks
Quality and District Responsiveness are key drivers

HOW DO I GET A COST CERTIFICATION?

- PCX Agency Technical Review (ATR) Lead or Project Manager contacts MCX ATR Coordinator
- MCX ATR Coordinator matches reviewer availability and skill set to the project
- Products and funding are sent to MCX and reviewer
- Comments in DrChecks
- At review completion, MCX issues certification and archives documents and cert on SharePoint

REVIEWS ARE PERFORMED BY TRAINED AND CERTIFIED REVIEWERS ACROSS USACE.

(~99 Certified Reviewers for ~300 projects per year.)





**HAVE YOU COORDINATED WITH THE
COST CENTER FOR A REVIEWER?**

Yes

No



AGENCY TECHNICAL REVIEW & COST CERTIFICATION



REQUIRED SUBMISSIONS FOR COST ATR:
REPORT
ESTIMATE w/supporting backup
SCHEDULE
CSRA
FUNDING



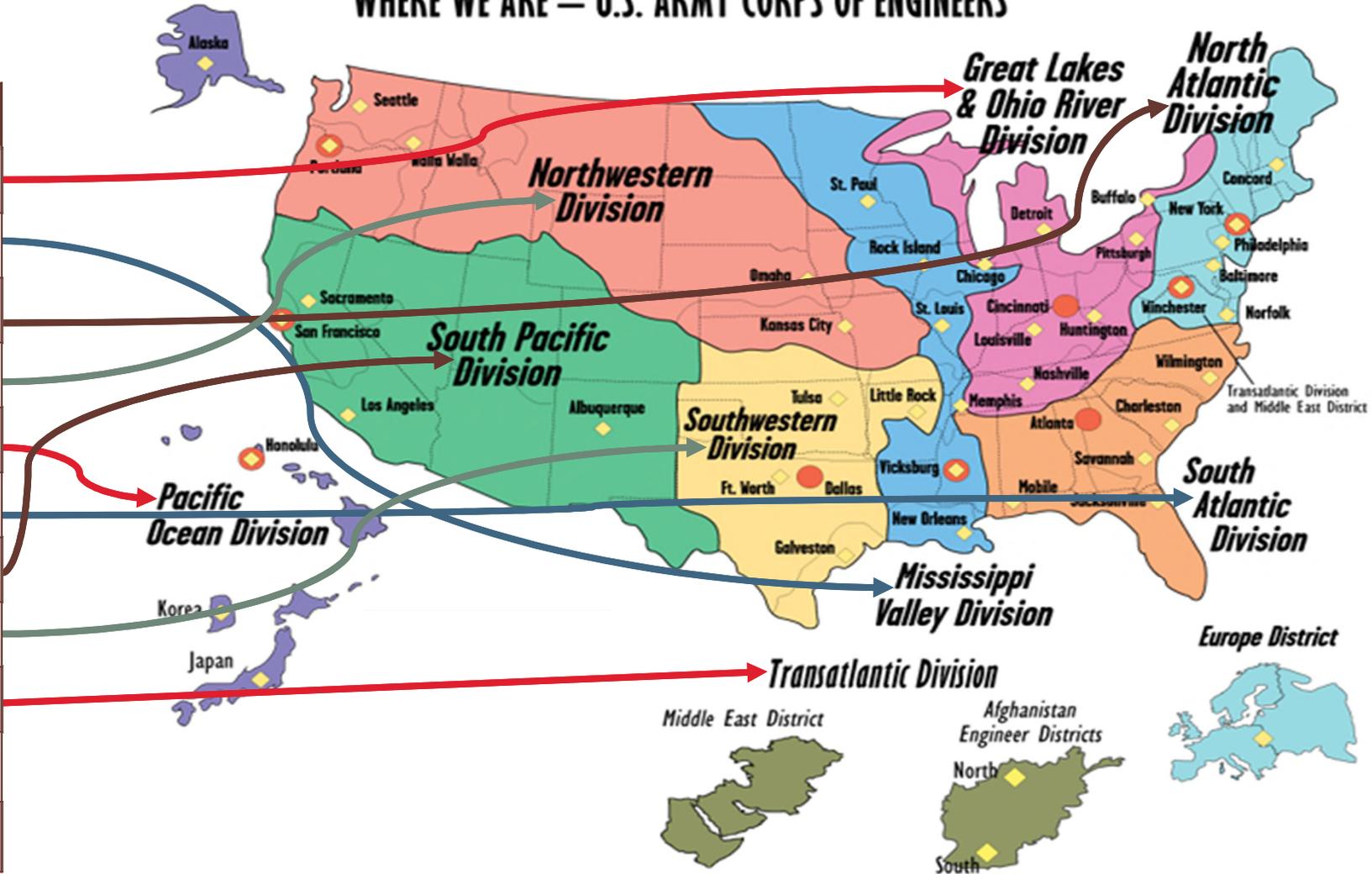
NATIONAL COST RESOURCES



WHERE WE ARE — U.S. ARMY CORPS OF ENGINEERS

Division	CE	ATR
LRD	59	34
MVD	44	18
NAD	42	9
NWD	55	12
POD	42	1
SAD	40	16
SPD	39	7
SWD	28	1
TAD	10	1
TOTAL	359 CE	99 ATR

CE = Cost Engineer
ATR = ATR Reviewer



● Division Head Office Locations ◆ District Head Office Locations ◆ District & Division Co-located



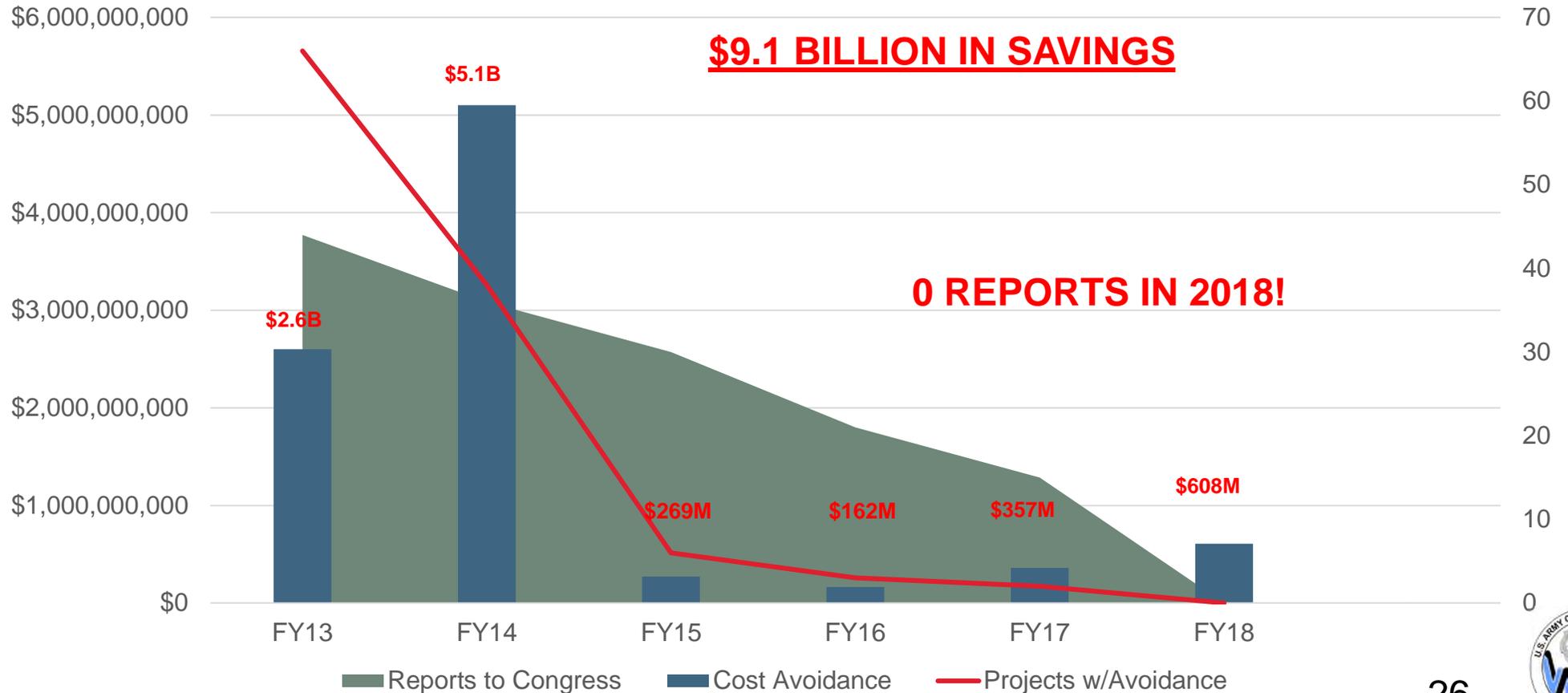
IMPROVEMENT IN CIVIL WORKS PERFORMANCE



902 Cost Includes:

- Preconstruction engineering & design
- Construction
- Real estate
- Appropriate credit provisions of WRDA 1986, Section 104, & Public Law 90-483, Section 215

Exceedance of 902 Cost Limit Requirements for Civil Works Projects Reported to Congress





COST ATR

Smart Planning Milestone 1 (Alt's) through Milestone 3 (TSP)

- Cost ATR Review, No Cost Cert, Reviewer coordinated thru Cost MCX
- This review is a concurrent review with TSP development. Key focus of review is to assure alternatives have been properly developed for comparison basis. This aids in vertical team approval.

Smart Planning Milestone 3 (ADM) through Milestone 4 (CWRB)

- Cost ATR Review, Cost Cert Required, Thru Cost MCX

Smart Planning Milestone 4 through Milestone 5 (A

- Re-Cost Cert (if changes), Thru Cost MCX





PAST ISSUES/LESSONS LEARNED



Study Schedule: Everyone on the PDT can not finish on the same day.

Always present a TOTAL PROJECT COST

Start Early on the “Common Elements”

Make sure the plan is “complete” and buildable – TEAM EXPERIENCE-SME!

Walk in the right direction vs. Run in any direction. Don't skimp on the high value process!
ESPECIALLY DQC Follow the plan, update, communicate, and keep moving!

Risk Register Development and “Ranges” of cost- Were alternatives truly compared fairly and how much do they overlap?

Quality of PDT Meeting, Risk Identification, and Quantification

Non-Compliant Designs-“We will get a waiver”



PAST ISSUES/LESSONS LEARNED



Lets kick the decision it to PED ?? Do we know enough to truly inform the decision?

Mitigation of project risks- How much \$? How long? Residual Risks?

Sponsor Generated/Provided cost- Quality? Accuracy?

COSTS PROVIDED BY OTHERS(non cost estimators)

Make sure you understand what the cost represents and assess the risk accordingly!--Real Estate, State DOT and other local/state agencies, NEPA EIS implications.



PAST ISSUES/LESSONS LEARNED



DON'T ESTIMATE THRU NEGOTIATION WITH THE SPONSOR

B/C Goalseek- How are you addressing in formulation? Solution cost vs reality of the budget/affordability?

Maintain a decision/change log! How did we get here?

Everyone can be late on product delivery except for Cost and Econ.

Don't be afraid to ask for help early! Find SME to help inform the PDT.



QUESTIONS & DISCUSSIONS