



**Smithsonian Institution**  
**Office of Facilities Engineering and Operations**

[AE120](#) REQUIREMENTS FOR PROJECT & CONSTRUCTION COST  
ESTIMATING SERVICES

March, 2014.

## **PROJECT & CONSTRUCTION COST ESTIMATING REQUIREMENTS**

**Overview**

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**Introduction** This document supplements the Smithsonian Institution Office of Facilities Engineering and Operations (OFEO) AE110 Standard Requirements for A/E Services. It describes the background, policies and procedures for estimating construction costs and budgets.

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**Goal** The goal of this document is to facilitate OFEO's review of budgets and estimates by establishing standard guidelines and formats for cost estimating for use by A/E's and other contractors.

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**Objectives** This document will help the reader to:

- understand the different kinds of budgets and estimates used by OFEO
- understand construction contract types issued by the Smithsonian
- understand construction estimate cost factors
- OFEO requirements for construction estimate submissions and deliverables

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**Contents** The following topics are covered in this document.

<b>Topic</b>	<b>Page</b>
Overview	1
General Information	2
Types of Cost Estimates	3
Estimate Cost Factors	5
Estimate Formats and Procedures	8

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## General Information

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**Purpose** Estimates are prepared to provide accurate cost assessments for total project and construction costs. Some specific purposes of estimates are:

- to ensure project costs are within the authorized dollar amount
- as a comparison of costs on previously constructed facilities
- to compile a record of historical costs
- to establish the "design to cost" limits for the Architect/Engineer (A/E)
- to provide a means of cost control during design
- to determine the necessity and extent for bid alternates
- as a standard of comparison for bids/offers prior to award of the construction contract
- as a comparison for evaluating the schedule of values submitted by the Contractor
- to evaluate the availability of funding for proposed Change Orders
- as a basis for negotiation for bids, offers, and other proposals

**The Smithsonian Estimate** In compliance with the Federal Acquisition Regulations (FAR), an **independent estimate** of construction costs, the "Smithsonian Estimate," or "Independent Government Estimate" is required for all contracting actions exceeding \$100,000. The IGE must be prepared and provided to the Smithsonian's Contracting Officer prior to bid/offer opening or negotiations with the Construction Contractor. This estimate is prepared by, or at the direction of the Office of Planning Design and Construction (OPDC), Facility Investment and Cost Engineering Branch (FICE).

**SI Construction Contracts** The Smithsonian Institution generally utilizes the FIXED PRICE contracting method for construction, in either of the following formats or in combination:

- Lump Sum Basis: a lump sum dollar amount is paid for the total work or defined parts of the work, such as bid alternates.
- Unit Price Basis: a unit price is paid for a specified quantity of work units.

The SI's budget is provided in the AE100 Scope of Work and may be adjusted throughout the Project. Evaluations of SI's budget, the preliminary estimate and updated milestone estimates prepared by the A/E, represent the A/E's judgment as a design professional. It is recognized, however, that neither the A/E nor SI has control over the cost of labor, materials or equipment; the Contractor's methods of determining bid prices; or competitive bidding, market or negotiating conditions

### **General**

The Federal Acquisition Regulation (FAR) 36.203 requires that every Government Estimate be prepared as though the Government were a prudent and well equipped contractor estimating the project. Therefore, all costs which a prudent, experienced contractor would expect to incur must be included in project cost estimates. This philosophy prevails throughout the entire project cycle from programming to completion of construction. Each estimate should be developed as accurately as possible, in as much detail as can be assumed, and based upon the best information available. A listing of known facts, construction tasks and supplemental judgments form the basis of the estimate at each stage of design. This provides a realistic approach to estimating and it creates a history of project cost development. This objective is to be maintained at all stages of the project. The cost estimate will in all aspects represent the "fair and reasonable" cost to the Government.

**Cost Estimating Consultant:** All estimates submitted for the project must be prepared independently of the design team by a skilled and experienced professional estimating company external to and not under the jurisdiction of that design team. The SI shall maintain oversight of the development of the A/E's construction estimates and cost control requirements.

**Site Visit:** Prior to commencing work on any cost estimate the Construction Cost Consultants shall visit the site and fully familiarize themselves with all conditions under which the work will be performed. The Contractor shall co-ordinate all site visits through the COTR (DM).

## Detailed Estimate Development

### A. Estimating Format and Standards.

1. **Uniformat II:** All construction cost estimates shall be prepared using the estimate systems categories and levels of detail specified within Uniformat II (ASTM-E1557-09).
2. **ASTM E-E1804-07:** Unless otherwise directed by the SI, adhere to the Design Phase definitions and required Uniformat II design/level requirements specified within *Standard Practice for Performing and Reporting Cost Analysis During the Design Phase of a Project, ASTM E-E1804-07*.

### B. Estimating Software.

1. **Computer Assisted Estimating:** The SI requires the use of computer assisted estimating software for all construction cost estimates prepared for its projects.
2. **Projects valued greater than \$1 Million:** All construction cost estimates for projects valued at over \$1 million shall be executed using U.S. Cost's "SUCCESS ESTIMATOR" estimating software. The estimator shall preserve all settings and linkages supporting Uniformat II to CSI Masterformat pricing coding so that either report can be run later.

A download of the **SI Success Cost Management Estimating and Report Template** will be made available. **Contact the SI COTR for direction.**

Do not reformat or revise the standard SI Success Estimator (.pwz) template file without the expressed prior approval from the SI COTR.

**The SUCCESS estimating software and commercial database(s) are NOT provided by SI. The SI SUCCESS Cost Management Estimating and Report Template IS provided by SI**

3. Projects valued less than \$1 Million: Obtain the approval of the SI COTR prior to using software other than "Success". For construction cost estimates for projects valued less than \$1 Million, especially those that involve limited time and material quantities, estimates may be executed using standard Microsoft "Excel" spreadsheets. Do not reformat or revise the standard S.I. MS Excel (.xlsx) file without the expressed prior approval from the S.I. COTR. Download the MSEXcel **SI Construction Cost Estimate** template at:  
[http://www.ofeo.si.edu/ae\\_center/construction.html](http://www.ofeo.si.edu/ae_center/construction.html)

### **Preliminary Budget Estimates (Planning).**

Preliminary project budgets are established by estimating facilities construction costs as well as line items for related fees, contingencies and other project costs. As programming and preliminary design information becomes available, the preliminary project budget estimate may be refined and updated. Preliminary Project Budget Estimates are used by the Smithsonian in long-range project planning and serve as the basis for funding requests. The following format is generally used:

**Preliminary Project Budget Estimate:** Building systems estimates utilizing Uniformat II and indicating costs for building construction (architectural + major engineering systems) and site development. Various multipliers or line items are included for: architect/engineer fees, construction management and inspection fees, furniture, furnishings and equipment, move-in and occupancy, escalation, and design and construction contingencies.

A **Project Prospectus** for major new construction often includes an estimate of First Year Program Expenses and an estimate of Annual Operating Costs as well as the Preliminary Project Budget Estimate described above. Requirements for the preparation of these Annual Operating Costs will be outlined in the Scope of Work for the Project Prospectus.

### **Project Budget Estimate Based on Concept or Schematic Design:**

When an estimate based on concept or schematic drawings is required, the A/E shall prepare a Project Budget Estimate in a format similar to the Preliminary Project Budget Estimate described above. Depending on the level of detail available in the drawings, direct costs subtotals are arrived at by estimating the building systems in Uniformat II format. Augment Uniformat II level 2 estimates with additional detail, to the fullest extent possible, as follows:

- i) under mechanical provide separate identifiable costs for HVAC, plumbing and fire suppression.
- ii) under electrical provide separate identifiable costs for service and distribution, lighting, power and special electrical.

Provide a methodology to create assemblies of cost. These assemblies shall define assumptions made and shall reflect the assumed units of measure and include materials, labor and equipment in unit breakouts. Records of project assemblies shall accompany the report and shall be entered into the SUCCESS system with the appropriate project work breakdown structure.

The following indirect costs shall also be considered and included as appropriate:

- design development contingency,
- material and labor burden,
- overhead and profit,
- prime commission on subcontract work,
- escalation to the mid-point of construction,
- area factor,
- site factor and logistics (if applicable),
- general and supplementary conditions,
- Performance Bond, Liability and Builder's Risk Insurances
- A/E fees,
- construction management and inspection fees,
- construction reserve contingency.

Line items are also included for furniture, furnishings and equipment, security devices and special equipment as applicable or as directed by SI.

### **Construction Cost Estimates Based on Design Development and Construction Documents:**

Construction cost estimates are prepared throughout the design process, increasing in detail as the design develops from Design Development through Construction Documents to submission of the Final Documents. A construction cost estimate is a required deliverable along with each design submission (always at 35%, 65% and Construction Bid Set; sometimes an intermediate estimate is required). This helps ensure that the design is within budget and targets problem areas in cost which could affect final design. The requirements for Construction Cost Estimates are as follows:

1. **Design Development (35%):** Prepare the Design Development estimate using Unifomat II Level 3 based on design development floor plans, outline specifications for principal materials, finishes and building systems and typical unit costs for structural, mechanical and electrical systems. Provide allowances for materials or systems not yet defined.
2. **Construction Documents (65%, Intermediate, and Construction Bid Set):** Milestone design phase estimates shall ordinarily be submitted at 65%,



Intermediate and Construction Bid Set. Levels of completion for construction document phase estimates shall conform to Unifomat II Level 4. Lump sum pricing shall be held to a minimum. Project cost control will be maintained to appropriate limits through the development of the project cost estimates. Complete and detailed line item estimates for Division 1 – General Requirements, shall be provided with all construction document phase estimates.

**Costs.**

**General:** The SI will identify the contracting method and execution strategy to be used for the project delivery. The pricing method applicable to the project delivery method shall be selected:

**Direct Costs:** direct material and labor costs for the prime and all subcontractors

**Indirect Costs:** material sales tax (if applicable) and labor burden; overhead; profit; prime commission on subcontractor work; design contingency\*; escalation to the mid-point of construction; area factor; site factor (if applicable) general and supplementary conditions; bond and insurances.

**Mark -Up:** Calculate mark-ups for the General Contractor in the following hierarchical sequence for all submission phases:

**a. Direct Costs.**

Labor Burden

Sales Taxes

**b. Indirect Costs**

Sub-Contractor

General Contractor

Bond and Insurances

Design Development Contingency

Escalation

**c. Total Estimated Construction Cost**

**Life Cycle Cost Analysis (LCCA):** Where the performance of Life Cycle Cost Analysis forms part of the scope of work or is being offered in support of proposed design options the following guidelines shall be used.

### Life Cycle Cost Analysis (LCCA) Guidelines

#### Selection of Useful Life Parameters

A thirty year (30) useful life is to be used unless otherwise specified on a case by case basis.

#### Discount/Interest Rate

A discount/interest rate of 3 percent is to be used unless otherwise specified.

#### Recommended Approaches

The two most frequent methodologies used to calculate LCCA are annualized costs and present worth costs. Both methods will arrive at an equivalent answer for selection of alternatives. SI recommends the use of the present worth method of Life Cycle Cost Analyses of competing alternative design solutions. The present-worth method requires the conversion of all present and future expenditures to a base line of today's costs. Initial costs are already expressed in present worth.

#### Impact of Escalation:

Department of Energy (DOE) guidelines for escalating future cost increases for fuel will be followed. Indices are prepared by the National Institute of Standards and Technology (NIST) for the DOE Federal Energy Management Program and published annually in NISTIR 85327325.

#### Economic Criteria:

The AE/consultant shall itemize the economic criteria as part of each LCCA analysis for reference in the final report of the VE study proceedings and results. The economic criteria shall clearly reference the values of key parameters and for all significant variables in LCCA analyses.

### Technical Guidelines

An LCCA analysis should be undertaken when the design recommendation has significant impact on future costs. It must be emphasized that the analysis need only cover those items which vary between options under consideration. Items in common can be ignored.

#### **Construction Phase Cost Estimating:**

When changes over \$100,000 are proposed to an existing construction contract, an independent Government Estimate (IGE) must be prepared by OPDC or its authorized consultant (A/E firm or Cost Estimating firm). The Government Estimate is compared to the Contractor's estimate of costs. The Contracting Officer must approve the Contractor's final Change Order proposal before "Notice to Proceed" is authorized. Only when no agreement in costs can be reached between the Contractor and the Smithsonian or when the cost cannot be estimated because of unknown conditions, will Change Orders be considered on a Time and Materials (T/M) basis. Use the standard MS Excel ***SI-Construction Cost Estimate*** template in CSI format, which includes complete, detailed cost itemization and cost summary, and is available at;

[http://www.ofeo.si.edu/ae\\_center/construction.html](http://www.ofeo.si.edu/ae_center/construction.html)

## Definition of Estimate Cost Factors

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### **OFEO Criteria**

The OFEO Cost Engineer, in agreement with the Office of Contracting (OCON), establishes and maintains guidance criteria for use by A/E's in the preparation of estimates.

In preparing cost estimates, the A/E shall be permitted to include contingencies for design, bidding and price escalation; to determine what materials, equipment, component systems and types of construction are to be included in the Contract Documents; to make reasonable adjustments in the program and scope of the Project; and to include in the Contract Documents alternate bids as may be necessary to adjust the estimated Cost of the Work to meet SI's budget. The A/E's cost estimate shall be based on current area, volume or similar conceptual estimating techniques.

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### **Wage Rates**

A current list of Davis-Bacon wage rates, prepared by the US Department of Labor, can be accessed at <http://www.wdol.gov/dba.aspx> for all geographic areas where the Smithsonian Institution (SI) has construction activity. These wage rates are used in determining the minimum direct labor costs on federally funded projects.

The wage rates used should be included, or otherwise identified, in the estimate or estimate report.

**Material Tax and Labor Burden**

Material Tax and Labor Burden is composed of:

1. Material and equipment taxes as applicable.
2. Labor Burden for supervisory personnel (salaried people working in field and office) shall consists of:
  - Social security and Medicare taxes
  - Federal unemployment taxes (FUTA)
  - State unemployment taxes
  - Major medical, pension, vacation, disabilities and any other additional benefits provided by the employer
  - Workmen's compensation
  - General and Excess liability
3. Labor Burden for Craft Labor (covered by wage scales) shall consists of:
  - Social security and Medicare taxes
  - Federal unemployment taxes (FUTA)
  - State unemployment taxes
  - Health, welfare and pension (fringes)
  - Workmen's compensation
  - General and Excess liability

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**Overhead and Profit**

Generally, estimates shall show appropriate additions to the direct cost of the work for overhead and profit for both the Prime (General Contractor) and all Subcontractors. The A/E shall determine the level of overhead by considering the size and complexity of the project, risk factors and current local market conditions. When lump sum quotes from subcontractors are shown in the estimate they shall be fully inclusive of overhead and profit.

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**Prime Commission on Subcontract or Work**

Generally, the Prime Contractor is allowed a commission (mark-up) on subcontractor work. The A/E shall use his experience and current local market conditions to establish the appropriate level of this mark-up. This factor may be adjusted at the discretion of the OFEO Cost Engineer or OCON.

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**Escalation**

As required by the FAR the A/E will include escalation from the date of the estimate to the mid-point of construction. The escalation factor and mid-point of construction shall be enumerated in the estimate.

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**Area Factor** This represents an adjustment to costs for material and labor outside the Washington, DC, metropolitan area. These area factors may be derived from acceptable historical cost indices, such as Engineering News Record and R.S. Means City Cost Index. Washington, DC, is to be used as the baseline (factor 1.00).

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**General and Supplementary Conditions** This is a variable component taking into account the various requirements of generic and project-specific conditions. This may include: mobilization and demobilization; personnel/property protection and barricades; ingress and egress to the site; demolition and removal of debris; testing; contractor and guard overtime; off-hours work; supervision; project management; field office; office overhead; construction equipment and any other condition affecting the Contractor's ability to perform the Work.

Complete and detailed line item estimates for General and Supplementary Conditions shall be provided with all construction document phase estimates.

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**Bonds and Insurances** The A/E shall estimate and include the cost of all Bonds and Insurances the contractor is required by contract to possess. The estimate shall show these amounts as separate line items.

**Design Development Contingency** The A/E shall provide a design development contingency considered reasonable for that stage of design development. The A/E shall provide the rationale to support this contingency in his qualifications statement.

Design Development Contingency lowers in value as the project design advances and the scope definition is further refined. As a general rule SI uses the following values:

***Schematic:*** Provide a contingency of 20-25%

***Design Development:*** Provide a contingency of 10-15%

***Construction Documents:*** Provide a contingency of 10% reducing to 0% at final completion of construction documents.

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**Construction Contingency** This is a variable markup that typically ranges from 5% to 20% in a Project Budget Estimate to allow for a construction reserve to cover unforeseen and unknowable circumstances particular to the project that occur during the construction phase.

*Typically SI will carry the Construction Contingency “below the line” and the AE is not expected to include this in his estimates unless directed otherwise.*

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If SI's budget at the conclusion of the Construction Documents Phase Services is exceeded by the lowest bona fide bid or negotiated proposal, SI shall:

1. give written approval of an increase in the budget for the Cost of the Work;
2. authorize rebidding or renegotiating of the Project within a reasonable time;
3. terminate the Project;
4. in consultation with the A/E, revise the Project program, scope, or quality as required to reduce the Cost of the Work; or
5. implement any other alternative.

If SI chooses to proceed, the A/E, without additional compensation, shall modify the Construction Documents as necessary to comply with SI's budget at the conclusion of the Construction Documents Phase Services, or the budget as adjusted. The A/E's modification of the Construction Documents shall be the limit of the A/E's responsibility.

## Estimate Formats and Procedures

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**General Formats** All estimates shall consist of back-up **worksheets** and a cover **summary** sheet. The worksheets for construction and proposed change estimates shall organize item descriptions according to Unifomat II.

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**Procedures** A/E's shall consult with the OFEO Cost Analyst prior to beginning design projects. Historical data, cost factor information and other guidance criteria will then be made available. In addition, the A/E may also obtain MS EXCEL spreadsheet files with standard OFEO estimating formats.

**EXCEL spreadsheet files** The Standard Construction Cost Estimate Summary format and Cost Estimate Worksheet format are available from OFEO in both hard copy form and on diskette.

<b>File Name</b>	<b>Sheet Name</b>	<b>Sheet Description</b>
Construction Cost Summary.xls	Construction Cost Estimate Summary	Summary sheet for all direct and indirect costs, mark-ups and final total construction cost

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**DISCLAIMER** OFEO does not guarantee the integrity of the files, formats, formulas nor linkages between spreadsheets. Calculations should be manually spot checked. Accuracy of calculations is the responsibility of the spreadsheet user.

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**Attachments** Construction Cost Estimate Summary

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**Questions** See COTR

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