



Cost Engineering Policy and Procedures

Interim Guidance 2017 - 2019

Version 1.0
20 January 2017

FOREWORD

This policy and procedures manual represents Naval Facilities Engineering Command (NAVFAC) specific criteria, requirements and procedures related to the development and delivery of Cost Engineering Services.

This interim policy is provided from FY 17 through FY 19. The cost software transition from SUCCESS Estimator to MCACES Second Generation (MII) is substantially complete in CIBL. At the time of this publication, PWBL and AMBL have yet to decide whether they will transition to MII or choose another option.

This is also the expected transition period from desktop cost estimating software to the TRACES Portal. Tri-Service Automated Cost Engineering System (TRACES) is the collection Department of Defense (DoD) Facilities Cost Estimating Software applications. The TRACES Portal is the comprehensive platform fulfilling cost estimating needs across DoD. This is the DoD platform of choice for facilities cost estimating. Once the TRACES portal is fully implemented revised policy will be issued.

As we move toward this new centralized platform, we will start adapting our work flow towards a more structured estimating environment. Starting now will provide a learning period, as well as developing a data set of more consistently formatted estimates.

Note: There have been significant changes to this document from the previous version and we recognize changes and revisions will occur along the way. Please direct any comments or questions to either Derek Bowers, Bill Jennings or Tony DiPiero.

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CHAPTER 1 - INTRODUCTION

1-1 PURPOSE AND SCOPE.

1-1.1 PURPOSE.

This policy establishes criteria and standards for delivering cost engineering services within NAVFAC. This includes the development and preparation of cost estimates for constructing or renovating military facilities. The goals are to raise the quality of cost estimates across NAVFAC and to promote consistency of deliverables across NAVFAC and across DoD Components..

1-1.2 SCOPE.

This policy addresses development and delivery of cost engineering products and services within the Capital Improvements Business Line. Other Business Lines may adopt these procedures or tools for development and delivery of their cost engineering services.

1-2 Applicability - Interim.

This policy applies to construction cost engineering products and services within the Capital Improvements Business Line (CIBL) as described below. This criteria is applicable to (although not required for) projects of lesser dollar amounts. The criteria may be referenced by other Business Lines. When this document is referenced as part of an AE Task Order, it is applicable via the terms of the contract. This criteria will also be used by dedicated NAVFAC Cost Engineers reviewing AE deliverables.

For NAVFAC CIBL this portion is set forth with the intent to align with ECB 2016-xx "Design Execution" – Draft. There are other resource considerations, so variations may be necessary in some areas for non-MILCON projects. These guidelines should be considered minimum thresholds.

1-2.1 Budget Estimates:

Budget Estimates for 1391 documents shall be performed in accordance with these requirements and developed by a CIBL dedicated Cost Engineer for projects in the following categories:

1-2.1.1 All MCON or MCNR 1391's cost estimates and related cost engineering services under Preliminary Design Authorization for MILCON (E-5 project and service category) and 1391's for Unspecified Minor Construction.

1-2.2 Construction Cost Estimates: Construction Cost Estimates including Current Working Estimates, Final Independent Government Estimate and related cost engineering services shall be performed in accordance with these requirements and developed by a CIBL dedicated Cost Engineer for projects in the following categories:

1-2.2.1 All MCON or MCNR projects cost estimates and related cost engineering services under Final Design Authorization for MILCON (E-2 project and service category) and for Unspecified Minor Construction.

1-2.2.2 Other MILCONs (E-2 project and service category) for which NAVFAC is the execution agent.

1-2.2.3 Non-MILCON Projects (E-2 project and service category):

- a) Applicable to all Non-MILCON Projects cost estimates and related cost engineering services for projects above \$ 10 Million.
- b) Applicable to Non-MILCON Projects cost estimates and related cost engineering services for projects with a dollar amount between \$5 and 10 Million that **are** assigned to the Core or IPT's.
- c) Recommend that Non-MILCON Projects cost estimates and related cost engineering services be reviewed by a CIBL dedicated Cost Engineer for projects with a dollar amount between \$5 and 10 Million that **are not** assigned to the Core or IPT's.

1-2.3 Definition of CIBL dedicated Cost Engineer:

Not every person performing cost estimates in NAVFAC is considered a part of the Cost Community of Practice (CoP). The Tri-Service Cost Certification Bylaws, Article D-1, requires individuals to be engaged in cost engineering activities at least of 50% of their time for eligibility. If an individual is not eligible for Tri-Service Cost Certification they would not be considered part of the Cost Community. Rather they would be considered part of another Technical Discipline or part of another CoP.

Members of the Cost CoP are expected to develop cost estimates and other cost engineering products and services in accordance with applicable Cost Engineering Unified Facilities Criteria requirements as well as the NAVFAC Cost Engineering Policy and Procedures document.

1-2 GENERAL REQUIREMENTS.

1-2.1 Basis of Cost Estimate:

A Basis of Cost Estimate (BoCE) will be required for all projects.. As a minimum, the BoCE must be submitted with the cost estimate in the notes of the cost estimate file and include the following information:

- 1) Method used for the cost estimate development.
 - a) Scope of work used, such as “Project X Final Design Submittal, dated 15 June 2017”.
 - b) State whether the cost estimate is based on quantity take-off (QTO) method, other method(s), or combination.
 - c) Overall description of work plan including phasing, construction windows, significant need for construction aids or other necessary work not shown on the plans since it is not part of the final product.

- 2) Assumptions and exclusions to the cost estimate –
 - a) Summary of subcontracting assumptions and why,
 - b) Summary of Prime and Subcontractor markups and why the values were selected.
 - c) Mobilization and demobilization costs, including costs for labor camps for projects in remote locations
 - d) List and explain the use of other markups such as design contingencies, bonds, gross receipts tax (GRT), other taxes, etc.
 - e) Examples of other assumptions include access restrictions, work hours (normal or overtime), etc.
 - f) Anticipated market conditions at the time of award.
 - g) Additional risk addressed as contingency

- 3) Source of information if other than PACES or MII Cost Book:
 - a) Detailed explanation of the source(s) of material and equipment unit costs used.
 - b) Basis for labor unit rates and labor burdens used including explanation for additional labor adjustments such as productivity.
 - c) For projects in remote locations, indicate if burdened unit rates assume use of non-local labor and if so, indicate percentages of local and non-local labor.
 - d) Escalation calculations and source of escalation factor used, such as the NAVFAC Building Cost Index (BCI). The latest BCI can be found at <http://www.wbdg.org/ffc/navy-navfac/cost-engineering-guidance-ceg>

1-3 REFERENCES

Appendix A contains a list of references used in this document.

CHAPTER 2 - BUDGET ESTIMATES

2-1 GENERAL

This section applies primarily to MCON or MCNR 1391 cost estimate development. These principals can also be used for non-MILCON 1391 cost estimate development. The MILCON 1391 effort begins with Preliminary Design Authority (PDA) issuance from NAVFAC HQ. This authorizes the use of MILCON funds for the 1391 design and cost estimate development.

2-2 PROCESS REQUIREMENTS

2-2.1 All NAVFAC 1391's are built in the Electronic Project Generator application, EPG. CIBL Cost Engineers are responsible for Block 9 inputs at the PDA stage.

2-2.2 The development of costs for Block 9 takes place outside of EPG in either PACES or MIL. The expectation at PDA issuance is that a minimum 15% level of design and Class 3 – 4 Parametric or better Cost Estimate will be achieved. The use of Square foot – Square Meter (such as Guidance Unit Cost) or Project Comparison methods are not appropriate. Where there is less than a 15% design other cost estimating methods may be considered, such as for a late issuance of PDA. These other methods should be discussed between the FEC Cost Engineer and Echelon III Chief Cost Engineer.

2-2.3 Currently UFC 3-710-01A "CODE 3 DESIGN WITH PARAMETRIC ESTIMATING" contains guidance on parametric estimate development. This UFC is scheduled to be replaced in FY 18 with UFC 3-710-01 "PARAMETRIC ESTIMATING". For now the guidance is still relevant and is expected to be followed. Much of the design product requirements are covered in the recently issued "Engineering & Construction Bulletins (ECB) 2016-01: Preliminary Design Deliverables for Department of Navy Military Construction Projects".

2-3 PRODUCT REQUIREMENTS

2-3.1 Cost Engineers and AE's will be expected to develop "Parametric or better" Budget estimates for NAVFAC MILCON 1391s. "Or better" means that where parametric models are not available, or where detailed quantities are available, a Quantity Take Off (QTO) estimate will be done for that portion of the project.

2-3.2 Specific MILCON funding rules and estimate formatting requirements (work breakdown structure) for MILCON 1391's in EPG are covered in the "Consistency Review Board Guidelines".

2-3.3 Per ECB 2016-1, provide a basis of cost as described in paragraph 1-2.1 above.

2-3.4 Update costs in the ECONPACK file to reflect current estimates to verify the results of the initial Economic Analysis.

CHAPTER 3 - CONSTRUCTION COST ESTIMATES

3-1 GENERAL

3-1.1 The project estimate and the estimator play an integral role to project development. The importance of an accurate and well developed estimate cannot be understated. The project estimate provides valuable feedback to the Project Delivery Team (PDT) as design choices are encountered and changes are made in response to funding and other project constraints.

3-1.2 In comparison to the typical disciplines such as structural, electrical, and mechanical, the successful cost engineer or estimator often applies a much wider degree of judgment and professional opinion in the generation of an estimate, especially early in the project design. While design disciplines have defined criteria that define correct and incorrect design inclusions and calculations, there is no such equivalent for the construction cost estimate. All estimates comprise an opinion of probable project cost and take into account many variables such as bidding climate, strategy, history, local market factors, construction techniques and prime-sub contractor structures to name only a few.

3-1.3 Required Level of Accuracy of Cost Estimates. The required level of accuracy for cost estimates will vary depending on the design percentage of the submittal. The NAVFAC cost estimator is responsible for the accuracy of their cost estimate, and A-E cost estimates with significant deviations from the required accuracy ranges above will be considered in the overall performance evaluation of the A-E. Based on the AACEi Estimate Classification system, the required accuracy levels will be as follows:

- 1) 30% to 50% design shall be accompanied by a minimum Class 3 estimate.
- 2) 50% to 75% design shall be accompanied by a minimum Class 2 estimate.
- 3) 75% to 100% design shall be accompanied by a minimum Class 1 estimate.

3-2 PROCESS REQUIREMENTS

Development of a detailed cost estimate can be compared to the building of a pyramid. The basis of the estimate is the scope of work (foundation) and the bottom – up process consists of higher levels of refinement to the product. Refer to Figure 1.

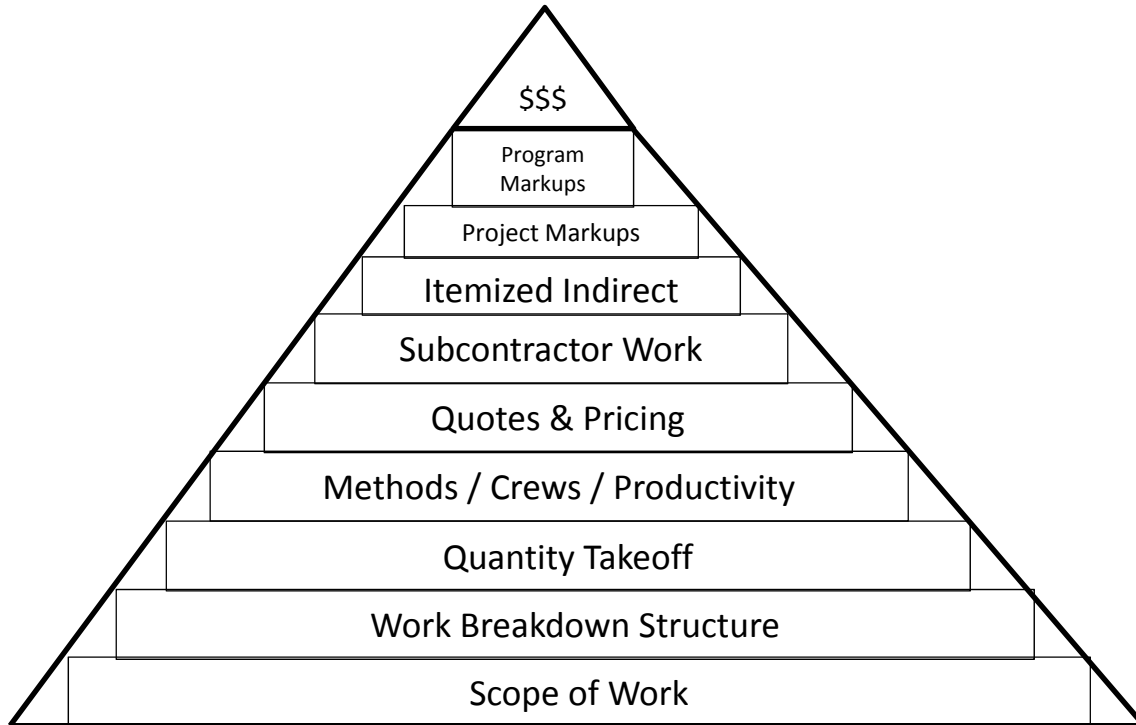


Figure 3-1. “Bottom – Up”, detailed cost estimate development.

3-3 PRODUCT REQUIREMENTS

3-3.1 Quantity Takeoff (QTO): All estimates shall be based on a detailed quantity takeoff of construction tasks unless the project is a Design-Build procurement. Files shall be maintained in an organized and retrievable manner such that examination or recalculation can be performed if necessary. The final quantity shall be recorded in the quantity field of the appropriate software package. Separate QTO files shall be submitted with the estimate. In the event the QTO for an item is materially different from that shown in the project documents, such as adding a 10% waste factor, the difference of recorded and apparent quantity shall be noted appropriately within the estimate file.

3-3.2 Detailed quantity take off (QTO): A quantity take off is required as part of the detailed estimate process. Contact the cognizant NAVFAC Cost Engineer for further guidance on quantity take off reports.

3-3.3 Basis of Estimate for Detailed Estimates: With each project estimate, documentation of the basis of estimate shall be provided with each submittal. This documentation shall be included in the Notes tab of the project properties screen in MII.

MII Project Library Properties:

The basis of the estimate should include the following:

- a. Project title
- b. Location or Installation
- c. Work Order Number
- d. Delivery method Design-Bid-Build or Design-Build
- e. Fiscal Year
- f. Solicitation # (if known)
- g. Program amount (PA)
- h. Construction Cost Limit (CCL)
- i. Description of project scope and assignment of base bid and option items
- j. Significant assumptions
- k. Direct Cost Markups (as applicable)
 - a. Productivity
 - b. Overtime
 - c. Sales tax (required)
 - d. Adjustments
- l. Prime Contractor Markups (as applicable)
 - a. Profit (required) The use of the Profit Weighted Guidelines Wizard in MII is recommended.
 - b. JOOH (required) Itemized JOOH for final IGE of DBB projects is recommended.
 - c. HOOH (required)
 - d. Bond (required)
 - e. Design fees
 - f. Design Contingency
 - g. Other
- m. Project Markups (as applicable)
 - a. Escalation (required)
 - b. Construction Contingency (required)
 - c. S&A or SIOH (required)
 - d. Other
- n. Construction schedule, use of overtime, construction windows, phasing, acquisition plan and subcontracting. (Where applicable.)
- o. Other pertinent information

3-3.4 Wage Rates:

3-3.4.1 CONUS: Federal projects are subject to Davis-Bacon Act prevailing wage rates in the locality of construction as a minimum; however appropriate wage rates may be higher in certain locales. The corresponding minimum wage rate can be found at the Dept. of Labor website: www.dol.gov

3-3.4.2 Other sources of labor rates should also be considered. Bureau of Labor Statistics (www.bls.gov) also has data on prevailing wages as well as employer costs.

3-3.4.3 OCONUS: Where wage determinations do not exist other sources for wage data must be considered. There are several commercial resources available. Some may require subscriptions. These sources may not be readily available so advance planning and purchasing may be necessary.

3-3.5 Equipment Rates:

3-3.5.1 Contractor Owned Equipment: Equipment rates in the Cost Book for MII are based on EP 1110-1-8 "Construction Equipment Ownership and Operating Expense" for contractor-owned equipment. Custom equipment rates may be developed using the "Checkrate" program available from USACE at: <http://www.nww.usace.army.mil/Missions/Cost-Engineering/>

3-3.5.2 Rental Equipment: If rental rates for equipment are used in the estimate they must be determined separately. This data can be obtained from some commercial sources or directly from quotes.

3-3.6 Estimate Structure:

It is important that the format of all estimates be as consistent as possible. NAVFAC has standardized with Uniformat II (ASTM Standard E 1557-97) for all estimate types. The basic estimate structure is shown in Table 3-1. This basis is the standard for all detailed estimates in MII. Standardization promotes consistency of our products and allows for easier collaboration within NAVFAC. This will also be the basis for future benchmarking capabilities.

Table 3-1. Basic Estimate Structure and Levels on MII Project Items Tab

	MII Folder	MII Folder	Sample	UNIFORMAT II		
Source	Levels	Level Title	Level Description	Levels	Values	Use
Template	0	Project	<i>Project Name</i>	N/A	N/A	Mandatory
Template	1	Project Phase	<i>Phase 1</i>	N/A	N/A	Mandatory
Template	2	Facility Type	<i>Primary Facilities</i>	N/A	N/A	Mandatory
Template	3	Project Element	<i>Primary Facility #1</i>	N/A	N/A	Mandatory
Template	4	Major Group Element	<i>Shell</i>	1	B	Mandatory
Template	5	Group Element (System)	<i>Superstructure</i>	2	B10	Mandatory
Template	6	Individual Element (Subsystem)	<i>Floor Construction</i>	3	B1010	Mandatory
Template	7	Sub-Element (Assembly)	<i>Floor Decks and Slabs</i>	4	B101003	Mandatory
User	8	Sub-Assembly or Unit Price	<i>Floor Slabs</i>	N/A	N/A	Optional
User	9	Unit Price - Line Items	<i>Detail Items</i>	N/A	N/A	Optional

Notes:

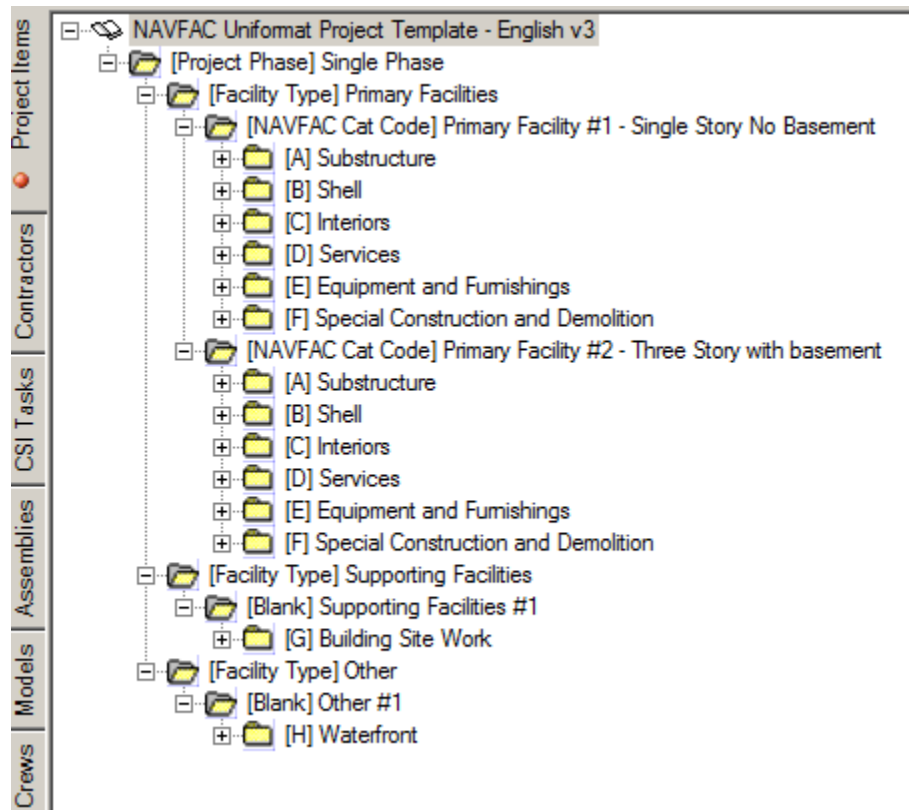
1. Project Phase is associated with large projects, such as Phase 1 of 4.
2. Facility Type values are either Primary, Supporting or Other.
3. For Primary Facilities, include Cat Code as Source Code.
4. For Primary Facilities Title use Cat Code description.
5. Include number of stories above and below ground in the Primary Facilities Title.

3-3.7 NAVFAC Template file: NAVFAC MII Template files are available as a “seed” files. The estimate structure follows Table 3-1. The template files are available in English and Metric versions, with the ASTM E-1557 Units of Measure selected on the folders from MII folder levels 4 through 7. Folders level 1 and 2 will be Lump Sum, and folder level 3 will usually be either square feet or square meters. Other units of measure for level 3 will be considered based on the facility type. Supporting Facilities at Level 3 will be Lump Sum.

The template files are available here:

<http://www.wbdg.org/ffc/navy-navfac/cost-engineering-guidance-ceg>

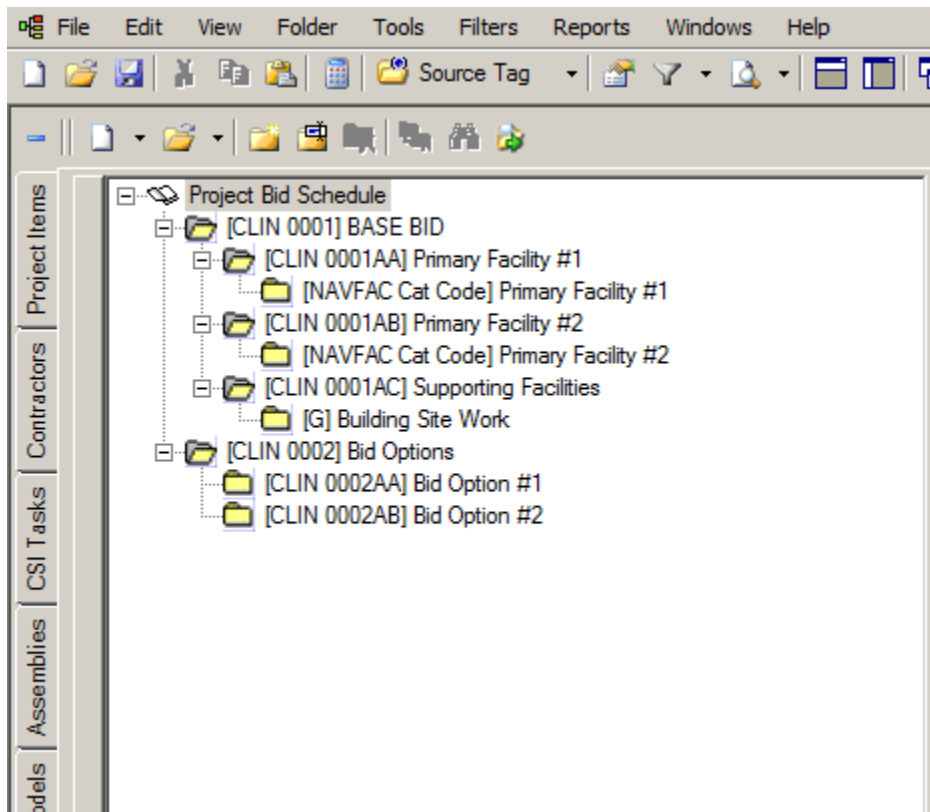
Figure 3-2. Basic Estimate Structure for Multiple Facility Estimates to MII Folder Level 4 or UNIFORMAT II Level 1.



3-3.8 Bid Schedules using Alternate Views in MII:

The contract Bid Schedule is an integral part of project Bid Packages, and it is therefore important that the format of the Bid Schedule be anticipated during the development of cost estimates. UFC 1-300-09N “Design Procedures” is mandated for all NAVFAC projects, and it requires that a “Project Information Form” (PIF) be developed and provided for all procurements. The PIF typically requires the utilization of UFGS 00 22 13 “Supplementary Instructions to Offerors”, which provides guidance on the formatting to be followed in the development of the Bid Items/Contract Line Item Numbers (CLIN’s). A typical Bid Schedule will break out 1) each individual facility to the five foot line, 2) total site work/utilities from the five foot line, and 3) total Design Build Design Fee as part of a single CLIN item. As is appropriate to each project’s requirements, the recommendations of UFGS 00 22 13 shall be tailored to best represent the project . Contact the cognizant NAVFAC Cost Engineer and PM/DM for further guidance on development of the Bid Schedule and CLIN’s.

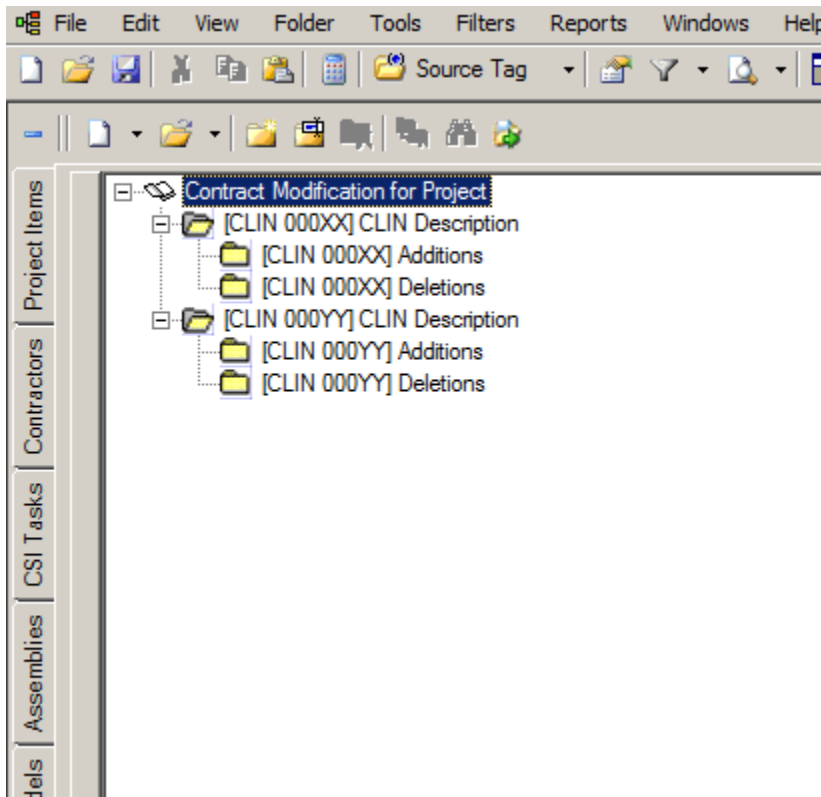
Figure 3-3. Estimate Structure for a Bid Schedule using Alternate View:



3-3.9 Contract Modification Estimates using Alternate Views in MII:

For construction contract modifications, the estimate structure shall match the CLIN structure of the contract. Under each CLIN the next folder levels shall consist of two folders, one being “additions” and the other “deletions”. The basic estimate structure can follow below these levels.

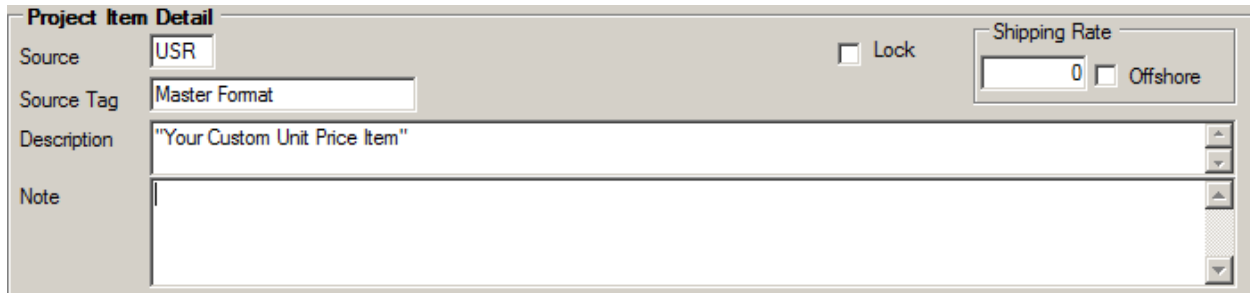
Figure 3-4. Estimate Structure for a Contract Modification using Alternate View:



3-3.10 Unit Price Items and Assemblies

3-3.10.1 Per UFC 3-740-05, User created items that have an extended direct cost of \$10,000 or more, or 5 percent or more of the total direct cost, whichever is less, a detailed backup for the cost should be prepared or vendor quotations obtained as pricing support to the cost estimate.

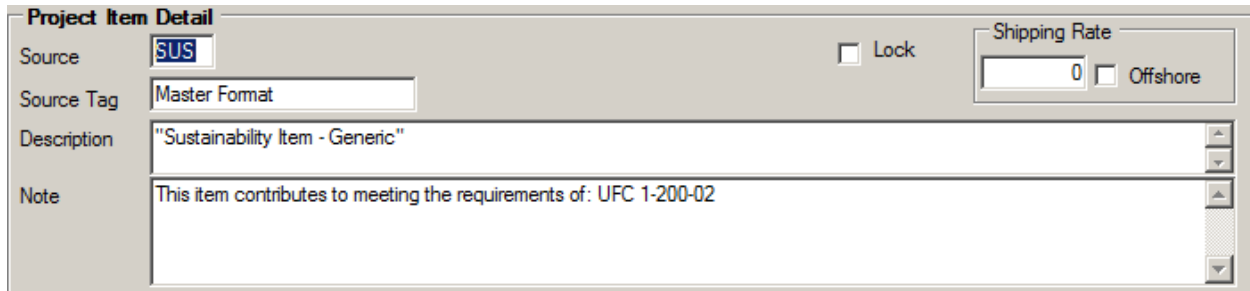
Figure 3-5. User created Unit Price item.



The screenshot shows a 'Project Item Detail' form. The 'Source' field contains 'USR'. The 'Source Tag' field contains 'Master Format'. The 'Description' field contains '"Your Custom Unit Price Item"'. The 'Note' field is empty. There is a 'Lock' checkbox which is unchecked. The 'Shipping Rate' field contains '0' and the 'Offshore' checkbox is unchecked.

3-3.10.2 Tracking of Cost Items for UFC 1-200-02 - High Performance and Sustainable Building Requirements: In order to identify these items in the estimate, change the Source field in MII project libraries to "**SUS**" for unit price items in estimates that address sustainability requirements.

Figure 3-6. Sustainment Unit Price Item.



The screenshot shows a 'Project Item Detail' form. The 'Source' field contains 'SUS'. The 'Source Tag' field contains 'Master Format'. The 'Description' field contains '"Sustainability Item - Generic"'. The 'Note' field contains 'This item contributes to meeting the requirements of: UFC 1-200-02'. There is a 'Lock' checkbox which is unchecked. The 'Shipping Rate' field contains '0' and the 'Offshore' checkbox is unchecked.

3-4 Submittals:

Submit both hard and electronic copies of cost estimates with each submittal. Electronic copies of the estimate native files (PACES, MII or SUCCESS) are required with each submittal.

3-4.1 35% or less Submittal: For a 35% design or less submittal either software package may be used. If the project is a standard facility, PACES is probably more expedient, however MII may be used as well. Concept level estimates in MII must have summarized costs noted and documented using the Notes section. Assemblies, SF costs, and general allowances must be explained and noted in detail sufficient to verify applicability. The estimator may employ the use of design contingencies at this submittal commensurate with project detail.

For design-build (DB) projects PACES is likely the preferred package as it may be used throughout project development. The use of design contingencies is permitted in the final IGE of a DB-RFP estimate since the design is still not complete.

3-4.2 Interim (35% - 75% Design) Submittal: For design-bid-build (DBB) projects, MII is the preferred software package for this submittal. At this stage sufficient detail should be available to create a detailed, task oriented estimate utilizing fewer summarized costs than at the concept submittal. The MII estimate may be an import from PACES or original creation. At this stage, the estimator should be migrating from primarily aggregate, summarized costs to detailed task analysis with more significant quantity takeoff. Additionally, design contingencies should be of diminished value from the concept submittal.

Inclusion of editable draft bid schedule is encouraged with this submittal. The estimate structure shall reflect that of the bid schedule.

3-4.3 Final (75% to 100% Design) Submittal: For final DBB project submittals, all estimates should be complete using MII and based on detailed quantity takeoff and task analysis. At this stage, remnants of PACES import or summarized costs should be eliminated, as well as the use of design contingencies.

Field Office Overheads should be itemized since the requirements are generally known at this point. Several cost models for Indirect Cost itemization exist.

An editable and completed bid schedule is required for this submittal. The estimate structure shall reflect that of the bid schedule.

The estimates shall incorporate comments and changes from the interim review.

3-4.4 Subsequent Submittals: For post-final submittals, the submittal expectations are the same as for final. For AE deliverables the estimate should require no manipulation by the government during the advertisement period and incorporate all comments and changes made to date.

In accordance with the A-E contract documents, the AE estimator shall provide estimating services for cost impacting amendments. All cost estimating principles stated within this document shall apply to the development of the cost estimate changes due to amendments during solicitation.

The detail for each cost estimate submittal shall be commensurate with the level of design required for that submittal. Contact the NAVFAC LANT PM/DM prior to submission to confirm the project's authorized construction costs.

CHAPTER 4 - PRE-AWARD CONSTRUCTION SCHEDULES

4-1 GENERAL

Development of a pre-award construction schedule is a natural evolution in the development of a detailed cost estimate. The construction schedule shall be based on tasks developed at a manageable level of detail. The level of detail should show predecessor – successor relationships and to allow for concurrent time periods for non-related tasks. Task durations should be obtained from crew hours in the cost estimate. The overall approach should follow a Critical Path Method (CPM) algorithm.

4-2 PROCESS REQUIREMENTS

4-2.1 A pre-award task based schedule is required for DBB projects >\$30 Million.

4-2.2 DBB projects during PDA or with less than 35% design may use empirical methods to develop construction durations.

4-2.3 Projects with a Program Amount (PA) less than \$ 30 Million may use empirical methods to develop construction durations.

4-2.4 For DB projects >\$30 Million a subjective duration analysis in conjunction with tabular values should be developed.

This would include addressing items listed in the current template SAES for DB projects:

- a) Estimated timeline of major construction activities.
- b) Approximate durations for long lead time items and installation.
- c) Work items that will delay the completion of the entire project if started or completed late (i.e., critical path).
- d) Significant others (i.e., permits, SHPO, fish windows, eagle nesting, etc.)
- e) Impact of known station activities upon the Construction Contractor's operations.
- f) Seasonal weather considerations (including impacts on site soils).
- g) Approximate durations for submission and approval of administrative submittals.
- h) Approximate durations for material lead time and installation.
- i) Interface of work trades within the project.

4-2.5 None of these exclusions should preclude development of a schedule. The preceding paragraphs just indicate circumstances where a schedule is not required.

4-2.6 The \$30 Million is a transitional threshold and as an organization we need to work toward lowering that threshold to include more projects.

4-2.7 The schedules will be developed either by the Cost AE or the NAVFAC Cost Engineer for the project.

4-2.8 For additional information, see UFC 3-740-05 paragraph 4-33, or contact the NAVFAC Chief Cost Engineer.

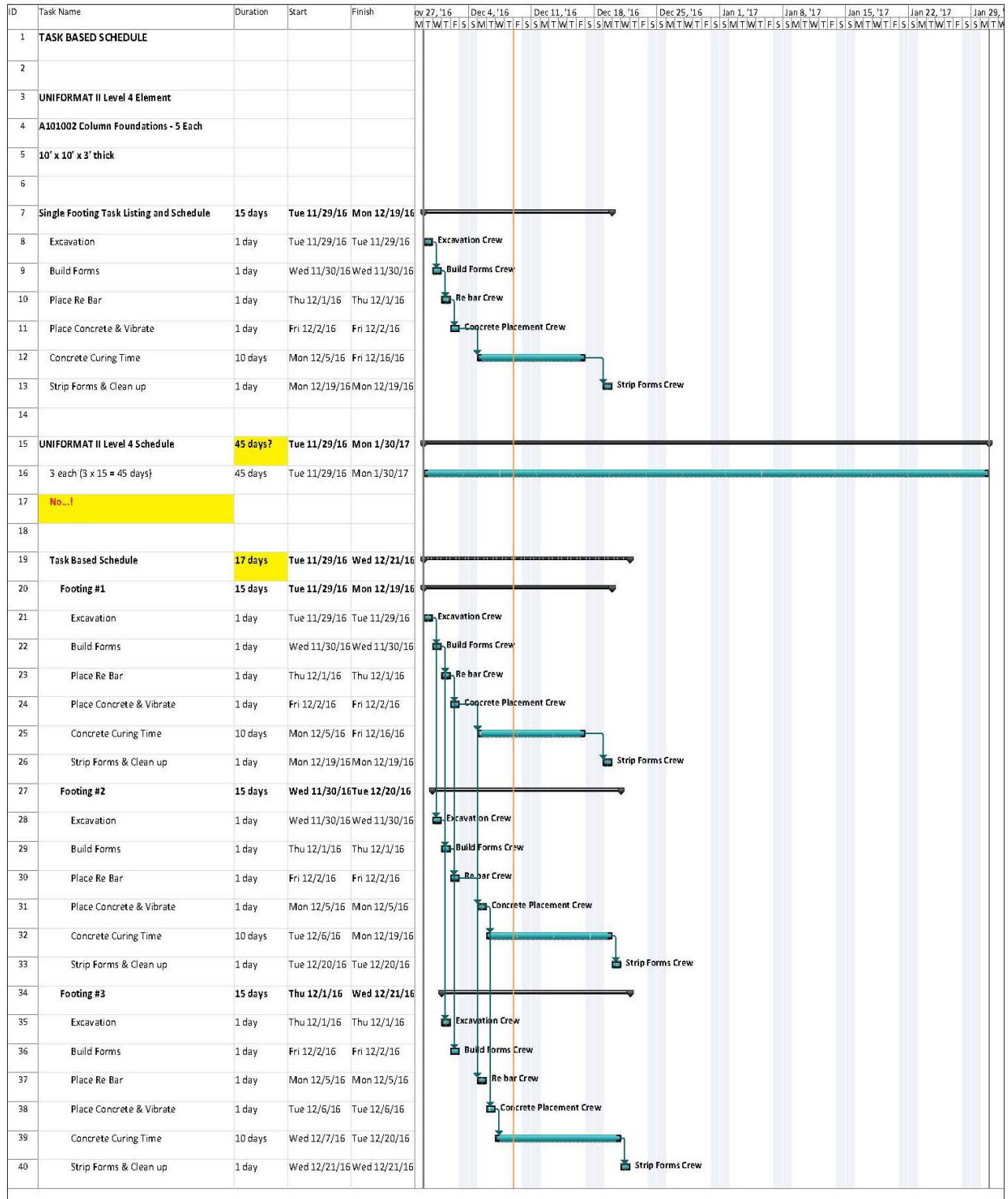
4-3 PRODUCT REQUIREMENTS

4-3.1 Pre-Award Task Based Construction Schedule. Deliverable shall be an MS Project file. Basis of the schedule should be task based with crew hours derived from the MII estimate.

4-3.2 The proposed construction schedule should be in the form of a bar chart. Format of construction schedule shall be divided into months showing sequence of work and phases (if any), and time required for each phase of the work. For renovation projects, prepare a phasing plan to address partial occupancy and key functions to remain operational during renovation.

4-3.3 Figure 4-1 illustrates the concept of a task based schedule.

FIGURE 4-1. TASK Based Schedule compared to UNIFORMAT based Schedule.



CHAPTER 5 - VALUE ENGINEERING STUDIES

5-1 GENERAL

Value Engineering is recognized as an effective technique for reducing costs and improving quality-related features such as durability, reliability and maintainability.

5-2 PROCESS REQUIREMENTS

5-2.1 Value Engineering Studies: Formal Value Engineering process is required for all vertical DBB MCON projects over \$30 Million and should be identified at the DD-1391 stage. A Value Engineering Study is not required for DB MCON projects. The VE process requirement should be indicated on the DD-1391. This additional cost and time should be included in the DD-1391 block 12A.

The Value Engineering process (facilitated) should be initiated shortly after final solicitation document design authorization is received and can be completed in conjunction with the Functional Analysis Concept Development (FACD) phase of design development.

5-3 PRODUCT REQUIREMENTS

Specific product requirements are found in the NAVFAC Functional Analysis Concept Development (FACD)/Design Charette Design Manual.

CHAPTER 6 - COST AND SCHEDULE RISK ANALYSIS

6-1 GENERAL

The goal of risk management is to identify project risks and develop strategies to manage those risks. In that process of managing and mitigating risks, there are likely project opportunities and benefits that are realized. Four main building blocks of the risk management process are identification, assessment, response, and documentation. The Cost and Schedule Risk Analysis (CSRA) process addresses the “identification” and “assessment” portions of the risk management process.

6-2 PROCESS REQUIREMENTS

A formal CSRA is recommended for high risk DB and DBB MCON projects over \$30 Million and should be identified at the DD-1391 stage. This requirement should be indicated on the DD-1391. The additional cost and time should be included in the DD-1391 block 12A. The CSRA process (facilitated) should be initiated shortly after final solicitation document design authorization is received. Refer to USACE Cost and Schedule Risk Analysis (CSRA) Guidance.

http://www.nww.usace.army.mil/Portals/28/docs/costengineering/CSRA/CSRA_Guidance.pdf

The CSRA identification and assessment portions focus on the total project. The outcome identifies the more critical risks to the project cost and schedule and assists in establishing contingencies to manage the project to completion. It is critical that the CSRA be performed on the best known confident scope available with the most likely cost estimate and schedule; otherwise, the contingencies developed from the CSRA may be too low and unable to capture the funding needed as the project scope is further developed.

The CSRA is the process of determining the risks associated with the studied project. The CSRA attempts to quantify potential value variance of the risks as related to the project cost and schedule. The results are expressed as contingency amounts in the form of dollars and time with reflective confidence levels for successful execution. It is a formal documented process that includes the involvement of the entire project team, utilizing nationally recognized crystal ball software based on the Monte Carlo principles.

The project team for a CSRA should include individuals from Acquisition, Environmental Construction Management, the Installation and Asset Management. The group environment is similar to a Charette or Value Engineering Study.

Refer to the cognizant FEC Cost Engineer or Echelon III Cost Engineer for specific project recommendations and project stages for the CSRA.

6-3 PRODUCT REQUIREMENTS

6-3.1 General:

A deterministic CSRA shall be provided as a separate report using the USACE CSRA process. CSRA models shall be developed using Oracle Crystal Ball add in to MS Excel.

The starting documents recommended for beginning a CSRA include:

- Well-developed project scope
- Quality estimate excluding contingency and escalation
- Schedule reflecting the estimate
- Expended project costs and durations
- Crystal ball software used to run a CSRA
- Risk presentation to educate the project team
- PDT risk checklist presenting typical risks considered
- Sample risk register
- Sample cost and schedule risk templates/models
- Sample report of the process, outcome, and recommendations

6-3.2 Cost Risk Model Development: CRA are most commonly performed by a trained senior cost engineer and/or a senior risk analyst. On larger projects, this may require several members to study the initial risk register, evaluate the concerns captured within the brainstorming session(s), perform market studies of those risk events, and validate whether the project team's risk level assignments are accurate.

6-3.3 Cost Risk Model Template: The risk model utilizes the risk register as its basis within the excel format. The risk analyst and the pm must determine the best modeling method that provides adequate CRA model output for the project. The result is a customized model specifically related to the project. The final product must present contingencies in the desired format for the total project cost estimate. For example, risk analyses can be performed on each contract (assuming several contracts), on each project feature, or on the total project base cost.

6-3.4 Methods: In developing the cost risk model template, two common approaches are recommended. The approaches are dependent upon the desired outcome when

establishing the contingencies. For example, if just a single project or contract is planned, a single contingency value may be preferred or a contingency developed for each project feature. If several projects or contracts are planned, a separate contingency for each project may be more appropriate. These issues should be resolved before preparation of the CRA model. Typical approaches currently used:

6-3.4.1 Risk event based (Preferred): Develop the model to reflect the completed risk register. In a sense, the risk register becomes the model. In that way, the crystal ball outputs directly reflect the risk register's risk events established by the project team. This output is better suited to document traceability, risk management, and follow-on risk studies. The CRA output is risk based and typically presents the contingency per each project.

6-3.4.2 Cost based: this method might be used when several contracts are being studied within the program and separate contract contingencies or feature contingencies are desired. The resulting model reflects the work breakdown structure (WBS) within the estimate(s). To pursue this avenue, the CRA model is developed by downloading the most likely estimate into an excel file at the chosen WBS level that best relates to the risk register. Once that is accomplished, refer to the market study and the various risk events, creating the best and worst case estimates, again reflecting the chosen WBS. The CRA output is cost based, because it reflects the WBS within the estimate template and is more intuitive for the cost engineer. The advantage is that the model output can better reflect multiple project features, contracts or different funding accounts. The disadvantage is that it does not directly correlate to the risk events established by the project team and is less traceable to the risk register. If this alternative is chosen, the report must document how the CRA outputs relate to the risk register event concerns.

6-3.5 Cost Risk Model Output: There are numerous crystal ball outputs that are helpful in presenting the data as well as supporting the CSRA report. While not all are portrayed in this guidance, the more common figures used to support the final report are presented in the USACE Guidance. This data is obtained from the crystal ball report output after the risk simulation is run.

6-3.5.1 A sensitivity chart the sensitivity chart reflects the risk register areas of greatest concern (risk event based), rated in order of criticality, also referred to as the key risk drivers. It is commonly referred to as a tornado chart. Generally, the more common areas of high risk concern are scope development, contract acquisition, bidding climate, funding availability, and contract modifications.

6-3.5.2 The contingency analysis is measured against the most likely estimate in dollars. The output presents the cost values based on the confidence levels for successful project execution and completion. It can be presented in tabular form and also represented graphically and termed as the confidence curve.

CHAPTER 7 COST ENGINEERING SOFTWARE

7-1 DoD approved Cost Software for Facilities:

7-1.1 Parametric Estimating Software: (**PACES**)

PACES parametric estimating software allows the project estimator to estimate and manage costs during the critical planning and budgeting stage of project development. PACES uses predefined model relationships to link basic facility parameters (function, gross floor area, number of floors, heating load, electric load, etc.) to detailed engineering quantities. Appropriate modifications must be made to the base model to ensure estimate accuracy and account for standard features, special costs, and recent criteria changes.

7-1.2 Detailed Estimating Software: MCACES 2nd Generation (**MII**)

MII (or “M-two”) is the second generation of the Micro-Computer Aided Cost Estimating System (MCACES). It is a detailed cost estimating software application that was developed in conjunction with Project Time & Cost LLC. (PT&C). MII is one of several modules of an integrated suite of cost engineering tools called Tri-Service Automated Cost Engineering Systems (TRACES). It interfaces with other PC based support modules and databases used by the Tri-Service Cost Engineering community. MII provides an integrated cost estimating system (software and databases) that meets Department of Defense requirements for preparing cost estimates for Military Facilities worldwide.

Note: SUCCESS Estimator is still approved for ongoing projects. Beginning in October 2016 (FY 17) all new detailed estimates shall use MII.

7-1.3 Life Cycle Cost Analysis Software: **ECONPACK**

ECONPACK is a unique economic analysis computer package available to engineers, economists, master planners, accountants, and other personnel throughout the Department of Defense (DOD) and the Government. ECONPACK is a comprehensive program incorporating economic analysis calculations, documentation, and reporting capabilities. It is structured so it can be used by non-economists to prepare complete, properly documented economic analyses (EAs) in support of DOD funding requests. The analytic capabilities of ECONPACK are generic, providing standardized economic analysis methodologies and calculations to evaluate a broad range of capital investment categories such as barracks, hospitals, family housing, information systems, utility plants, maintenance facilities, ranges, runways, commercially financed facilities, and equipment.

7-1.4 Cost and Schedule Risk Analysis: **Oracle Crystal Ball**

Crystal Ball is a spreadsheet based application for predictive modeling. NAVFAC and USACE use this application for deterministic cost and schedule risk analysis.

Table 7-1: Approved Cost Estimating Tool Application.

PRELIMINARY DESIGN AUTHORITY					
Approximate Design Percentage	0 – 5%	5 – 10%	15%		
(AACE Estimate Class)	(Class 5)	(Class 5,4)	(Class 4,3)		
Estimating Tool(s)	N/A	P/M	P/M		

DESIGN BUILD CONTRACTS					
		<i><-----DB Post-Award Services-----></i>			
Approximate Design Percentage	15 – 35%	>35%	60 - 65% ¹	100%	Final
(AACE Estimate Class)	(Class 4,3)	(---)	(---)	(---)	(---)
Estimating Tool(s)	P/M	E	E	E	E

DESIGN BID BUILD CONTRACTS					
Approximate Design Percentage	15%	35%	60 - 65% ¹	100%	Final
(AACE Estimate Class)	(Class 5,4,3)	(Class 3,2)	(Class 2,1)	(Class 1)	(Class 1)
Estimating Tool(s)	P/M	M	M	M	M

KEY

P=PACES/Parametric

M = MII (MCACES Second Generation)

E=Engineer's Estimate from DB Contractor (As Specified by Appendix A/SAES)

1. Typically applies to USAF projects.

7-2 Obtaining Current Software

7-2.1 PACES:

7-2.1.1 For NAVFAC CIBL Employees: NAVFAC has PACES user licenses available for all in-house dedicated CIBL Cost Engineers.

7-2.1.2 For NAVFAC AE's: Architect-Engineer (AE) firms must purchase the software from AECOM. The current version of PACES can be obtained directly from the software vendor via the following:

Sales/Support Phone: 1-800-499-2919

Sales/Support Email: PACES@AECOM.COM

The requestor will receive a current License pricing list, order form and contractor verification form. Software training may also be purchased directly from the software vendor and if conjunction with software purchase, may be offered at a discounted rate. A-E firms can contact the software vendor for details.

7-2.2 MII and Cost Book Data:

7-2.2.1 For NAVFAC CIBL Employees: NAVFAC has MII user licenses and Cost Book databases available for all in-house dedicated CIBL Cost Engineers. In order to be issued an MII license an individual in NAVFAC will have to either be a Tri-Service Certified Cost Engineer or have successfully completed the course DoD #770 "Cost Estimating Policy Overview". A copy of the training certificate will be required.

7-2.2.2 For NAVFAC AE's: The current version of MII (MCACES Second Generation) can be obtained via request by A-E firms or others under contract or providing services to NAVFAC may request software installation packages from NAVFAC Atlantic CI Cost. The A-E is to send an email to NAVFAC-CI-Cost@navy.mil

Software is generally distributed to A-E's free of charge, however accompanying database licenses must be purchased and licensed as appropriate by the user. The installation and setup software is distributed directly to the requestor.

After installing MII, the user must register the software following the prompt at program startup. During this process, record the email address and password provided. In order to activate the Cost Book Library, the user must login at:

<http://www.miisoftware.com/Login.aspx> using the registration email and password.

Once login is successful, the user can purchase the appropriate cost book by clicking "Products" choosing the appropriate option(s), providing billing information, and completing the ordering process. Once payment has processed the required activation key will be emailed to the user. The user can then enter the activation key as prompted to use the library.

Support and training for software usage can also be purchased after login at:

<http://www.miisoftware.com/Default.aspx>. This site contains FAQ's and other resources for the MII user.

7-2.3 SUCCESS Estimator and RS Means Data:

7-2.3.1 For NAVFAC CIBL Employees: NAVFAC provides SUCCE user licenses and RS Means databases to all in-house CIBL Designers and Cost Engineers.

7-2.3.2 For NAVFAC AE's: The current version of Success Estimator can be obtained by contacting US Cost directly at <http://uscost.net> for pricing and procurement information on the software and any accompanying databases. NAVFAC does not provide SUCCESS Estimator to its AE contractors.

7-2.4 ECONPACK:

7-2.4.1 For NAVFAC CIBL Employees: ECONPACK software and installation instructions can be downloaded from the NAVFAC web page at:

[https://hub.navfac.navy.mil/webcenter/portal/am/Programs+\[A-H\]/Economic+Analysis](https://hub.navfac.navy.mil/webcenter/portal/am/Programs+[A-H]/Economic+Analysis)

Or - contact Joe Lane at Joseph.Lane@navy.mil or DSN 325-6222 / Commercial at 202-685-6222.

7-2.4.2 For NAVFAC AE's: ECONPACK software can be obtained by contacting the PAX Support Helpdesk, paxspt-huntsville@usace.army.mil or at 256-895-1838 (Commercial) or 800-215-2082 (Toll free).

7-2.5 Oracle Crystal Ball:

7-2.5.1 For NAVFAC CIBL Employees: NAVFAC has Crystal Ball licenses available for all in-house dedicated CIBL Cost Engineers.

7-2.5.2 For NAVFAC AE's: Oracle Crystal Ball is available for purchase through Oracle

<http://www.oracle.com/us/products/applications/crystalball/overview/index.html>

APPENDIX A – REFERENCES

UNITED STATES DEPARTMENT OF DEFENSE REGULATIONS

DoD 7000.14-R Financial Management Regulation Volume 2B, Chapter 6

UNITED STATES DEPARTMENT OF DEFENSE, UNIFIED FACILITIES CRITERIA PROGRAM <https://wbdg.org>

FC 1-300-09N, Design Procedures

UFC 3-701-01, DOD Facilities Pricing Guide

UFC 3-730-01, Programming Cost Estimates for Military Construction

UFC 3-710-01A “Code 3 Design with parametric Estimating”

To be replaced by:

UFC 3-710-01 Parametric Estimates (Under Development)

UFC 3-740-05 Handbook: Construction Cost Estimating

USACE GUIDANCE

USACE [Cost and Schedule Risk Analysis \(CSRA\) Guidance](http://www.nww.usace.army.mil/Missions/Cost-Engineering/)

<http://www.nww.usace.army.mil/Missions/Cost-Engineering/>

NAVFAC GUIDANCE

Engineering & Construction Bulletins (ECB) 2016-01: Preliminary Design Deliverables for Department of Navy Military Construction Projects

BMS B-11.3.2 Regular Cycle Navy Blue MCON Region FEC Team 1391

NAVFAC Value Engineering, Functional Analysis Concept Development (FACD)/Design Charette

<https://hub.navfac.navy.mil/webcenter/portal/ci/page1182/page199/page1196>

MTP3 Process Improvement Report dated 18 March 2008

Consistency Review Board Guidelines (Latest Version)

OTHER INDUSTRY CRITERIA

AACEi 56R-08 Cost Estimate Classification System - Building and General Construction

ASTM E-1557 Standard Classification for Building Elements and Related Sitework –
UNIFORMAT II