

APPENDIX D PROCEDURES FOR PREPARATION OF COST ESTIMATES

1. Basis for Preparation of Estimate

a. General. This appendix establishes uniform guidance for estimating labor, equipment, materials and supplies, subcontracted work, overhead, profit, bond, and contingencies.

b. Planning the work. It is important to thoroughly understand the project scope of work and the biddability and constructability aspects of the project being estimated. The Cost Engineer must thoroughly review drawings, specifications, and other references to formulate a construction sequence and duration. A site visit is strongly recommended to relate the physical characteristics of the project to the available design parameters and details. The development of the construction sequence is necessary as soon as possible and should be used to provide a checklist of construction requirements throughout the cost estimating process.

c. Quantities. Cost Engineering is responsible for the accuracy of quantity "take-off's" when prepared by qualified Government personnel or A-E firms. On a case-by-case basis, assistance for making take-off's will be provided by the Technical Design Branch, Engineering Division, in support of Cost Engineering.

(1) Cost engineering personnel are responsible for independently spot-checking and reviewing all quantity estimates.

(2) The quantity take-off is an important part of the estimate and should be based on all available engineering and design data. All quantities should be shown in standard units of measure.

(3) The detail in which the quantities are prepared for each task is dependent on the design. Quantity calculations beyond design detail are often necessary to determine a reasonable price to complete the overall scope of work for the cost estimate. Project notes, added at the appropriate level in MCACES, will be used to explain the basis for the quantity calculations, to clearly show contingency allowances, and to note quantities determined by cost engineering judgment that will be reconciled upon design refinement.

(4) During construction, some material is wasted and lost from cutting, fitting, handling, or contamination. The Cost Engineer shall use judgment to determine the waste and loss allowance to be applied to appropriate items.

d. Sources of unit cost data.

(1) The Unit Price Book (UPB) associated with MCACES provides production rates, unit costs, and crew composition. The UPB supplies the majority of cost data for construction tasks normally found in building and building site work construction.

(2) Each Cost Engineering Branch should develop and maintain a record of past bids, unit costs, and completed project cost reports. Sources of unit cost data may include the UPB, quotes, audits, catalogs, pricing data, previous bid results, historical costs, the cost engineering database, as well as the expertise from other districts and MSC's. Such data serves as a source for developing or verifying the reasonableness of future unit prices.

(3) In Civil Works construction, the work is primarily of a specialized nature. During the reconnaissance phase, historical unit costs may be used or unit costs may be developed for the construction tasks. As the project develops through the feasibility phase and beyond, historical cost data should be used as a guide and unit cost development should become the primary goal.

e. Unit pricing.

(1) As a general rule, approximately 80 percent of the direct costs of a project are represented by only 20 percent of the estimated work items. The greatest estimating effort should be concentrated on these critical elements. The unit cost for each of these items shall be carefully analyzed and shall be developed as the summation of all direct and indirect costs which will likely be incurred by an experienced and well-equipped contractor. Direct costs are those costs that can be associated with a specific item or unit of construction work in the project. Indirect costs are those costs that

cannot be associated with a single item or unit of construction work in the project.

(2) The direct cost of the construction tasks comprising the remaining 80 percent of the work elements may be priced from historical sources. The Cost Engineer must use judgement to adjust for project conditions, when cost data is based on previously completed projects to include overhead and price level date adjustments for inflation.

(3) Lump sum bid items may be used for small and easily identified work noted in the drawings and included in the estimate. The cost of the lump sum item should be based on cost data related to the item's total direct and indirect costs.

2. Cost Estimate Components and Supporting Documentation

The following is provided to support the cost estimate submission requirements specified for each phase of project development as outlined in Appendix C, "Type of Cost Estimates."

a. Backup data. All information which was collected or prepared for the cost estimate should be organized by work item and included in the backup data. Such information might include notes on site visits, discussions or telephone conversations with individuals, brochures on special equipment or materials, sketches, and working drawings.

b. Bid schedule. The bid schedule is part of the procurement package and is included with the solicitation for bids. The estimate must be prepared showing the unit prices, quantities, extension of unit prices, lump sum items, and the total costs consistent with the bid schedule.

c. Construction schedule. The Cost Engineer will prepare a construction schedule to support the Government estimate that is consistent with the plans and specifications for completion of the work. It may be in the form of a bar chart or a Network Analysis System, but it must identify the sequence and duration of the tasks upon which the cost estimate is developed. The schedule must be prepared in sufficient detail to adequately develop the required labor, equipment, crew sizes, and production rates required for each of the identified construction tasks.

d. Detail sheets. Detail sheets generated by MCACES provide a complete listing of all labor, equipment, materials and/or crews used to develop all direct costs for each construction task. Although not required as documentation to support a cost estimate submission to HQUSACE, these reports become an important part of the cost estimate in the review and approval process at the district and as necessary for the MSC level submissions.

e. Drawings and sketches. Drawings and sketches which are appropriate may be used to show the basis of the cost estimate. Drawings may include a project map showing the location of the work with respect to principal cities, roads, railways, and waterways; a site map showing the location of the work, borrow, quarry, and spoil areas, and existing work access roads; any existing facilities usable by the contractor; a general plan and elevation, or profile of the work with typical sections; and a construction plan layout.

f. Notes. Notes are any explanations necessary to support the development of cost for individual construction tasks in the cost estimate. This descriptive information that covers areas such as manufacturers quotes, overtime requirements, material availability, and contingencies should be entered as notes to the appropriate MCACES title or detail level of the cost estimate.

g. Project narrative. The narrative defines the parameters upon which the cost estimate has been prepared to support the project scope and schedule and is applied by definition to the project level within MCACES. It describes the project requirements that must be performed in sufficient detail to give a clear understanding of the scope of work including length, width, height, and slope of primary features, special problems that will be encountered in performing the work, site conditions affecting the work, reasons for selection of major plant and equipment, assumptions made for mobilization and demobilization of all equipment, and the reasons for unusually high or low contingencies.

h. Project summary reports. Project summary reports are printouts from MCACES used to summarize costs for each title level established for the specific project cost estimate. There are a variety of summary reports that may be printed from MCACES such as project owner, project indirect, and project direct summaries. The summary reports required for a cost

estimate submission depend on the phase of project development and are outlined in Appendix C.

i. Signature page. The signature page for the Government estimate should contain the names and signatures of those individuals responsible for the preparation, review, submittal, and approval of the cost estimate. If there is sufficient space on the bid sheet for these signatures, a separate signature sheet is not required. If there is not sufficient space on the bidding schedule, a separate signature sheet is necessary. It is important that the sheet containing the approval signatures also contain the estimate of total cost so that there will be no question(s) later as to the estimated amount approved. A statement relating the date of pricing levels on which costs were prepared should also appear on this page.

j. Table of contents. The table of contents is the MCACES table of contents printout.

k. Title page. The title page is the title page printed with the MCACES cost estimate. It should include the name and location of the project, the district or MSC responsible for the project design, the Cost Engineer responsible for preparation of the cost estimate, and the date and price level of the cost estimate.

l. Total project cost summary. The total project cost summary provides a summary of project costs in accordance with ER 5-7-1, Project Management. It relates the MCACES cost estimate and identified price level date to the fully funded cost estimate by applying the appropriate adjustments for inflation in accordance with the developed project schedule. Approval and signature by the Chief, Cost Engineering, affirms that the construction feature costs are correct and that the backup data provided for the nonconstruction features (Lands and Damages; Planning, Engineering and Design; and Construction Management) support these feature costs.

3. Labor

a. Direct labor costs are defined as base wages plus payroll taxes, fringe benefits, and overtime allowances paid by the contractor for personnel who perform a specific construction task. In addition to the actual workers, there are generally crew foremen who receive an hourly wage and are considered part of the direct labor costs.

b. Indirect labor costs are wages paid to contractor personnel whose effort cannot be attributed to a specific construction task. Personnel such as superintendents, engineers, clerks, and site cleanup laborers may be included as indirect labor costs (overhead).

c. Crews. Direct labor cost requirements are broken into tasks of work. Each task is usually performed by a labor crew. Crews may vary in size and mix of skills. The number and size of each crew should be based on such considerations as having sufficient workers to perform a task within the construction schedule and the limitation of work space. Once the crews have been developed, the labor costs can be determined based on the productivity of the crew and the labor wage rates.

d. Productivity.

(1) Estimating labor productivity is subject to many diverse and unpredictable factors. There is no substitution for the knowledge and experience of the Cost Engineer in estimating labor productivity. The productivity of some crew members such as equipment operators, helpers, or oilers is determined by the productivity of the equipment. The productivity of craftsman such as carpenters, steel workers, and masons may be based on the MCACES crews database, the experience of the Cost Engineer, historical records, or other appropriate reference manuals.

(2) The labor effort needed to perform a particular task varies with many factors, such as the relative experience, capability, and morale of the workers, the size and complexity of the job, the climatic and topographic conditions, the degree of mechanization, the quality of job supervision, and the existing labor-management agreements and/or trade practices.

(3) The complexity of the variables affecting productivity makes it difficult to estimate a production rate. Therefore, whenever possible, production rates should be based on averaging past production rates for the same or similar work. The Cost Engineer must be sure to incorporate particular job factors and conditions to adjust historical data to the project being estimated. Other sources of productivity include reference manuals, field office reports, construction log books, and observation of ongoing construction.

(4) The Cost Engineer must be aware of labor efficiency and work practices that exist in each project

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locality and must consider these practices when preparing the cost estimate.

(5) Other factors affecting production rates include special contract clause requirements, limited working space, and inclement weather conditions, such as temperature and wind.

e. Wage rates. In contrast to productivity, wage rates are generally well-defined. The Davis-Bacon Act requires a contractor performing construction for the Government in the United States to pay not less than the prevailing rates set by the Department of Labor. A schedule of minimum rates is included in the specifications. Where labor is in short supply for certain crafts in the area, the work is in a remote area, or it is well-known that rates higher than the set rate scale will be paid, these higher wage rates should be used instead of the minimum wage, since this would be required of the contractor to attract labor to the job. The wage rate should be adjusted to include travel time or night differential where these are customary requirements. Future wage increases should be taken into account when there will be an extended construction period.

f. Overtime and shift differential.

(1) Operation shifts. The Cost Engineer should carefully consider the available working time in the progress schedule for each task, sequence of tasks, availability of labor and equipment, labor and equipment production rate to determine the number of shifts to be adopted for the construction of each task. The efficiency of both the second and third shifts should be adjusted to recognize that production will not be as high as the day shift for most types of construction operations. A three-shift operation should be avoided due to a lower labor efficiency and the requirement to include equipment maintenance.

(2) Overtime should be included in the labor cost computation when work in excess of regular time is required by the construction schedule or is the custom of labor in the local vicinity. Overtime is normally calculated as a percentage of the base wage rate. It is usually based on time and one-half, but may be double time depending on the existing labor agreements. Tax and insurance costs are applied to overtime, but fringe benefit costs are not. Overtime is expressed as a percentage of direct labor costs and is calculated in the

following manner using time and one-half as the basis:

48 hours at straight time = 48.00 hours

8 hours at 1/2 time = 4.00 hours

(52 hrs paid/48 hrs worked = 0.0833) = 8.33 %

(3) Many construction projects utilize multiple shift operations. When estimating direct labor costs for multiple shift operations, the Cost Engineer should estimate the number of hours to be worked and the number of hours to be paid for each shift based upon the developed construction schedule.

(4) A tabulation of overtime percentages for most conditions are shown in Table D-1, Overtime and Shift Differential. The percentage also includes an allowance for the direct work loss of multiple shift or shift differential, where applicable.

g. Taxes and insurance.

(1) Rates for all taxes and insurance should be verified prior to computation.

(2) Workman's compensation and employer's liability insurance costs applicable for the state in which the work is performed should be included in the composite wage rate. Insurance rates may be obtained from the state if the state law provides a monopoly or from insurance companies providing this type insurance. The project compensation rate is based on the classification of the major construction work.

(3) Unemployment compensation taxes are composed of both state and Federal taxes. Unemployment compensation tax will vary with each state while the Federal unemployment tax will be constant for all projects.

(4) The social security tax rates and the income ceilings on which social Security taxes must be paid vary from year to year. Therefore, the Cost Engineer must verify the rate to be used in the cost estimate.

(5) Rates for all taxes and insurance should be verified prior to computation.

(6) The total percentage of the above taxes and insurance is applied to the basic hourly wage rate plus overtime for the various crafts.

Table D-1
Overtime and Shift Differential

Shift	Actual Hours Worked		Hours Paid		Percentages for OT and Shift Differential		
	Day	Week	Reg	OT	1.5x Wk/Sat 2x Sun	1.5x Week 2x Sat/Sun	Week 2x All OT
One-shift operation							
5-Day Week	8	40	40	0	0	0	0
	9	45	40	5	5.55	5.55	11.11
	10	50	40	10	10.00	10.00	20.00
	11	55	40	15	13.64	13.64	27.27
	12	60	40	20	16.67	16.67	33.33
6-Day Week	8	48	40	8	8.33	16.67	16.67
	9	54	40	14	12.96	21.30	25.93
	10	60	40	20	16.67	25.00	33.33
	11	66	40	26	19.70	28.03	39.39
	12	72	40	32	22.22	30.56	44.44
7-Day Week	8	56	40	16	21.43	28.57	28.57
	9	63	40	23	25.40	32.54	36.51
	10	70	40	30	28.57	35.71	42.86
	11	77	40	37	31.17	38.31	48.05
	12	84	40	44	33.33	40.68	52.38
Two-Shift Operation (one 8 hours and one 7.5 hours)							
5-Day Week	15.5	77.5	80	0	3.23	3.23	3.23
	18	90	80	12.5	9.72	9.72	16.67
	20	100	80	22.5	13.75	13.75	25.00
	22	110	80	32.5	17.05	17.05	13.82
	24	120	80	42.5	19.79	19.79	37.50
6-Day Week	15.5	93	80	16.0	11.83	20.43	20.43
	18	108	80	30.5	16.44	24.77	30.56
	20	120	80	42.5	19.79	28.13	37.50
	22	132	80	54.5	22.54	30.87	43.18
	24	144	80	66.5	24.83	33.16	47.92
7-Day Week	15.5	108.5	80	32.0	25.35	32.72	32.72
	18	126	80	48.5	28.37	35.52	40.48
	20	140	80	62.5	31.25	38.39	46.43
	22	154	80	76.5	33.60	40.75	51.30
	24	168	80	90.5	35.57	42.71	55.36
Two-Shift Operation (each 7.5 hours)							
5-Day Week	15	75	80	0	6.67	6.67	6.67
	18	90	80	15	13.89	13.89	22.22
	20	100	80	25	17.50	17.50	30.00
	22	110	80	35	20.45	20.45	36.36
	24	120	80	45	22.92	22.92	41.67
6-Day Week	15	90	80	16	15.56	24.44	24.44
	18	108	80	33	19.91	27.24	35.19
	20	120	80	45	22.92	31.25	41.67
	22	132	80	57	25.38	33.71	46.97
	24	144	80	69	27.43	35.76	51.39
7-Day Week	15	105	80	32	29.52	37.14	37.14
	18	126	80	51	31.35	38.49	44.44
	20	140	80	65	33.93	41.07	50.00
	22	154	80	79	36.04	43.18	54.55
	24	168	80	93	37.80	44.94	58.33
Three-Shift Operation							
5-Day Week	22.5	112.5	120	0	6.67	6.67	6.67
6-Day Week	22.5	135	120	24	15.56	24.44	24.44
7-Day Week	22.5	157.5	120	48	29.52	37.14	37.14

(7) Example 1 illustrates the method for deriving the total tax and insurance percentage. Since rates are subject to change and in some cases vary by region, the calculations shown are presented as an example only. Actual values must be determined by the Cost Engineer.

Example 1

Workman's compensation and employer's liability (varies with state and contractor)	7.60%
State unemployment compensation (varies with each state)	3.20%
Federal unemployment compensation	0.80%
Social security & medicaid	<u>7.65%</u>
Total taxes and insurance	19.25%

h. Fringe benefits.

(1) Fringe benefits may include health and welfare, pension, vacation, apprentice training, travel, and subsistence; depending on the craft and the location of the work. These costs are usually expressed as an hourly cost with the possible exception of vacation which may be easily converted to an hourly cost. The type of fringe and the amount for the various crafts can usually be found with the Davis-Bacon Act wage determination in the specifications. Non-union contractors pay comparable fringe benefits directly to their employees.

(2) Example 2 illustrates the calculations for fringe benefits. Since the values change and vary by region and union agreement, the calculations shown are presented as an example only. Actual values must be determined by the Cost Engineer.

Example 2

Health and welfare	\$0.70/hr
Pension	0.75/hr
Vacation (6% of straight time rate of \$10)	0.60/hr
Apprentice training (N/A in this case)	_____
Total fringe benefits	\$2.05/hr

(3) Travel and Subsistence. Travel and subsistence costs are normally expressed as a daily or weekly cost. When they are to be included in the cost estimate, they should be converted to an hourly cost.

4. Equipment

a. Construction plant and equipment refers to the tools, instruments, machinery, and other mechanical implements required in the performance of construction work. Construction plant is defined as concrete batch plants, aggregate processing plants, conveying systems, and any other processing plants which are erected in place at the job site and are essentially stationary or fixed in place. Equipment is defined as items which are portable or mobile, ranging from small hand tools through tractors, cranes, and trucks. For estimating purposes, plant and equipment are grouped together as equipment costs.

b. Selection of equipment.

(1) An important consideration in the preparation of an estimate is the selection of the proper equipment to perform the required tasks. The Cost Engineer should carefully consider number, size, and function of equipment to arrive at optimum equipment usage. Some factors to consider during the selection process are: conformance to specification requirements; job progress schedule (productivity); magnitude of the job; type of materials; availability of space; mobility and availability of equipment; suitability of equipment for other uses; equipment capabilities; number of shifts; distances material must be moved; steepness and direction of grades; weather conditions; hauling restrictions; standby time; mobilization and demobilization costs.

(2) The Cost Engineer preparing the estimate must be familiar with current construction equipment and job site conditions. The equipment selected should conform to contract requirements and be suitable for the materials to be handled and conditions that will exist on the project.

c. Estimating methodology. Use the "crew concept" for construction cost estimates requiring detailed estimating of labor, materials, and equipment. For each significant work task, workers and equipment are related to the hourly cost and expected productivity. Where a major piece of equipment serves more than one crew, the total equipment time should be prorated between both crews.

d. Productivity. After determining the type of equipment to be employed, select equipment which has a productivity rate suited to the efficient and economical performance of the work. The size and number of units required will be influenced by equipment productivity, job size, availability of space for equipment operations, the project construction schedule for the various work tasks, number of shifts to be worked, and the availability of equipment operators. Emphasis must be placed on the importance of establishing a reasonable productivity rate. Production may be based on MCACES historical equipment models and assemblies or on the output rating recommended by the manufacturer.

e. Mobilization and demobilization.

(1) Mobilization costs for equipment include the cost of loading at the contractor's yard, transportation cost from the yard to the construction site, unloading at the site, necessary assembly and testing, and standby costs during mobilization and demobilization. Trucks for the project capable of highway movement are usually driven to the site and are often used to transport minor items. All labor, equipment, and supply costs required to mobilize the equipment should also be included in the mobilization cost. When the equipment location is unknown, base the mobilization and demobilization distance on a circular area around the project site which will include a reasonable number of qualified bidders. Demobilization costs should be based on that portion of the equipment that would be expected to be returned to the contractor's storage yard and may be expressed as a percentage of mobilization costs.

(2) Mobilization and demobilization costs for plant should be based on the delivered cost of the item, plus erection, repairs, maintenance, taxes, and dismantling costs minus salvage value at the end of the project.

f. Equipment ownership and operating expense schedule, EP 1110-1-8, determines the hourly rates. These rates are also included in the MCACES database and will be used in the preparation of all cost estimates. These pamphlets have been developed for different geographic regions in the United States, and the appropriate pamphlet or MCACES database should be used based upon project location.

g. Small tools. The cost of small power and hand tools and miscellaneous noncapitalized equipment and supplies must be included in the estimate.

(1) This item may be estimated as a percentage of the labor cost. The allowance must be determined by the Cost Engineer in each case, based upon experience for the type of work involved. Unit prices based on historical data already include a small tools allowance. The small tool cost shall be considered as part of equipment cost.

(2) The crews database in the UPB includes an allowance for small tools. It is also possible to add small tools as an equipment item.

5. Materials and Supplies

a. Materials and supplies are defined and, for the purpose of estimating, both can be considered materials unless they need to be separated because of different tax rates.

(1) Materials. Those items which are incorporated into and become part of the permanent structure.

(2) Supplies. Those items which are used in construction but do not become physically incorporated into the project such as concrete forms.

(3) Free on board (FOB) refers to the point to which the seller will deliver goods without charge to the buyer.

(4) Cost estimates will be prepared for all subcontract work using the same methodology and degree of detail outlined for work by the prime contractor.

b. Sources of pricing data.

(1) Cost may be obtained from the UPB, reference manuals, manufacturers catalogs, quotes, or historical data.

(2) Quotes from manufacturers and suppliers. Quotes should be obtained for all specialized or not readily available items of materials and equipment to be furnished and installed by the contractor and for all supplies of significant cost required by the contractor for performance of the work. Quotes from manufacturers and suppliers should be collected and compiled by task. It is preferable to obtain a new quote for each project to ensure that the cost is current and that the item meets specifications. If possible, more than one quote should be obtained to be reasonably sure

the prices are competitive. The Cost Engineer should attempt to determine and ensure that contractor discounts are considered in the Government estimate. Quotes should be considered proprietary information and kept confidential to protect the information entrusted to the Cost Engineer.

c. Forward pricing. Sometimes quotes are requested in advance of the expected purchase date. Suppliers are reluctant to guarantee future prices and often will only quote current prices. It may be necessary to adjust current prices to reflect the cost expected at the actual purchase date. This cost adjustment, if required, should not be included as a contingency, but should be clearly and separately defined in each estimate. Adjust current pricing to future pricing using OMB escalation factors. Computations of adjustment should be clear and should be maintained as cost estimate backup support.

d. Freight. The Cost Engineer should check the basis of the price quotes to determine if they include delivery. If they do not include delivery, freight costs to the project site must be determined and included. The supplier can usually furnish an approximate delivery cost.

(1) If the materials or supplies are FOB factory or warehouse, freight costs to the construction site should be added to the cost of the materials or supplies.

(2) If the cost of materials or supplies includes partial delivery, FOB to the nearest rail station, the cost of unloading and transporting the materials or supplies should be included in the estimate.

(3) If the materials or supplies are a large quantity in bulk form which would require extensive equipment for unloading and hauling, it may be desirable to prepare a labor and equipment estimate for the material handling and delivery.

e. Handling and storage. The contractor is usually required to off-load, handle and stockpile, or warehouse materials on site. These costs should be included in the estimate. An item of electronic equipment requiring special low-humidity storage might have this special cost included in the direct cost of the equipment. For other items, such as equipment needing secure storage, the cost for the security fencing or a temporary building should be considered as an indirect cost and be included in the job site overhead cost.

f. Taxes. When applicable, state and local sales tax should be added to the materials or supplies cost. In some states, material incorporated into Federal construction is exempt, but supplies are not. Care should be taken, therefore, that the sales tax rate is applied when required. The Cost Engineer should verify the tax rates and the applicability of these rates for the project location. Sales tax is considered to be a direct cost of the materials and supplies.

g. Materials or supplies manufactured or produced at the site. If it is likely the contractor will manufacture or produce materials or supplies at the project site, a separate estimate component should be developed for this work. This estimate should be a detailed equipment, labor, material, and supplies estimate, and should conclude with a unit cost of material or supply delivered to the stockpile, storage yard, or project feature.

h. Government furnished materials. Government furnished materials should be estimated in the same manner as other materials, except that the purchase price is not included. The estimate should include an allowance for transporting, handling, and storage from point of delivery. There may be special costs associated with Government furnished materials such as insurance to cover loss until final installation, special storage costs, or special security measures.

6. Subcontracted Work

a. Speciality items, such as mechanical and electrical work, are usually performed by subcontract. Subcontracted work may be a significant portion of the total cost of construction.

b. The Cost Engineer must first determine those parts of the work that will probably be subcontracted. When the work to be subcontracted has been determined, those items shall be identified in the estimate. The appropriate subcontractor overhead and profit costs should be applied to those items.

c. The cost of subcontracted work is the total cost to the prime contractor for the work performed. This includes the subcontractor's costs for direct labor, materials and supplies, equipment, second tier subcontracts, and charges for overhead and profit. The total subcontract cost is considered a direct cost to the prime contractor.

d. *Use of quotes.* The Cost Engineer may utilize quotes for the expected subcontracted work in preparing the estimate or to verify the reasonableness of independently estimated subcontract work. Subcontractor quotes will be treated as proprietary information and should only be revealed to those who have a need to know.

7. Contingencies

a. *General.* The goal in contingency development is to identify the uncertainty associated with an item of work or task, forecast the risk/cost relationship, and assign a value to this task that will limit the cost risk to an acceptable degree of confidence. Consideration must be given to the details available at each stage of planning, design, or construction for which a cost estimate is being prepared. During development of the project cost estimate, sufficient contingencies should be added at the lowest MCACES title or detail level where the risks or uncertainties have been identified.

Contingencies may vary throughout the cost estimate and could have a significant impact on overall costs being high when the lack of investigation data or design detail is associated with critical/high cost elements. The reasons for final contingency development and assignment, that describes the potential for cost growth must be included in the cost estimate as a part of the project narrative. When the contingency factors shown are applied to any portion of the cost estimate up to the feature level, the statement "Normal design variances are expected - normal contingency values used" is acceptable in addressing that specific portion.

b. The following contingency factors (%) represent a reasonable guide for the construction features of the cost estimate:

Phase of Project	Total Project Construction Cost	
	> \$10,000,000	< \$10,000,000
Development		
Reconnaissance/Feasibility	20%	25%
Project/Feature Design Memorandum	15%	20%
Plans and Specifications	10%	10%

c. The table provides a guide for contingency development and is not intended to restrict or limit contingencies to these values. If the overall contingency value developed through a detailed analysis as described above exceeds these guidelines, the district or MSC management team should consider further investigation and/or design be accomplished in order to reduce the uncertainties.

8. Overhead

a. Overhead costs are those costs which cannot be attributed to a single task of construction work. Costs which can be applied to a particular item of work should be considered a direct cost to that item and not be included in overhead costs. The overhead costs are customarily divided into two categories:

(1) Job Overhead, also referred to as General Conditions or Field Office Overhead.

(2) General Home Office Overhead, commonly referred to as G&A, General and Administrative costs.

b. The Cost Engineer must be sure that costs are not duplicated between the two categories. Because of the nature of overhead costs, it is not practical to discuss all overhead items. Specific considerations must be evaluated for each project. The Cost Engineer must use considerable care and judgement in estimating overhead costs.

c. The application of a previously determined overhead rate may be used for early design stages, but it is not an accurate or reliable method of forecasting costs. Overhead will vary from project to project and may even vary from month to month within any given project. Job overhead items for the prime contractor should be estimated in detail for all projects of final design requiring a Government estimate. Detailing of overhead costs for subcontract work is recommended when the impact of these costs is significant.

d. *Job overhead (JOH).* Job overhead costs are those costs at the project site which occur specifically as a result of a particular project. Some examples of job overhead costs are:

(1) Job supervision and office personnel.

(2) Engineering and shop drawings.

- (3) Site security.
- (4) Temporary facilities, project office.
- (5) Temporary utilities.
- (6) Preparatory work and laboratory testing.
- (7) Transportation vehicles.
- (8) Supplies and maintenance facilities.
- (9) Temporary protection & OSHA requirements.
- (10) Telephone and communications.
- (11) Permits and licenses.
- (12) Insurance (project coverage).
- (13) Schedules & reports.
- (14) Quality control.
- (15) Cleanup.
- (16) Taxes.
- (17) Equipment costs not chargeable to a specific task.

e. Home office overhead (G&A). Home office overhead expenses are those incurred by the contractor in the overall management of business, associated with all costs at the home office. Since they are not incurred for any one specific project, they must be apportioned to all the projects. Many expenses are not allowable, such as interest and entertainment. An accurate percentage of G&A can only be determined by an audit.

On major changes requiring an audit, it is important to request that the G&A rate be determined. This will assist the Cost Engineer for ongoing negotiations and more accurate overhead rates. Some examples of home office overhead are:

- (1) Main office building, furniture.
- (2) Management and office staff, estimators.
- (3) Utilities.

- (4) Communications and travel.
- (5) Supplies.
- (6) Vehicles.
- (7) Business insurance.
- (8) Taxes.

f. Duration of overhead items. After the overhead items have been listed, a cost must be determined for each. Each item should be evaluated separately. Some items such as erection of the project office may occur only once in the project. The Cost Engineer should utilize the job schedule in estimating duration requirements. Costs reflective of each particular item during the scheduled period should then be applied. The product of duration and unit cost is the overhead cost for the item.

g. Sources for Pricing. The Cost Engineer must rely on judgement, historical data, and current labor market conditions to establish overhead costs. Some contractors will informally discuss and furnish information for overhead items. Audit reports are available to provide information on overhead costs for previous similar projects. Comparable average salaries in other commercial organizations are frequently available. Overhead salaries should include an allowance for payroll taxes and fringes such as FICA, health benefits, and vacation. Other sources include previously negotiated modifications and review of organizational charts of construction firms for staffing and overhead costs evaluation.

9. Profit

a. Profit is defined as a return on investment and provides the contractor with an incentive to perform the work as efficiently as possible. A uniform profit rate should be avoided.

b. Weighted guidelines method. Reference is made to FAR and EFAR concerning the use of weighted guidelines method for determining profit. EFAR directs the use of the weighted guideline method when price is to be negotiated. This method (Table D-2 Profit Factor) yields a reasonable profit value and should be used to determine profit for all

**Table D-2
Profit Factor**

Project: _____

Estimated By: _____

Contract No: _____

Checked By: _____

Change Order No. _____

Date: _____

Profit Objective For: (Prime Contractor, Subcontractor)

<u>Factor</u>	<u>Rate (%)</u>		<u>Weight</u>		<u>Value</u>
			(0.03 - 0.12)		
1. Degree of Risk	20	x	_____	=	_____
2. Difficulty of work	15	x	_____	=	_____
3. Size of Job	15	x	_____	=	_____
4. Period of Performance	15	x	_____	=	_____
5. Contractor's Investment	5	x	_____	=	_____
6. Assistance by Government	5	x	_____	=	_____
7. Subcontracting	<u>25</u>	x	_____	=	_____
	100		Profit Factor:		_____ %

COMMENTS (Reasons for Weights Assigned):

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

Table D-3
Guidelines for Weighted Factors Profit Determination

Degree of Risk (Judgmental):

Degree	Weight
Small	0.03
High	0.12

Relative Difficulty of Work (Judgmental):

Degree	Weight
Difficult	0.12
Simple	0.03

Size of Job:

<u>Value</u>	<u>Weight</u>	<u>Value</u>	<u>Weight</u>
\$ 0 to 100,000	0.120	\$ 2,700 to 2,800,000	0.081
100 to 200,000	0.119	2,800 to 2,900,000	0.800
200 to 300,000	0.117	2,900 to 3,000,000	0.079
300 to 400,000	0.116	3,000 to 3,100,000	0.077
400 to 500,000	0.114	3,100 to 3,200,000	0.076
500 to 600,000	0.113	3,200 to 3,300,000	0.074
600 to 700,000	0.111	3,300 to 3,400,000	0.073
700 to 800,000	0.110	3,400 to 3,500,000	0.071
800 to 900,000	0.109	3,500 to 3,600,000	0.070
900 to 1,000,000	0.107	3,600 to 3,700,000	0.069
1,000 to 1,100,000	0.106	3,700 to 3,800,000	0.067
1,100 to 1,200,000	0.104	3,800 to 3,900,000	0.066
1,200 to 1,300,000	0.103	3,900 to 4,000,000	0.064
1,300 to 1,400,000	0.101	4,000 to 4,100,000	0.063
1,400 to 1,500,000	0.100	4,100 to 4,200,000	0.061
1,500 to 1,600,000	0.099	4,200 to 4,300,000	0.060
1,600 to 1,700,000	0.097	4,300 to 4,400,000	0.059
1,700 to 1,800,000	0.096	4,400 to 4,500,000	0.057
1,800 to 1,900,000	0.094	4,500 to 4,600,000	0.056
1,900 to 2,000,000	0.093	4,600 to 4,700,000	0.054
2,000 to 2,100,000	0.091	4,700 to 4,800,000	0.053
2,100 to 2,200,000	0.090	4,800 to 4,900,000	0.051
2,200 to 2,300,000	0.089	4,900 to 5,000,000	0.050
2,300 to 2,400,000	0.087	5,000 to 10,000,000	0.040
2,500 to 2,600,000	0.086	Over 10,000,000	0.030
2,600 to 2,700,000	0.084		

Period of Performance:

	<u>Factor</u>
Over 24 Months	0.120
23 to 24 Months	0.116
22 to 23 Months	0.112
21 to 22 Months	0.109
20 to 21 Months	0.105
19 to 20 Months	0.101
18 to 19 Months	0.098
17 to 18 Months	0.094

(Continued)

Table D-3 (Continued)

16 to 17 Months	0.090
15 to 16 Months	0.086
14 to 15 Months	0.082
13 to 14 Months	0.079
12 to 13 Months	0.075
11 to 12 Months	0.071
10 to 11 Months	0.068
9 to 10 Months	0.064
8 to 9 Months	0.060
7 to 8 Months	0.056
6 to 7 Months	0.052
5 to 6 Months	0.049
4 to 5 Months	0.045
3 to 4 Months	0.041
2 to 3 Months	0.038
1 to 2 Months	0.034
Under 30 Days	0.030

Contractor's Investment (Judgmental):

Degree	Weight
Below average	0.03
Average	0.07
Above average	0.12

Assistance by Government (Judgmental):

Degree	Weight
Below average	0.12
Average	0.07
Above average	0.03

Subcontracting:

<u>Subcontracting</u>	<u>Factor</u>
80% or more	0.030
70% to 80%	0.042
60% to 70%	0.055
50% to 60%	0.068
40% to 50%	0.080
30% to 40%	0.092
20% to 30%	0.105
10% to 20%	0.118
0	0.120

contracts where profit is a factor. Profit shall be determined by using the following procedure:

c. Based on the circumstances of each procurement action, each of the factors listed in Table D-2 shall be weighted from 0.03 to 0.12 as discussed in the following text and provided in Table D-3, Guidelines for Weighted Factors, Profit Determination. Statements in sufficient detail to explain the reasons for assigning the specific weights shall be included on the profit computation sheet. The value shall then be obtained by multiplying the rate column by the weight column. The value column when totaled indicates the fair and reasonable profit percentage.

(1) Degree of risk. Where the work involves no risk or the degree of risk is very small, the weighting should be 0.03; as the degree of risk increases the weighting should be increased up to a maximum of 0.12. Lump sum items will have, generally, a higher weighted value than unit price items for which quantities are provided. Other things to consider: the portion of the work to be done by subcontractors, nature of work, where work is to be performed, reasonableness of negotiated costs, amount of labor included in costs, whether the negotiation is before or after the period of performance of work.

(2) Relative difficulty of work. If the work is most difficult and complex, the weighting should be 0.12 and should be proportionately reduced to 0.03 on the simplest of jobs. This factor is tied in to some extent with the degree of risk. Some things to consider: nature of the work, by whom work is to be done, where, what is the time schedule.

(3) Size of the job. All work not in excess of \$100,000 shall be weighted at 0.12. Work estimated between \$100,000 and \$5,000,000 shall be proportionately weighted from 0.12 to 0.05. Work from \$5,000,000 to \$10,000,000 shall be weighted at 0.04 and work in excess of \$10,000,000 at 0.03.

(4) Periods of performance. Jobs in excess of 24 months are to be weighted at 0.12. Jobs of lesser duration are to be proportionately weighted to a minimum of 0.03 for jobs not to exceed 30 days. No weight where additional performance time not required.

(5) Contractor's investment. Jobs are to be weighted from 0.03 to 0.12 on the basis of below average, average, and above average. Things to

consider: amount of subcontracting, mobilization payment item, Government-furnished property, method of making progress payments.

(6) Assistance by Government. Jobs are to be weighted from 0.12 to 0.03 on the basis of average to above average. Things to consider: use of Government owned property, equipment and facilities, and expediting assistance.

(7) Subcontracting. Jobs are to be weighted inversely proportional to the amount of subcontracting. Where 80 percent or more of the work is to be subcontracted, the weighting is to be 0.03 and such weighting proportionately increased to 0.12 where all work is performed by the contractor's own forces.

d. Profit on subcontractors. A separate profit calculation should be performed for the prime contractor and for each subcontractor. When the subcontractor assumes the risk and responsibility for portions of the work, the prime contractor's profit rate on that work should be decreased. As a general rule, profit is applied as a percentage rate to the total of all costs required by the contract or modification scope. For early design stage estimates, a rate of profit may be assumed based on past historical experience.

10. Surety Bonds

a. Surety bonds are three-way agreements between a bidder or contractor (the principal), and a second party (the surety), to assure fulfillment of the principal's obligations to a third party (the obligee). If the principal obligations are not met, the bond assures payment to the extent stipulated, of any loss sustained by the obligee. In most Government construction contracts, these three parties are as follows:

<u>Three</u>	<u>Under a General Contract</u>	<u>Under a Subcontract</u>
The Principal	Contractor	Subcontractor
The Obligee	Government	Contractor
The Surety	Surety	Surety

b. Purpose of bonds. The purpose of surety bonds varies with the type of bond. Bonds are classified as Class A, Class B, or Class A-1, depending on the type of construction.

(1) Bid bonds or bid guarantee provide an assurance that the bidder will not withdraw his bid within the specified period for acceptance and will execute a written contract and furnish the required bonds.

(2) Payment bonds protect subcontractors, suppliers, and laborers against nonpayment by the prime contractor.

(3) Performance bonds ensure the contractor will complete the project as specified and for the agreed price. It does not shift responsibility for administering the contract to the surety. A performance bond provides a financial guaranty for the work and provides the contractor with a method of freeing his working capital and other assets which might otherwise be tied up by other forms of security such as certified checks, retainage, or deposits.

c. Amount of required surety bonds. The amount allowed should be based on the actual contractor bond cost. Performance and payment bonds are required for all construction contracts (FAR 28.102). The cost of all performance, payment bonds, and other types of bonds determined to be appropriate by the Cost Engineer are allowable costs.

d. Rules governing the application of bond rates (Table D-4).

(1) If the contract is susceptible to two classifications, normally the higher rate is applicable.

(2) Separate contracts take the same classification as a general contract. Neither the classification nor the rate is changed by subdividing the work or by the Government's providing certain materials.

(3) Subcontracts take the same classifications and rates as general contracts.

(4) For nondeviating Surety Association of America (SAA) rates where the construction time exceeds the bond stipulated time of 12 months, add 1 percent of the bond premium for each month in excess of 12 months.

(5) For nondeviating SAA rates where the construction time exceeds the bond stipulated time of 24 months, add 1 percent of the basic premium for each month in excess of 24 months.

(6) For deviating rates where the construction time exceeds the bond stipulated time of 12 months, add 1/2 percent of the basic premium for each month in excess of 12 months up to 24 months and 1 percent of the basic premium for each month in excess of 24 months.

(7) If the consent of the surety is not required and given for changes or extras, first and renewal premiums for the additional cost thus caused are computed at manual rates from the date of the bond.

(8) If the consent of the surety is required and given for changes or extras, premium for the additional cost thus caused is computed at manual rates from the date of such surety's cost.

(9) The minimum bond premium charge is \$25.00.

e. Cost of performance and payment bonds.

(1) Performance and payment bonds are obtained as a single package. The premium is the same as for the performance bond alone. Rates vary with the nature of the contract work, the dollar value, and length of the contract. Most types of Civil Works construction are classified as Class B.

(2) Performance bonds cover the full amount of the contract price (bid amount). The premiums are adjusted at the completion of the work for any subsequent changes in the contract price other than changes due to time bonuses or penalties. If the original contract price is increased through change order, the contractor must pay an additional premium. Conversely, if any part of the original work is deleted and the original price thereby reduced, the contractor will receive a refund from the surety.

(3) Example 3 illustrates the calculation of bond premium cost. Since the rates are subject to change and may vary by state, the calculations are to be used as a sample only. The Cost Engineer is responsible to ensure the rates used are accurate and current. This example assumes a canal excavation project in Tennessee, to be accomplished at an estimated cost of \$2.5 million, including profit with a duration of 20 months. Referring to the Class B rate schedule in Table D-4, Bond Rates, the premium for a

Table D-4
Bond Rates

1. Performance and performance-payment bond rates and lump sum and unit fixed price contracts where the stipulated time for completion is not over 12 months (Bond rates may change and should be verified on an annual basis).

a. Nondeviating SAA advisory rates per \$1,000 of contract value for all jurisdictions except South Carolina, Louisiana, Delaware, Hawaii, and Arkansas are as follows:

<u>Amount of Contract Price</u>	<u>Class B</u>	<u>Class A</u>	<u>Class A-1</u>
First \$ 100,000	\$25.00/M	\$15.00/M	\$9.40/M
Next 400,000	15.00	10.00	7.20
Next 2,000,000	10.00	7.00	6.00
Next 2,500,000	7.50	5.50	5.00
Next 2,500,000	7.00	5.00	4.50
Over 7,500,000	6.50	4.50	4.00

b. Deviating rates from companies that may or may not belong to the SAA and are dependent on competition and contractor net worth. The following rates per \$1000 of contract value are typical of a large contractor having a preferred rate structure:

<u>Amount of Contract Price</u>	<u>Class B</u>	<u>Class A</u>	<u>Class A-1</u>
First \$100,000	\$10.00/M	\$7.50/M	\$4.90/M
Next 400,000	8.00	5.50	4.50
Next 2,000,000	7.00	5.00	4.10
Next 2,500,000	6.00	4.40	3.80
Next 2,500,000	5.00	3.80	3.50
over 7,500,000	4.50	3.25	2.95

2. Performance and performance-payment bond rates for lump sum and unit fixed price contracts where the stipulated time for completion is not over 24 months (Bond rate may change and should be verified on an annual basis). Nondeviating SAA advisory rates per \$1,000 of contract value for South Carolina, Louisiana, Delaware, Hawaii, and Arkansas are as follows:

<u>Amount of Contract Price</u>	<u>Class B</u>	<u>Class A</u>	<u>Class A-1</u>
First \$ 500,000	\$14.40/M	\$10.80/M	\$7.20/M
Next 2,000,000	8.70	6.72	6.00
Next 2,500,000	6.90	5.28	4.92
Next 2,500,000	6.30	4.92	4.44
Over 7,500,000	5.76	4.44	3.96

performance-payment bond written in the full amount of the contract price and by a nondeviating Surety Association Company, would be calculated as follows:

Example 3 - Bond premium calculation

First	\$ 100,000	@	\$25.00/M	\$ 2,500
Next	400,000	@	15.00/M	6,000
Next	<u>2,000,000</u>	@	10.00/M	<u>20,000</u>
	\$2,500,000			28,500
Eight additional months @ 1%/MONTH				
	(8 mo × 1% × \$28,500)			<u>2,280</u>
	Total premium			\$30,780

(4) The consent of the surety is required for changes or extras, and premiums for the additional cost are computed at manual rates from the date of the bond.

(5) It should be noted the surety industry has become a state regulated industry. The SSA issues advisory rates, but these rates may or may not be accepted by the state involved. Therefore, actual rates charged by surety corporations may vary from state to state.

(6) Table D-5, Contract Bonds Rate Classifications, shows the various types and classes of bonds as follows:

Table D-5

Contract Bonds Rate Classifications

Class A

Unless otherwise stated, the rates on the preceding page apply to contracts for furnishing and installing, or installing only, certain services or equipment such as the following:

Airport runways	Glazing	Playgrounds and parks
Aluminum siding	Greenhouses	Research contracts
Athletic fields	High-pressure power piping	Ski lifts
Beacon or flood lights	Janitorial service	Sprinkler systems
Burial contracts	Machinery made to special order	Stone (furnishing, delivering only)
Ceilings (metal or acoustical tile)	Map making	Storage tanks, metal
Certain walls (nonstructural)	Mill work	Tennis courts
Coal storage	Murals	Water carnage of freight
Ducts (underground power, light, phone)	Parking areas	Water proofing (except with gunite)
Elevators/escalators	Planting and cultivation of land	Wind tunnels

(Continued)

Table D-5 (Continued)

Class B

Unless otherwise stated, the rates on the preceding page apply to contracts such as the following:

Airport buildings	Gas mains and laterals	Power plants
Aqueducts	Gas piping	Public improvement
Atomic energy plants	Golf courses	Railroad roadbeds
Breakwaters	Grain elevators	Sand blasting
Canals and canal lining	Gunite contracts	Sculptures
Carpentry	Heating systems	Sea walls
Coal stripping	Hospital buildings	Sewage disposal plants
Commercial buildings	Incinerators	Sewers/septic tanks
Concrete work	Industrial buildings and plants	Shipyards
Dams	Jetties	Spillways
Dikes	Landscaping	Stone
Ditches	Locks	Subways
Docks and drydocks	Masonry	Swimming pools
Drilling contracts	Missile installations	Terminals - buses
Educational buildings	Nuclear reactors	Test borings
Electrical	Office buildings	Tile and terrazzo
Embankments	Offshore platforms	Transmission or distribution lines
Excavations	Painting	Tunnels
Filling stations	Piers	Underwater cables
Filtering plants	Piling	Ventilation systems
Fountains	Pipelines for water	Water works
Garbage disposal plants	Plastering	Wells
Gasoline cracking plants	Plumbing	Wharves
Gas compressor stations		

Class A-1

Unless otherwise stated, the rates on the preceding page apply to contracts for furnishing and installing, or installing only, certain services or equipment such as the following:

Arms	Generators	Recapping automobile tires
Ash conveyors	Grain doors, salvage and disposal	Repair of automobiles and trucks
Automatic stokers	Guard rails	Resmelting old metal
Automatic telephone exchange equipment	Heating	Rip rap stone (furnishing only)
Automotive service contracts	Incinerator operation	Rolling stock
Band concerts	Insulation contracts	Scaffolding
Bird control	Kitchen equipment	Sidewalks
Boiler retubing and repair	Laboratory equipment	Signaling systems on railroads
Bookbinding	Leasing of motor vehicles	Signs (all)
Cataloging	Lightning rods	Stack rooms
Coal handling machinery	Lock gates	Stand pipes
Computers and data processing equipment	Mail handling machinery	Street and subway lighting systems
Conveyors	Metal windows and shutters	Temporary personnel services
Data processing and computer work	Mosquito control contracts	Thermostat equipment
Doors	Movies	Toll gates
Dynamos	Office personnel	Track laying
Exterminating contracts	Organ repairs	Traffic control systems on highways
Fire alarm systems	Ornamental iron work	Training manuals
Fire escapes	Parking meters	Tree trimming and removal
Flag poles	Photogrammetric work	Watchmen and signal services
Floats	Pipelines for oil or gas	Water towers
Floors	Police alarm systems	Weather stripping
Furnishing food services	Projectiles	Weed mowing
Gas tanks	Public address and music systems	Window cleaning
	Radio towers	Work and labor
	Radiological equipment	X-Ray inspections