



Cost Estimating Requirements

Handbook

National Park Service

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CHAPTER 1. Introduction

- 1.1 **Purpose** This handbook supports construction programs within the National Park Service. Technical and administrative requirements are presented for the development, preparation and submittal of cost estimates during a construction project's planning, design, and construction process. Through adherence to this handbook:
- A. Project costs will be better managed to authorized and appropriate limits.
 - B. Project costs and scope changes will be easier to manage and track through the planning, design and construction process.
 - C. Helps assure the maintenance of a NPS cost data base, which can be used to help plan and estimate future projects.
- 1.2 **Application** The instructions and criteria contained herein are to be incorporated by reference with design A-E and other professional services contracts that involve cost management and/or estimating tasks. Criteria that describe practices and documentation requirements, apply to all sources of professional services, whether provided through contract or NPS estimators.
- 1.3 **Cost Management Policies**
- A. **Cost Effectiveness.** In accordance with the national Energy Conservation Policy Act, and Executive Order 12759, Federal construction shall be designed with the objective to achieve the lowest life cycle cost, while assuring delivery of programmed performance requirements.
 - B. **Design Within Budget** Unless otherwise specified in the design contract documents, the A-E shall design the project so that bid construction costs will not exceed funding limitations established as the "Basis of Fee Negotiation." Federal Acquisition Regulation (FAR 36.609-1) applies, conditionally requiring the A-E to redesign the project at his own expense to assure that a responsive construction bid amount will be within funding limitations.
 - C. **Cost Data Bases** NPS is to maintain a historical cost data base of its completed new construction and repair/rehabilitation projects to support functional area/asset type unit costs within the National Park Service Class C-Benchmark Cost Data Guide. Construction cost data shall also be evaluated to support a UNIFORMAT II Level 3 building system cost database.

CHAPTER 2. Design Estimating Submissions

- 2.1 Submission Levels Historically, the cost estimating industry has recognized 3 levels of estimating.¹ The National Park Service also recognizes these three levels of estimating (Class C, Class B and Class A). Definitions, Samples and Templates for each of these estimate levels can be found in the Appendix portion of this document,

The following is a list of required cost estimate and cost related submissions during the design process and the level of estimate required:

Pre-Design

- Class C Estimate
- Cost Comparability Data Collection
- Scope & Cost Validation Report

Schematic Design

- Class C Estimates for VA Alternatives
- Class B Estimate for Preferred Alternative
- Cost Comparability Analysis

Design Development

- Updated Class B Estimate
- Market Survey

Construction Documents

- Contract Price Schedule
- Class A Construction Cost Estimate

- 2.2 Phased Projects. For project work divided into more than one construction contract (phase), the minimum level of cost estimating submissions shall be based upon the summed costs of all phases. Each phase shall be supported by separate cost estimating submissions, accompanied by an overall project estimate summary.
- 2.3 Multi-Structure (Multi-Asset) Estimates Each Structure (Asset) shall be broken out separately in the estimate and the estimate summary. Multiple structures or assets shall never be included within the same contract price item. Reference: Section 3.2 Estimating Formats.
- 2.4 Optional Contract Line Items Where project design requires construction contract line items as options, each option shall be estimated as a separate contract line item. Reference: Section 3.2 Estimating Formats.

Optional Contract Line Item is defined as: A contract line item or series of contract line items that may be added to the contract during the award phase or after award (within a time frame specified in the contract). This may take the form of new work or alternative materials from those covered in the base contract price.

¹ A new 5 level estimate system is being integrated into the industry at this time.

Optional Contract Line Items generally, do not come into play with project costs until the Class A estimate. It is important that the designer provide a proposed contract price schedule with the construction documents to the estimator prior to preparation of the class A estimate.

- 2.5 Resolution of NPS Comments NPS review comments of A-E estimate submissions shall be resolved in writing in accordance with other design submission review/comment response requirements defined within the task order scope of services.

Chapter 3 Cost Estimating Practices

- 3.1 Cost Management Cost management is the process of estimating, control, and data analysis to establish a continuous cycle of cost information for the efficient implementation of projects. All types of projects can benefit from the appropriate application of cost management techniques, not just the biggest companies. Even Shakespeare noted the choices one makes in business and projects:

When we mean to build, We first survey the plot, then draw the model; And when we see the figure of the house, Then we must rate the cost of the erection; Which if we find outweighs our ability, What do we then but draw anew the model in fewer offices, or at least desist to build at all. --Shakespeare, Henry IV, Part 2

It is imperative that the cost of NPS Construction Projects remains within budget throughout the planning, design, and construction processes. The NPS tries to incorporate cost management methodologies into this process, by requiring:

- A. **Independent Cost Estimate Preparation:** Estimates must be prepared independently of the design team for all capital improvement projects. Estimates shall be prepared under the direct supervision of a professional cost estimator whose full time or primary duty is that of construction cost estimating.² The estimator's work shall be influenced by the design team only to the extent that drawings and specifications are modified.
- B. **Cost Comparability:** A good metric or mensuration of managing project construction cost is to compare estimated project costs with the costs of recent similar construction projects in the same area. Information should reflect the following:
- Comparable projects should be broken down by primary and substantial secondary assets and respective unit costs. For example: cost per square foot of building, cost per linear feet of trail, cost per square foot of parking area, cost per linear foot of pipe, and cost per linear foot of roadway.
 - Comparable projects should reflect regionalized costs – comparable projects are projects that are located in a close proximity to the proposed project to reflect similar regional or local cost variables.
 - Comparable projects should reflect construction costs within 5 years and be adjusted for inflation to present time.

² Certification. Although not required, certification by the Association for the Advancement of Cost Engineering (AACE) as a cost engineer or value engineer will be accepted as evidence of someone whose primary duty is that of estimating.

- Comparable projects should provide a good representation of similar projects constructed by other Federal, state, or local government agencies and private sector investments.

Standardized forms for a Cost Comparability Analysis can be found in Appendix F. A checklist for data collection and a sample of collected Cost Comparability Data can be found in Sample 4 at the end of this document. A Sample of a Cost Comparability Analysis can be found in Sample 5 at end of this document.

- C. **Scope and Cost Validation Report:** This submittal is to verify the validity of the PMIS scope and budget to achieve a viable project. The validation document must contain the following information:
1. **EXISTING CONDITIONS** - Does the PMIS Project Statement adequately describe the current level of performance and/or functionality being provided (i.e. describe current conditions)? If not, provide additional description(s) of the existing performance and/or functionality, as necessary, to complete current conditions.
 2. **IDENTIFIED PROJECT GOALS** - Does the PMIS Project Statement adequately describe the proposed level of performance and/or functionality required? If not, provide additional description(s) of any proposed level of performance and/or functionally required that is not described in the PMIS Project Statement.
 3. **REQUESTED SCOPE** - Does the PMIS Project Statement adequately describe the capital investments needed to optimally close the performance gap between existing performance and required performance levels? Provide description(s) and Class C Construction Cost Estimates for each capital improvement required to optimally close the performance gap and which were not shown in the PMIS Project Statement. For each capital improvement, clearly identify the benefits accrued to the project by adding the capital improvement(s) to the existing PMIS Project Statement SOW. Provide a side by side comparison of existing PMIS Project Statement scope and cost estimate and new proposed scope and cost estimate required to close the functional needs.
 4. **FUNDING ANALYSIS** - Does the existing budget (PMIS Class C Cost Estimate) provide a viable solution sufficient to solve the PMIS stated problem (SOW)? If the PMIS Project Statement SOW and budget do not fully close the required performance gap, provide an analysis of what performance and/or functional improvements can be provided within the existing budget (PMIS Class C Cost Estimate), and what performance and/or functional improvements would be deleted. Analysis should include a description of the impacts related to deleted work.

A copy of the Scope and Cost Validation Form can be found in Appendix E of this handbook.

- D. Appropriately Scheduled Cost Estimate Submittals: The class (C, B, or A) of an estimate is not defined by the timing of its submittal, but rather by the completion level of the design and construction documents, that it is submitted with. If the design documents submitted with a schematic design level are incomplete and do not meet schematic design submittal requirements in either whole or part, the construction cost estimate level cannot be better than a Class C (instead of a Class B), in whole or part.

The cost estimate submittals outlined in section 2.1 of this document, allow for NPS review and comment of project construction costs a minimum of 5 times during the design process of a project.

- 3.2 Estimating Formats [Work Breakdown Structure (WBS)] It is important that cost estimates be formatted consistently and orderly to facilitate design cost analysis, monitoring of costs from the programming phase through the completion of construction documents, and analysis/negotiation of construction proposals. A WBS is used to organize (index) projects from one main and relatively large entity into many smaller, defined, manageable and controllable units. The WBS can be viewed as an organization chart of the main project components of the project.

- A. Asset Categories: The National Park Service has classified and defined 35 asset categories in their asset management program and are listed in Appendix G. All levels of estimates shall be broken down to the individual asset at its top hierarchy.
- B. Two cost estimating formats are in wide use today, UNIFORMAT II and CSI MasterFormat95. Depending on the project's stage of development either one or both may be required. The two classification systems relate to each other as represented in Appendices H and I.

1. UNIFORMAT II Government Services Administration (GSA), in conjunction with the American Institute of Architects (AIA), established this twelve part cost classification format, corresponding to major building systems. This format is particularly suited to project planning and early design estimating, as well as, for work and pay schedules during construction. This approach is necessary as detailed design take-off assessments/measurements are not possible in a project's early development. UNIFORMAT II is represented in Appendix H.

- a. Levels: Criteria references for required estimating detail are designated by UNIFORMAT II Levels, corresponding to the assigned cost element³ and number. [For example, the UNIFORMAT II cost element "D" (Services)

³ Elements, as defined here, are major components common to most buildings and related site work. Elements usually perform a given function, regardless of the design specification, construction method, or materials used.

represents Level 1, with “D20” (Plumbing) representing Level 2, and “D2010” (Plumbing Fixtures) representing Level 3, and “D2013” (Lavatories) representing Level 4]. Where a UNIFORMAT II Level is specified, the estimator must address all project related cost elements at that level with supporting backup cost estimate data at a greater degree of detail, when available or applicable.

- b. Detailed Backup Data: Cost estimating back-up materials for specified UNIFORMAT II Levels should be presented in a systematic organization (preferably MasterFormat95).

2. MasterFormat95. Supported by the Construction Specifications Institute (CSI), this cost element classification system organizes costs according to material and trade designations. MasterFormat95 is aligned with CSI’s sixteen part specification system as represented in Appendix I. MasterFormat95 is most appropriate for cost estimating applications that have construction documents (drawings and prescriptive specifications), which facilitate detailed take-off measurements and quality assessments. This format will typically be required for Class A Construction Cost Estimates with Construction Documents preparation and those estimates relating to construction modifications. MasterFormat95 may also be used for formatting detailed backup data for Class B Estimates with the Design Development Drawings.

C. Contract Line Items

1. Construction of New Assets Projects: A general guide for contract line items for new construction projects is to make each asset a separate contract line item. There are several asset categories that would tend to have multiple contract line items per asset. For example: a project for construction of a new wastewater utility system would likely have separate contract line items for portions of the system (i.e., sewage collection system, wastewater treatment system, disposal or discharge system). In some situations, additional contract line items would be conducive to efficient proposal analysis/negotiation and construction payment (i.e., various sizes of pipes, types of pipe). More contract line items are not always better; balance of the proper quantity of contract line items is important for acquiring the best contract line proposals.

2. Repair/Rehabilitation of Existing Assets Projects: A general guide for contract line items for repair/rehabilitation projects repair or rehabilitation work on each system (UNIFORMAT II, Level 3) within the asset should be designated as a separate contract line item. For example: Contract Line Item 1 could be replacement of windows, Contract Line Item 2 could be replace roof shingles, etc. As an alternative to contract line items defined according to building system (UNIFORMAT II), contract line items may also be defined by area of work within an asset. For example: Contract Line Item 1:

Refinish vestibule surfaces, Contract Line Item 2: Replace Electrical in West Wing, etc. In some situations, additional contract line items would be conducive to efficient price proposal analysis/negotiation and construction payment (i.e., various sizes of pipes, types of pipe. More contract line items are not always better; balance of the proper quantity of contract line items is important for acquiring the best contract price proposals.

3.3 English Unit Costs: A/E design calculations and drawing/specification measurements will typically be represented in English units of measurement unless otherwise addressed within contract documents. As such, estimators shall be expected to convert between English and Metric units as necessary to utilize existing cost data bases/sources. Unless otherwise provided within contract documents, all costs represented within cost estimates shall be in English units.

3.4 Unit Pricing: Unit prices shall be based upon construction costs as if the overall construction contract were awarded on the date of the estimate. Unit costs shall include mark-ups as prescribed below.

A. Class C Construction Cost Estimates: Mark-ups shall be applied to the end of the estimate as shown in Appendix A.

B. Class B Construction Cost Estimates: Unit costs shall include overhead and profit allowances only at the sub-contactor or installing contractor level. All other mark-ups shall be applied to the end of the estimate as shown in Appendix B.

C. Class A Construction Cost Estimates: Mark-ups associated with project location should be allocated to unit costs. Unit costs shall include overhead and profit allowances only at the sub-contactor or installing contractor level. Mark-up for state and local levied taxes shall be allocated to unit costs on materials. All other mark-ups shall be applied to the end of the estimate as shown in Appendix C.

3.5 Cost Estimate Data Sources: The estimator shall provide a general statement, describing sources of cost data (unit costs, system costs and quantities) used within the estimate. This is not to be construed as requiring individual source references for each itemized cost element. The estimator shall be able and willing to discuss the source and applicability of any quantity or unit cost within an estimate. This statement should be located on the Basis of Estimate page of the estimate.

3.6 Estimate Mark-ups

A. Location Factors: The location of a construction project can greatly influence the cost of labor, equipment and material. Location factor can be broken down further into 3 separate location related sub-factors: *Published Location Factor*, *Remoteness Factor*, and *Federal Wage Rate Factor*.

1. Published Location Factor: There are many published location factors available (i.e., RS Means, ENR, McGraw Hill, etc.). RS Means publishes location factors for over 500 U.S cities. These factors indicate the cost of commercial construction for each of these locales as compared to the national average. The 2006 range of these factors is from 131.9 (New York, NY) to 67.0 (Clarksdale, Mississippi), indicating that the cost of construction would be 31.9 percent more in New York City, and 33 percent less in Clarksdale than the national average. Our A/E design firms and their estimators are encouraged to know and utilize appropriate published factors for regional market economics for their project estimates, as appropriate for the cost data that they have utilized.

2. Remoteness Factor: A substantial percentage of the national park units are not located in a major city or commercial center as represented in published location factors, as described above. Even NPS units such as Statue of Liberty National Monument is remote from New York City or Newark, New Jersey, since it is on an island in New York Harbor. There are additional cost consequences to the project, because of location that affects both material and labor costs. In a more straightforward way, the nearest published location factor to the South Rim of Grand Canyon NP is Flagstaff, Arizona which is located approximately 85 miles away. This distance will have an effect on the cost of material and labor. This remoteness factor should be considered and accounted for in the construction cost estimates prepared for NPS projects.

3. Federal Wage Rate Factor: A construction contractor awarded a NPS construction project, at a minimum, must pay his employees according to the appropriate county Davis-Bacon wage rates. In areas, with strong labor unions the Davis-Bacon wage rates generally exceed prevailing wage rates reflected in the published location factors. Therefore, there needs to be an adjustment to these factors to reflect the government wage rates requirements. This location factor pertains and impacts only the labor costs on a project and therefore should be applied to the labor portion of the estimate. [As a rule of thumb: Labor Costs equal approximately 40 percent of total base costs for new construction projects and 65 percent of repair/rehabilitation projects.]

B. Design Contingencies: This mark-up relates to the accuracy of the estimate and completeness of the design/construction documents. Design Contingencies should NOT be confused with the Design Cost or Construction Contingencies (reference Appendix K). Design Contingencies vary by project, but also vary (gradually reducing) by where there project is in the design process. At the preliminary stages of planning and design it is very difficult to determine the complete scope of the project in detail, therefore the design contingency is set at a high percentage.

Typical ranges for design contingency are:

Class C Cost Estimate – Conceptual Design	15 to 50 Percent
Class B Cost Estimate – Schematic Design	10 to 20 Percent
Class A Cost Estimate – Construction Documents	0 to 10 Percent

C. General Conditions (General Requirements):

1. Standard General Conditions: These are the costs to the government from the contractor which are basically the cost items defined in the Division 1 specifications for a project. The costs associated with temporary utilities, field offices, fencing, field engineering, operation and maintenance manuals, etc. are all included as standard general conditions. Also included in the General Conditions percentage should be the cost of construction permits, bonds, and insurance. Generally, the Construction Contractor passes the cost of standard general conditions on to the government through contract line items, but they are really indirect costs of the construction of the project. Standard general conditions costs run from 4 to 20 percent depending on the size, location and complexity and other variables of the project and estimate.

2. Government General Conditions: Not included in *Standard General Conditions* is the cost of doing work for the United States Government, and the National Park Service. Many of these government costs are attributable to increased administrative requirements and quality requirements along with sensitivity to the NPS mission of protecting the cultural and natural resources while allowing the public access and enjoyment thereof.

D. Historic Preservation Factor: Many projects within the National Park Service involve work in and around historical structures. It is part of the National Park Service's mission to preserve and maintain the integrity of the original architectural construction and historical fabric of these structures. This often creates additional access, control and protection processes and problems during construction. Material costs are often increased significantly because of care to select compatible materials. The range for this factor is significantly variable and should be set at the estimator's professional discretion.

E. Overhead: Overhead is the cost that a contractor has for staying in business. A general contractor has expenses not directly related to the construction of a project, but vital to the contractor's business operations. These include fixed overhead (Federal and State Unemployment costs, Social Security Tax, Builder's Risk Insurance and Public Liability Costs) and variable overhead (Worker's Compensation Insurance, Main Office Overhead, etc.).

F. Profit: Profit is variable on size of job, and a contractor's annual billing. Contractors generally take more profit on a smaller job. Also consideration

should be given to the fact that, the installing contractor(s) (sub-contractors) will also charge profit on a project.

G. Sales Tax: Contractors are required to pay State Sales Tax on materials and rental equipment for construction projects in most of our parks.

H. Contracting Method Adjustment: The National Park Service seldom awards construction contracts based on the lowest price proposal of full and open competitive bid solicitations. The contracting methods most often employed by the NPS add additional cost to construction projects as compared to a competitive price proposal solicitations, because these methods limit competition. The primary procurement method is competitive negotiation where award is based on negotiating a price with the best technically-qualified contractor. The NPS also awards many contracts through the Small Business Administration's 8-A program. Depending on the Procurement method chosen, cost can be affected as much as 15 percent.

- 3.7 Adjusting for Escalation All unit prices within the estimates should be priced using current (date of estimate) costs. An adjustment for inflation shall be added to the bottom line total of the estimate. This escalation shall be based on careful analysis of current market trends and published construction economics predictions. Escalation shall be dated to the proposed mid-point of construction.

Chapter 4. Standards of Conduct

- 4.1 Standards. The standards of practice described within the Canons of Ethics, published by the American Association of Cost Engineers, International (AACE) shall be applied to all estimating services. This document is available through the AACE, International, 209 Prairie, Morgantown, West Virginia, 26501.

- 4.2 False Statements. NPS contractor's are advised that in accordance with 18 USC 1001, reflecting provisions of the False Statements Act, "Whoever, in any matter within the jurisdiction of any department, or agency of the United States knowingly and willfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statements or representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement, or entry, shall be fined not more than \$10,000 or imprisoned not more than five years or both."

APPENDIX

Appendix A

CONCEPTUAL (CLASS C) CONSTRUCTION COST ESTIMATES

This Appendix describes the estimating products and services to be prepared at the concept level of design for a construction project. The following estimate submittals are considered conceptual (Class C) estimates:

- a. General Management Plans⁴
- b. Cost Estimates for Condition Assessments (FMSS and CESS)⁵
- c. Project Management Information System (PMIS) Cost Estimates
- d. Programming – Validation of PMIS Estimate (Pre-design Phase)
- e. Schematic Design Concepts Estimates (Design Alternatives for Value Analysis Study, during Schematic Design Phase)

Conceptual (Class C) Construction Cost Estimating

Defining a Class C Estimate: The design and construction industry refers to these estimates as *conceptual* or *order-of-magnitude* estimates and are generally used for:

- Feasibility studies
- Development of project scope and program
- Selection from among alternative designs

A Class C estimate is a conceptual cost estimate based on square foot cost of similar construction. These estimates are generally prepared without a fully defined scope of work (SOW). Support information should include:

- Anticipated square footage and building type
- Anticipated site development, including existing and proposed utilities
- Anticipated mechanical and electrical needs (often based on square footage of building or anticipated power load)
- Anticipated structural systems
- Anticipated site utility requirements and utility systems

The accepted industry **accuracy range** of Class C estimates is –30% to +50 %. Therefore a \$1,000,000.00 Class C estimate figure actually has a range of: \$700,000.00 to 1,500,000.00.

Typical Design (Estimating) Contingency used for Class C estimate: 15 to 30%.

⁴ DO-2 has established a need for a Class D estimating guide to be developed for GMP cost estimates.

⁵ FMSS Facility Management Software System and CESS Cost estimating Software System – systems created and maintained by the Facility Management Program Division of the National Park Service to manage the maintenance requirements of NPS facilities (Assets).

Work Breakdown Structure for Class C Estimates

A. Work Breakdown Structure (WBS) for Class C Estimates shall be formatted in outline form with Primary Divisions (I, II, III, etc.) by **Asset** (Building, Road, Bridge, etc.) and Secondary Divisions by measurable major systems or portions of Asset (i.e., pedestrian paving, distribution pipe, etc.) For example, the estimate for a project to construct a trailhead parking area with comfort station may have a WBS as follows:

I. Gravel Parking Area (Area or # of Parking Spaces)

- a. Gravel Surface [including grading, etc.] (Area)
- b. Fence Split Rail (Length)
- c. Curb wooden (Length)
- d. Signage (# or area)

II. Comfort Station – Vault type (Area)

III. Gravel Access Road (Width and Length)

B. Estimate Mark-ups for Class C Construction Estimates should be shown at the end of the estimate as multiples of subtotals (see Sample Class C Estimate Sample 1).

- ✓ Federal Wage Rate Factor – Percentage shall be applied to Labor Cost portion of Direct Construction Cost Subtotal [Rule of thumb: 40 Percent – New Construction Projects and 65 Percent – Repair/Rehab Projects]
- ✓ Design Contingencies – Percentage shall be applied to Direct Construction Cost Subtotal [Class C 15 to 50 Percent]
- ✓ Standard General Conditions – Percentage applied to Direct Construction Cost Total
- ✓ Government General Conditions – Percentage applied to Direct Construction Cost Total
- ✓ Other Mark-ups – see sample Class C Estimate

C. Horizontal Format for the estimate should include the following **5 columns** (minimum standard):

Item Description - Item Quantity – Unit of Measure - Unit Cost – Total Cost.

D. Template (Sample) for Class C Estimates is provided on the NPS Project Workflows website at <http://www.nps.gov/dsc/workflows/publicforms.htm#ds>

Submittal Package The estimate submittal package shall contain the following at a minimum:

A. Basis of Estimate Statement: This page(s) of the estimate doubles as a cover page for the estimate. The Basis of Estimate statement page should include the following items:

- ✓ Title of Project
- ✓ Park Name and Location within park, if applicable
- ✓ Date of Estimate
- ✓ Estimators Name, Company, Address and Contact information
- ✓ List of Supporting Material referenced for Estimate
- ✓ Source of Cost Data
- ✓ Short Descriptions/Justifications for Mark-ups, Add-ons, Escalations used in estimate
- ✓ Comments and Assumptions regarding estimate or supporting material.

B. Estimate: Estimate should be formatted as described above and show all cost items, subtotals, mark-ups and total.

Appendix B

BUDGETARY (CLASS B) CONSTRUCTION COST ESTIMATES

This Appendix describes the estimating products and services to be prepared for a Class B Construction Cost Estimate. Class B Estimates are included in the following design submittals:

- a. Schematic Design of Preferred Design
- b. Design Development

A project must have a Class B estimate when submitted for Development Advisory Board Review and Director Decision. It is at this juncture that a decision is made to one of four ways for the future of a project (Cancel project, Revise design, Proceed with design, or Approach Congress with a Budget Request for more funds).

Budgetary (Class B) Construction Cost Estimating

The design and construction industry refers to Class B Estimates as *budgetary* estimates and are generally used for:

- Budgeting or construction forecasting
- Authorization for full or partial funding

A Class B estimate is a **combination** of lump sum (conceptual costs) and unit costs. Typically, project designs have been developed far enough to define major systems (i.e., roof type, HVAC system type, etc.) of the project. Support information shall include:

- Site Design (existing and proposed utilities, grading, planting, etc.)
- Building Design (plans, elevations and typical wall sections showing structural systems, proposed room finish or function).
- Schematic Mechanical and Electrical Systems Design (may be in the form of written analysis, based upon available information).
- Outline Specifications - including cut sheets of proposed equipment, fixtures or specialty items, which may significantly influence estimate.
- Initial Quantity Take-offs for utilities, site, and building systems (civil, landscape, and architectural).

The accepted industry **accuracy range** of Class B estimates is –15% to +30 %.⁶ Therefore a \$1,000,000.00 Class B estimate figure actually represents a range of: \$850,000.00 to \$1,300,000.00.

Typical Design (Estimating) Contingency used for Class B estimate: 10 to 20%.

⁶ AACE International Recommended Practice No. 18R-97, Figure 31a (ANSI Standard Z94.0)

Work Breakdown Structure for Class B Estimates

A. Work Breakdown Structure (WBS) for Class B cost estimate shall be formatted in outline form with Primary Divisions (I, II, III, etc.) by **Asset** (Building, Road, Bridge, etc.) and Secondary Divisions (A10, A20, B10, B20, etc) in accordance with **ASTM UNIFORMAT II Level 2** (<http://www.uniformat.com/figure1.html> and <http://www.uniformat.com/figure2.html>).

Any support levels of detail costs for each of these categories should be shown when possible. An example of the Class B estimate WBS for the project described for the Class C estimate above would be similar to:

I. Gravel Parking Area

G10 Site Preparation

G1010 Site Clearing

G1030 Site Earthwork

G20 Site Improvements

G2020 Parking Lots

a. curbs, rails, barriers

G2040 Site Development

a. fences

b. signs

G2050 Site landscaping

a. fine grading and soil preparation

b. seeding and sodding

c. planting

II. Comfort Station (vault type)

A10 Foundations

A20 Basement (Vault) Construction

B20 Superstructure (Floor and Roof Construction)

B20 Exterior Enclosure (Walls, Windows, Doors)

B30 Roofing

C10 Interior Construction

C30 Interior Finishes

D20 Plumbing

D30 HVAC

D50 Electrical

E10 Equipment

E20 Furnishings

III. Gravel Access Road

G10 Site Preparation

G1010 Site Clearing

G1030 Site Earthwork

G20 Site Improvements

G2010 Roadways

G2040 Site Development

a. fences

b. signs

G2050 Site landscaping

a. fine grading and soil preparation

b. seeding and sodding

c. planting

B. Estimate Mark-ups for Class B Construction Cost Estimates should be shown at the end of the estimate as multiples of subtotals (see Sample Class B Estimate Sample 2).

- ✓ Federal Wage Rate Factor – Percentage shall be applied to Labor Cost portion of Direct Construction Cost Subtotal
- ✓ Design Contingencies – Percentage shall be applied to Direct Construction Cost Subtotal [Class C 10 to 20 Percent]
- ✓ Standard General Conditions – Percentage applied to Direct Construction Cost Total
- ✓ Government General Conditions – Percentage applied to Direct Construction Cost Total
- ✓ Other Mark-ups – see sample Class B Estimate

C. Horizontal Format for the estimate should include the following 9 columns (minimum standard):

Item Description - Item Quantity – Unit of Measure –Material Unit Cost –
Material Cost – Installation Unit Cost – Installation Price Cost –
Composite Unit Cost – Total Cost

D. Template (Sample) for Class B Estimates is provided on the NPS Project Workflows website at <http://www.nps.gov/dsc/workflows/publicforms.htm#ds>

Submittal Package The estimate submittal package shall contain the following at a minimum:

A. Basis of Estimate Statement: This page(s) of the estimate doubles as a cover page for the estimate. The Basis of Estimate statement page should include the following items:

- ✓ Title of Project
- ✓ Park Name and Location within park, if applicable
- ✓ Date of Estimate
- ✓ Estimators Name, Company, Address and Contact information
- ✓ List of Supporting Material referenced for Estimate
- ✓ Source of Cost Data
- ✓ Short Descriptions/Justifications for Mark-ups, Add-ons, Escalations used in estimate
- ✓ Comments and Assumptions regarding estimate or supporting material.

B. Estimate Summary: Should summarize estimate detail sheet by Asset and UNIFORMAT II Level 2. Summary should have a minimum of 3 cost columns (Material Costs and Installation Costs and Total Costs). Mark-ups should be shown and totaled at the bottom of Estimate Summary.

C. Estimate Detail: Estimate should be formatted as described above and as shown in Sample Class B Construction Estimate.

Appendix C

ACTUAL (Class A) CONSTRUCTION COST ESTIMATES

This Appendix describes the estimating products and services to be prepared for a Class A Construction Cost Estimate. Class A Estimates are included in the following design submittals:

- a. Construction Documents

Construction Document (Class A) Cost Estimating.

Defining a Class A Estimate: The design and construction industry refers to Class A estimates as *detailed, definitive, or construction* estimates. The typical purpose of this type of estimate is:

- Authorization of full funds
- Conducting a cost check of an authorized project
- Presentation of a contract price proposal
- To compare with a contractor's price proposals for negotiations/construction award
- To use as the control budget for construction.

The National Park Service uses Class A estimates at the end of the design process, when the project is ready to be advertised for construction contract. It is often referred to as the **Official Government Estimate**.

This estimate is based on a **complete** quantity take-off from completed construction drawings and specifications. Support information shall include:

- Final Construction drawings and specifications.
- Estimate based on complete quantity takeoffs.
- Final Contract Price Schedule.
- Contractors overhead and profit as well as general conditions shall be shown as a separate cost item on the estimate.

Although we all hope that the Class A estimate is greater than or equal to the awarded contract cost. Industry standards do give an accuracy range for Class A estimates.

The accepted industry **accuracy range** of Class A estimates is -5% to +15 %. Therefore a \$1,000,000.00 Class A estimate figure represents a range of: \$950,000.00 to 1,150,000.00.

Contingencies are generally not used for a final Class A estimate. Sometimes a preliminary Class A is prepared before 100 percent design, and a contingency of 0 to 10% can be used. On rare occasions, a Class A estimate may carry a small

contingency for project unknowns (hazardous materials, unknown excavation, unknown project conditions).

Work Breakdown Structure for Class A Estimates.

A. Class A Estimate shall be a detailed estimate with a Work Breakdown Structure (WBS) formatted in outline form with Primary Divisions (I,II, III, etc.) by **Asset** (Building, Road, Bridge, etc.), and Secondary Divisions (A10, A20, B10, B20, etc) in accordance with **ASTM UNIFORMAT II Level 2** (<http://www.uniformat.com/figure1.html> and <http://www.uniformat.com/figure2.html>), followed by detailed cost items indexed by CSI MasterFormat 95 (16 divisions).

It is very important that the WBS organization correspond with Contract Line Items in the Project Specifications and Contract Price Schedule.

An example of the Class A estimate WBS for the project described for the Class C estimate above would be similar to:

I. Gravel Parking Area [**Contract Line Item 1**]

G10 Site Preparation

G1010 Site Clearing

02230-200-0100 Clearing Brush by hand (acre)

02230-500-1400 Topsoil, remove & stockpile (CY)

G1030 Site Earthwork

02310-100-0100 Finish grading (SY)

02720-200-7000 Prepare and roll sub-base (SY)

02720-200-0100 Aggregate Base Course – 6” deep (SY)

G20 Site Improvements

G2020 Parking Lots

02770-300-0300 Concrete curbs (LF)

02840-800-0100 Timber Parking Barriers (Each)

G2040 Site Development

02820-520-1520 Split Rail Fence (LF)

02870-510-0900 Trash Receptacles (Each)

02880-900-0010 Information Signs (SF)

G2050 Site Landscaping

02910-810-0400 Topsoil, spread from pile (CY)

02920-310-0300 Fine grading and seeding (SY)

II. Comfort Station (vault type) [**Contract Line Item 2**]

A10 Foundations

A1030 Slab on Grade

02315-520-0600 Gravel fill, compacted 6” (SF)

03310-240-5010 Cast-in-place Concrete 6” (SF)

03150-860-5010 Rubber Waterstops (LF)

A20 Basement (Vault) Construction

A2010 Basement Excavation

02315-424-3850 Excavation, Bulk Shovel (CY)

02315-424-1250 Excavation, Front-end Loader (CY)

02315-490-0200 Haul, 6 CY Dump Truck (CY)

02315-120-2000 Backfill, dozer (CY)

A2020 Basement Walls

03310-240-4250 CIP Walls, 8" (CY)
15120-730-0550 Ductile Iron Wall Pipe (Each)

B20 Superstructure (Floor and Roof Construction)...

III. Gravel Access Road [**Contract Line Item 3**]...

B. Estimate Mark-ups (see Appendix) on a class A estimates should be added to the subtotals at Contract Line Item level of the estimate.

- ✓ Location Factors (published, remoteness, and federal wage rate) shall be allocated into individual unit prices.
- ✓ Design Contingency applied to appropriate contract line items if necessary. Design Contingency at the Class A Level should not exceed 10 percent of total Direct Costs.
- ✓ General Conditions (standard and government) for the project shall be broken out in detail (CSI MasterFormat95 level) for a Class A (Government Estimate).
- ✓ Escalations for future assumed inflation should be shown as an end-of-estimate mark-up. Unit costs in estimate shall reflect current (date of estimate) prices.
- ✓ Other Mark-ups – See Sample A Cost Estimate

C. The horizontal format for the estimate should include the following 11 columns (minimum standard):

Item Description - Item Quantity – Unit of Measure –Material Unit Cost – Material Cost – Labor Unit Cost – Labor Cost – Equipment Unit Cost – Equipment Cost – Composite Unit Cost – Total Cost

D. Template (Sample) for Class A Estimates is provided on the NPS Project Workflows website at <http://www.nps.gov/dsc/workflows/publicforms.htm#ds>

Submittal Package The estimate submittal package shall contain the following at a minimum:

A. Basis of Estimate Statement: This page(s) of the estimate doubles as a cover page for the estimate. The Basis of Estimate Statement should include the following items:

- ✓ Title of Project
- ✓ Park Name and Location within park, if applicable
- ✓ Date of Estimate
- ✓ Estimators Name, Company, Address and Contact information
- ✓ List of Supporting Material referenced for Estimate
- ✓ Source of Cost Data
- ✓ Short Descriptions/Justifications for Mark-ups, Add-ons, Escalations used in estimate
- ✓ Comments and Assumptions regarding estimate or supporting material.

B. Estimate Summary: Should summarize estimate detail sheet by Contract Line Item and UNIFORMAT II Level 2. Summary should have a minimum of 11 cost columns:

- ✓ Material Costs
- ✓ Labor Costs
- ✓ Equipment Costs
- ✓ Total Direct Construction Costs
- ✓ Design Contingency
- ✓ General Conditions
- ✓ Overhead
- ✓ Profit
- ✓ Contracting Method Adjustment
- ✓ Inflation Escalation
- ✓ Contract Line Item Totals

C. Contract Price Schedule: Should show each Contract Price Item with Quantities and Units, Unit Price and Total Contract Line Item Price

D. Estimate Detail: Estimate should be formatted as described above and as shown in Sample Class A Construction Estimate.

E. General Conditions: In the Class A Construction Cost Estimate, General Conditions should be itemized, quantified and totaled as a separate section of the estimate. Format shall be as shown in Sample Class A Construction Estimate – Sample 3.

Appendix D

MARKET SURVEY

Application. It is strongly recommended that a Market Survey be conducted to verify that projected unit costs are appropriate and to assure that project delivery assumptions of materials and labor availability are reasonable, for every project anticipated to have an estimated NET construction cost greater than \$4,000,000, or when requested by the NPS project manager .

Survey Approach. The Estimator shall visit the site and local market areas to determine the following:

- Availability of major materials to be in the project
- Capability of local fabricators, pre-cast yards, concrete plants, etc.
- Availability of labor crafts necessary for the project
- Availability of special erection equipment
- Anticipated capacity of local contractors during proposed solicitation period
- Special conditions that may influence price proposals
- Local escalation experience
- Site accessibility

Report Content. Submit a written report (the Market Survey) which shall include:

- Who was contacted
- Location of those contacted in relation to project site
- Date of contact(s)
- Why contact was made
- Information obtained
- A summary assessment with specific recommendations

Scheduling. The market survey should be conducted during design development. The market survey should be submitted with the Budgetary (Class B Estimate) as part of the design development submittal to enable the designer to address/revise design, incorporate price proposal alternates, change construction schedule, or whatever else might be necessary to assure project feasibility.

Appendix E

SCOPE AND COST VALIDATION REPORT

Project Creep. The designer shall identify those project features, systems, equipment, finishes, etc. not specifically mandated by the project's design program. The designer shall identify the source(s) of these design features as to whether it was an unforeseen requirement or requested by contacts. If requested by contacts, identify the individuals involved and their organizational affiliation. Submit these findings to the estimator and the NPS project manager.

Cost Management. If the overall project's budgetary (Class B) estimate exceeds the budgeted estimate, the designer is required to propose cost saving ideas that bring the project within budget. As a separate cost savings task, the designer shall identify at least five cost saving ideas to bring the project at least 5 percent below budget. The estimator shall make a list of proposed cost savings ideas with an order-of-magnitude estimate of savings for each. The designer shall provide narrative on the list of cost savings ideas, including the proposed impact on the project, recommend acceptance or rejection of each cost savings idea with rationale. This analysis shall be submitted in a Cost Savings Report having the following features:

- a. Previous Cost Savings. The first part of the review shall be a report on what cost saving ideas were actually incorporated in the design as a result of recommendations made for any previous submittals.
- b. Estimate Discrepancies. Considering the ECCA Summary, provide a narrative description explaining any cost change greater than 10 percent for each MASTERFORMAT cost category.
- c. Cost Saving Opportunities. Review the design (including structural, mechanical, and electrical systems and computations) to ensure that over design and/or higher cost is not caused by:
 - Excessive spare capacity
 - Unnecessary redundant systems/components
 - Designing for unnecessary expansion
 - Splitting systems/loads
 - Not designing for a degree of risk in lieu of peak conditions
 - Unwarranted factors of safety in sizing equipment/systems
 - Selection of equipment/material sizes from manufacturer's catalogues only in the next size higher than that calculated.

Design Modifications. Identify/discuss changes in design features and/or project scope necessary to bring the project within the construction cost budget. In a separate section, identify changes in design features and/or scope to bring the project 5 percent below the construction cost budget.

Scope and Cost Validation Report



NPS
National Park Service

Preparation Date: _____
Park: _____
PMIS #: _____ Construction Year: _____
Project Title: _____

Financial Data

PMIS Class C Construction Cost Estimate: \$000,000.00 (net)
Project Program Class C Construction Cost Estimate: \$000,000.00 (net)

See "[Scope and Cost Validation Documentation](#)" definition for additional information.

Answers to the following questions shall not exceed two pages per numbered question.

1. EXISTING CONDITIONS - Does the PMIS Project Statement adequately describe the current level of performance and/or functionality being provided (i.e. describe current conditions)? If not, provide additional description(s) of the existing performance and/or functionality, as necessary, to complete current conditions.
2. IDENTIFIED PROJECT GOALS - Does the PMIS Project Statement adequately describe the proposed level of performance and/or functionality required? If not, provide additional description(s) of any proposed level of performance and/or functionality required that is not described in the PMIS Project Statement.
3. REQUESTED SCOPE - Does the PMIS Project Statement adequately describe the capital investments needed to optimally close the performance gap between existing performance and required performance levels? Provide description(s) and Class C Construction Cost Estimates for each capital improvement required to optimally close the performance gap and which were not shown in the PMIS Project Statement. For each capital improvement, clearly identify the benefits accrued to the project by adding the capital improvement(s) to the existing PMIS Project Statement SOW. Provide a side by side comparison of existing PMIS Project Statement scope and cost estimate and new proposed scope and cost estimate required to close the functional needs.
4. FUNDING ANALYSIS - Does the existing budget (PMIS Class C Cost Estimate) provide a viable solution sufficient to solve the PMIS stated problem (SOW)? If the PMIS Project Statement SOW and budget do not fully close the required performance gap, provide an analysis of what performance and/or functional improvements can be provided within the existing budget (PMIS Class C Cost Estimate), and what performance and/or functional improvements would be deleted. Analysis should include a description of the impacts related to deleted work.

Appendix F

COST COMPARABILITY DATA COLLECTION AND ANALYSIS

Standardized forms for Cost Comparability Analysis are included on the following pages.

A checklist for Cost Comparable Data Collection and a Sample of Collected Project Data are provided in Sample 4 in the back of this handbook or can be accessed on the NPS Design Workflows website: <http://www.nps.gov/dsc/workflows/dbbpre design.htm>

A Sample of the Cost Comparability Analysis has been provided in Sample 5 in the back of this handbook.

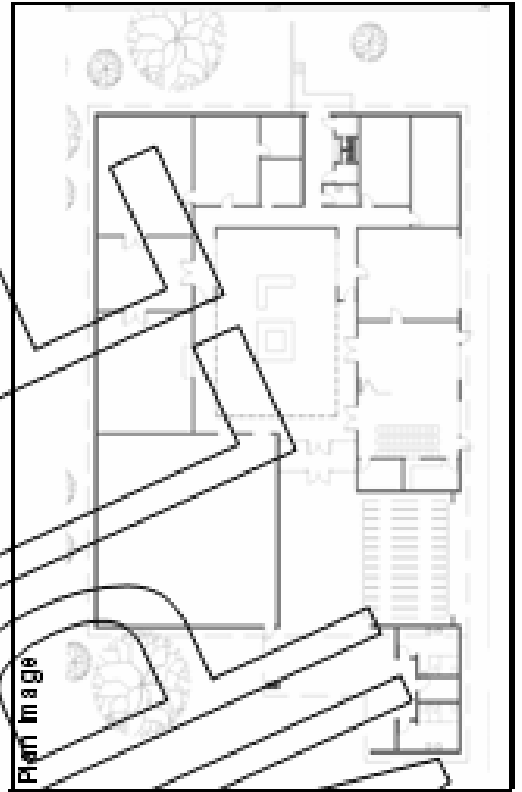
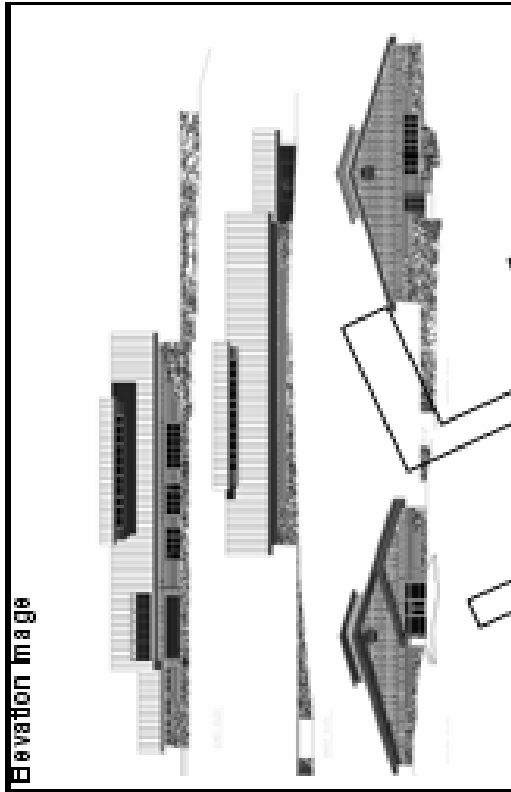
Cost Comparability Analysis (Comp 1)

NPS



National Park Service

<p>Project Title: Roger Anderson Visitor Center at Deep Canyon State Park</p>
<p>Location: Sixty miles north of Fresno, California</p>
<p>Year Completed: 2008</p>
<p>Program Summary: ORIENTATION Orientation of the visitor center on the site is dictated by the view of Sheep Rock and the relationship of building functional space to site vehicular and pedestrian circulation. Solar building orientation will be studied. Site visual and spatial separation of visitor and employee functions will be examined. Logical and sequential movement for both vehicular and pedestrian movement through the site and building will be achieved. CONCEPT AND PLAN The visitor center's major purpose is to provide building space for the protection of geological resources of the Roger Anderson Basin and provide for, and promote the scientific and public understanding of these resources.</p>



Plan image

Cost Comparability Analysis

NPS



National Park Service

Comp 3

Comp 2

Comp 1

Current NPS Project

PMIS # 04567

Project Title	Thomas Condon Paleontology Center at John Day Fossil Beds NM	Bridge Creek Nature Center	Flagstaff Mountain Visitor Center	Warm Springs Nature Center
Location	Central Oregon	Central Oregon	Central Oregon	Central Oregon
Year Completed	2006	2004	2002	2003
Construction Type ¹	New	New	New	New
Primary Asset Category ^{2,3}	+100 Building	+100 Building	+100 Building	+100 Building
Primary Asset Size (Quantity)	11000	12700	8388	14000
Unit of Measure	Square Feet	Square Feet	Square Feet	Square Feet
Cost of Primary Asset	\$2,800,000.00	\$3,500,000.00	\$1,467,983.00	\$3,700,000.00
Unit Cost of Primary Asset	\$254.55	\$197.74	\$219.17	\$264.29
Second Asset Category	3100 Maintained Landscapes, 1300 Parking Areas, 5000 & 5200-Water and Waste Water Systems	7100 Exhibits	3100 Maintained Landscapes, 1300 Parking Areas, 5100 & 5200 Water and Waste Water Systems	2100 Trails
Second Asset Size (Quantity)	1	1	1	46400
Unit of Measure	Lump Sum	Lump Sum	Lump Sum	Linear Feet
Cost of Secondary Asset	\$3,800,000.00	\$1,620,000.00	\$287,500.00	\$650,000.00
Unit Cost of Secondary Asset	\$3,800,000.00	\$1,620,000.00	\$287,500.00	\$14.01
Third Asset Category	10000 Site Area (park purchases), 3100 Maintained Landscapes, 2100 Trails	2100 Trails	7100 Exhibits	7100 Exhibits
Third Asset Size (Quantity)	1	1	1	1
Unit of Measure	Lump Sum	Lump Sum	Lump Sum	Lump Sum
Cost of Third Asset	\$1,620,000.00	\$1,620,000.00	\$1,350,000.00	\$1,350,000.00
Unit Cost of Third Asset	\$1,620,000.00	\$1,620,000.00	\$1,350,000.00	\$1,350,000.00
Total Project Cost	\$5,500,000.00	\$5,120,000.00	\$1,755,483.00	\$5,700,000.00
Year of Comparability Analysis	2006	2006	2006	2006
Comparable Primary Asset Unit Cost (Year of Comparison) ⁴	\$254.55	\$213.88	\$256.39	\$297.29

¹ Designate "New Construction" or "Repair/Rehab."

² Primary asset type should only be the comparable project components that correspond to current NPS project

³ See "Assets Code" tab for asset code and categories

⁴ For each comparable, primary unit assets costs shall be evaluated to the proposed date of construction for the NPS project

⁵ Add additional assets to table, as appropriate

Appendix G

ASSET CATEGORIES

The National Park Service Facility Management Division has developed a list of Asset Types and Categories for management of NPS Assets. The National Park Service defines an asset as a physical structure or grouping of structures, land features, or other tangible property which has a specific service or function. National Park Service employees manage over thirty different categories of assets--from roads, trails, campgrounds, buildings, and utility systems to maintained landscapes, waterfronts, monuments, ruins, and fortifications. The following are the Categories & Asset Codes for the NPS

FY 2005 Asset Categories & Codes

Revision Date November 18, 2004

0000	Site/Area
1100	Road
1300	Parking Area
1700	Road Bridge
1800	Road Tunnel
2100	Trail
2200	Trail Bridge (Substantial)
2300	Trail Tunnel (Substantial)
3100	Maintained Landscapes
3600	Campground/Overnight Campsite
3700	Picnic Area
3800	Boundary
4100	Building
4300	Housing
5100	Water System
5200	Waste Water System
5300	Heating & Cooling Plant
5400	Electrical System
5500	Radio System
5510	Phone System
5520	IT System (i.e. LAN)
5700	Fuel System
5800	Solid Waste/Recycling System
6100	Dam/Levee/Dike
6200	Constructed Waterway
6300	Marina/Waterfront System
6400	Aviation System
6500	Railroad System
7100	Outdoor Sculptures/ Monuments/Memorials/ Large Interpretive Objects
7200	Ruins
7300	Fortification
7400	Towers/Missile Silos
7900	Amphitheaters
8999	Fleet
9999	No Asset Code Available

Appendix H

UNIFORMAT II

Uniformat II is an elemental or a systems classification framework providing a consistent reference for the description, economic analysis, and management of buildings during all phases of their life cycle. Elements are major components, common to most buildings, that usually perform a given function regardless of the design specification, construction method, or materials used. Examples of elements are foundations, exterior walls, sprinkler systems, and lighting.

The need for an elemental classification is most apparent in the economic evaluation of building alternatives at the design stage. One way of obtaining an estimate of the lifecycle costs of design alternatives is to perform detailed quantity takeoffs of all materials and tasks associated with the construction, operation, and maintenance of the buildings.

MasterFormat 95^{TM,3} a classification that is based on products and materials, is a logical format choice when preparing detailed cost estimates. But a cost estimate prepared using a format based on a listing of products and materials is time consuming, costly, and inappropriate at the early design stages. Yet, it is in the early stages of design that economic analysis is most important in establishing the economically efficient choices among building alternatives. Only estimates based on an elemental classification such as UNIFORMAT II provide the necessary cost information for the analyst to evaluate building alternatives in a cost-effective manner.⁷

Level 1

Level 2

Level 3

A SUBSTRUCTURE

A10 Foundations

A1010 Standard Foundations

A1020 Special Foundations

A1030 Slab on Grade

A20 Basement Construction

A2010 Basement Excavation

A2020 Basement Walls

B SHELL

B10 Super Structure

B1010 Floor Construction

B1020 Roof Construction

B20 Exterior Enclosure

B2010 Exterior Walls

B2020 Exterior Windows

B2030 Exterior Doors

⁷Charette, Robert P. and Marshall, Harold E., UNIFORMATII Elemental Classification for Building Specifications, Cost Estimating and Cost Analysis, NISTIR 6389, National Institute of Standards and Technology, U.S. Department of Commerce, October, 1999.

- B30 Roofing**
 - B3010** Roof Coverings
 - B3020** Roof Openings
- C INTERIORS**
 - C10 Interior Construction**
 - C1010** Partitions
 - C1020** Interior Doors
 - C1030** Fittings
 - C20 Stairs**
 - C2010** Stair Construction
 - C2020** Stair Finishes
 - C30 Interior Finishes**
 - C3010** Wall Finishes
 - C3020** Floor Finishes
 - C3030** Ceiling Finishes
- D SERVICES**
 - D10 Conveying**
 - D1010** Elevators & Lifts
 - D1020** Escalators & Moving Walks
 - D1090** Other Conveying Systems
 - D20 Plumbing**
 - D2010** Plumbing Fixtures
 - D2020** Domestic Water Distribution
 - D2030** Sanitary Waste
 - D2040** Rain Water Drainage
 - D2090** Other Plumbing Systems
 - D30 HVAC**
 - D3010** Energy Supply
 - D3020** Heat Generating Systems
 - D3030** Cooling Generating Systems
 - D3040** Distribution Systems
 - D3050** Terminal & Package Units
 - D3060** Controls & Instrumentation
 - D3070** Systems Testing & Balancing
 - D3090** Other HVAC Systems & Equipment
 - D40 Fire Protection**
 - D4010** Sprinklers
 - D4020** Standpipes
 - D4030** Fire Protection Specialties
 - D4090** Other Fire Protection Systems
 - D50 Electrical**
 - D5010** Electrical Service & Distribution
 - D5020** Lighting and Branch Wiring
 - D5030** Communications & Security
 - D5090** Other Electrical Systems
- E EQUIPMENT & FURNISHINGS**
 - E10 Equipment**
 - E1010** Commercial Equipment

- E1020** Institutional Equipment
- E1030** Vehicular Equipment
- E1090** Other Equipment
- E20** Furnishings
 - E2010** Fixed Furnishings
 - E2020** Movable Furnishings

F SPECIAL CONSTRUCTION & DEMOLITION

- F10** Special Construction
 - F1010** Special Structures
 - F1020** Integrated Construction
 - F1030** Special Construction Systems
 - F1040** Special Facilities
 - F1050** Special Controls and Instrumentation
- F20** Selective Building Demolition
 - F2010** Building Elements Demolition
 - F2020** Hazardous Components Abatement

G BUILDING SITEWORK

- G10** Site Preparation
 - G1010** Site Clearing
 - G1020** Site Demolition and Relocations
 - G1030** Site Earthwork
 - G1040** Hazardous Waste Remediation
- G20** Site Improvements
 - G2010** Roadways
 - G2020** Parking Lots
 - G2030** Pedestrian Paving
 - G2040** Site Development
 - G2050** Landscaping
- G30** Site Mechanical Utilities
 - G3010** Water Supply
 - G3020** Sanitary Sewer
 - G3030** Storm Sewer
 - G3040** Heating Distribution
 - G3050** Cooling Distribution
 - G3060** Fuel Distribution
 - G3090** Other Site Mechanical Utilities
- G40** Site Electrical Utilities
 - G4010** Electrical Distribution
 - G4020** Site Lighting
 - G4030** Site Communications & Security
 - G4090** Other Site Electrical Utilities
- G90** Other Site Construction
 - G9010** Service and Pedestrian Tunnels
 - G9090** Other Site Systems & Equipment

Appendix I

CSI MasterFormat95

The Construction Specifications Institute (CSI) developed a 16 division classification system for construction specifications. This system, the most widely accepted in the industry, is used extensively by architects and engineers for construction specifications, by contractors for estimating and record keeping, and by manufacturers and suppliers for the categorization of materials and products.⁸ The CSI MasterFormat Divisions:

- Division 01 – General Requirements
- Division 02 – Site Work
- Division 03 – Concrete
- Division 04 – Masonry
- Division 05 – Metals
- Division 06 – Wood & Plastics
- Division 07 – Moisture-Thermal Control
- Division 08 – Doors, Window, and Glass
- Division 09 – Finishes
- Division 10 – Specialties
- Division 11 – Equipment
- Division 12 – Furnishings
- Division 13 – Special Construction
- Division 14 – Conveying Systems
- Division 15 – Mechanical
- Division 16 – Electrical

⁸ In 2004, the MasterFormat 16 division system was modified and expanded to a 50 division system. This system is slowly being adopted by the construction industry, but is the dominant system to date.

Appendix J

Federal Acquisition Regulations (re: Design with Funding Limitations)

Design Within Funding Limitations. The following are excerpts form the Federal Acquisition Regulations regarding the importance of true and accurate reporting of estimates and the architect-engineer contractor's responsibility to design with available funds:

36.609-1 Design within funding limitations.

(a) The Government may require the architect-engineer contractor to design the project so that construction costs will not exceed a contractually specified dollar limit (funding limitation). If the price of construction proposed in response to a Government solicitation exceeds the construction funding limitation in the architect-engineer contract, the firm shall be solely responsible for redesigning the project within the funding limitation. These additional services shall be performed at no increase in the price of this contract. However, if the cost of proposed construction is affected by events beyond the firm's reasonable control (e.g., if there is an increase in material costs which could not have been anticipated, or an undue delay by the Government in issuing a construction solicitation), the firm shall not be obligated to redesign at no cost to the Government. If a firm's design fails to meet the contractual limitation on construction cost and the Government determines that the firm should not redesign the project, a written statement of the reasons for that determination shall be placed in the contract file.

(b) The amount of the construction funding limitation (to be inserted in paragraph (c) of the clause at 52.236-22) is to be established during negotiations between the contractor and the Government. This estimated construction contract price shall take into account any statutory or other limitations and exclude any allowances for Government supervision and overhead and any amounts set aside by the Government for contingencies. In negotiating the amount, the contracting officer should make available to the contractor the information upon which the Government has based its initial construction estimate and any subsequently acquired information that may affect the construction costs.

(c) The contracting officer shall insert the clause at 52.236-22, Design Within Funding Limitations, in fixed-price architect-engineer contracts except when—

(1) The head of the contracting activity or a designee determines in writing that cost limitations are secondary to performance considerations and additional project funding can be expected, if necessary;

(2) The design is for a standard structure and is not intended for a specific location; or

(3) There is little or no design effort involved.

36.609-2 Redesign responsibility for design errors or deficiencies.

(a) Under architect-engineer contracts, contractors shall be required to make necessary corrections at no cost to the Government when the designs, drawings, specifications, or other items or services furnished contain any errors, deficiencies, or inadequacies. If, in a given situation, the Government does not require a firm to correct such errors, the contracting officer shall include a written statement of the reasons for that decision in the contract file.

(b) The contracting officer shall insert the clause at 52.236-23, Responsibility of the Architect-Engineer Contractor, in fixed-price architect-engineer contracts.

52.236-22 Design Within Funding Limitations.

As prescribed in 36.609-1(c), insert the following clause:

DESIGN WITHIN FUNDING LIMITATIONS (APR 1984)

(a) The Contractor shall accomplish the design services required under this contract so as to permit the award of a contract, using standard Federal Acquisition Regulation procedures for the construction of the facilities designed at a price that does not exceed the estimated construction contract price as set forth in paragraph (c) of this clause. When bids or proposals for the construction contract are received that exceed the estimated price, the contractor shall perform such redesign and other services as are necessary to permit contract award within the funding limitation. These additional services shall be performed at no increase in the price of this contract. However, the Contractor shall not be required to perform such additional services at no cost to the Government if the unfavorable bids or proposals are the result of conditions beyond its reasonable control.

(b) The Contractor will promptly advise the Contracting Officer if it finds that the project being designed will exceed or is likely to exceed the funding limitations and it is unable to design a usable facility within these limitations. Upon receipt of such information, the Contracting Officer will review the Contractor's revised estimate of construction cost. The Government may, if it determines that the estimated construction contract price set forth in this contract is so low that award of a construction contract not in excess of such estimate is improbable, authorize a change in scope or materials as required to reduce the estimated construction cost to an amount within the estimated construction contract price set forth in paragraph (c) of this clause, or the Government may adjust such estimated construction contract price. When bids or proposals are not solicited or are unreasonably delayed, the Government shall prepare an estimate of constructing the design submitted and such estimate shall be used in lieu of bids or proposals to determine compliance with the funding limitation.

(c) The estimated construction contract price for the project described in this contract is \$_____.

(End of clause)

52.236-23 Responsibility of the Architect-Engineer Contractor.

As prescribed in 36.609-2(b), insert the following clause:

RESPONSIBILITY OF THE ARCHITECT-ENGINEER CONTRACTOR (APR 1984)

(a) The Contractor shall be responsible for the professional quality, technical accuracy, and the coordination of all designs, drawings, specifications, and other services furnished by the Contractor under this contract. The Contractor shall, without additional compensation, correct or revise any errors or deficiencies in its designs, drawings, specifications, and other services.

(b) Neither the Government's review, approval or acceptance of, nor payment for, the services required under this contract shall be construed to operate as a waiver of any rights under this contract or of any cause of action arising out of the performance of this contract, and the Contractor shall remain liable to the Government in accordance with applicable law for all damages to the Government caused by the Contractor's negligent performance of any of the services furnished under this contract.

(c) The rights and remedies of the Government provided for under this contract are in addition to any other rights and remedies provided by law.

(d) If the Contractor is comprised of more than one legal entity, such entity shall be jointly and severally liable hereunder.

Appendix K

Direct/Net/Gross Construction Costs and Total Project Costs

Direct Construction Costs: Direct costs are those costs directly linked to the physical construction of a project, those costs without which the project could not be constructed. The material, labor and equipment costs, as well as, subcontract costs are all direct costs. Design Contingencies (unknown construction requirements) are considered a direct cost for NPS construction projects.

Indirect Construction Costs: Indirect costs are usually added to the estimate at the summary stage and are most often calculated as a percentage of the direct costs. They include such items as sales tax on materials, overhead, profit, and general conditions.⁹

Net Construction Costs: Net Construction Costs are the sum of Direct and Indirect Construction Costs.

Gross Construction Costs: Gross Construction Costs are equal to the sum of Net Costs + Construction Supervision Costs + Construction Contingencies. For National Park Service Line-Item Construction (LIC) Projects, Construction Supervision is 8 percent of Net Cost and Construction Contingencies is 10 percent of Net Cost. Therefore for LIC projects, **Gross Construction = 1.18 x Net Construction Cost.**

Construction Supervision Costs: The NPS Line-Item Construction budget sets aside 8 percent of Net Construction Costs to pay for independent contract construction supervision on a project site during the construction phase of the project.

Construction Contingencies: The NPS Line-Item Construction budget sets aside 10 percent of Net Construction Costs to pay for incidental construction modifications that may arise during construction.

Total Project Costs: Total Project Costs are equal to the sum of Gross Construction Costs plus the Cost of Design for the project. The NPS uses the following percentages for project design costs for LIC projects:

Pre-design	5 percent of NET Cost
Design	10 percent of NET Cost
<u>Supplemental Design Services</u>	<u>2 percent of NET Cost</u>
Total Design Costs	17 percent of NET Cost

Total Project Costs = Design Costs + Gross Construction Costs

⁹ R.S. Means Company, Inc., Means Estimating Handbook, 91-115713, Pg. 14.

SAMPLES

1. [Class A Construction Cost Estimate](#)
 - Basis of Estimate
 - Estimate Summary
 - Price Schedule
 - Contract Line Item 1 Detail
 - Contract Line Item 2 Detail
 - General Conditions

2. [Class B Construction Cost Estimate](#)
 - Basis of Estimate
 - Estimate Summary
 - Estimate Detail

3. [Class C Construction Cost Estimate](#)
 - Basis of Estimate
 - Estimate

4. [Cost Comparability Analysis Worksheet](#)
 - Comp 1
 - Comp 2
 - Comp 3
 - Analysis
 - Asset Codes
 - Sample Comp
 - Sample Analysis

5. [Cost Comparability Data Checklist](#)
 - Checklist
 - Sample