

# GUIDE FOR ARCHITECTS-ENGINEERS

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## General Requirements

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**CHAPTER 1**

**GENERAL INFORMATION**

1.1 Purpose of Manual. The purpose of this guide is to inform architect-engineer (A-E) firms or professional service contractors (hereinafter referred to as A-E) of general procedures, standards, policies, and requirements for development and presentation of consulting, planning, and design work for construction projects for Seattle District, Corps of Engineers (hereinafter referred to as District). To efficiently assimilate voluminous material which governs design of projects for the District, the A-E should not only be thoroughly familiar with contents of this guide but should take into account that these procedures may require a more complete and extensive analysis and treatment than is customary in private practice.

1.2 Applicability. The procedures and instructions in this manual shall be used in the planning, design, and preparation of documents the District and will be referenced in the statement of work (SOW) for all A-E contracts where applicable. In the event of conflict between this manual and the contract document, the contract will take precedence. However, the conflict shall be brought to the immediate attention of the contracting officer (CO) and/or contracting officer's representative (COR).

1.3 Coordination With District. The CO may appoint a COR to administer the contract. Each design project in the District is managed by a project manager (PM). The PM may or may not be the COR. Inquiries concerning details of the work may be discussed with the PM or the COR. The PM or COR will assist the A-E in achieving smooth and timely fulfillment of contractual requirements. Any problems relating to design which endanger such fulfillment should be immediately brought to attention of the COR. Oral understandings should be confirmed in writing by either A-E or COR at request of either party. The A-E is cautioned to take instructions from the CO, COR, and/or PM only. Changes in contract scope can only be authorized by the CO. Correspondence by the A-E should be transmitted in triplicate and addressed as follows:

District Engineer  
Seattle District, U. S. Army  
Corps of Engineers  
Post Office Box C-3755  
Seattle, Washington 98124-2255  
ATTN: CENPS-E (Name of COR)

1.4 A-E Services. The specific contract requirements for a project will be in appendix A, "Statement of Work," to the A-E contract. A-E contracts normally provide for one or more of the following: Preparation and submission of (1) project planning reports for budgetary and authorization purposes and to establish basis of design, (2) preliminary plans, (3) contract plans, and (4) environmental impact statements. A-E contracts may also include inspection during construction (Title II services), checking shop drawings, and preparing as-built drawings.

1.5 Conduct of Work. In the performance of contracts with the District, the A-E shall:

1.5.1 Execute the work (see typical design submittal requirements) per contract schedule. Immediately advise the COR/PM of any delays.

1.5.2 Furnish (within 5 days) to the COR/PM copies of all written, verbal, and telephone communications pertaining to the work under this contract received from other Government agencies, except where it is clearly indicated that a copy of the communications has been furnished to the COR/PM by the originator.

1.5.3 Acquire, obtain clarification, and incorporate all design criteria and other information required by the contract.

1.6 Contract Modifications. During progress of design, minor changes in basic criteria within general scope of work should be expected, and the A-E should make necessary adjustments in work accordingly. However, in the event of scope changes that the A-E considers to be outside the scope of work, appropriate contract modifications will be negotiated with A-E. Negotiation procedures for a change order follows closely that of a basic contract.

1.7 Contract Payments. The A-E shall submit monthly estimates of value of services rendered on ENG Form 93 (furnished by the District) which will be checked against progress made and certified for payment. Blocks 13, 14, and 15 of Form 93 will be completed by the Government. A "release of claims" must accompany the final payment Form 93.

1.8 Review Comments. Data prepared by the A-E will be reviewed by the District, users, and/or other Government representatives for conformance with the contract requirements. The method of processing review comments at the various review phases as illustrated on the NPD Form 32 (figure 1). The A-E shall respond to the review comments by compliance or provide an acceptable explanation for noncompliance. The A-E should indicate the nature and location of his correction in the "Design Office" column of the form. The design office description should be detailed enough for the reviewer to verify compliance without extensive search. All notes, descriptions, etc. should be made on the original. Comment sheets and the originals shall then be returned to the PM for backcheck. In addition copies of previous review comments (with design office column completed) shall be included in the design analysis of the next submittal.

1.9 Checking and Coordinating. The responsibility of the A-E for checking and coordination of all drawings and specifications cannot be overemphasized. A-E is responsible for producing complete, competent, properly coordinated, and thoroughly checked design documents within agreed schedules. A final, independent, thorough check by the A-E shall be accomplished of all plans and specifications and other required data prior to any scheduled review. This check and coordinating review shall be for the purpose of eliminating errors, interferences, inconsistencies between all design disciplines of the work, inconsistencies between drawings and specifications, and for the incorporation of criteria, review comments, guide specifications, and information included in this manual. The A-E shall submit a fully coordinated check print set and quality control checklist (see addendum) showing comprehensive review effort. Designs containing numerous drafting, typing, and referencing errors will be returned to the A-E for checking and resubmittal.

1.10 Trade Names and Proprietary Items. The use of trade names, proprietary items, and the drafting of a specification by adopting a manufacturer's description of a particular commercial article shall be avoided. The item shall be specified by giving its physical characteristics, chemical composition, laboratory test results, and performance in actual

use in such a manner as to insure full and free competition among suppliers. Full justification and Government approval is required prior to specifying any unique or "single manufacturer" items for specific Government projects. Such items shall be submitted with justification for their use at the concept submittal stage.

1.11 Guide Specifications. In order to promote uniformity of construction throughout the Corps, guide specifications will be given to the A-E's on all projects. The guide specifications are complete specifications which must be edited by the designer to remove inapplicable items and occasionally to add some information. Each guide specification has a number of "notes to the designer" in the rear which are important since they contain criteria. The technical manuals also contain information on preparation of technical sections of the specifications and should be fully utilized. The guide specifications also indicate items to be shown on the drawings and in this regard can act as a checklist for the designer. The designer shall edit each guide specification by marking it up with a black pencil and sending a copy of the "marked-up guides," along with the typed specifications, with the final submittal. For areas where guide specifications do not exist, the A-E shall prepare the complete specification. Detailed instructions for preparation of specifications are covered in this A-E Guide, Volume 3.

1.12 Construction Cost Estimate. The estimate of cost submitted with the concept or early preliminary submittals shall be as accurate as possible based on the design accomplished at that time. These estimates will be used for programming and budgeting purposes and will be a major factor in determining if the project is to proceed through the final design and construction phases. The A-E shall design the project within the programmed funds. If, at any time, it becomes apparent that the project cost will exceed the programmed amount, the A-E shall notify the COR/PM immediately. The A-E shall suggest cost savings measures. These cost saving measures are basic design and not considered value engineering (VE) studies listed below. The estimate shall be supported by a complete written takeoff which is organized and correlated with the design documents. Price quotes shall also be documented with names, telephone numbers, and product cuts. Detailed instructions for preparation of cost estimates are covered in this A-E Guide, Volume 2.

1.13 Value Engineering. The District reserves the right to perform VE studies on projects either during or after completion of design. The VE studies may be performed by the District or other A-E forces designated by the District. The District, at its discretion, may modify A-E contracts to implement any or all design changes resulting from the VE studies or the engineering evaluations after completion of design. The A-E, during the course of his design, shall be alert for and shall identify those high cost, low value items or areas which he considers may be accomplished in different ways and possibly at less cost. For projects with an estimated construction cost over \$500,000, the A-E shall review project for value engineering potential and submit with the 35 percent documents a list of approximately 10 (or more) project features offering best potential value engineering savings. These features may include layout, principle features of construction, criteria, scope, or any item having "high cost low value" where value improvements can be accomplished. The A-E shall include a brief statement of the rationale for proposing each feature listed. This list shall be accomplished through brainstorming techniques by A-E's multidiscipline staff and be certified by a senior designer that it represents the best efforts of the firm.

1.14 Site Visits. The A-E shall make adequate visits to the project site to become familiar with local conditions. In some cases, as-built surveys, geotechnical

investigations, and survey services may be required. The A-E shall contact the COR/PM for coordination of all site visits.

1.15 Safety. All work shall include the necessary features required to produce a facility in which safety has been incorporated so as to conform to the established safety codes and regulations. Particular attention shall be given to such safety features as snow guards, windscreens, mechanical equipment guards, stairway head clearances, handrails, access hatches, ladder cages, fixed ladders, and nonslip treads. All projects shall meet the requirements of the Corps of Engineers Safety Manual EM 385-1-1, OSHA Standards, and other applicable user/agency safety standards.

1.16 Use of Automatic Data Processing Systems (ADPS). The District encourages use of ADPS whenever this will result in cost reductions and/or improved design.

1.16.1 The A-E shall furnish writeups or identification of programs to be used on major features of the work as part of the concept (early preliminary) submittal. The writeup shall contain sufficient detail so that the general method of solution and problem limitations may be identified and test problem data may be assembled for trial runs by the District if desired. When programs not otherwise identified are implemented while the work is in progress, output listings shall include enough input data and intermediate results to afford manual checks on the final results.

1.16.2 When designs are accomplished by ADPS, the design analysis will include description of design methods, including assumptions, theories, and technical formulas, employed. Copies of ADPS input data and output listings shall be presented, annotated in language understandable by personnel not familiar with ADPS, and accompanied by diagrams and notations of sufficient detail to facilitate manual checks of final results. Computer programs employed shall be described so that the general methods of solution and program limitation are identified. ENG Form 2883, Electronic Computer Program Abstract, may be used for this purpose. Location of ADPS cards, tapes, or other pertinent medium utilized in the design analysis shall be indicated.

1.16.3 Unless otherwise specified, data card decks, discs, or tapes used for final computations shall be retained by the A-E for the life of the construction contract and shall be available to the District without additional cost.

1.16.4 When earthwork designs are processed by computer, plotted cross sections shall not be furnished except to clarify the structural or geometric arrangement of the proposed installation. When plotted cross sections are not used to prepare quantity estimates, the A-E shall note in the outline and final specifications that plotted cross sections are not available for the bidder's inspection.

1.16.5 The District's approval of any computer program or acceptance of computed results shall not relieve an A-E of any responsibility for accuracy of data or technical validity of assumptions and formulas used. All input data shall be double checked for accuracy.

1.17 Austerity in Design. All design and construction shall be performed consistent with the principals of maximum economy. Materials and finishes shall result in minimum maintenance and first cost. Efforts shall be made to produce esthetically pleasing structures, especially for buildings housing functions pertaining to administration,

housing, community, or morale. This embraces use of suitable facing materials to provide a more pleasing appearance, use of picture windows, overhangs, architectural treatment of main entrances, and other measures. The basic concept is to achieve pleasing appearance with due consideration of economy of design and without resort to purely decorative features. This improved appearance concept does not apply to industrial type buildings located in industrial areas of the complex. Energy conservation and VE are also important design considerations.

1.18 Federal, State, and Local Pollution Abatement Criteria and Environmental Permits. To avoid wasted effort, the A-E shall contact permitting agencies early in the design process. The A-E shall insure that the project is in full compliance with the requirements of all Federal, state, and local clean air, clean water, water rights, resource recovery, and solid waste disposal standards and the Federal Endangered Species Act. All applicable standards and criteria shall be obtained and reviewed by the A-E.

1.18.1 The A-E shall identify, in the design analysis, the following:

1.18.1.1 The permitting authority(ies).

1.18.1.2 Construction/operating permits required.

1.18.1.3 Time required by the permitting agency(ies) to process the application(s).

1.18.1.4 Fee schedule, including filing/application fees, emissions fees, certification testing, etc.

1.18.1.5 Monitoring and/or compliance testing requirements.

1.18.1.6 Actual agency regulations governing applications, exemptions, variances, etc.

1.18.2 Should permits be required, the A-E shall obtain all required application forms, complete all technical sections, and provide the partially completed forms to the Seattle District. The A-E shall prepare all supporting material required for the applications, including emission surveys, diagrams, pollutant load calculations, etc.

1.18.3 The A-E shall notify the District of any major discrepancies existing between the A-E design criteria provided and the pollution abatement criteria.

1.18.4 Copies of all correspondence from permitting agencies which either detail permit requirements or indicate that no permits are necessary shall be furnished to the District by the A-E.

1.19 Standard Drawings. Standard plans and/or fully developed project plans and design analysis, prepared by others, furnished for a site adaptation to another site, shall be carefully reviewed for technical adequacy and for conformance to criteria furnished, which may in some instances supersede data on the standard plans, and shall be corrected as required. When errors or deficiencies are found in the definitive or standard plans, complete details with recommendation of corrective action necessary shall be reported by letter. Complete adaptation to the site and for connection to utilities at that site will

be required. Standard plans and/or site adaptation plans will be furnished by the District. In the event that readable prints cannot be obtained, the A-E shall prepare a new drawing of the quality required by the drafting standards.

1.20 Extra Services. A-E's are not to perform services requested which are considered to be a change in his contract until a proposal covering such extra services, has been made, a mutually satisfactory fee has been negotiated, and a written notice to proceed has been received.

1.21 Responsibility After Design Completion. The A-E will be required to support the District after completion of his contract should errors or omissions in the documents prepared by the A-E create problems in bidding or administering the contract for construction. The support provided by the A-E shall take whatever form is necessary to correct the errors or omissions in the original documents. Such required corrections shall be done at no additional cost to the Government. Action shall be prompt in order to minimize impact costs to the Government/A-E.

## CHAPTER 2

### A-E CONTRACT PROCEDURES AND REQUIREMENTS

## 2.1 Synopsis of A-E Actions Before Contract Award.

2.1.1 Pre-design Conference. Upon approval of selection, the A-E will be notified in writing. This notification will contain a brief description of the nature and scope of the project. The A-E will be requested to visit the District and/or project site to participate in pre-design/prenegotiation conferences prior to preparation of a proposal and actual negotiations. There may be a separate pre-design and a separate prenegotiation conference or they may be combined into one meeting. During the pre-design conference, the PM will discuss the technical requirements and the general approach with the A-E's designers. The users of the facility may also attend this conference. The A-E will be furnished with a draft SOW, PB's, DD Form 1391, this guide, design criteria, and such other data that defines the extent of the work to be done. At this time the A-E may propose design changes he feels would be in the best interests of the project. The scope of Army projects are rigidly set by the DD 1391 and little change is allowed at the pre-design conference. The Air Force uses the pre-design conference as a primary design tool and the minutes of the conference become the major design scoping document.

2.1.2 Pre-negotiation Conference. During the pre-negotiation conference, the required effort which will affect the A-E's fee are discussed to enable the A-E to make a reasonable proposal. The District negotiator is the A-E's point of contact for matters relating to the fee proposal. Questions pertaining to technical matters will be addressed to the negotiator and questions pertaining to nontechnical contractual related matters will be directed to the procurement representative. The proposal and the design quality assurance (DQA) plan (see 2.1.4) shall be required to be submitted on a specific date established by mutual agreement during the pre-negotiation conference. The supporting data required by the District negotiator will also be specified at this time.

2.1.3 Fee Proposals. The A-E's proposal shall be prepared by a detailed analysis method based on man-hour requirements and skills involved, which establishes values of A-E services. The proposal will be broken down to extent necessary to permit negotiation of a fair and reasonable price and will include an attached estimated schedule of drawings and/or outlines or report as well as a listing of major activities involved in completing the A-E contract.

2.1.4 Design Quality Assurance Plan. The A-E will submit concurrently with the fee proposal, but under a separate cover a logical plan to follow to accomplish the required design services. This plan, to be reviewed by the District, is considered to be merely a formalized version of the plan that an A-E uses on all his projects for private industry. The A-E will be expected to closely follow the DOA plan throughout the course of the project to assure a quality end product. Should future events dictate revisions to the approved DQA plan, the A-E is required to notify the COR/PM in writing and submit the revised plan for approval. The following elements are to be included in the DQA plan:

2.1.4.1 Management Approach. Define the specific management methodology to be followed during the course of the contract, including such aspects as design coordination procedures, quality control, communications, and managerial continuity and flexibility. Names of all associates and consultants who will perform services on the project shall be identified.

2.1.4.2 Management Structure. Delineate the organizational composition of the firm to clarify the interrelationship of the management design team components, including all consultants. Include an organization chart to identify the key design and review team members showing their specific organizational responsibilities.

2.1.4.3 Quality Control. The A-E shall have a logical and functional quality control program to minimize errors or deficiencies. The A-E shall perform independent technical reviews and correct all errors and deficiencies in the design documents prior to submitting them to the Government for review. This review shall be accomplished by persons not directly involved in design but with expertise in the design. The final check prints of the drawing shall reflect a complete review by yellowing out correct items and making corrections in red. This set of check prints shall be provided with each submittal for review by the District.

CAUTION: The A-E is cautioned to place special emphasis on this aspect of the DQA plan. The contractual obligation of the A-E to provide complete, well coordinated, and error free documents has far reaching consequences. In the event possible subsequent damage to the Government results from negligent performance of any of the services to be furnished under this contract, the A-E will be held liable for such damages. The Government's reviews in no way relieve the A-E of these contractual responsibilities. For this reason, an effective quality control plan is very important.

2.1.4.4 Planning and Scheduling. A time-scaled bar chart or CPM design schedule showing the sequence of events involved in carrying out the project task within the specified period of service shall be provided. This shall be at a detailed level of scheduling with planning efforts focused on identifying major items that most often control the flow of work. Indicate the A-E review and correction period prior to submittal. It should be a forward planning as well as project monitoring tool.

2.1.5 Negotiation. Negotiations will normally be held in the District office. The objective is to assure a mutual understanding of the SOW and to reach an agreement on a fair and reasonable fee. During negotiations, the SOW will be thoroughly reviewed and the A-E's proposal will be examined and discussed in detail. Major changes in the SOW are discouraged at this time unless the A-E has previously notified the negotiator that certain scope changes are necessary. If agreement is reached, the contract will be forwarded to the A-E for signature within approximately 15 days after completion of negotiation. The approval and subsequent award of the contract will constitute the A-E's notice to proceed with the work. If an agreement cannot be reached, a new firm will be selected and procedure repeated.

2.2 Design Phases. Military projects evolve from the major scoping documents of the predesign conference (reference paragraph 2.1.1) and progress through final design to construction contract award. The drawings, design analysis, specifications, and estimate for each phase shall be prepared in accordance with instructions contained within the of this guide and the A-E contract. These requirements may be modified by negotiation for projects of unusual nature or scope if the PM determines the usual format is not appropriate.

2.2.1 Preconcept Design Study Phase (Army Projects). Normally this phase is not part of the A-E contract. This phase represents approximately a 10 percent design effort. If the A-E contract requires this phase, the A-E shall prepare a project development brochure, a project site plan, a building outline plan, and a control estimate.

2.2.2 Concept Design Phase (Air Force Projects). The concept design phase is normally 20 percent of the total design effort and is intended to establish the basic direction of the design effort. This phase will provide a basis for design, schematic drawings, and a gross cost estimate. This phase shall establish a fixed design direction for the project by demonstrating the appropriateness of one design solution over other possible alternatives.

2.2.3 Concept Design Phase (Army Projects). The concept design phase is normally limited to not more than 35 percent of the total design and is based on data furnished for a particular project. Concept design shall include the design requirements in each technical section, drawings, outline specifications, data, and documentation so the using agency can determine if the design is responsive to their design criteria memorandum and provide a firm basis to allow a dependable cost estimate to be prepared and on which the final design can be initiated. Concept design calculations shall be carried to the same percentage of completion as the items they support and shall be included with the concept documents.

2.2.4 Early Preliminary Design Phase (Air Force Projects). Early preliminary design (EPD) represents 35 percent of the total design effort and is intended to fix and illustrate size and character of the entire project as to plan and vertical relationships, functional layout based on work flow, kinds of materials and finishes, structural scheme, and type of mechanical and electrical systems. If a 20 percent concept design phase is submitted, the 35 percent EPD is usually not a required submittal.

2.2.5 Regular Preliminary Design (Air Force Projects) or Prefinal Design (Army Projects). This phase is seldom required. When it is the A-E's design shall be submitted at 60 percent stage of completion and permit a technical evaluation of design before final submission in order to verify concept and insure that the design is clear, consistent, within budget and suitable to proceed to final design.

2.2.6 Final Design Phase (Army and AF Projects). Final design phase documents shall be submitted in two parts. The first will be for review of the final design (100 percent complete except for incorporation of final review comments) and will include final drawings, typed specifications, design analysis, and construction cost estimate. The submittal will be reviewed by the District as described in paragraph 1.8. The A-E shall submit copies of corrected portions of the design, along with the originals of the review comments for backchecking. This process will continue until all review comments are satisfied or withdrawn. The A-E shall hold original documents until they are requested by the PM. Upon request from the PM, the A-E shall submit the corrected original mylar reproducible drawings and specifications ready for advertisement. If overlay drafting was used, composite chronoflex mylar reproducibles shall be provided. Ozalide mylars or reproducible sepias are not acceptable. The District drafting standards shall govern drawing quality.

### 2.3 Criteria.

2.3.1 The COR/PM will, in most cases, furnish the A-E with appropriate data and criteria concerning the project, such as site surveys, geotechnical reports, PDB's or PB's, etc. In addition, the following publications will routinely be furnished as applicable: Guide for A-E's, Volumes 1, 2, 3, and 4; Standard Details; Architectural and Engineering Instruction Design Criteria (Army projects only); Air Force Regulation, AFR 88-15 (AF projects only); Seismic Design for Buildings, TM 5-809-10; Safety and Health Requirements Manual, EM 385-1-1. The A-E will request technical manuals, AF manuals, guide specifications, and any other pertinent Government publications as required. As a guide in selecting these publications, refer to "Criteria Index" in volume 4.

2.3.2 Before negotiations, the A-E should thoroughly familiarize himself with the PDB's and PB's and the detailed technical criteria furnished since his design must conform with all applicable requirements contained therein. Any deviations therefrom, including the use of criteria obtained from the using agency or other sources, must receive prior approval of the COR/PM. Where the technical criteria contained or referred to herein is not met, the A-E will be required to conform his design to same at his own time and expense. Any questions or problems encountered by the A-E in following the criteria should be submitted to the COR/PM for resolution.

#### 2.4 Geotechnical Investigations.

2.4.1 General Procedure. Results of foundation investigations, geological data, seismic design criteria, foundation design criteria, and pavement design sections are normally provided by the District in the form of geotechnical reports. Two geotechnical reports will generally be provided, consisting of: A preliminary report which presents general criteria and which will be provided after notice to proceed on A-E contract; and a final report which provides site specific data and recommendations as well as exploration logs and locations and which will be provided after exploration and testing are completed, based on the site layout contained in the 35 percent submittal. The A-E will provide a site plan mylar at the 35 percent submittal to the District on which the actual exploration locations and boring logs will be indicated by the District. The site plan shall show the topography and the coordinate grid. On larger jobs, a separate boring log sheet may be required. The A-E shall incorporate the information on reproducible drawings into the final plan set. On larger jobs, the A-E will insert the separate boring log sheet into the final plan set. The A-E shall accurately maintain boring log numbers, log profiles, and boring locations in the final design. The A-E shall utilize pertinent geotechnical details and design criteria in his design analysis, drawings, and specifications.

2.4.2 Investigations by A-E Firm. Generally, all geotechnical investigations will be conducted by the Corps of Engineers. However, when foundation investigations are performed by A-E contract, such information shall be obtained by a competent and reputable firm specializing in such work and satisfactory to District. Adequate information shall be obtained for use by designers of structures, grading, drainage, disposal fields, and other features. Prior to negotiation of contract, A-E will furnish recommendations as to extent and type of foundation investigation he proposes. Scope of these services agreed upon will become a part of the contract. A-E shall include cost of this investigation in his total fee proposal. A-E shall discuss results of field investigations with CO's specialists in foundation and materials design.

2.4.3 Airfield Pavements. For all projects involving design of airfield pavements, the District will furnish the following to A-E for incorporation into design analysis, plans, and specifications.

2.4.3.1 Sketches of pavement sections for the project, including types and thicknesses of surfacing and base materials, and lateral limits of each type.

2.4.3.2 Sketches of geometric layout of all joints, and sections of all joints showing configuration and sealing details.

2.4.3.3 Sketches of subdrains (if required for project) showing general location and typical sections, and guidance criteria as required.

2.4.3.4 Draft specifications (guide specifications marked up for the specific project) for inclusion by the A-E in the construction contract documents for the following items of work:

2.4.3.4.1 Clearing and grubbing.

2.4.3.4.2 Excavation, embankment, and subgrade preparation.

2.4.3.4.3 Subdrainage system (if required).

2.4.3.4.4 Base materials.

2.4.3.4.5 Surfacing.

2.4.3.4.6 Joint sealing.

2.4.3.4.7 Pavement repairs (if required).

2.5 Surveying and Mapping.

2.5.1 General. Surveying and mapping are normally performed by District and topographic maps and other survey data are provided to A-E. When surveying and mapping are performed by A-E, work will be accomplished by personnel licensed in such work.

2.5.2 Procedures. Generally type of work, extent, and accuracy requirements will be prescribed in a Government-furnished SOW for each specific project. When specific instructions are not furnished, the following will apply.

2.5.2.1 Basic mapping control, "P" lines for route surveys, as-built control, and cadastral surveys will be conducted to 3rd Order accuracy, both horizontally and vertically, and comply with "Classification, Standards of Accuracy and General Specifications of Geodetic Control Surveys," published by National Ocean Survey. Secondary or supplementary traverses, base lines, or levels may be executed to 4th Order grade A accuracy.

2.5.2.2 When surveys include legal land surveys or descriptions, work will be accomplished in accordance with Bureau of Land Management methods and procedures and state statutes, where appropriate, and by or under supervision of a professional land surveyor holding a current license issued by the state in which work is located.

2.5.2.3 All extension of survey control and mapping accomplished by photogrammetric methods and procedures shall comply with National Map Accuracy Standards.

2.5.2.4 The A-E will inform PM of his proposed methods, procedures, and type of equipment to be used, and work will be subject to inspection by Government personnel. However, the A-E will retain responsibility for quality of work within limits prescribed in the SOW.

2.5.2.5 Original field notes, computations, aerial negatives, photographs, and maps, without alteration, will be furnished the District when the project is completed.

2.5.3 Topographic Drawings. Topographic and planimetric data shall be plotted to prescribed scale and contour interval on polyester drafting film of approved quality in accordance with Seattle District Drafting Standards. When specific instructions are not furnished, the following will apply:

2.5.3.1 Contours shall be shown with fine, solid line. Every fifth (guide) contour shall be somewhat heavier and periodically broken for insertion of the contour elevation. In general, identification of guide contours shall follow a regular pattern to allow for "easy map reading."

2.5.3.2 All survey stations, bench marks, designations, and elevations are to be shown on topographic drawings in accordance with Seattle District Drafting Standards.

2.5.3.3 Buildings and structures shall be shown with solid lines, omitting cross hatching or complete blanking.

2.5.3.4 Maps and drawings will be so oriented that north will be toward top of sheet, when practicable, or toward left of sheet if top orientation is impractical.

2.5.3.5 Items to appear on all completed topographic drawings are as follows:

2.5.3.5.1 North arrow.

2.5.3.5.2 Grid ticks and values.

2.5.3.5.3 Scale and graphic scale.

2.5.3.5.4 Grid system, projection, and datum with latter referenced to National Geodetic Vertical Datum (NGVD).

2.5.3.5.5 Date aerial photography flown, if applicable.

2.5.3.5.6 Date of ground survey.

2.5.3.5.7 Survey control points, identification, and elevations where appropriate.

## CHAPTER 3

### PRESENTATION OF DATA

3.1 General. The standards for data presentation contained in this chapter shall be used in preparation of the contract drawings and the analysis of design. These standards generally describe various technical features and requirements of drawings and specific information that must be included on the drawings but is not intended to be a complete list of all features. The A-E shall show all the information necessary to completely describe the project. Drawing presentations shall be consistent with the District drafting standards. Use of District standard details shall be made whenever possible to decrease design costs.

### 3.2 Drawings.

3.2.1 1 General information Sheets (Plates G-1 and G-2). Depending on the size and nature of the project, one or two sheets shall be used to show the title and location of the project, schedule of drawings, a project location plan, and a vicinity map. See District drafting standards for the typical A-E title sheet.

3.2.1.1 The schedule of drawings shall include the consecutive sheet numbers, the drawing titles, and the discipline sheet numbers and plate numbers. Titles in the schedule of drawings shall agree exactly with those on the individual sheets.

3.2.1.2 The vicinity map shall be a single-line type showing major cities, nearby towns, major rivers, streams, routes of nearby highways and railroads, and a north arrow.

3.2.1.3 The location map shall show the north arrow and indicate the project area, contractor's equipment yard, contractor's entrance to the installation, haul roads, location of the District project office, location of the facilities engineer's or base civil engineer's office, hospital, fire station, and the location of the borrow and disposal areas. If there are no onpost borrow or disposal areas, provide a note to that effect.

3.2.1.4 Safety logo.

3.2.1.5 The type of submittal (concept/final) shall be indicated directly above the title box on plate G-1.

3.2.2 Mylar The mylars, complete with blank title blocks, will be supplied by the COR/PM

3.2.3 Numbering of Drawings. All drawings will be consecutively numbered in box marked "sheet." The drawings are to be placed in the drawing set in the discipline sequence as shown in the District drafting standards. Discipline drawings shall be numbered in box marked "plate."

3.2.4 Signature. All final drawings prepared by the A-E shall bear the professional stamp/seal and signature of a licensed engineer or architect, preferably one of the principals. In addition, one of the principals shall sign the first sheet of each discipline. Name and certificate number of qualified analyst shall appear on sheet which shows design of a fallout shelter.

3.2.5 Graphic Scales. A graphic scale for each of the different scales used on a drawing shall be placed on the drawing to the left of the title block.

3.2.6 Orientation. Orientation of all plans and maps should be consistent, with north arrow pointed toward the top of the sheet or towards the left when necessary. Plans shall show both true north and reference north.

3.2.7 Title Block Layout. The A-E shall complete the entire title block of all final drawings as shown in the District drafting standards.

### 3.3 Drawing Preparation.

3.3.1 General. All drawings shall conform to the Seattle District Drafting Standards. Preparation of all work shall be for one-half size reduction. Therefore, it is necessary that drawings be inked or drawn with plastic lead using one as standard throughout the set of drawings unless instructed otherwise. Most modern reproduction processes of half-size or smaller do not tolerate shading, whether it be by color or background shading; therefore, shading will not be permitted on reproducible material. Parallel lines should never be so close together that they will merge into one line. The clear space between lines should always be of greater width than the adjoining lines. Lettering shall be single stroke, vertical, freehand or mechanical, all capitals, with a minimum height of 1/8 inch, again keeping in mind that lettering must tolerate half-size reduction. Drawings shall be edge bound for submittals.

#### 3.3.2 Notes on Drawings.

a. Should not duplicate requirements stated in the specifications or requirements which should be in the specifications.

b. Should not make reference to pay items.

c. Should not refer to Owner, User, Architect, etc. Instead, use the words "Contracting Officer" or "Contracting Officer's Representative."

d. Should not refer to the specifications, such as note: "SEE SPECIFICATIONS."

e. Should not refer to bid items, that is bid item numbers should not be placed on drawings (unless absolutely necessary) without the written approval of the Seattle District Specifications Section.

3.3.3 Scales. Scales shall be selected to avoid overcrowded and cluttered conditions on the drawings. Drawing layout, together with the proper scales to properly delineate the project, should be carefully planned in advance. Where necessary to maintain proper scale, drawings of large structures shall be placed on two or more sheets, with appropriate key plan and match lines provided on these sheets. Deliberate reduction of the scale shown below or use of unusual scales is unacceptable. It is suggested that in designs for complex projects the floor plans be oriented the same direction on the drawings and drawn to the same scale to allow overlays to be readily accomplished. It is also suggested that the designer overlay sections to assure that major interferences between structural

members, architectural features (suspended ceilings, doorways) and HVAC ducts are resolved. Scales may be discussed with the PM at the prenegotiation conference. The scales indicated in the following list will, in general, be used for most projects:

#### 3.3.3.1 Civil Drawings.

Site Plan - 1" = 40'

to avoid a crowded condition it may be necessary to use  
1" = 20' or 1" = 10'.

#### 3.3.3.2 Architectural Drawings.

Floor Plan - 1/4" = 1'0"

for large, open structures, a 1/8" = 1'0" scale may be used, with congested areas such as toilet rooms, mechanical rooms, etc., being blown-up to 1/4" = 1'0" scale.

Building Sections - 1/8" - 1'0"

Reflected Ceiling Plan - Same scale as architectural floor plan.

Roof Plan - 1/16" = 1'0"

Elevations - 1/8" = 1'0"

Wall Sections - 3/4" = 1'0"

Details - as appropriate for clarity.

#### 3.3.3.3 Structural Drawings.

Foundation Plan - same scale as architectural floor plan.

Floor Plan - same scale as foundation plan.

Roof Plan - same scale as foundation plan.

Wall Sections - as appropriate for clarity.

Details - as appropriate for clarity.

#### 3.3.3.4 Mechanical-Plumbing Drawings.

Floor Plan - same scale as architectural floor plan, with congested areas enlarged as required for clarity.

details - as appropriate for clarity.

#### 3.3.3.5 Electrical Drawings.

Power Plan - Same scale as architectural floor plan.

Lighting Plan - same scale as architectural floor plan.

Site Plan - 1" - 40'

Details - as appropriate for clarity.

3.3.3.6 All Discipline Drawings. When applicable phasing sequence construction schedule and limits of work shall be clearly indicated.

3.3.4 Revisions. Revisions are changes occurring at any time after the project is out for construction bids. The A-E will be responsible to make all necessary revisions to the drawings and specifications when he has been deemed liable due to an obvious error in the contract documents. Revisions to the drawings shall be made in accordance with the Seattle District Drafting Standards. Where revisions result in new sheets to be added, then the schedule of drawings shall be changed. The new sheet will be added at the end of the discipline to which it belongs, taking the next consecutive discipline number, with the sequential numbering handled thusly, 58, 58A, 59, etc. The revision block(s) shall indicate the changes resulting from the drawing(s) amendment. The revision symbol for such change(s) shall be first available letter such as A, B, etc. Drawings that are revised by Amendment or Proposed Project Modification (PPM) shall have the amendment or PPM number for same placed between the border lines directly below the title box. Brackets or clouds shall be placed around those area(s) of the drawing(s) being revised or amended. Only the latest amendment change(s) shall be enclosed with brackets or clouds.

3.3.5 Legends. Legends of symbols shall be placed on the initial sheet of each design discipline. If two or more disciplines are presenting the same item, they must use the same symbol.

3.3.6 Abbreviations. Define abbreviations on the first sheet of each discipline. Use abbreviations which are generally understood and accepted.

3.3.7 Structural Notes. Design loads and respective criteria shall be listed. See exhibit B for standardized notes to be placed on structural drawings. Primary factors used in calculating loads shall be listed such as follows:

3.3.7.1 Seismic. TM 5-809-10, zone, coefficients I and K.

3.3.7.2 Wind. ANSI A58.1, coefficients I and K, wind velocity and exposure factor, velocity pressure.

3.3.7.3 Snow. ANSI A58.1, ground snow load, thermal factor  $C_t$ , I, exposure factor  $L_c$ , and basic snow load.

3.3.7.4 Live Loads. TM 5-809-1, list specific.

3.3.7.5 List specific structural materials, specific type, and allow stresses for each.

3.3.7.6 List specific structural direction to be able to discern the principle methods of design.

3.4 Analysis of Design. The analysis of design is a document composed of a basis for design and computations. Chapters 4, 5, 6, and 7 delineate specific requirements of submittals by discipline.

3.4.1 Basis for Design. The basis of design documents the process used to achieve the project design solution through directives, statements of work, criteria, and studies which demonstrate different methods and systems analysis with justification for the particular selections made at each submittal stage. A title page which states the appropriate submittal, such as "Concept Data" or "Early Preliminary Data," and includes the name of the project, the location, name of the A-E firm, the Corps of Engineers identification, and the date, shall be provided. Also, provide a table of contents. Provide a statement referencing the geotechnical report, which shall be attached as appendix I. Number and letter paragraphs for review referencing and number pages. This document must be revised and updated for each submittal to reflect the level of development consistent with the percent of project completion. The entire document must be submitted for each submittal. The basis for design shall be bound. Submission of revised and updated pages only is not acceptable. Any additional background material necessary to describe the design solution, such as meeting minutes, letters, standard designs, or field investigations, should also be documented in the basis of design. The basis for design should be developed concurrently with the design documents and specifications.

3.4.2 Computation. The computations shall consist of a bound assembly of all functional and engineering criteria, design information, and calculations to support the design plans and specifications.

3.4.2.1 Design Calculations. The design calculations shall be presented in a clear and legible form incorporating a title page and a table of contents. Pages shall be numbered consecutively and identified in the table of contents. Cross referencing shall be clear. The sources of information, formula, and references shall be explained.

3.4.2.2 Preparation of Computations. The computations shall be presented on 8-1/2-inch by 11-inch paper, except that larger sheets may be used when required for graphs or other special calculations forms. The material may be typewritten, handlettered, handwritten, or a combination thereof, provided it is legible, clearly expressed, and properly indexed. Both side margins shall be 3/4-inch minimum to permit side binding and head to head printing. Calculation sheets shall carry the names or initials of the designer and the checker and dates of calculations and checking. No portion of a design analysis shall be computed and checked by the same person.

3.4.2.3 Assembling and Binding of Computations. The several parts and sheets of a design analysis shall be given a sequential binding number and bound under a cover indicating the name of the facility and project number, if applicable. The title page shall carry the designation of the submittal being made. The complete design analysis presented with the final plans and specifications shall carry the designation "Final Analysis of Design" on the title page.

3.4.2.4 Classified Material. Analysis of design containing classified material shall be marked and handled in accordance with instructions of the COR/PM. Where only a minor portion of the criteria or calculation is of a classified nature, every effort shall be made to prepare the analysis of design so as to permit it to be an unclassified document with proper references to sources of classified material.

3.4.2.5 Concept and Early Preliminary Submittals. The analysis of design submitted with concept or EPD shall consist of the original or appropriate copies as required in the contract.

3.4.2.6 Final Submittal. A-E should append (i.e., catalog cuts) his final submission of the analysis with commercial and technical data of individual items not specifically identified but used in detail and specifications. This information should be limited to that which will be useful in final design review and administration of the construction contracts. The final submittal shall be consistent with the requirements of the contract.

3.4.2.7 Computer Analysis. This item is addressed specifically in chapter 1, paragraph 1.16.

3.5 Construction Analysis Report. The A-E shall submit a construction analysis report 30 days prior to the final submittal package. The purpose of this report is to bring to the attention of the contracting officer any special or unusual aspects of the design or construction which might affect the administration of the project.

This A-E report is for the orientation of Seattle District Resident Engineer and Construction Division personnel who will administer the construction contract. The report shall include a general description of the project, flag critical, unique, or special construction features or details and include, but not be limited to, the following:

3.5.1 Outline the project scope of work. Include construction schedule.

3.5.2 Explain the structural concept, materials, or unusual construction features. Outline critical structural elements, tolerance, special anchors, pile foundations, testing requirements, joint seals, etc.

3.5.3 Outline specified testing requirements, i.e., pile loading, field tests, etc. Where tests specified are unusual or nonstandard, give more detail.

3.5.4 Brief description of mechanical, electrical, utility designs, and unusual features such as high pressures, temperatures, capacities, etc.

3.5.5 Discuss critical areas where 100 percent inspection is required.

3.5.6 Discuss requirements for supervision of installation by the manufacturer.

3.5.7 Explain special requirements for operation and maintenance manuals.

3.5.8 Outline the long-lead procurement items and Government-furnished equipment and the impact that these items may have on the timely completion or coordination of the project.

3.5.9 Explain customer operational requirements (i.e., utility outage periods, aircraft runway closures, phasing of work in certain buildings, areas, etc.). Refer to the specified requirement.

3.5.10 Discuss permit requirements.

3.5.11 Outline hazardous materials and safety precautions (i.e., asbestos, beryllium, lead paint removal, mercury, and toxic substances).

3.6 Typical Design Submittal. Requirements are shown in tabular form in exhibit B. The A-E shall use this listing as an aid to verify the completeness of his submittal package.

**CHAPTER 4**

**PRECONCEPT DESIGN STUDY SUBMITTAL (FOR ARMY  
PROJECTS)  
10 PERCENT**

**CONCEPT DESIGN SUBMITTAL (FOR AIR FORCE PROJECTS)  
20 PERCENT**

4.1 General. The concept submittal (10 or 20 percent) shall consist of an analysis of design, schematic drawings, and a cost estimate. The requirements for the analysis of design and the drawings will be defined in this chapter by discipline. The preparation of the cost estimate is covered in Cost Estimating, "Code A," in volume 2.

4.2 Objective. The concept submittal shall provide sufficient information to demonstrate that the users' project requirements can be met within the programmed budget and scope of work. The concept submittal shall indicate the designer's proposed design approach demonstrating up to three alternate schemes for review. Applicable criteria shall be listed and major design constraints and opportunities addressed. Any information needed to support the designer's approaches shall be provided for review.

#### 4.3 Civil Design.

4.3.1 Basis for Design. The various aspects of the civil site design shall be shown at this phase. A narrative shall describe the type and extent of the civil design features under consideration and the designer's recommendation for their design. This shall include such elements as storm drainage, roads and paved areas, fencing, environmental impact, landscaping, site efficiency, and future expansion if appropriate.

4.3.2 Computations. Computations shall include estimated grading and excavations and an approximation of site utilities involved as well as any paving and miscellaneous site improvements. These computations shall be consistent with the level of detail of design involved in a 10- or 20-percent submittal.

4.3.3 Drawings. The drawings shall include a location map indicating the relationship of the site to the surrounding area. All major existing structures and/or streets shall be shown to facilitate identification of the proposed site. The schematic site plan(s) showing building orientation, paving and access, and landscaping, shall be provided.

#### 4.4 Architectural Design.

4.4.1 Basis for Design. Indicate how the structure relates to existing structures. Themes for the architectural treatment and the possible types of building construction shall be shown stating the reasons for the selections made. The occupancy and barrier free access requirements must be defined and criteria listed. Describe how the location and orientation of the structure relates to environmental considerations. Describe any additional or unusual features which will affect further design development.

4.4.2 Computations. The gross floor areas of finished and unfinished space shall be provided. The floor areas of specific programmed areas and/or rooms shall be calculated to indicate compliance. The floor areas of additional covered or uncovered spaces related to the structure must also be computed and described.

4.4.3 Drawings. The drawings shall include the schematic floor plan(s) showing the overall size of the structure, the functional arrangement, occupancy, and circulation spaces. The floor plan shall indicate major zoning requirements and building organization. A building section indicating the structures vertical relationship to the site as well as internal floor to floor heights shall be shown.

**CHAPTER 5**

**CONCEPT DESIGN SUBMITTAL (FOR ARMY PROJECTS)**

**35 PERCENT**

**EARLY PRELIMINARY DESIGN SUBMITTAL (FOR AIR FORCE  
PROJECTS)**

**35 PERCENT**

5.1 General. The concept (Army) and early preliminary (Air Force) submittals (35 percent) are essentially the same and consist of an Analysis of Design, drawings, outline specifications, and a cost estimate. This chapter shall define, by discipline, all the specific requirements of the Analysis of Design and the drawings. Guidance for the preparation of the outline specifications is described in the General Instructions, Volume 3, Specifications. Requirements of the Code B cost estimate are provided in the General Instructions, Volume 2, Cost Estimating. It is especially important to provide a useable cost estimate at this submittal. Refer also to Chapter 3, "Presentation of Data." Volume 4, Design Criteria, presents design criteria which consists of specific criteria references for developing the design.

5.2 Objective. The concept and early preliminary submittals shall be of sufficient detail to show the user how his functional and technical needs will be met, to indicate the designer's approach to solution of technical aspects to all reviewers, to show compliance to the criteria or justification for noncompliance, and to provide a valid estimate of construction cost. The submittal shall be heavily oriented toward creating the proper architectural treatment and establishing the design of the basic structural, mechanical, and electrical systems, and in general, show the District that the project has been sufficiently thought-out to enable it to proceed with no major changes in design. All deviations from applicable criterion such as military construction criteria, building code, fire protection, life safety, OSHA, and safety manual, shall be summarized and enumerated in design analysis. Identify deviation, citing source and paragraph, what criteria requires and nature of deviation, followed by authority granting waiver and date. If waiver has not been granted, indicate NONE.

### 5.3 Civil Design.

5.3.1 Basis for Design. Establish basic criteria for each aspect of the overall civil design. Provide justification for the selection of criteria and proposed features over alternate options or possible solutions.

#### 5.3.1.1 Water Distribution.

5.3.1.1.1 Develop basic and controlling water demands and show required residual pressures. Include fire, domestic, and industrial average and/or peak demands as applicable. Show adequacy of distribution system to supply controlling demands and include information basic to this determination such as known flow tests and/or computations. State whether additional fire hydrants are needed and indicate the recommended location of each hydrant. If the water requirements for the project are considerable, state whether a determination has been made regarding the capability of the existing system to meet the additional demand or if future analysis is needed.

5.3.1.1.2 For service lines, distribution main extensions, and new distribution systems, state the proposed friction coefficient, approximate controlling elevations, special material requirements, and any special features of the design such as pressure reducing or regulating values. For irrigation systems, indicate types of sprinkler heads, effective coverage, proposed spacing, and sectionalization.

5.3.1.2 Water Supply. Water supply (including sources, treatment, storage, pumping, and supply lines) for new systems or additions.

5.3.1.2.1 Give basic information such as population, capacity factor, per capita allowances, industrial, and irrigation requirements, and fire demands.

5.3.1.2.2 Provide information on type, condition, and adequacy of existing units such as well, pumps, reservoirs, etc., and current water consumption. If these items are already described in detail in an existing report, give summary statement and appropriate reference.

5.3.1.2.3 In describing proposed works, including functional design concepts basic to selection of type of units, materials, economy of operation, controls, etc. Provide statement of tentative sizes or capacities of major components, any critical elevations or dimensions, and essential related items as estimated from preliminary computations.

5.3.1.2.4 Identify the requirement for a new or additional source of water and the use of such water at an early stage. Normally, the District will provide data on additional water supply after the requirements have been identified. Where the scope of work specifically includes the determination of new or additional water supply, the following should be included: For new sources, include data on existing supplies and alternatives for new sources such as wells and surface supplies. Provide data for all proposed water wells and test drilling programs with full explanation of geological and other factors affecting choice of location, type, diameter, depth, and important related characteristics.

5.3.1.3 Water Treatment. Where water treatment is included in the job, the designer shall provide a copy of the water analysis and describe the elements of the design, including the capacities and number of units, monitoring equipment, and controls. The alternatives that were considered and the reason for selecting the design over the alternatives shall be discussed demonstrating how the design will correct the objectionable characteristics of the water.

5.4.1.4 Sewage.

5.4.1.4.1 Sewage Collection. Discuss peak and average flow determinations for building connections, individual sewer lines, and force mains based upon population data, measurements, or computations from the number of fixture units. Indicate controlling elevations and compliance with slope and size criteria. Confirm adequacy of existing sewers to carry additional flow.

5.3.1.4.2 Provide basic information, such as population, capacity factor, per capita flows, quantity, and nature of waste, etc., as applicable and develop required size and capacity for sewage lift stations.

5.3.1.4.3 Sewage Treatment. Where waste treatment is included in the job, explain the degree of treatment required to meet the applicable discharge standards. A complete description of the nature of the waste shall be included. Describe the elements of the design, including the capacities and number of units, monitoring equipment, and controls. The alternatives that were considered and the reason for selecting the design over the alternatives shall be discussed demonstrating how the design will achieve the treatment goals. Pilot plant testing programs which are to be conducted will be described, and in the case of land treatment, a soil testing program will be developed and described.

5.3.1.5 Storm Drainage and Grading. Discuss the proposed drainage design. The discussion shall include the rainfall intensity and return period, concentration times, infiltration rates, the size of the contributing area, method of computation, and the reasons behind the selection of each of the above. Describe the grading plan and the controlling slopes which will be used in the design.

5.3.1.6 Roads. Street. Open Storage Areas. Hardstands. and Walks. Discuss the geometric features of the paved areas such as widths of traffic lanes, shoulders, parking spaces, and walks. Data relating to the design such as type, volumes and composition of traffic; vertical and horizontal controls; and the class and category of road or street shall be included. The design section for all exterior pavements will be provided by the District in the geotechnical report. This section will be used in preparation of bidding documents and all other items related to pavements will be developed by the designer using applicable criteria and instructions. This report shall be referenced and a copy appended to the Basis for Design as an appendix.

5.3.1.7 Fencing. Describe the type and height of fences and gates. The description shall include features such as outriggers, barbed wire, or tape and gate controllers.

- 5.3.1.8 Dust and Erosion Control. Include a statement of the proposed type and method of accomplishing dust and erosion control, reasons for selection, extent of area treated, etc. If no treatment is proposed, justify omission.
- 5.3.1.9 Railroads. Include the type of service, volume, and traffic; the condition and weight of rails; type and thickness of ballast; ruling grade; type of treatment and size of ties; subgrade compaction requirements; types of track accessories, turnouts, and switches; and the name of the operating agency.
- 5.3.1.10 National Pollution Discharge Elimination System (NPDES) Permit. In projects where wastewater is not discharged into an existing collection and disposal system, the NPDES permit will be referenced and appended to the Basis for Design. Excepted from this requirement are small storm drainage facilities where no separate permit is issued.
- 5.3.1.11 Economic Analysis. Furnish economic comparisons between feasible alternatives for site layout, facility orientation, utilities systems, paved areas, and other site improvements.
- 5.3.1.12 Environmental Impact. Review the environmental impact analysis (environmental impact assessment or environmental impact statement) to determine whether any design feature changes the conclusions or recommendations of the analysis. Should changes to the analysis be required as a result of the design, a complete description of the required changes shall be included in the Basis for Design. If no changes are required to the analysis, the designer shall indicate this conclusion in the Basis for Design.
- 5.3.1.13 Energy Efficiency. Where the civil design includes energy consuming processes, provide studies on comparative energy conservation measures.
- 5.3.1.14 Landscaping. Include a statement of need and justification for proposed landscaping and description of existing and proposed plantings. State any unusual climatic or soil conditions or other local factors which affect the design or selection of plant species. State that no landscaping is required if this is the case.
- 5.3.1.15 Corrosion Mitigation. Refer to Paragraph 5.8, Corrosion Design.
- 5.3.1.15 Airfield Pavements. The District will furnish the pavement section design in the geotechnical report consisting of a brief description of foundation explorations, materials investigations, field tests, a statement of foundation conditions, results of field tests, a statement of values used in pavement design, basis for selection of pavement section, a diagram of the geometric layout of pavement joints, and a description of the adopted pavement sections. A copy of the report shall be attached to the basis for design as an appendix.
- 5.3.1.17 Future Expansion. Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble free fashion. State that no provisions have been made for future expansion if this is the case.
- 5.3.2 Computations. Computation appropriate to level of 35 percent design.
- 5.3.3 Drawings. The site plans shall show existing and proposed features such as buildings, paved areas, utilities with actual or tentative sizes, hydrants, valves, fences, and landscaping. The new facility shall be superimposed on existing topography. Reference the source of the survey data and the location where filed. The drawings shall have sufficient horizontal and vertical control to clearly indicate the proposed siting of the facility in relation to existing features. A small scale location map shall be provided showing the location of the project on the base and the general relation between the new facility and major existing structures and/or streets to facilitate identification of the proposed site.

#### 5.4 Architectural Design.

##### 5.4.1 Basis for Design.

5.4.1.1 State what general type of architectural treatment exists both on the installation and in the immediate vicinity of the subject project. Although selected design features of this structure should be repeated from existing structures, the design need not necessarily be identical. Motif must follow the most recent, predominant, existing theme of the installation to insure future long range design continuity. Give description as to how this design satisfies these requirements. Give a description of particular framing and wall systems selected, others considered, and reasons for selection.

5.4.1.2 Provide a statement as to type of construction per criteria, e.g., fire-resistive, noncombustible, noncombustible protected, etc.

5.4.1.3 Building Wall and Roof Construction. Provide statement of required type of construction based on occupancy, area, and height, i.e., noncombustible, etc., per fire protection analysis.

5.4.1.4 The "U" or overall heat transmission factor as required by AEI.

5.4.1.5 Provide an economic comparison of the in-place costs of three or more wall systems. The comparison will only consider systems which meet criteria for type of construction and the required "U" factors, are suitable to the seismic zone, and meet the durability and esthetic requirements for the project and life cycle costs. Present the first costs for each component of the wall system, combine these, and arrive at an overall cost per square foot of wall surface. Describe the maintenance requirements for each system studied. Provide a section through each wall system and show all components of the wall. Attach the economic comparison to the Basis for Design as an appendix.

5.4.1.6 Building Orientation. State how location on the site relative to local climate effects the placement of entries, fenestration, and roof overhangs due to prevailing wind, sun, and noise. Discuss architectural features resulting therefrom and relative costs thereof, i.e., tinted or thermal glass if required as opposed to glass ordinarily used.

5.4.1.7 Provide a tabulation of all equipment in the project to show the following: (If none, so state for each subparagraph below).

5.4.1.7.1 Contractor Furnished-Contractor Installed (CF-CI).

5.4.1.7.2 Government Furnished-Contractor Installed (GF-CI).

5.4.1.7.3 Government Furnished-Government Installed (GF-GI) or not in contract (NIC).

5.4.1.8 Provide a description of materials for all major building components and of all interior and exterior finishes. The description shall include type of exterior wall construction, window types, panel materials, etc.

5.4.1.9 Provide a discussion of the designer's reasons for selecting specific materials, plan solutions, and architectural treatment in all cases in which the reason for selection is not obvious.

5.4.1.10 Color Boards. Submit in a standard 8-1/2 inch by 11 inch three-ring binder. Fold outs may be employed to 25-1/2 inch by 33 inch as long as they refold within the standard binder. Provide two color schemes for projects which involve building construction or building modification.

5.1.4.10.1 Actual material samples shall be displayed showing color, texture, pattern, finish, thickness, etc., for all appearance-related items where choice exists. These samples shall be large enough to indicate true patterns. However, care should be taken to present materials in proportion to that which will actually be installed in a given situation. Samples shall be organized by color schemes with a separate sample for each scheme. The schemes shall be coordinated by room names and numbers shown on the architectural floor plans. Colors shall be labeled with generic color names.

5.1.4.10.2 Project title and base shall occur in the lower right-hand corner of each module.

5.1.4.10.3 Where special finishes such as architectural concrete, carpet, or prefinished textured metal panels are required, samples not less than 12 inches square shall be submitted with the boards.

5.4.1.11 Provide a systematic criteria/code analysis of building construction and fire protection/life safety requirements by citing applicable criteria and paragraph reference indicating what is "required" by the referenced citation and "actual" design condition for the following features. This shall include Fire Protection Life Safety Plan and Narrative similar to the example attached in exhibit A. Where there is a conflict among the different codes, the most restrictive shall govern.

5.4.1.11.1 Building construction requirements:

5.4.1.11.1.1 Ground floor area, total area, height, and number of stories.

5.4.1.11.1.2 Occupancy use classification as defined in UBC, table 5-A, for purposes of determining area and occupancy separations.

5.4.1.11.1.3 Building height limit per UBC, table 5-D, and MIL-HDBK-1008 section 2-2.

5.4.1.11.1.4 Fire area limit per UBC section 505-507, table 5-C, AEI ch. 9, and MIL-HDBK-1008 section 2-2.

5.4.1.11.1.5 Fire resistive requirements of type of construction required to meet area/height/story limits. List from UBC, table 17-A. Also specific type of construction requirements for military projects under AEI chapter 9.

5.4.1.11.1.6 Mix occupancy/occupancy separation per UBC 503, table 5B, and NFPA 101.

5.4.1.11.1.7 Area separation UBC 505, 503a, and requirements for separation between structures.

5.4.1.11.2 Spacing between structures per AFR-88-15, table 13-3, and MIL-HDBK-1008, tables 2-4 and 2-5.

5.4.1.11.3 Life safety requirements, NFPA 101.

5.4.1.11.3.1 Occupancy load for exiting.

5.4.1.11.3.2 Means of egress requirements for the occupancy-occupant load, capacity of means of egress, exit units, number, arrangement, travel distance, illumination, emergency lighting, exit marking, and panic hardware requirements.

5.4.1.11.4 Additional Fire Protection and Life Safety Requirements.

5.4.1.11.4.1 Protection of vertical openings (UBC and NFPA). The codes are specific in regards to fire rating requirements but the exceptions to the requirements are not specific. The A-E is advised to obtain an acceptable interpretation from authority having jurisdiction before proceeding with design of unprotected floor openings.

- 5.4.1.11.4.2 Protection from hazards per NFPA 101, AEI, and AFR 88-15.
- 5.4.1.11.4.3 Corridor separation per UBC and NFPA. (For sprinkled building the UBC is more restrictive than the NFPA.) The A-E shall coordinate with local authority having jurisdiction to applicable criteria.
- 5.4.1.11.4.4 Smoke barrier if required by occupancy.
- 5.4.1.11.4.5 Fire rated door.
- 5.4.1.11.4.6 Fire rated glass.
- 5.4.1.11.4.7 Fire alarm system
- 5.4.1.11.4.8 Interior finish per MLL-HDBK-1008 and AFR 88-15, ch. 15.
- 5.4.1.11.5 Extinguishing and/or fire sprinkler system
  - 5.4.1.11.5.1 Show extinguisher location.
  - 5.4.1.11.5.2 Fire sprinkler system requirements per NFPA, AEI ch. 9, and AFR 88-15, ch. 15.
- 5.4.1.11.6 Operation involving use or storage of flammable and explosive liquids, gases, or dusts. (Describe type of electrical equipment, lighting fixtures, ventilation, and other related fire protection features.)
- 5.4.1.11.7 Physical handicapped (requirements per Uniform Federal Accessibility Standard).
- 5.4.1.12 State whether a fallout shelter has or has not been provided. If fallout protection is required, state protection factor and number of shelter spaces being provided.
- 5.4.1.13 Future Expansion. Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble free fashion. State that no provisions have been made for future expansion if this is the case.
- 5.4.2 Computations. Gross floor area computations. The floor area for each room shall be presented in tabular form in the computations. These areas will not be shown on the drawings. Break down the area into two categories, those calculated on the basis of full area and those calculated on the basis of one-half area, then show the grand total. Also show the programmed area for each room
  - 5.4.2.1 Calculate full areas (including all openings in floor slabs) measured to the outer surface of the inclosing walls for the following:
    - 5.4.2.1.1 Floors, including basements.
    - 5.4.2.1.2 Mezzanines and balconies.
    - 5.4.2.1.3 Penthouses.
    - 5.4.2.1.4 Inclosed passages and walks.
    - 5.4.2.1.5 Finished usable spaces with sloping ceilings with an average height of 7 feet and minimum of 5 feet at perimeter walls.
    - 5.4.2.1.6 Appended covered shipping and receiving platforms measured from the face of the building wall to edge of the platform

5.4.2.2 One-half of the actual area of the following shall be calculated:

5.4.2.2.1 Covered open porches.

5.4.2.2.2 Appended, uncovered, shipping and receiving platforms at truck or railroad car floor height, measured from the face of the building wall to the edge of the platform

5.4.3 Drawings.

5.4.3.1 Floor Plan. Show overall dimensions, functional arrangement, type of occupancy of all areas, major pieces of equipment, and interior/ exterior colors and finishes in tabular form

5.4.3.2 Elevations. Provide all principal elevations showing any exterior electrical/mechanical equipment affecting the appearance of the structure. Also include story heights, fenestration, control joints, and site adaptation to the finished grades.

5.4.3.3 Building Section. Provide at least one principal section showing floor and roof framing, suspended ceilings, floor to floor heights, concealed or open ducts, relation of fenestration to supporting columns or walls, etc. If necessary to show special features, other primary transverse or longitudinal sections may be shown.

5.4.3.4 Provide exterior wall section for each type of wall system. These wall sections are to be cut from the floor plan not the elevation.

## 5.5 Structural Design.

5.5.1 Basis for Design. Outline and define the structural methods and materials of design and construction and enumerate all criteria and assumptions on the following items:

5.5.1.1 Provide a statement referencing the geotechnical report which will be attached as an appendix to the Basis for Design. The geotechnical report will normally be provided by the District. Describe the type of foundation proposed, estimated depth of bearing, allowable bearing values, compaction requirements, and any other measures mentioned in the geotechnical report or recommended by the designer. In some projects, the geotechnical report may recommend two foundation types as being acceptable. In these cases, an economic comparison between the two shall be presented and the more cost effective type selected.

5.5.1.2 Provide an economic comparison of at least three structural framing systems for each area of the building that has a distinctly different framing scheme. Availability of local labor and materials will be considered in selecting the systems. A portion of the structure large enough to be representative of the entire building will be designed in enough detail to provide for a labor and materials estimate that will be the basis of the structural system selection. Each of the systems shall be presented on a sketch indicating the sizes of all the framing members for each area of the building with a different framing scheme. For a one-story structure, the comparison shall be done for the roof structure. For a multistory facility, one cost comparison shall be presented for the floor system and one for the roof system. Attach the comparison to the Basis for Design as an appendix. Provide a word description of all the candidate solutions and indicate that the most economical has been selected. The comparison shall consider the fire protection requirements for the specific structural features being investigated.

5.5.1.3 Describe the lateral force resisting system by defining the location and number of shear walls, materials to be used for a diaphragm, seismic joint locations, foundation ties, and any other components of the lateral force resisting system.

5.5.1.4 List all design live loads identifying them with use and area; show wind velocity and load; ground and roof snow load; and state the seismic zone, K, C, I, K, and S values. Indicate loading combinations for which structure will be designed. List documents used in determining loads with all applicable factors used in determining loads.

5.5.1.5 State the strength (working stresses or yield stresses) for all structural materials on the project.

5.5.1.6 For structures designed for blasts, list all appropriate design parameters such as for the donor system amount, type, TNT equivalent, and location of explosive material in each area. For the receiver system, state the personnel, equipment, and other explosive material which requires protection in each area. Also define the protection categories for each area to prevent the following: (a) communication of detonation by fragments and high blast pressures and (b) mass detonation of explosives as a result of subsequent detonations produced by communication of detonation between two adjacent areas. Define blast wall, blast door, and frangible element locations to complete the description of the protective construction design approach.

The design shall be signed off by the holder of a current accreditation in blast design as given by Federal Emergency Management Agency (FEMA).

The requirements for FALL OUT SHELTERS shall be covered in the basis of design. The A-E shall address whether a full area or partial area shelter is appropriate. Economic comparison of both types shall be included in the basis of design.

5.5.1.7 Future Expansion. Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble free fashion. State that no provisions have been made for future expansion if this is the case.

5.5.2 Computations. Provide those design calculations required by the economic comparison to size the framing members.

5.5.3 Drawings.

5.5.3.1 Foundation and Floor Plan. Show type of foundation proposed, depths of footings, relation of walls and floor slab to foundation system, overall dimensions, column spacing, joint pattern in slab-on-grade, tie beams, grade beams, etc.

5.5.3.2 Floor Framing Plan. Show spacing of framing members, overall depth of floor structure, column spacing, principal dimensions, and shape of the building.

5.5.3.3 Roof Framing Plan. Show locations of framing members, overall shape and dimensions, diaphragm, etc.

5.6 Mechanical Design.

5.6.1 Basis for Design.

5.6.1.1 Provide a statement of indoor and outdoor design temperatures for heating and cooling and proposed "U" factors for walls, ceilings, floors, etc.; personnel load; equipment heat release (if any); outside air or ventilation requirements; and any other special conditions.

5.6.1.2 State type of heating plant and justification for selection, operating pressure and temperature, and approximate capacity. Provide discussion of temperature control system. Indicate type of conducting system, e.g.; forced warm air with direct fired furnace or hot water coil, forced hot water or steam with direct radiation, or single zone variable volume air system with baseboard heating. Type of heat distribution outside of buildings; steam or high temperature hot water and whether above ground or under ground. State requirement for outside air and basis for determination of quantity, i.e.; number of air changes per hour, of CFM per person, or other.

5.6.1.3 Economic Comparison. When specific Army or AF criteria does not indicate the preferred method of heating, ventilating, and air conditioning, the designer is to discuss the alternatives considered and the final selected based on economics, fuel cost, ease of maintenance, etc. Provide a present worth, life cycle cost economic study of the candidate systems. The study shall show the annual costs of fuel and maintenance for each system over its service life. These costs shall then be brought back to the present and combined with the first costs to determine the most economical system. Attach the economic study as an appendix. The District will provide such economic study parameters as interest rates, fuel escalation rates, energy costs, etc.

5.6.1.4 Computer of the Building. When the SOW requires a computer simulation of the building, compare a minimum of three heating and air-conditioning systems. Multizone, variable volume, or constant volume air handling equipment in combination with water or air cooled reciprocating chillers; reciprocating chillers with cooling towers; double bundle condensers; and other system combinations shall be considered. Variation of the "U"

factor from the stated criteria may also be integrated into the study. Following guidance referenced in the Criteria Index Volume 4 under "HVAC, Computer Simulation for Buildings," present the installed first cost, energy consumption (BTU's/6q. ft./yr.), total annual owning and operating cost, annual operating cost, etc., for each system considered. Then select the best system based on the life cycle costing/energy analysis.

5.6.1.5 Energy Budget. Provide an energy budget unless the SOW indicates otherwise. If a computer simulation of the building is required, then a separate energy budget need not be performed. The energy budget is the sum total of the energy consumed in a year within the boundaries of the building for space heating and cooling, ventilation domestic hot water, and lighting. The analysis shall not be performed on candidate building systems but only on the final, selected systems, and shall be presented in BTU's per square foot per year. For additional guidance, refer to the Criteria index under "HVAC, Computer Simulation for Buildings," Volume 4.

5.6.1.6 For air-conditioning systems, provide a statement as to the extent authorized and as to any authority for waiver of these criteria. State whether for comfort cooling or according to technical requirements or both. For technical requirements, show the authorized tolerances for temperature and humidity control, the degree of air cleaning or purity required, and any other special considerations involved. A description of the air-conditioning system proposed, including the approximate capacity, location of the major components, cooling media (water or DX), zoning and duct arrangement, and type of controls. State requirement for outside air and basis for determination of quantity, i.e., number of air changes per hour, for CFM per person, or others

5.6.1.7 For evaporative cooling, show approximate criteria reference or state any authorized waiver of this criteria. Note if single or two-stage process.

5.6.1.8 For cold storage project, indicate room holding temperatures and commodities to be held in cold storage. Also show approximate equipment sizes.

5.6.1.9 Determine the approximate capacity of compressed air, vacuum, or other service piping systems.

5.6.1.10 Fuel. State type, source, firm, or interruptible gas and metering arrangements. Indicate type of standby fuel for interruptible gas. Designs must meet Environmental Protection Agency emission standards or local emission standards when standards are enforced by local air pollution control agency, whichever is more stringent. when No. 5 fuel oil, No. 6 fuel oil, or coal is burned as fuel and when other hazardous emissions are produced.

5.6.1.11 Determine plumbing fixtures by listing quantity and type referred to in the Federal Specifications. Indicate male and female building population. Describe domestic water heating and storage equipment including capacity, materials, piping types, and insulation requirements.

5.6.1.12 Provide a list of energy saving features which have been incorporated into the project such as run-around coils, thermal wheels, and double bundle condensers. Additional energy saving ideas may be found in the Criteria Index under "HVAC, Computer Simulation for Buildings," Volume 4.

5.6.1.13 Provide a statement indicating if there is a base wide energy monitoring and control system (EMCS) and if 80, indicate the pieces of equipment and controls that will be tied into the system. If an EMCS does not exist, provide for future installation by providing such items as empty conduits from remote mechanical rooms to future field interference device locations, thermometer wells in hot and chilled waterlines, etc.

5.6.1.14 State procedures to be used for seismic support and anchorage of mechanical equipment.

5.6.1.15 For physically handicapped requirements, state whether or not provisions have been incorporated.

5.6.1.16 Provide the following information for liquid petroleum storage and distribution systems: describe the unloading facilities, the type of system such as LPG vapor or central air mix, state the basis for storage capacity, rate of pumping and number of dispensing outlets, equipment power requirements, and a description of the tank.

5.6.1.17 Fire Protection. Coordinate with the architect to ensure all aspects of the fire protection plan are addressed.

5.6.1.17.1 For sprinkler systems, provide evidence that the system is in compliance with criteria referenced in Criteria Index, Volume 4.

5.6.1.17.2 For carbon dioxide, foam, dry chemical, and other special extinguishing systems, show information justifying the arrangement, size, and coverage of each system.

5.6.1.18 Future Expansion. Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble free fashion. State that no provisions have been made for future expansion if this is the case.

5.6.2 Computations.

5.6.2.1 Provide all calculations necessary to justify the systems selected on the basis of economic and environmental impact.

5.6.2.2 Provide all calculations for heat gain/loss and all equipment sizing calculations, including the method for handling diversities in the air-conditioning load and method of sizing boilers or furnace. Show all air-conditioning load calculations, including the building peak loads. Detailed room calculations are required.

5.6.2.3 Show plumbing calculations as necessary to determine number of fixtures, cold and hot water capacity requirements, and equipment or capacities of miscellaneous and special systems.

5.6.3 Drawings.

5.6.3.1 Prepare a floor plan showing heating, ventilating, and air-conditioning equipment layout; chillers or refrigeration compressors; boilers, pumps, condensers, or cooling towers; air handling units; fans; typical air distribution duct layout (may be single line); hoods; and other items of major equipment required for the facility. Sprinkler system layout shall be diagrammatic in contract drawings. Specifications shall require shop drawings of the sprinkler system be submitted by the installation contractor before construction.

5.6.3.2 Show plumbing fixture and equipment layout.

5.7 Electrical Design.

5.7.1 Basis for Design

5.7.1.1 Provide electrical characteristics (phase, voltage, and number of wires) or circuits. Show characteristics of any subsequent transformation on the load side of the service entrance and a statement of why specific voltage was selected. State also, alternative systems or equipment considered and reasons a given system was selected.

5.7.1.2 Provide an economic comparison to justify selection of major pieces of electrical equipment such as transformer types or main switchboards. The study will only consider alternatives which meet the design criteria and perform the functions intended. Provide the first cost for each alternative considered and list advantages/disadvantages of each. Attach the economic comparison to the Basis for Design as an appendix.

5.7.1.3 Provide a present worth, economic/energy study for the various types of lighting fixtures considered. The study will show the annual costs of power and maintenance for each fixture type over its service life. These costs will then be brought back to the present and combined with the first cost to determine the most economical fixture type. Economic parameters to be used in the life cycle cost analysis will be provided by the District. Advantages and disadvantages of each will also be noted.

5.7.1.4 State type of service entrance equipment (circuit breakers and/or fusible switches) and reason for selection.

5.7.1.5 Show an estimate of total connected kilowatt (kW) load and demand factors, diversity, and resulting total demand kW load. Break down the loads to show lighting load, convenience receptacle load, air-conditioning loads, heating loads, pump loads, power roof ventilator loads, power receptacle loads for special equipment, load allocated for spare capacity, and special loads such as air compressors, generators, etc. State the total estimated power factor, the resulting kilovoltampere load, and size of transformers selected. Estimate separately the above for the service entrance transformers and subsequent transformers (such as dry-type transformers within the building).

5.7.1.6 Provide a statement describing the proposed standards of design for voltage drop used regarding service entrance, panel feeders, and branch circuits.

5.7.1.7 Discuss proposed wiring methods to be used indicating type of conductors, insulation, rigid metal conduit, EMT, NMS cable, etc.

5.7.1.8 Provide a brief description of the interior lighting systems indicating types, lighting intensities, and discuss energy conservation measures such 1-8 task lighting and selection of most efficient type of lighting fixtures. Provide a tabulation indicating the following:

5.7.1.8.1 Room name and number.

5.7.1.8.2 Lighting intensity for each room (state design basis such as AEI Design Criteria, IES, Definitive Drawings, etc.).

5.7.1.8.3 Type of fixtures, either standard COE 40-06-04 drawings by number or description. Where standard COE fixtures are not proposed, submit catalog cuts with narrative indicating what are proposed.

5.7.1.9 Provide a brief description of the exterior lighting system for street lighting, security lighting, parking lot lighting, sidewalk lighting, area lighting, etc. Include lighting intensity, types, and discuss energy conservation measures which were examined for selection of exterior lighting fixtures.

5.7.1.10 Provide a description of type of exit and means of egress, emergency lighting fixture systems with intensities, if none, so state. Coordinate with Fire Protection/Life Safety narrative.

5.7.1.11 Provide a description of type of hazardous area fixtures which will be used.

5.7.1.12 Provide a description of the physical limits of each hazardous area and the class, division, and group of equipment and wiring.

- 5.7.1.13 Describe the features of the fire detection and fire alarm system and means for transmission of signal.
- 5.7.1.14 Comment on the electrical characteristics of the power supply to the base, including circuit interrupting requirements and voltage regulation. Provide a statement on the adequacy of the existing power supply at the point of takeoff.
- 5.7.1.15 Discuss the basis for selection of primary and secondary distribution voltage and of overhead or underground construction. Indicate characteristics and standards of design for overhead or underground line. Include justification for underground line.
- 5.7.1.16 Provide an abbreviated short circuit study of the system, including interrupting requirements for major components of the distribution system.
- 5.7.1.17 Provide a description of all automatic and/or manual transfer devices being used.
- 5.7.1.18 Discuss signal systems provided such as program clock, MATV, central sound systems, intrusion detection, etc.
- 5.7.1.19 Discuss provisions for a telephone system relative to use of existing or new telephone cable. Provide discussion of special control, e.g., generator paralleling, switchgear remote control, telemetering, central supervisory control, etc.
- 5.7.1.20 Discuss the following: lightning protection, motor control centers, standby electric power, special purpose receptacles and outlets D.C., high frequency or other special systems, intercommunication system, controls for supervisory control systems, static grounding or any other special grounding requirements, specialize electronics equipment installation requirements, etc.
- 5.7.1.21 For airfield lighting projects, state whether cable is to be direct burial or in duct; discuss provisions for standby power; comment on type of lighting system (such as high intensity or medium intensity, runway, approach, or taxiway lighting) and lighting equipment and any conditions peculiar to the installation; as well as provisions for standby electric power.
- 5.7.1.22 For protective lighting systems, provide a statement of requirements for fence lighting, area lighting, building security lighting, etc. Include proposed type of luminaire, wattage of lamp, type of lamp beam spread, and how mounted on poles, buildings, etc.; clear zones illuminated, design foot-candle illumination at clear zones, fence, etc., and uniformity ratios.
- 5.7.1.23 If cathodic protection is required, provide a description of the location, type, and extent of the system to be installed and basis for the design proposed, including field survey data.
- 5.7.1.24 Generating Plants. In addition to a discussion of the design approach, provide the following for generating plants: estimates connected load, maximum demand load, number and size of units including kW and pF ratings, engine governor and voltage regulating requirements, voltage and basis for selection, and justification for use of special equipment such as load sensing governors.
- 5.7.1.25 Future Expansion. Indicate spare capacity allocated to electrical distribution system. Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble free fashion. State that no provisions have been made for future expansion if this is the case.
- 5.7.1.26 Provide a sample of all schedules, tables, calculations, etc., which will be used on the project drawings and in design analysis, i.e.:

5.7.1.26.1 Lighting calculations.

5.7.1.26.2 Lighting fixture schedules.

5.7.1.26.3 Panel schedules.

5.7.1.26.4 Symbol schedule (legend).

5.7.1.26.5 Panel sizing calculations.

5.7.1.26.6 Voltage drop calculations.

5.7.1.26.7 Outline of final design analysis.

5.7.1.26.8 Outline of catalog cuts pertaining to all proposed equipment or systems used in the project.

5.7.1.26.9 Lighting fixtures.

5.7.1.26.10 Transformer schedule.

5.7.2 Computations. Provide calculations to back up sizing of major pieces of electrical equipment. The degree of completion shall be comparable to that of the narrative and drawings.

5.7.3 Drawings

5.7.3.1 Exterior electrical to be shown on utility site plan.

5.7.3.1.1 Existing and new electrical lines, both overhead and underground, properly identified.

5.7.3.1.2 Show removals and relocations, if any.

5.7.3.1.3 Indicate electrical characteristics, voltage, phase, conductor size, etc.

5.7.3.1.4 Show new construction and location of transformation.

5.7.3.1.5 Indicate the service to the facility and whether overhead or underground.

5.7.3.2 Interior Electrical.

5.7.3.2.1 Floor plans shall show the proposed location of all major items of electrical equipment, including vaults, transformers, equipment rooms, switchgear, motor control centers, distribution panels, telephone terminal cabinets, and power and lighting panelboards. Include space required for maintenance and future expansion.

5.7.3.2.2 Partial Lighting Layouts. Show a partial layout of typical lighting in the building indicating proposed fixtures and spacing. Locate exterior lighting on plans when applicable. Lighting intensities shall be based upon the requirements of AEI Design Criteria and applicable ETS's, I.E.S. Lighting Handbook, and criteria as applicable.

5.7.3.2.3 Single-line diagrams shall be provided for interior distribution systems. Diagrams of high and low voltage interior electrical distribution and communication systems shall show all of the important features such as the following:

5.7.3.2.3.1 Auto transfer switches.

5.7.3.2.3.2 Emergency generators.

5.7.3.2.3.3 Emergency systems.

5.7.3.2.3.4 Major subpanels.

5.7.3.2.4 Riser Diagrams. Show the proposed riser diagram. Sizes of all conduits, wires, cables, panels, etc. need not be included if shown elsewhere.

5.8 Corrosion Design. Satisfactory design and construction of CP, protective coatings, and water treatment are functional requirements for virtually all projects. Project design and construction without these items is not acceptable. CP shall be provided on all new facilities and repair or replacement of existing facilities. This includes all buried or submerged ferrous piping (gas/heat distribution/fuel/water), buried tanks, and related facilities regardless of soil resistivity.

Exceptions. Ductile or cast iron pipe may not require CP or protective coatings in soil resistivities about 10,000 ohm-cm. Aboveground tanks in contact with the earth built to present criteria (on an oil filled sand pad with plastic liner underneath) do not require CP.

5.8.1 National Association of Corrosion Engineers (NACE) Certified Designers. For each project with utilities systems and/or metallic features that are buried, submerged, or in contact with the ground or other reasons, a corrosion specialist. Sufficient surveys, calculations, details, and 1-line diagrams to show the magnitude and layout of the CP system shall be provided. Deletion of CP work shall not be made without the specific approval of the MAJOM corrosion engineer (Air Force) or the equatable Army corrosion engineer.

#### 5.8.2 General Requirements.

5.8.2.1 All cathodic protection design shall be based upon specific field tests made at the construction site. Tests shall include, but not be limited to, soil resistivity and water conductivity. Design drawings shall show location of anodes, rectifiers, etc.; installation details, insulators, and bond connections.

5.8.2.2 Existing cathodic protection systems in the vicinity of the construction shall be identified as to location, type, and level of protection. New and supplemental cathodic protection shall be compatible to the existing cathodic protection systems. Other piping systems in the areas of ground beds shall be considered when locating ground beds to prevent interference problems.

5.8.2.3 If the project contains an underground heat distribution system (prefabricated insulated pipe), the pipe supplier shall be made responsible for the preliminary survey, design, and testing of the CP system. In addition, the construction contract specification particularly shall provide for the following:

5.8.2.3.1 That the system supplier shall use a NACE accredited corrosion specialist for survey, design, inspection, and testing of the CP system for their piping system. The system supplier shall be held responsible for correcting all CP construction deficiencies and must provide additional CP at no cost to the Government where required to achieve or meet NACE RP-01-69 CP criteria.

5.8.2.3.2 That the construction contractor shall not proceed with the CP work until the shop drawings have been approved by the contracting officer's technical representative (CP technician or corrosion engineer).

**CHAPTER 6**

**PREFINAL DESIGN SUBMITTAL (FOR ARMY PROJECTS)  
60 PERCENT**

**REGULAR PRELIMINARY DESIGN SUBMITTAL (FOR AIR  
FORCE PROJECTS)  
60 PERCENT**

6.1 General. This chapter will define by discipline the basic requirements of a prefinal design submittal or a regular preliminary design submittal (60 percent) pertaining to the analysis of design and drawings. This submittal will incorporate all the requirements of a 35 percent concept or early preliminary design plus additional information to complete this level of design. Basis of design narrative and computations developed and submitted at concept design shall be expanded during preliminary design to include review comments and changes addressed during concept review. Guidance for preparation of the "Code B" cost estimate if not submitted at a previous submittal is provided in volume 2. The "Code B" cost estimate should reflect a level of detail consistent with 60 percent submittal. The specifications, if not submitted at a previous submittal, shall be provided per the guidance in volume 3 for outline specifications. The prefinal or regular preliminary design shall incorporate the responses to previous submittal reviews.

6.2 Objective. The 60 percent design submittal is intended to provide a thoroughly thought-out design conforming to all the applicable criteria. The 60 percent design will be a logical further development of the concept design. The design shall define all the elements to be incorporated into the project to a level demonstrating a complete functional design consistent with a 60 percent design effort.

6.3 Review Comments and Revisions. Any major design changes which are necessary due to review comments or other reasons shall be resolved at this design submittal. Any changes at this time should only be for the purpose of coordination and refinement of the complete design package.

#### 6.4 Civil Design.

6.4.1 Basis of Design. The narrative provided at the concept submittal shall be expanded to give a thorough description of each of the civil design features included in the project.

6.4.2 Computations. The computations shall support the narrative and be expanded from the previous submittal to be consistent with the 60 percent design effort. Each area of the design shall have sufficient computations to demonstrate basic design feasibility.

6.4.3 Drawings. The design drawings shall cover all aspects of the project design. The drawings should be of sufficient detail to indicate a complete and coordinated design effort appropriate for review. The drawings shall include all the sheets that will be in the final set to indicate what the final package will include.

#### 6.5 Landscape Architectural Design.

6.5.1 Basis for Design. The narrative shall completely explain and substantiate the design provided and expand upon what was provided in the previous submittal. State that no landscaping is required if this is the case. Also state whether or not irrigation will be included in the project.

6.5.2 Drawings. The landscape plan shall show the general placement of plant material, lawn, and all other pertinent landscape features. A legend shall indicate mature height and/or spread of all plant material whether deciduous or evergreen and whether shrub, tree, or ground cover. Specific plant names may be indicated as well, if known in this phase. The level of detail shown for other landscape features such as benches, planter walls, tree grates, bollards, etc., shall be consistent with the percentage of design completed.

#### 6.6 Architectural Design.

6.6.1 Basis for Design. The narrative description shall be expanded upon and any changes in color board or scheme boards shall be made for resubmittal.

6.6.2 Computations. Revise any floor plan area computations as necessary to reflect changes from the concept submittal.

6.6.3 Drawings. The design drawings shall be sufficiently complete to describe the complete architectural design effort in a form appropriate for review. Every sheet that will be in the final set shall have sufficient Completeness to indicate what type of information will be provided.

#### 6.7 Structural Design.

6.7.1 Basis for Design. The narrative description must completely explain and substantiate the design provided. This shall be an expanded document from the previous submittal.

6.7.2 Computations. Design calculations covering all the major structural elements must be presented. The calculations must support the design to a level consistent with the percentage of design completion.

6.7.3 Drawing . The design drawing must be sufficiently complete to explain the total structural design. Pertinent structural criteria will be noted on the drawings, and any other information consistent with a 60 percent design. Each sheet that will be in the final set will be provided to illustrate the extent of the complete set.

#### 6.8 Mechanical Design.

6.8.1 Basis for Design. Design aspects affecting the types of systems will be described. The systems designs shall be sufficiently described to demonstrate design functionality.

6.8.2 Computations. The calculations must support the design assumptions made to this stage and be descriptive enough to allow adequate review.

6.8.3 Drawings. A complete design drawing set showing all mechanical systems in the project is required. The drawings must include any information required to permit a design review consistent with at least 60 percent of design completion. All sheets which will be in the final set shall be included.

#### 6.9 Electrical Design.

6.9.1 Basis for Design. The narrative shall explain the electrical design. Any detection, alarm, or miscellaneous systems will also be explained. These descriptions will represent an extension of those in the previous submittal to a level of detail consistent with the percentage of design completed.

6.9.2 Computation. The calculations will also be expanded to reflect a percentage of completion consistent with the design submission.

6.9.3 Drawings. All sheets which will be in the final set shall be provided. These sheets shall be complete to a level of detail consistent with the percentage of design completion.

#### 6.10 Corrosion Design.

6.10.1 Basis for Design. The narrative shall explain the corrosion design. Any detection, alarm, or miscellaneous systems shall also be explained. These descriptions shall represent an extension of those in the previous submittal to a level of detail consistent with the percentage of design completed.

6.10.2 Computations. The calculations shall also be expanded to reflect a percentage of completion consistent with the design submission.

6.10.3 Drawings. All sheets which shall be in the final set shall be provided. These sheets shall be complete to a level of detail consistent with the percentage of design completion.

**CHAPTER 7**  
**FINAL DESIGN SUBMITTAL**  
**100 PERCENT**

7.1 General. This chapter will define, by discipline, all specific requirements of a final design submittal pertaining to the drawings and the Analysis of Design. Guidance for preparation of the final cost estimate and the final specifications is provided in volumes 2 and 3, respectively. The final submittal will be reviewed as described in volume 1. The A-E response to Government review will then be backchecked. If all review comments are not satisfied, rechecks and resubmittals will continue until all comments are resolved or withdrawn.

7.2 Objective. The final submittal is intended to present a biddable, design package conforming to all the appropriate criteria. Final design will be accomplished by developing and refining the design in its various stages by using the review comments as a communication vehicle between the A-E, the District, and the user.

7.3 Project Review Comments. The A-E shall annotate the action taken on each preliminary and/or concept comments and shall include the annotated comments with the submittal package. If the A-E feels that any comment is inappropriate or in error, he shall call the COR/PM prior to proceeding with the final design to resolve the conflict. If the comment is modified or omitted as a result of this coordination, then a brief record of the conversation shall be included with the annotated comments. Updated listing on deviations from criteria developed for the previous submittal shall be provided. All deviation shall be supported by waivers from authority or by record of correspondence to user by project manager. Review conference actions are not considered supporting authority.

7.4 Changes to Basic Design. Major changes to the basic design will not be permitted at this time unless these changes are the result of review comments, changes in criteria, changes in SOW, or unforeseen problems necessitating the A-E to alter his original design. All the changes will be resolved through the COR/PM before proceeding.

#### 7.5 Civil Design.

7.5.1 Basis for Design. Complete the discussion of civil features that was presented in previous submittals. Update the Basis for Design to include any changes brought about by the design process or review comments.

#### 7.5.2 Computations.

7.5.2.1 Water Distribution and Service Lines. Furnish final flow requirements, line sizes, friction factors, head 1068, water velocities, and line pressures. Provide fire flow test data or other measurements upon which the calculations are based. Show complete calculations demonstrating the ability of the water distribution and service lines to deliver the required pressure and quantity of water.

7.5.2.2 Water and Sewage Treatment. List all criteria used for the design of each treatment process and operation. Furnish all calculations showing the design of the processes and operations including the hydraulic and organic loading. Provide a hydraulic profile of the treatment plant.

7.5.2.3 Sewage Collection. Show the population or fixture unit basis for computing expected flows. Show peak and average expected or measured flows and any factors used in estimated flows. Provide the flows, sizes, slopes, and velocities for each line segment. In addition for lift stations, show required head, volume of wet well, cycle times at peak and average flows, and pump controls.

7.5.2.4 Storm Drainage. Show all the computations used for determining the designs flow and pipe sizes (including all options in pipe materials). List rainfall intensity, return period, concentration times for each drainage area, and the infiltration factors used. Provide an analysis of each new culvert and of existing culverts which are used in the designing. Show adequacy of existing drainage facilities to carry runoff. Include a sketch of the drainage area which shows the grading, principal water courses and the location, size, and invert elevation of existing and proposed new drainage facilities, including surface ditches, storm sewers, and culverts.

7.5.2.5 Roads, Street, Open Storage Areas, Hardstands, and Walks. Show all design calculations including elevation of design wheel loads, material, and type of construction and class of each type of paving. Include all computations for curves, alignment, sight distance, passing distance, and superelevation.

7.5.2.6 Grading. Furnish cross sections and complete calculations for all earthwork.

7.5.3 Drawings. Expand and fully develop drawings used in concepts or early preliminaries as applicable. Add any new sheets necessary to complete the presentation, including the following:

7.5.3.1 Foundation Explorations and Logs. The District will provide information on exploration locations and logs of explorations which be incorporated and coordinated into the final drawing set by the A-E.

7.5.3.2 Siting. Show the dimensions of all new work and the relation of new work to existing facilities. The new work will be located by coordinates or other definite means. only one bench mark shall be used except where a very large area is involved. Indicate the bench mark location, elevation, and description. Provide a north arrow and at least two horizontal control points. Provide complete vertical alignment descriptions. With airfields, this information must be shown for each separate area of pavement. Clearly locate onsite borrow and spoil areas. Indicate possible future construction using short dashed lines.

7.5.3.3 Grading. Provide a north arrow and show the grading and drainage conditions, including scales, direction of drainage, point of discharge, and ditches using notes, symbols, and spot elevations or contours. Provide finished grades for new work and show existing topography. In rigid pavements, grades are to be shown at all joint intersections, or at intersection of joints and centerline, if no regular pattern of intersection exists. Provide sections showing the relationship between existing ground and finished grades, pavements, shoulders, ditches, scales, curbs, gutters, buildings, and other structures.

7.5.3.4 Paving, Railroads, and Fencing. Show the location and dimensions of all roads, streets, walks, pads, open storage areas, runways, aprons, taxiways, overruns, railroads, fences, and gates. Indicate different surfaces and pavement sections with symbols and notes. Furnish all alignment and curve data needed to lay out the work. Provide details showing joints, curbs, gutters, signs, sealants, sidewalks, pavement sections, switches, turnouts, and road crossings. Include all elements of the pavement or track section with depths and compaction requirements. Clearly show joint layout, thickened edges, dowels, tie bars, reinforcement, joint keys, location of tie-down anchors, markings, and striping. For airfield pavements, all joints will be shown on a scaled drawing(s) with elevations shown at all joint intersections. Typical geometric layouts will not be used.

7.5.3.5 Utilities.

7.5.3.5.1 Show all pipes with sizes (such as water, sewer, storm drain, and gaslines) valves, manholes, fire hydrants, service boxes, inlets, culverts, headwalls, and cleanouts. Provide a north arrow on the utilities site plan and show the relation between the utilities and roads, buildings, sidewalks, etc. Provide the sizes, strengths, or classes corresponding to the different material options. Indicate the points of entry to buildings for utility lines.

7.5.3.5.2 Profiles shall be provided for wastewater collection lines, force mains, water supply, and distribution lines where there is a possibility of interference with other utilities. Profiles will also be provided to show adequate cover in areas of varying topography. The profiles shall show minimum cover; new and existing utilities; invert elevations; stationing; surface features such as roads, curbs, sidewalks, etc.; and appurtenances to the utility system

7.5.3.5.3 Furnish details of all features such as valves, manholes, fire hydrants, service boxes, inlets, headwalls, cleanouts, thrust blocks, pipe encasements, frames, grates, covers, steps, etc. For treatment facilities, provide details for treatment units. Show all inplant lines and process piping. In congested areas or in area where data is unclear as to the exact location of utilities, the utilities drawings should contain the following note: "Elevations of utilities are given to the extent of information available. Where elevations are not given at points of existing utilities crossings, such elevations shall be determined by the contractor and reported to the CO. When unknown lines are exposed, their location and elevation shall likewise be reported."

#### 7.5.3.6 Landscaping.

7.5.3.6.1 The plan shall be clearly delineated and dimensioned where necessary to insure the proper location of plants, lawn divider strips, and similar items. The plant list shall have the botanical and common name, quantity, container size or caliper, and spread of the plants specified. Header board, planting, and staking details shall be shown. Lawn areas, where specified, shall be clearly defined. The planting plan shall be a separate drawing and shall not have irrigation details on the same drawing. Where erosion control seeding and special treatment for erosion control is required, the areas shall be well described and delineated. The irrigation plan shall show the layout of the sprinkler system locating the heads, pipe sizes, valves, backflow preventer, and connection to main. State that no landscaping is required if this is the case.

#### 7.6 Architectural Design.

7.6.1 Basis for Design. Complete the discussion of architectural features that was presented in previous submittals. Update the narrative to include any changes brought about by review comments. Update the color boards as directed by the review.

7.6.2 Computations. Update the floor area computations to reflect changes brought about by review comments and/or floor plan changes.

7.6.3 Drawings. Expand and fully develop drawings used in concepts or early preliminaries if applicable. Add any new sheets necessary to complete the presentation, including the following:

7.6.3.1 Provide a detailed typical interior wall section for each type of wall being used. Section to be taken from plans, not elevations.

7.6.3.2 Roof Plan. Indicate mechanical equipment and vents, roof drains, roof slopes, crickets, etc. Cross reference to where flashings and curbs are detailed for roof penetrations.

7.6.3.3 Caulking Joint Shapes. Show all appropriate joint shapes per referenced criteria. Detail and dimension joints and cross reference to drawings where they are required.

7.6.3.4 Fire Ratings. Show only required, not inherent, ratings of 1 hour or more for partitions, ceilings, ceiling-roof, or ceiling-floor assemblies. This may be shown on the reflected ceiling plan when provided in a "REQUIRED FIRE RATING SCHEDULE" listing each room or area to be separated; or in a single line floor plan which indicates only fire partitions and firewalls.

7.5.3.5 Reflected Ceiling Plan. Provide for all buildings with suspended ceilings except industrial type containing minimal office space.

7.5.3.6 Update the color boards as directed by the review comments, and resubmit them. Also, provide one additional color board for each Army and AF project.

## 7.7 Structural Design.

7.7.1 Basis for Design. Complete the discussion of structural features that was presented in the concept or early preliminary submittal. Update the narrative to include any changes brought about by review comments.

### 7.7.2 Computations.

7.7.2.1 Present complete structural calculations covering all parts of the structure and miscellaneous facilities. When a computer is utilized to perform design calculations, the analysis will include, but not be limited to, the following information, in addition to information required elsewhere in this manual:

7.7.2.1.1 Describe design methods, including assumptions, theories, and technical formulas, employed in design solutions.

7.7.2.1.2 Present copies of computer input data and output summaries presented in human language, accompanied by diagrams which identify joints, members, areas, etc., according to the notations used in the data listings. Complete listing of all computer output will be provided in a separate binding when it is too voluminous for including in the design analysis. These listings will be augmented with intermediate results where applicable so that sufficient information is available to permit manual checks of final results.

7.7.2.2 Live loads shall be placed to produce maximum stresses and minimum stresses where there is a possibility of stress reversal.

7.7.2.3 If special methods of solution, tables, etc., are employed, references shall be made in the calculations to the sources of such material.

7.7.3 Drawings. Expand and fully develop drawings used in concepts or early preliminaries if applicable. Add any new sheets necessary to complete the presentation.

7.7.3.1 The structure should be carefully studied so that elaborate details are not required and all information necessary for construction is clearly and simply presented on the drawings. Typical sections shall be truly typical and not representative of one particular condition.

7.7.3.2 Wall Elevations. Wall elevations shall be provided for precast or tiltup concrete panels showing typical reinforcing, reinforcing around openings, connections, etc. The intent is to show one complete design on the drawings, even though manufacturers may prefer to detail things differently.

7.7.3.3 Joints. The locations and details of all concrete joints shall be shown on the drawings. Included are control joints in slabs on grade; construction joints in walls, floors, and roofs; and expansion and seismic joints.

7.7.3.4 Structural Data. State the design stresses for all materials, soil bearing values, and other pertinent information from the geotechnical report; classes of concrete and where used; design live loads for various areas of the building including all loads considered in the floor slab; design windload; seismic zone, Z, I, R, C, and S values, whether or not the building has been designed for future horizontal or vertical loads; and any other notes necessary to clarify or complete the information shown on the drawing.

## 7.8 Mechanical Design.

7.8.1 Basis for Design. Complete the discussion of mechanical features that was presented in the concept or early preliminary submittals. Include any changes brought about by review comments.

### 7.8.2 Computations.

7.8.2.1 Finalize all computations leading to sizing of distribution systems, selection of powered equipment and its power requirements and controls, and selection of auxiliary equipment.

7.8.2.2 Equipment selection is restricted to regularly cataloged items of domestic manufacturers, in commercial service for more than 1 year, supplied by dealers having service organizations supporting the project location. Completely identify, but not on the drawings, each piece of equipment by manufacturer's name, model, and characteristics. Present a study of floor space in the mechanical room by selecting the largest of three competing makes of each piece of equipment to go into the room. Allow ample room for servicing and replacement of equipment.

7.8.2.3 Provide complete tabulation of cooling loads and psychrometric charts for all the air handling systems with cooling.

7.8.3 Drawings. Expand and fully develop drawings used in concepts or early preliminaries if applicable. Add any new sheets necessary to complete the presentation, including the following:

#### 7.8.3.1 Plumbing.

7.8.3.1.1 Show piping and venting in two-dimensional riser diagrams for complicated plumbing systems, e.g., medical and dental facilities and all multistory buildings.

7.8.3.1.2 Provide a schedule of plumbing fixtures and equipment, showing size data and specification reference.

#### 7.8.3.2 Mechanical.

7.8.3.2.1 Provide double-line drawings for all duct work shown on cross sections and in mechanical rooms. Single-line drawings may be used for air distribution duct layout provided sufficient cross sections are shown for congested areas.

7.8.3.2.2 If required for clarification of duct sizes, show singleline riser diagrams for supply and exhaust systems for multistory buildings. Provide sections where needed to show special relations and indicate the typical location of lights, structural members, etc.

7.8.3.2.3 Locate and detail all fire dampers.

7.8.3.2.4 Provide piping schematics to show all complicated flow processes.

### 7.9 Electrical Design.

7.9.1 Basis for Design. Complete the discussion of electrical features that were presented in the previous submittals. Include any changes brought about by review comments.

7.9.1.1 Single-Line Diagram. Provide a simplified single-line diagram of the system showing all transformers, motors, conductors, circuit breakers and fuses, etc. All items shall be identified by the same alpha-numeric designation shown on the drawings. The purpose of the single-line diagram is to identify selected points where imaginary faults will be located for the short-circuit study to determine whether protective devices and/or components for such equipment can withstand the available short-circuit stresses. The system equipment may be so simple that calculations may be made using reactances only. This will suffice to indicate that equipment ratings are adequate. If the results are borderline, where equipment ratings are slightly under the required rating, then calculations shall be repeated, using all items such as circuit breaker contacts, small cables, and available reactances and resistances.

7.9.1.2 Deviations from Criteria Summary. Updated listing on deviations from criteria developed for the previous submittal shall be provided. All deviations shall be supported by waivers from authority or by record of correspondence to user by project manager. Review conference actions are not considered supporting authority.

## 7.9.2 Computations.

7.9.2.1 Provide complete design calculations for all interior and exterior electrical systems.

7.9.2.2 Provide manufacturers' names and model numbers for each major equipment item used in determining dimensional and weight requirements.

7.9.2.3 Calculations for the maintained foot-candle intensities in all areas shall be shown.

7.9.2.4 Provide transformer, generator, switchboard, and feeder computations indicating all demand, diversity, ambient temperature, or derating factors considered in the selection of equipment or conductor sizes. All factors, such as demand and diversity factors, derating factors, etc., shall be supported by engineering or manufacturer data.

7.9.2.5 Provide load summaries for each panel, switchboard, switchgear, motor control center, etc. The summaries shall have a categorization based on type of load (i.e., heating, pumps, lighting, air-conditioning, receptacle, panel, etc.), and include the respective demand factors applied to each. The summaries shall show spare kVA allocated to each piece of distribution equipment, coordinated with spare capacity in service equipment.

7.9.2.6 Compute the voltage drop on all service and feeder circuits and on worst case branch circuits supplied by each panelboard and switchboard.

7.9.2.7 State the rationale for selection of reduced voltage starting equipment.

7.9.2.8 Outside overhead distribution work shall also include calculations including but not limited to pole sizing calculations, conductor tensioning, and sagging calculations and guy wire sizing and placement calculations.

7.9.3 Drawings. Expand and fully develop drawings used in concept or early preliminary submittals if applicable. Add any new sheets necessary to complete the presentation, including the following:

### 7.9.3.1 Site Plan for Outside Distribution System

7.9.3.1.1 Show location of new and existing poles and routing of new lines on the plot plan.

7.9.3.1.2 Show location of new and existing manholes and pull holes on the plot plan. Locate and show details of major equipment. Show routing and cross section of duct line sections.

7.9.3.1.3 Show location of street, parking, and walkway lighting poles. Provide details of luminaire, pole, and base.

7.9.3.1.4 Provide layout of lighting poles showing dimensions and aiming angles. Provide complete backup calculations

7.9.3.1.5 Where airfield lighting is included in the project, show location, controlling dimensions, extent of the proposed system, routing of supply circuits, location of vaults and control towers, and locations for various types of lighting units.

7.9.3.1.6 Where cathodic protection is necessary, show extent of the facilities to be protected, location and type of anode beds, location of test points, details for sectionalizing an underground piping system, and source and routing of supply for impressed current and cathodic protection system

7.9.3.2 Floor Plan for Interior Distribution System. The floor plans shall show all principal architectural features of the building which will affect the electrical design. Separate floor plans shall be used to avoid congestion. The floor plans shall also show the following:

7.9.3.2.1 Room designation and number.

7.9.3.2.2 All lighting fixtures, fixture types, and number and size of lamps per fixture.

7.9.3.2.3 All switches for control of lighting.

7.9.3.2.4 All lighting circuits and associated wiring.

7.9.3.2.5 All receptacles and associated wiring. Receptacles shall be identified by appropriate NEMA type.

7.9.3.2.6 The location and designation of all panelboards. Drawings shall clearly indicate the type of mounting required (flush or surface).

7.9.3.2.7 Service entrance (weatherhead, conduit, and main disconnect).

7.9.3.2.8 Fixture mounting details where unusual conditions are encountered.

7.9.3.2.9 Location and designation of exit lights and main exit light switch.

7.9.3.2.10 Location of all fire alarm equipment and associated wiring, including alarm bells, manual stations, control panels, power supply switch, and empty service entrance conduit for connection to base fire alarm loop, if applicable.

7.9.3.2.11 Location and proper designation, including associated wiring, of all transformers, motor generator units, rectifiers, primary equipment, and primary and secondary bus and supports. Show the necessary space requirements for each.

7.9.3.2.12 Size, location, designation, and space requirements for all switchgear, switchboards, and similar equipment.

7.9.3.2.13 Location and designation of other signal, communication, or alarm system equipment.

7.9.3.2.14 All unusual grounding requirements and all grounding for transformer vaults, transformer pads, and enclosing fences; d.c. generators and rectifiers; and all a.c. generating equipment. Also include grounding for static grounds in hangars, all fuel handling or storage equipment, and all primary equipment.

7.9.3.2.15 Define the physical limits of each hazardous area and the class, division, and group of equipment and wiring.

7.9.3.2.16 Location, designation, and rating of all motors and/or equipment which requires electrical service. Show method of termination and/or connection to motors and/or equipment. Show all necessary junction boxes, disconnects, controllers (approximate only), conduit stubs, and receptacles required to serve the motor and/or equipment.

7.9.3.2.17 The number of conductors in each conduit or cable run when the number of conductors required exceeds two. Circuit designations shall be shown for all home runs and feeders. Circuit and wire sizes shall be shown on the floor plan when not shown on panelboard schedules and/or riser diagrams.

7.9.3.2.18 Elevation views of motor control centers, switchboards, switchgear, unit substations, and other major pieces of equipment.

7.9.3.3 Power Riser Diagrams. A complete power riser diagram shall be shown, including:

7.9.3.3.1 Characteristics of primary supply (voltage, phase, wire, and frequency); size and type of conduit; and size, type, and voltage rating of the primary cable.

7.9.3.3.2 Size, type, and rating of the primary disconnect.

7.9.3.3.3 Main transformer characteristics, including voltage kVA rating, impedance and wiring configuration (i. e., delta-wye, etc.).

7.9.3.3.4 Main secondary feeders and main secondary disconnect.

7.9.3.3.5 Ratings of panelboards, switchboards, and disconnects.

7.9.3.3.6 Characteristics, rating, and proper identification of all motor-generator units, rectifiers, battery chargers, minor transformers, fuses, circuit breakers, and all similar special equipment. Indication of all controls and control wiring required for the proper control of the 60-hertz equipment listed. (All 400-hertz and d.c. wiring, control, feeders, panelboards, and associated equipment shall be shown on a separate riser diagram.

7.9.3.4 Fire Alarm Riser Diagram. A complete, separate riser diagram shall be shown for each fire alarm system. The diagram shall include power supply, control panel, manual and automatic stations, alarm bell, coded transmitter, and zone annunciation. It shall show connection to the base fire alarm loop or provide a spare entrance for future connection to the base fire alarm. In addition, it shall illustrate conduit runs, numbers of conduit, and conduit size.

7.9.3.4 Exit Lighting System Riser Diagram. A separate riser diagram shall be shown for the exit lighting system and shall include power supply exit lights with conduit/conductor size and number.

7.9.3.5 Miscellaneous System Riser Diagram. A separate riser diagram shall be shown for each separate system such as telephone, intercom, paging, CCTV, master clock system, etc. The diagram shall include power supply, control panel or device, conduit runs, other components, and room location of each device.

7.9.3.6 Schedules for panelboards, switchboards, power-switchgear assemblies, and motor control centers shall be provided showing total connected load, total space load, demand factor, diversity factor, maximum demand, main and branch circuit ratings, bracing requirements, interrupting ratings for individual devices,, frame size for each circuit, number of poles, and description of each load.

7.9.3.7 Schedule for lighting fixtures shall be developed indicating fixture type, quantity, location, mounting height, and any other information required for installation. Lighting fixtures shall be selected from Corps standard drawings 40-06-04 series where possible. Fixtures required which are not contained in the 40-06-04 series shall be prepared and presented in the contract documents in same format as 40-06-04 series.

Description and pictorial view for each lighting fixture shall be prepared on 8-1/2-inch by 11-inch drawings and included in the contract specifications. Titles of fixture shall follow similar format as Corps 40-06-04 series.

7.9.3.8 Construction details shall be provided for concrete pads, fences, gates, special grounding, the installation of motor-generator units, padmounted transformers, primary and secondary bus supports, and similar items or equipment. The drawings shall clearly indicate all equipment which is furnished and/or installed by others.

7.9.3.9 Schematic diagrams shall be provided to indicate all electrical control, including motor control circuits; switchgear; auto transfer switches; emergency generators; limit controls; street lighting photocell control; etc.

Guide for  
Architects - Engineers

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# Cost Engineering

Vol 2

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## INTRODUCTION

1. Cost estimating or cost engineering in the Corps of Engineers is now in a critical transition. The need for accurate, well documented, estimates based on adequate engineering is of the highest priority in both civil and military cost engineering.
2. A major change in the formation of both civil and military estimates involves the use of the Micro-Computer Aided Cost Estimating System (M-CACES). A user guide is included as a supplement to this portion, (volume 23, of the A-E guide. The heart of any cost estimating system is the data base. The M-CACES data base, will in the future, cover more standard civil works type construction. The data Base, however, is not meant to replace the cost engineer's judgment and must be used by an experienced estimator to develop a meaningful document. All major cost engineering efforts will use M-CACES. Specific instructions on the use of software will be through private schools or where appropriate, through Seattle District, Cost Engineering Branch.
3. Another major change is the use of Code of Accounts and line item contingencies in civil works estimates. A sample summary format is shown as exhibit I. Specific guidance on the applications of Code of Accounts and contingency assignment will be accomplished on a case-by-case basis. Line item contingencies will provide the cost engineer a method to better define the risk and help in development of an accurate cost estimate.
4. The major portion of volume 2 remains unchanged because the fundamentals of cost engineering still apply in cases where small civil and military projects require an estimate. Cost engineering in the Corps of Engineers is still evolving and it is expected that this guide will continue to evolve. In summary, costs will control final designs.

1. Military Estimates.

1.1 Basic Types. The various types of military estimates known as current working estimates (CWE) are listed below.

- a. Code A - Less than concept design completed (10 percent of total design or less), and funding documents.
- b. Code B - Concept design completed.
- c. Code C - Final design completed.

CWE' s contain the direct construction costs (at current price level), including contractor' s overhead and profit plus costs pertaining to contingency, supervision and administration, and escalation to anticipated midpoint of construction.

The A-F shall estimate only the direct construction costs (including overhead and profit) based on the current price level. The price level shall be clearly indicated on the estimate. The additional items of cost to arrive at a CWE will be added by the Seattle District Cost Engineering Section. The estimate shall be manually math checked and initialed by both the estimator and checker. NPS Form 92-A or computer spread sheet program Lotus 1-2-3 shall be used exclusively for all estimates (see exhibit H for required computer format). The following guidelines are based on TM 5-800-2 "Preparation of Estimates-Military construction. A checklist as shown as exhibit G shall be submitted with each Code B and Code G submittals.

1.2 Code A Estimates. In cases of funding documents or where no design has been accomplished, the estimate will be based on AR 415-17 for the Army and the Air Force Pricing Guide for the Air Force. AR 415-17 and the Air Force Pricing Guide contains unit prices based on experience throughout military construction size adjustment factors, location adjustment factors, escalation factors, and technological updating factors. Where some design has been accomplished, the estimate will be prepared to the level of detail that the design will allow. Code A estimates are prepared on Forms 3086 (Army) or 1178 (Air Force) as shown on exhibits C and D.

1.3 Code B Estimates. The concept estimate is used to determine the adequacy of the previous current working estimate (Code A) and to ensure that the planned design does not exceed the project funding. The estimate shall be as accurate as possible using all data available at the time of its preparation. The estimate shall be summarized by: (1) each building, including all construction costs within the 5-foot line, and (2) supporting facilities outside the 5-foot line from the exterior walls which include:

- a. electrical service distribution system;
- b. water supply distribution system;
- c. gas supply and distribution system;
- d. sanitary collection and disposal sewage system;
- e. stream distribution system;

- f. roads, streets, parking areas, and shoulders;
- g. walks;
- h. curbs and gutters;
- i. fencing;
- j. storm drainage;
- k. unusual foundations for the primary facility in a above, such as drilled piers, piles, mat foundation, or spread footing;
- l. site improvements such as borrow, cut and fill material, rough grade, fine grade, topsoil, seeding, and landscaping;
- m. demolition; and
- n. communications system

A detailed estimate shall be developed for each facility or system in the estimate summary. The detailed estimate shall be a breakdown of all items of work required to construct the facility or system. The format shall be similar to that shown in exhibit A or exhibit H. The unit price for each item of work shall be broken into labor and materials. Equipment costs may be included in each item or at the end of the estimate at the A-E's option. where there 16 significant equipment hours, the equipment cost will show number of work hours with an appropriate operating rate as obtained from EP 1110-1-8 Construction Ownership and Operating Expense Schedules. Operator cost will be shown separately. The unit prices shall be exclusive of overhead and profit. The price for labor shall be the basic cost of labor plus fringe benefits including travel pay, overtime, insurance, and taxes. Labor wage rates shall be developed using applicable union labor agreements and on the NPS form (provided in form packet). The A-E shall estimate the number of man-hours required for each item of work and apply the cost per man-hour to the total man-hours required for each facility or system. The unit price for materials shall be current catalog prices or prices quoted from a supplier and will be documented similar to exhibit F. Items of work which are normally subcontracted shall be estimated as stated above plus an allowance (percentage) for subcontractor overhead and profit. The subcontractor total will then be included in the direct cost to the prime contractor. Costs for labor, materials, equipment, and subcontractor items shall be individually totaled and then added together for each facility or system. Allowances (percentages) for prime contractor overhead and profit shall be added to arrive at a total facility or system cost. The percentage of overhead and profit for both subcontractor and prime contractor will be discussed with the District Cost Engineering Section. All sales tax as appropriate for the state will be added to the estimate.

The quantities used in the estimate shall be supported by a backup showing computations. The backup shall be clear, organized, summarized, and indexed. The backup shall show computations of lengths, areas, volumes, weights, and numbers of items. The quantities shall be related to the drawings by sheet number. Quantities

shall be neat line, plus sufficient contingencies to cover anticipated final design quantities. A sample of a quantity takeoff is attached as exhibit E. The key to a good quantity takeoff is organization and to have a system where the quantities can be verified or revised quickly.

Computations for waste or loss shall be allowed for by adjusting neat line quantities where applicable. All computations shall be checked and initialed by both the originator and the checker.

All backup supporting the cost estimate shall be submitted with each estimate, including a floppy disk (5-1/4 inches) of all applicable data submitted on computer spread sheet Lotus 1-2-3.

The estimate shall also be summarized on the Form 3086 (Army) or 1178 (Air Force) for all MILCON (Military Construction) projects.

1.4 Code C Estimates. Code C estimates are used to develop the final Government Estimate and will be used to evaluate bids, assist in negotiations, and serve as a guide in establishing a schedule of payments. Code C estimates are based upon final design plans and specifications. Code C estimates shall be prepared in the same manner as Code B estimates, except as follows:

a. The detail of the estimate must reflect the level of detail in the design.

b. Quantities shall be neat line, without contingencies. Quantities for waste or 1088 shall be estimated by adjusting the neatline quantities carefully and only where waste is clearly justified. Significant waste factors shall be shown and justified. Allowances for compaction or swell shall be included and clearly identified.

c. The estimate shall be summarized to reflect the bid schedule.

d. The prime contractor's overhead shall be estimated separately (in lieu of using a percentage) and the overhead and profit shown as separate items on the summary sheet. These items must be realistic to reflect conditions as stated in the bid documents. Overhead over direct percentage should be computed in order to verify that it is reasonable, i.e., overhead and profit of 30 percent for routine building is not reasonable.

2.2.1 Current Estimates. Current estimates are prepared at each stage of design and are used for project justification, project authorization, comparison of alternatives, funding, and negotiations. Current estimates shall be prepared as described in EM 1110-2-1301, "Cost Estimates - Planning and Design Stages."

2.2.2 Reasonable Contract Estimate. This estimate is prepared after plans and specifications are complete. This estimate is used for bid evaluation and to assist in negotiations. Estimates (except for "Building Construction") shall be prepared as described in EM 1110-2-1302, "Government Estimate of Fair and Reasonable Cost to Contractor," with the following exceptions:

a. The exception noted in paragraph 2-3a and as stated in paragraph 2-3c will not apply.

- b. Paragraph 3-2. The Seattle District Estimating Section will prepare this portion of the estimate.
- c. Paragraphs 3-3f, 3-3h, 3-3i, 3-3j, and 3-3k will not apply.
- d. Paragraphs 3-5c and 3-5e will not apply.
- e. Paragraph 8-9, Distribution of Overhead, should be estimated and summarized only. Distribution to the contract payment items on ENG Form 1739 is not required.

2.3 Quantities. The quantity takeoff and backup shall be prepared as stated under paragraph "MILITARY ESTIMATES" and included under "Supporting Data," as described in paragraph 3-4 of EM 1110-2-1302.

3. SECURITY. Construction cost estimates shall be handled as confidential information. They shall be kept in a locked safe when not in use with access limited to those persons working on the estimates. All Code C and reasonable contract estimates shall be marked "FOR OFFICIAL USE ONLY" at the bottom of each sheet. All material marked "FOR OFFICIAL USE ONLY" shall be returned to the contracting officer. All employees shall be indoctrinated in the above security regulations. And request from the public or other Government offices for information regarding cost estimates shall be referred to the contracting officer.

4. CHECKLIST. A checklist is shown as exhibit G which will be required to be submitted with each estimate. This checklist is used to serve as a tool for assuring a quality product.

5. FORM PACKET. A form packet is attached for use as masters for reproducing the required number of forms for both Military and Civil Works Estimates.

## 2. Civil Estimates.

2.1 Basic Types. Civil construction can be classed as either Building Construction or Heavy and Highway Construction. For project classed as "Building Construction," the estimates shall be prepared as described for Military Code B and Code C estimates. See exhibit B for a sample Civil Estimate.

2.2 Heavy and Highway Construction. heavy and highway construction estimates can be classed as either "Current Estimate" or "Reasonable Contract Estimate".

2.2.1 Current Estimates. Current estimates are prepared at each stage of design and are used for project justification, project authorization, comparison of alternatives, funding, and negotiations. Current estimates shall be prepared as described in EM 1110-2-1301, "Cost Estimates - Planning and Design Stages."

2.2.2 Reasonable Contract Estimate. This estimate is prepared after plans and specifications are complete. This estimate is used for bid evaluation and to assist in negotiations. Estimates (except for "Building Construction" shall be prepared as described in EM 1110-2-1302, "Government Estimate of Fair and Reasonable Cost to Contractor," with the following exceptions:

- a. The exception noted in paragraph 2-3a and as stated in paragraph 2-3c will not apply.
- b. Paragraph 3-2. The Seattle District Cost Engineering Section will prepare this portion of the estimate.
- c. Paragraphs 3-3f, 3-3h, 3-3i, 3-3j, and 3-3k will not apply.
- d. Paragraphs 3-5c and 3-5e will not apply.
- e. Paragraph 8-9, Distribution of Overhead, should be estimated and summarized only. Distribution to the contract payment items on ENG Form 1739 is not required.

2.3 Quantities. The quantity takeoff and backup shall be prepared as stated under paragraph "MILITARY ESTIMATES" and included under "Supporting Data," as described in paragraph 3-4 of EM 1110-2-1302.

3. Security. Construction cost estimates shall be handled as confidential information. They shall be kept in a locked safe when not in use with access limited to those persons working on the estimates. All Code C and reasonable contract estimates shall be marked "FOR OFFICIAL USE ONLY" at the bottom of each sheet. All material marked "FOR OFFICIAL USE ONLY" shall be returned to the contracting officer. All employees shall be indoctrinated in the above security regulations. Any request from the public or other Government offices for information regarding cost estimates shall be referred to the contracting officer.

4. Checklist. A checklist is shown as exhibit G which will be required to be submitted with each estimate. This checklist is used to serve as a tool for assuring a quality product.

5. Form Packet. A form packet is attached for use as masters for reproducing the required number of forms for both Military and Civil Works Estimates.

6. Field Visits. Field visits shall be conducted by A-E cost engineers to review estimates to assure complete scope and accurate pricing. This section may be waived where justified. Where field visits are conducted, a trip report shall be made part of supporting data.

Guide for  
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# Specifications

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CHAPTER 1

GENERAL INSTRUCTIONS

1.1 General. Specifications shall normally be prepared and Submitted in two parts. The first submittal shall be the outline specifications at the concept design or early preliminary submittal and The second shall be the project specifications at the final design submittal. The notes in the back of some guide specifications begin with the sentence: "This guide specification is to be used in the preparation of project specifications in accordance with ER 1110-345-720." The referenced engineering regulation (ER) will not be issued in addition to these instructions. For your convenience, pertinent portions of the ER are included in the following text. Therefore, compliance with these instructions will constitute compliance with the ER.

1.1.1 Outline specifications (35 percent and 60 percent submittals) shall list or describe in a general way the material to be included in the contract specifications. Outline specifications are reviewed by Corps of Engineers and the using agencies to determine if the final specifications will be generally complete and meet project and Corps of Engineers requirements. Outline specifications shall conform to Construction Specification Institute's (CSI) Master Format for numbering of technical specification sections. Instructions for preparation of outline specifications are covered in chapter 2 of this manual.

1.1.2 Project specifications (100 percent submittals) are the final construction specifications for a specific project prepared by the A-E. Project specifications are used with the final drawings for bidding purposes. Instructions for preparation of project (final) specifications are covered in chapter 3 of this manual.

1.1.3 OCE and Seattle District Prepared Guide Specifications. Guide specifications issued or officially implemented by Office of the Chief of Engineers (OCE) and Seattle District establish the form to be used for the technical requirements of construction specifications and, as far as practicable, the specific requirements to be included. The guide specifications are intended to promote uniformity of construction throughout the Corps of Engineers, provide requirements that have been coordinated with industry, and serve as convenient worksheets to be marked by the specification writer preparing project specifications. Some of the requirements in the guide specifications have general applicability to all projects, while other requirements that vary from project to project have blanks to be filled in; alternative words, phrases, or paragraphs to be chosen; or special paragraphs to be added. Where parentheses or brackets are used to indicate alternative requirements, the parentheses or brackets shall be removed from the expression chosen to be a part of the project specifications. Guidance on choices is provided in general and technical notes at the end of the guide specifications, or in applicable technical manuals. These sources shall be fully utilized.

1.2 Statement of Method and Materials. When guide specifications are not available, a statement of the method of construction and materials to be used shall be stated in the outline specifications in lieu of an outline based on the above mentioned guide specifications.

1.3 Specification Format. Organization and number of specification division shall conform to the latest CSI format. Numbering of specification sections shall also conform to the CSI Master Format. Paragraph format and numbering shall be as used in the guide specifications. Guide specifications are being revised to incorporate the three-part CSI format (general, products and execution).

**1.4 Availability of Referenced Specifications and Standards.** Referenced specifications and standards listed in the various guide specifications are available for inspection in Specifications Section, Seattle District, U.S. Army Corps of Engineers, 4735 East Marginal Way South, Seattle, Washington.

**1.4.1 Federal and Military Specifications or Standards.** All requests for copies of these documents shall be submitted on DD Form 1425 (Specifications and Standards Requisition) to: Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120. When requesting a specification or standard, the request shall indicate the title, number, date, and any applicable amendment thereto by number and date. When DD Form 1425 is not available, the request may be submitted in letter form, giving the same information as listed above and the solicitation or contract number involved. Such requests may also be made to the Naval Publications and Forms Center by telephone (215) 697-3321 or (215) 697-2667.

**1.4.2 Ordering Guide Specifications.** INDEX OF GUIDE SPECIFICATIONS will be furnished to the architect-engineer (A-E). Necessary sections should be ordered after the materials of construction have been determined, but prior to the preparation of the outline specification. It is not usually necessary to order a guide specification for a subject that might become part of the project, depending on the outcome of a study of alternatives. To order OCE and Seattle District guide specifications, mark the desired guide specifications required on the INDEX OF GUIDE SPECIFICATIONS and submit to the Seattle District project manager.

CHAPTER 2

INSTRUCTIONS FOR PREPARATION  
OF OUTLINE SPECIFICATIONS

2.1. Source of Specification Material. Sources of specification material for use in the preparation of outline specifications shall be as follows:

- a. OCE Guide Specifications.
- b. Seattle District Guide Specifications.
- c. Specifications prepared by the A-E.
- d. SPECTEXT, CSI's, Master Guide Specification (when Federal guide specifications are not available).
- e. Guide Specifications prepared by other Government agencies.

2.2. Preparation of Outline Specifications. The A-E shall determine type of specification to use as a basis for the outline specifications except as directed. A-E shall use listed guide specifications required in Foundation and Materials (F&M) Branch's geotechnical report, and if not used, shall state reason why not used.

2.2.1 Based on Guide Specifications. When outline specifications are based upon Guide Specifications, they shall consist of a tabulation of which guide specifications are to be used for each section of the proposed project specification and a listing of "specific data" thereto. OCE guide specifications and Seattle District prepared specifications may be ordered from the project manager by ordering the ones needed from a current copy of Index of Guide Specifications for Military Construction (EP 3100P0).

2.2.2 Based on Architect-Engineer Specifications. For work not covered by Corps of Engineers Guide Specifications, the outline specification shall consist of a statement of method and materials proposed for use during construction which will be A-E prepared specifications.

2.2.3 Typing Paper. Outline specifications shall be typed on bond as specified in chapter 4 for project specifications.

2.3 Format for Outline Specifications. The outline specifications will follow the latest CSI Master Format for division and section titles and numbers as specified herein and as illustrated in exhibit 2A at the end of this chapter. Generally the Corps of Engineers Guide Specification (CEGS) number shall be used unless it conflicts with CSI Master Format, in which case the section number shall be as shown in the CSI Master Format.

2.3.1 General. (See paragraph 1 of exhibit 2A.)

2.3.1.1 Under the "General" heading shall be a statement relative to what guide specifications are used as a basis for the outline specification. When guides are not available, the statement shall explain that the outline specification consists of a description of the methods and materials to be used to perform the construction, and that the project specifications consists of newly composed specification sections.

2.3.2 Specifications. (See paragraph 2 of exhibit 2A.)

2.3.2.1 For specifications based on guide specifications, a reference to the applicable specification by number is adequate when the project specification consists of only deletions of the inapplicable portions from the Guide Specifications. In other words, if listing a guide specification will serve the purpose, the "Specific Data" column shall contain the word "none."

2.3.2.2 The "Specific Data" column shall include only the following information if not indicated on the drawing:

- a. Reference or statement of Air Force criteria contained in AFM 88-15 and other Air Force manuals that differ from the Guide specifications.
- b. Selection of alternatives from notes at the end of Guide Specifications.
- c. Any special items that will be included in the project.
- d. Section titles used shall be the edited Guide Specification titles, not necessarily the exact title shown on the Guide Specifications.

CHAPTER 3

INSTRUCTIONS FOR PREPARATION  
OF PROJECT (FINAL) SPECIFICATIONS

3.1. General. The following material shall be prepared and submitted a minimum of 2 weeks prior to 90 percent review in accordance with the instructions contained in this chapter:

- a. Cover sheet (exhibit 3A).
- b. Schedule (exhibits 3B, 3C, and 3D).
- c. List of drawings and standard details bound in specifications (exhibit 3E).
- d. List of Government-furnished property (exhibit 3F).
- e. Table of contents Section C Technical Specifications (exhibit 3G).
- f. Measurement and Payment paragraphs (exhibit 3H).
- g. Submittal register, ENG FORM 4288 (exhibit 3I).
- h. Marked-up copy of specification Section 01400, Contractor Quality Control (exhibit 3J).
- i. Technical Specifications. Section 01025 or Division 1 and Divisions 2 through 16. A-E shall also provide a marked copy of 01400, provide a typed submittal register (ENG FORM 4288) for addition to Section 01300/01305 Division 1, and provide any additional input for Division 1 such as coordination requirements or scheduling of work.
- j. Marked-up guide specifications as requested.

3.2. Schedule. Exhibits 3B through 3D at the end of this chapter are examples of bidding schedules. Contracts can be prepared on a lump sum or unit price basis and can have additional work established as additive items or optional items. All project specifications shall contain a schedule.

3.2.1 Lump Sum Contracts. Bidding will be on a lump sum basis for most projects. Some lump sum projects will require two or more items with a "Total Bid" line at the bottom. This will be determined by the project manager (i.e., Item No. 0001, Building to a Line 5 Feet Beyond the Building Walls and Item No. 0002, Site Work and Utilities Beyond the Line 5 Feet from the Building Walls). Projects where grading, paving, and utility items are incidental to structures, quantities can be determined from the drawings, and the monetary value is small by comparison, will be bid on a lump sum basis. An example of a lump sum bidding schedule is shown at the end of this chapter as exhibit 3B.

3.2.2 Unit Price Contracts. Bidding will be on a unit price basis where (1) quantities cannot be determined in advance of advertising within limitations that would permit a lump sum bid without a substantial contingency; (2) quantities may change significantly during construction; (3) quantities of cement, pozzolan, and admixtures are directed by the Contracting Officer after award of contracts wherein Portland cement concrete mix design is the responsibility of the Government, or (4) quantities of cement, pozzolan, and admixtures are directed by the Contracting Officer after award of contracts wherein Portland cement concrete mix design is the responsibility of the Government.

3.2.2.1 The selection of unit price bid items will be made in accordance with and under the circumstances given above. An example of a unit price bidding schedule is shown at the end of this chapter as exhibit 3C.

3.2.2.2 Measurement and payment for each item must be covered completely and in a clear and concise manner. The provisions for such measurement and payment will be covered in specification Section 01025, Measurement and Payment. They shall be specially written and included. It is important that all items of work be covered in the measurement and payment paragraph and that they are complete in coverage, clear in meaning, and are in agreement with each other, and are not duplicated in other bid items. When no measurement is involved, the section shall be titled Payment. Exhibit 3H (1 through 3) contains examples of measurement and payment and payment paragraphs.

3.2.3 Additive Items: When it appears the funds available for a project may be insufficient for all desired features of the work, and additional funds will not be available after bid opening, a base bid item is established for the most desirable features while additive items are established for the balance of the features in order of priority. These additive features must be clearly described in specification Section 01025, Measurement and Payment. When multiple Items are used, consideration should be given to the estimated cost of each item and what might happen when award is made in accordance with the standard paragraph shown below.

Additive Items: (APR 1968) The low bidder for purposes of award shall be the conforming responsible bidder offering the low aggregate amount for the first or base bid item, plus (in the order of priority listed in the schedule) those additive bid items providing the most features of the work within the funds determined by the Government to be available before bids are opened. If addition of another bid item in the listed order of priority would make the award exceed such funds for all bidders, it shall be skipped and the next subsequent additive bid item in a lower amount shall be added if award thereon can be made within such funds. For example, when the amount available is \$100,000 and a bidder's base bid and four successive additives are \$85,000, \$10,000, \$8,000, \$6,000, and \$4,000, the aggregate amount of the bid for purposes of award would be \$99,000 which would include the base bid plus the first and fourth additives, the second and third additives being skipped because each of them cause the aggregate bid to exceed \$100,000. In any case all bids shall be evaluated on the basis of the same additive bid items, determined as provided above. The listed order of priority need be followed only for determining the low bidder. After determination of the low bidder as stated, award in the best interest of the Government may be made to him on his base bid and any combination of his additive bid for which funds are determined to be available at the time of the award, provided that award on such combination of bid items does not exceed the amount offered by any other conforming responsible bidder to the same combination of bid items.

Unless unusual circumstances exist, an additive should never have an estimated cost of less than \$1,000. For an example of a bidding schedule with additive items see exhibit 3D.

3.2.4 Optional Items: When it appears that funds available at bid opening (although additional funds will be made available during a specified period after bid opening) for a project may be insufficient for all desired features of work, a base bid item is

established for the most desired features while optional items are established for the balance of the features. The Government may increase the quantity of work called for by requiring the completion of one or more of the numbered line items identified in the Schedule as optional items. The Contracting Officer may exercise this option at any time within a period (usually 30 to 90 days) by giving written notice to the Contractor. These optional items must be clearly described in the specification Section 01025, Measurement and Payment. Award will be made in accordance with the standard paragraph shown below:

Optional Items: Notwithstanding any other provisions of this invitation, the Government will award the base bid item or items as a minimum. The Government may increase the quantity of work awarded by exercising optional bid item or items any time, but not later than the number of calendar days indicated after notice of receipt by Contractor of notice to proceed for base bid or not at all. Bidders shall bid on all items (base and optional). Bids will be evaluated for purpose of determining low bidder by adding the total price for the optional items to the total price for the base bid items. Evaluation of optional items will not obligate the Government to award these items. For an example of a bidding schedule with optional items see exhibit 3D.

3.3. List of Drawings. The drawing list shall include all contract drawings, reference drawings, and standard drawings in the format shown in exhibit 3E. All drawings shall be listed by exact title together with the District file number and the sequential sheet number.

3.4. List of Government-Furnished Property. Government-furnished, contractor installed property together with the approximate cost shall be listed on a sheet as shown in exhibit 3F.

3.5. Table of Contents:

3.5.1 The Table of Contents for Section C - Technical Specifications shall show the division and section titles and numbers. Divisions not used shall be marked "Not Applicable." For a sample Table of Contents, see exhibit 3G. A-E shall prepare final Table of Contents to cover all specification divisions (1 through 16).

3.6 PREPARATION OF TECHNICAL SPECIFICATIONS: The District will furnish current guide specifications for use in the preparation of specific technical specification sections based on same. These specifications will be provided as hard copies or computerized format consistent with the information provided by the project manager. The Technical Specifications sections shall be prepared from and shall be consistent with the approved outline specifications.

3.6.1 Deviations. The requirements in the guides will not suit every project; therefore, some tailoring will be required. This "tailoring" may be accomplished by use of the "authorized deviations" listed below.

3.6.1.1 Authorized Deviations.

a. Changes required or permitted by Department of the Army publications or OCE publications, design directives or letters, or the "Notes" section of the guide specifications.

- b. For Air Force projects only, tailoring to comply with the requirements of AFM 88-15.
- c. Changes to reduce requirements for submittal of technical data and samples for noncritical items of relatively low value as compared to the cost of making the submittal.
- d. Deletion of inapplicable text material or insertion of additional needed text material (as necessary to tailor the specifications to fit a specific project) subject, however, to compliance with all regulations, procurement policies, criteria controls, and other explicit guidance established by official publications. Except when required to do so as result of explicit guidance mentioned herein, additional text material will not be added unless it is absolutely necessary in order to construct the specific project involved.

3.6.1.2 Unauthorized Deviations. Any changes desired beyond the scope of the above "authorized deviations" must be specifically approved by the District and are known as "unauthorized deviations." Permission to use "unauthorized deviations" must ultimately come from the Division office; therefore, a long lead time is necessary. Where "unauthorized deviation" is approved for use, a note to that effect shall be written in the back of the guide following the "Notes" which includes the reasons why and makes reference to a letter or other specific authorization.

3.6.1.3 Tables of Contents for individual specification sections over 10 pages long are desirable, and shall be provided when the specific technical guide specification furnished has been furnished with a table of contents. Pages of Tables of Contents shall be numbered with lower-case Roman numerals, e.g., "i" or "ii."

3.6.2 Titles and section numbers shall be as approved in the outline specifications. If no outline specifications were required guide specification titles and section numbers shall be in accordance with paragraph FORMAT FOR OUTLINE SPECIFICATIONS of chapter 2.

3.6.3 Editing of Guide Specifications shall normally be performed in any manner consistent with the office procedures of the A-E firm, however, certain types of projects may require submittal of mark-up hard copies of guide specifications. For marked-up guide specifications all material not to be final typed shall be lined out or crossed out with a black pencil. Paragraphs shall be renumbered when necessary but shall always be renumbered in the numerical format consistent with the latest guide specifications.

3.6.4 The paragraph REFERENCES which precedes the text of each guide specification shall be edited to be consistent with the text. Only those publications which are referred to in the remaining text should remain. The issue date of references included in project specifications need not be more current than provided by the latest change (notice) to the guide specification.

3.6.5 Trade Names and Proprietary Items.

3.6.5.1 Contracts issued by the Federal Government forbid the use of proprietary or exclusionary specifications in obtaining materials, equipment, and services, except when it is considered essential. Sole source requirements (only one acceptable brand name

product) may be specified but shall be fully justified in writing by the A-E to the project manager. Justification shall clearly state why no other product is acceptable. The A-E shall not design around or specify a sole source item until approval is secured (by waiver) by the Seattle District from North Pacific Division of the U.S. Army Corps of Engineers.

3.6.5.2 "Brand name or equal" specifications shall be held to a minimum and shall be limited only to instances where adequate performance or quality standards do not exist. Brand name specifications shall be used only when a specific product or particular feature of a product is considered essential to the Government's requirements, in which case at least two acceptable brand name products shall be referenced along with the words "or equal." In addition, the salient physical and functional characteristics shall be included. Generic identification of the product is the preferred method of specifying qualitative requirements.

3.6.6 The construction contract used by the Corps of Engineers is a two-party contract. The only parties involved are the Contractor and Contracting Officer. Whenever the terms "Contractor" or "Contracting Officer" are used in the specifications they must be capitalized. Do not refer to any third party (i.e., "Owner," "Architect," "Engineer," "Electrical Subcontractor," or other subcontractors).

3.6.7 A 1-year warranty clause will be included in Division 1 of the Technical Specifications. Several Guide Specifications contain guarantee clauses which require extended warranties which shall be retained but none shall be added to Guide Specifications not now containing them. When a section is to be A-E prepared, a special guarantee or warranty clause shall not be used unless the material or equipment is of special design where the interest of the Government clearly requires such a clause.

3.6.8 Architect-Engineer Prepared Sections. When subject matter cannot be found in the existing guide specification, it must be included in an existing guide or be written up as a new section. An A-E prepared new section shall follow the format of the most recent Guide Specifications (CSI format) and precisely state what is expected from the Contractor in clear and concise language. Vague statements shall be avoided (i.e., do not use: to the satisfaction of the Contracting Officer, in neat and workmanlike manner, good working order, or tests will be made unless waived). Carefully coordinate the text with the drawings to prevent conflicts.

3.6.9 Government property as referred to in military construction contracts will be classified in the categories specified below and the specifications will be prepared as follows:

3.6.9.1 Government-furnished, Contractor-installed (GF/CI) property is property in the possession of, or acquired directly by, the Government and subsequently delivered or otherwise made available to the Contractor to be incorporated or installed in the work or used in its performance. GF/CI property may be new or used and may or may not need repairs or alterations. Items of Government property being relocated/reused in the work are not to be considered GF/CI property unless the Government takes possession of the property from the Contractor and repairs or alters the property at no expense to the Contractor and then returns the property to the Contractor for reinstallation in the

work. GF /CI property will be listed in the SPECIAL CLAUSES of the contract and the drawings shall indicate such items as "GF/CI." A list of Government-furnished property including location where listed property will be made available to the Contractor shall be prepared by the A-E for this purpose (exhibit 3F).

3.6.9.2 Government-furnished, Government-installed (GF/GI) property will be procured and installed by the using agency. The contract drawings will indicate the location and include provisions necessary for installation by others. The equipment schedule on the drawings shall indicate GF/GI items.

3.6.9.3 Salvaged materials and equipment is property removed by the contractor and turned over to the using agency. The term "salvage" shall be used only in connection with property removed by the Contractor to be retained by the Government. Salvage items shall be included in the Demolition Section of Division 2, SITE WORK.

3.6.9.4 Contractor salvage is defined to be all materials and equipment that shall become the property of the Contractor, regardless of value. Materials and equipment will become property of the Contractor when the materials and equipment are removed from Government property.

3.6.10 Shop Drawings Submittal Requirements. Technical Specifications for items or equipment requiring shop drawings shall be prepared to only state "shop drawings shall be submitted." This may be contrary to what is stated in the guide specifications as some guide specifications state for Contracting Officer approval. The completed shop drawing submittal register ENG FORM 4288 will indicate which items or equipment shall be submitted for Contracting officer approval and which shall be submitted for information only. See exhibit 3I for guidance. The Corps of Engineers project manager will provide the A-E with blank ENG Form 4288.

3.6.11 Section 01400. Contractor Quality Control. The A-E shall edit Section 01400 to conform to specifications being prepared for each specific project. The A-E shall, at time of requesting guide specifications, request copy of section 01400 (see exhibit 3J for copy of Section 01400). Any reference in the technical specifications to Construction Quality Control shall be changed to read Contractor Quality Control.

3.7. A-E Input to Division 1. The Seattle District Specifications Section will finalize Division 1 after receiving input from the A-E. Input shall be due early enough during the final design effort to allow the Seattle District two (2) weeks to finalize and return the sections to the A-E for consolidation with the other specification sections prior to final design submission for final review.

3.7.1 Section 01001. Supplementary Requirements. The A-E shall provide input pertaining to any special requirements or restrictions such as construction phasing or sequence, power outages, etc.

3.7.2 Section 01005. Base Specific Supplementary Requirements. Seattle District prepared.

3.7.3 Section 01025. Measurement and Payment. The A-E shall provide measurement and payment paragraphs and in addition shall furnish the schedule with bid items. A-E shall furnish estimated quantities when there are unit price items.

- 3.7.4 Section 01035. Modification Procedures. Seattle District prepared.
- 3.7.5 Section 01061. Environmental Protection. The A-E shall provide input if there are any special environmental protection requirements.
- 3.7.6 Section 01300 to 01305. Submittal Procedures. Seattle District prepared, expect A-E shall provide a typed submittal register on ENG Form 4288.
- 3-7.7 section 01400. Contractor Quality Control. The A-E shall provide marked-up section.
- 3.7.8 Section 01501. Construction Facilities and Temporary Controls. Seattle District prepared.
- 3.7.9 Section 01701. Operations and Maintenance Manuals. Seattle District prepared.
- 3.7.10 Section 01702. A6-Built Records and Drawings. Seattle District prepared.
- 3.7.11 Section 01703. Warranty of Construction. Seattle District prepared.

Guide for  
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# Design Criteria

1.1 General Instructions. All projects shall conform to the criteria contained in the references indicated, unless the A-E is given instructions in writing to the contrary. In cases where a District review determines criteria has not been followed, the A-E will be required to conform his design to the criteria at his own time and expense, per paragraph 2 of the General Provisions of the A-E contract.

1.2 Date of Publications. To eliminate the need to continually change the dates of the criteria references, dates have not been shown. The A-E will be issued the latest copy for all District publications requested. Since the criteria often changes, the A-E shall obtain the up-to-date material and discard criteria from any past District projects. For all non-Corps of Engineers references, the A-E shall use those latest editions at the time his contract is signed. If there is any question regarding this issue, it should be brought up and discussed at the prenegotiation conference.

1.3 Availability of Criteria. Publications such as guide specifications, TM s, AFM s, DM s, DOD manuals, and Seattle District prepared manuals are available on request. Other Government documents which are not available from the District will be so noted in the criteria list. The A-E is responsible for obtaining these items from the appropriate Government agencies. All other references, such as American Concrete Institutes, "Building Code Requirements for Reinforced Concrete," will be obtained by the A-E from other sources.

1.4 Conflicts in Criteria. In many instances, a subject has more than one criteria reference. These references may give conflicting information on a given point. In all cases, the Government publication will control over non-Government publications and Seattle District references will control over other Government references, unless otherwise stated. If there is any doubt regarding the controlling criteria, the A-E should contact the PM

1.5 Criteria Index. The criteria that follows has been organized by discipline, with subjects listed alphabetically by key word to insure easy success by the designer. Each of the references should be thoroughly examined by the A-E to make certain that all applicable criteria has been met. Use the references for both Army and AF projects, unless noted otherwise in the remarks column.

1.6 Amended Criteria. It is sometimes necessary to update portions of the TM s, AFM s, DM s, and DOD manuals with Air Force/AFRCE/OCE guidance letter of revision or correction. A current list of these letters will be provided to the A-E by the PM

1.7 Drafting Standards (Simple Drawings). The sample drawings provides guidance for desired drafting symbols, sheet layout, graphic quality, and other information relevant to drawing production.

1.8 Standard Details. Standard detail drawings are available upon request. The PM can provide pertinent details as required to assist the A-E.

CIVIL

Subject	Criteria References	Remarks
Airfield and Heliport Planning Criteria	TM 5-803-7	
Airfield Design, General	TM S-824-1/AFM 88-6, Chapter 1	Defines traffic areas.
Airfield Markings	AFR 88-1s TM 5-823 4	Air Force only Army
Arms Range, Small Arms	AFM 50-25	Air Force only.
Backfill for Subsurface Structures	TM 5-818-4	
Design Analysis	ER 1110-345-700	Covers all disciplines.
Details	Standard Details for Utilities, Foundations, Paving, and Railroads require.	Details may be modified as conditions
Drainage and Grading	AFM 88-15, Chapter 15, Section C	AF only. For airfields, roadways, and built-up areas.
Drainage, Surface for Airfields and Heliports	TM 5-820-1/AFM 88-5, Chapter 1	
Drainage, Subsurface for Airfields	TM 5-820-2/AFM 88-5, Chapter 2	
Drainage and Erosion Control Structures for Airfields and Heliports	TM 5-820-3/AFM 88-5, Chapter 3	
Drainage, Areas Other than Airfields	TM 5-820-4/AFM 88-5, Chapter 4	
Environmental Impact	DA PAM 200-1 (Army Pamphlet)	

CIVIL

Subject	Criteria References	Remarks
Fence, Chain Link	Guide Specifications, CECS 02444	
Fire Protection for Facilities (Engineering, Design & Construction)	ML-HDBK-1008	
Landscaping, Planting Design	TM 5-803-5/AFM 88-43	
Landscaping, Planting Turf	TM 5-830-2/AFM 88-17, Chapter 2	
Landscaping, Dust Control	TM 5-830-3/AFM 88-17, Chapter 3	
Landscaping, Planting and Maintenance of Trees, Shrubs, and Vines	TM 5-830-4/AFM 88-17, Chapter 4	Some bases have a list of trees, shrubs, and vines suitable for that locale. Contact the PM for that list.
Pavements, General Provisions, Geometric vision for Roads, Streets, Walks, and Open Storage Areas	TM 5-822-2/AFM 88-7, Chapter 5	
Pavements, Personnel Parking	TM 5-803-5 EIRS Bulletin 81-05	
Pavements, Handicapped Uniform Federal Accessibility Standards Personnel Parking		
Pavements, Soil Stabilization for Road/ Streets	TM 5-822-4/AFM 88-7, Chapter 4	
Pavements, Flexible for Roads, Streets, Walks, and Open Storage Areas	TM 5-822-5/AFM 88-7, Chapter 3	
Pavements, Rigid, for Roads, Streets, Walks, and Open Storage Areas	TM 5-822-s/AFM 88-7, Chapter 1	

CIVIL

Subject	Criteria References	Remarks
Pavements, Concrete, Standard Practice	TM 5-822-7/AFM 88-6, Chapter 8	
Pavements, Bituminous, Standard Practice	TM 5-822-8/AFM 88-6, Chapter 9	
Pavements, Rigid, Repair of	TM 5-822-9	
Pavements, Flexible, Airfield-Heliport	TM 5-823-2	Army only.
Pavements, Rigid and Overlay, Airfield and Heliport	TM 5-823-3	Army only.
Pavement, Design for Frost Conditions	TM 5-818-2	
Foundations in Expansive Soils	TM 5-818-7	
Pavements, Rigid Airfields Other Than Army	TM 5-824-3/AFM 88-s Chapter 3	
Planning, Master	ASCE Urban Planning Guide, TM 5-803-1 and TM 5-803-5/AFM 88-43 Installation Design	Principles and procedures.
Planning in the Noise Environment.	TM 5-803-2/AFM 19-10	General information.
Planning, Army Aviation Facilities	TM 5-803-4	Army only.
Planning, Site, Community Centers	TM 5-803-s	
Planning, Outdoor Sports Facilities	TM 5-803-10/AFR 88-3	
Planning, Childrens Play Areas and Equipment	TM 5-803-11/AFM 88-30	

CIVIL

Subject	Criteria References	Remarks
Planning, Outdoor Recreation Facilities	TM 5-803-12	
Planning, Master Base	Air AFM 86-6	AF only.
Planning, Airfield and Airspace	AFM 88 4, Chapter 5	AF only.
Railroad Design	TM 5-850-2/AFM 88-7, Chapter 2	
Reserve Center, Army Design Guide	DG 1110-3-107	
Sewage, General Considerations	ASCE Glossary-Water and Wastewater Control Engineering; AFM 88-15, Chapter 2	AFM 88-15, Chapter 11, applies to AF only.
Sewage, Sanitary, and Industrial Waste Sewers	TM 5-814-1/AFM 88-11, Volume 1; AFR 88-15, Chapter 15, Section B; ASCE Manual No. 37; Guide Specification, CEGS 15302	Gravity Sewers: Pipe materials and bedding, refer to guide specification. Pipe materials for AF refer to AFM 88-15, Chapter 11, Section B.
Sewage and Industrial Waste Pumping Stations	TM 5-814-2/AFM 88-11, Volume 2; AFR 88-15, Chapter 15, Section B; ASCE Manual No. 37	TM 5-814-2/AFM 88-11, Chapter 2, Controls Design. AFM 88-15 applied to AF only.
Sewage, Treatment Plants	TM 5-814-3/AFM 88-11, Volume 3; AFR 88-15, Chapter 15; ASCE Manual No. 3s; EPA Process Design Manuals; EPA Technology Transfer Seminar Pubs	TM 5-814-3/AFM 88-11, Chapter 3, Controls Design. AFM 88-15 applies to AF only.
Site Criteria	Architectural and Engineering Instructions; TM 5-803-5; AFM 8s-2	
Solid Wastes, General	AF 88-15, Chapter 15, Section D Considerations	AF only.

CIVIL

Subject	Criteria References	Remarks
Solid Wastes, Sanitary Landfill	TM 5-814-5/AFM 88-11, Chapter 5; ASCE Manual No. 39 5, Controls	TM 5-814-5/AFM 88-11, Chapter Design.
Symbols	Standard Details for Utilities, Foundations, Paving, and Railroads	Symbols shown are mandatory.
Utility, Services, and Siting	AFR 88-15, Chapter 15, Section E	AF only.
Water, General Considerations	ASCE Glossary - Water and Control Engineering, TM 5-813-1/AFM 88-10, Volume 1	Definition and general policies.
Water Distribution Systems	TM 5-813-5/AFM 88-10, Chapter 5	
Water Systems, Design of Small	EM 1110-2-503	
Water, Sources		
Water Storage	TM 5-813-4/AFM 88-10, Chapter 4	
Water, Supply	AFR 88-15 TM 5-813-4 of materials to be	AF only. This provides guidance in selection used in water supply treatment and distribution facilities.
Water, Supply for Fire Protection	TM 5-813-s/AFM 88-10, Chapter 6	Prescribes water supply requirements for fire protection at the installation level and requirements to the vicinity of a facility.
Water, Supply for Special Projects	TM 5-813-7/AFM 88-10, Chapter 7  and Reserve Centers.	For antiaircraft tactical sites, including family housing, Air Control and Warning Stations

CIVIL

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Subject	Criteria References	Remarks
Water Treatment	ASCE Manual - Water Treatment Plant Design; TM 5-813-3/AFM 88-10, Chapter 7	Approval of water quality is the responsibility of the Medical Department activity. In case of conflict, the TM/AFM controls.

ARCHITECTURAL

Subject	Criteria References	Remarks
Air Force Design, General	AFR 88-15	
Army Design, General Definitions of ant Fire-Resistive Requirements for Types of Construction	Army-AEI Design Criteria Air Force- AFR 88-15	
Allowable Floor Areas (Fire Areas) Based on Occupancy, Type of	Army-AEI Design Criteria and UBC; Air Force AFR 88-15	Based on occupancy and type of construction as Construction defined in UBC.
Occupancy Separation and Enclosures	Army-AEI Design Criteria and UBC, Table 5B; Air Force- AFR 88-15, Table 5B	Note: Only outside entrance into mechanical rooms permitted.
Separation/Spacing Between Buildings and Area Separation Walls	AEI Design Criteria (ML-HDBK-1008), Air Force- AFR 88-15	
Protection of Openings, Fire Doors, Hardware, Windows	NFPA 80	Must be used for all fire doors and windows
Egress and Exit Requirements	NFPA 101, Based on NFPA Occupancy Classification	Apply to determine occupant load, number and width of exits, travel distances, dead end limits, etc.
Smoke Barriers	NFPA 101	Follow for specific occupancy requirements
Additional Life Safety/ Occupancy Requirements	NFPA 101; UBC	Check for additional occupancy specific requirements.

ARCHITECTURAL

Subject	Criteria References	Remarks
Interior Finish Fire Class (Flame Spread and Smoke Developed)	Army-AEI, Design Criteria Air Force-AFR 88-15	
Thermal Insulating Material Restrictions	Army-AEI Design Criteria; Air Force-AFR 88-15	
Carpet Limitations As Finish	Army-AEI Design Criteria; Air Force-AEI 88-15	
Fire Protection - Sprinkler Systems, Detection and Alarm Systems	Army-AEI Design Criteria; Air Force-AFR 88-15	Apply referenced NFPA as indicated.
Caulking and Sealants  805-6  TM	Air Force-AFR 88-15, TM 5-805-s/ AFM 88 4, Chapter 7; Army- the guide specification. Standard Details  in lieu of those	<p>           Joints must be detailed to coordinate with <span style="float: right;">TM :</span>             Request the generic drawings to be used shown on the         </p>
Paints and Protective Coatings	TM 5-618	
Colors	District Acceptable Manufacturers Standard	Must be used to select and list paint colors. No other system is permitted.
Color Selection	Air Force Project Book; Army-AEI Design Criteria and TM 5-807-7	
Doors	AEI Design Criteria	
Flashing Joints, Sheet Metal	Guide Specifications Supplemented by Architectural Sheet Metal Manual by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)	
Hardware, Builders	CEGS 08710	

ARCHITECTURAL

Subject	Criteria References	Remarks
Insulation	Guide Specification CE-235.03, CEGS-07241, and CE04230	
Interior Finishes	AEI Design Criteria and AFR 88-15	
Kitchen Equipment, Army Reserve Centers and Army Enlisted Personnel	Food Service Equipment/Details by USA Troop Support Agency, Ft. Lee, Virginia Dining Facilities	
Kitchen Equipment (Air Force)	Specified Criteria Will be Provided for Each Project.	
Masonry Wall, "U" Values	Army-AEI Design Criteria Air Force-AFR 88-15	
Materials of Construction	Army-AEI Design Criteria Air Force-AFM 88-15	
Medical Facilities	TM 5-838-2 and Other Project Directives	Army only.
Medical Facilities	AFR-88-50 and other Project Directives	AF only.
Occupational Safety and Health Standards	EM 385-1-1, OSHA, General Indus-	More stringent criteria governs.
Partition Framing	NFPA 220, Guide Specification CE-235-.02	
Physically Handicapped	AEI Design Criteria UFAS (uniformed Federal accessibility standard)	Applies to all designs, unless specifically exempted.
Roof Decking	Army-TM 5-805-3, TM 5-805-14; Air Force-AFR 88-15	Describes types of decking permitted. Warning: Wood shown is rarely permitted.

ARCHITECTURAL

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Subject	Criteria References	Remarks
Roofing	Guide Specifications CEGS- 07311, CE- 222. 01, CE- 222. 02, CEGS- 07414, CEGS- 074s3, CEGS- 07510, CE 220. 13, and CE- 220. 15	
Waterproofing	Guide Specifications CEGS- 071s0,	

STRUCTURAL

Subject	Criteria References	Remarks
Aluminum Structural	The Aluminum Association, "Specifications for Aluminum Structures."	
Anchor Bolts, Strength of	TM 5-809-10/AFM 88-3, Chapter 13	
Blast Design	TM 5-1300/AFM B8-15 Ch. 18 Sect. D (Fall Out Shelters)	TM 5-1300 is available on loan basis only.
Composite Decking	Design Manual for Floor Decks and Roof Decks by Steel Deck Institute	
Composite Design	ACI 318-Building Code Requirements for Reinforced Concrete; AISC's Manual of Steel Construction; TM 5-809-10/AFM 88-3, Chapter 13	
Concrete Design	ACI 318 Building Code Requirements for Reinforced Concrete	
Concrete Details	TM 5-809-2/AFM 88-3, Chapter 2; TM 5-809-10/AFM 88-3, Chapter 13	
Decking, Steel, Roof and Floor	TM 5-809-10/AFM 88-3, Chapter 13; Design Manual for Flood Decks and Roof Decks by Steel Deck Institute	
Expansion Anchors, Strength of	Federal Specification FF-S-325	Not available from District.
Expansion Joints	TM 5-809-2/AFM 88-3, Chapter 2	
Foundation Design	Geotechnical Report and Pavement Design; TM 5-809-2/AFM 88-3, Chapter 2; TM 5-809-10/AFM 88-3, Chapter 13; ACI 318 Building Code Requirements for Reinforced Concrete TM 5-818-1	

STRUCTURAL

Subject	Criteria References	Remarks
Frost Penetration	Geotechnical Report; TM 5-809-1/AFM 88-3, Chapter 1	
Glu-Lam Beams	AITC 117, Standard Specifications for Structural Glued Laminated Timber	
Gypsum Diaphragms	TM 5-809-10/AFM 88-3, Chapter 13	
Loads, Heavy Floor	TM 5-809-12/AFM 88-3, Chapter 15	
Lateral Loads (Interior)	TM 5-809-1/AFM 88-13, Chapter 1	
Loads, Live	TM 5-809-1/AFM 88-3, Chapter 1	
Loads, Snow	TM 5-809-1/AFM 88-3, Chapter 1	
Loads, Wind	TM 5-809-1/AFM 88-3, Chapter 1	
Masonry	TM 5-809-3/AFM 88-3, Chapter 3; Masonry Institute of America, Design Handbook	
Metal Buildings, Pre-Engineered	Guide Specification CECS 13120 and Metal Building Systems Manual by Metal Building MFGRS Association	See notes in rear of guide specifications.
Metal, Roofing and Siding 07413; NPS 07414; and	Guide Specifications CECS 07415	See notes in rear of guide specifications
Plywood	Plywood Design Specification, American Plywood Association	
Precast Concrete	TM 5-809-10/AFM 88-3, Chapter 13; Guide Specifications CECS 03450, PCI Design Handbook, Precast and Prestressed Concrete	
Prestressed Concrete	Tff 5-809-10/AFM 88-3, Chapter 13; and PCI Design Handbook Precast, and Prestressed Concrete	

STRUCTURAL

Subject	Criteria References	Remarks
Retaining Walls	EM 1110-2-2502; ACI 318 Building Code Requirements for Reinforced Concrete	
Security Construction	AFM 127-100	
Seismic Design	TM 5-809-10/AFM 88-3, Chapter 13 Letter: NPDEN-TE (Kenyon) to Seattle District of 1s Apr 84 Titled: Seismic Design for Buildings Use of Tension Only Diagonal Bracing	
Slabs on Grade, Subjected to Heavy Loads	TM 5-809-12/AFM 88-3, Chapter 15	
Steel, Cold Formed	American Iron and Steel Institute, Cold-Formed Steel Design Manual TM 5-809-10/AFM 88-3, Chapter 13	
Steel Joists	AISC's Manuals of Steel Construction; Steel Joist Institute Standard Specifications (SJI)	Tables and Weight Table for steel joists and joist girders.
Structural Steel	TM 5-809-10/AFM 88-3, Chapter 13; AISC's Manual of Steel Construction	
Timber Design	TM 5-809-5/AFM 88-3, Chapter 5; TM 5-809-10/AFM 88-3, Chapter 13; and National Design Specifications for Stress Graded Lumber and its Fastenings	
Vaults, Arm Storage and	DOD 5100.7s-M; Guide Specifications 08318	
Welding	AWS, Structural Welding Code	

MECHANICAL

Subject	Criteria References	Remarks
Energy Conservation Investment Programs (ECIP)	Annual Guidance Letter by OCE and AFRCE; AFR 88-15, Chapter 1	
Fire Protection, Classification of Occupancy, hazards, groups.	ML-HDBK-1008	
Fire Protection, Data Processing Facilities	Army-NFPA 75; Air Force-AFR 88-15, Chapter 15	
Fire Protection, Fire Dampers	NFPA 90A required in 1-hour walls in addition to 2, 3, and 4.	Fire dampers will be
Fire Protection, General Requirements	Army-AEI Design Criteria; Air Force-AFR 88-15, Chapter 15	
Fire Protection, Special Hazards	ML-HDBK-1008	
Fire Protection, Water Supply	ML-HDBK-1008	
HVAC, Computer Simulation for Buildings	TM 5-810-1/AFR 88-15, Chapter 1 AEI Design Criteria on energy analysis	District will provide additional guidance requirements
HVAC, Energy Monitoring Control Systems	TM 5-815-2/AFM 88-3s	District may give and additional guidance.
HVAC, Fuel Selection	TM 5-810-1/AFR 88-15, Chapter 15	
HVAC, General Requirements	ASHRAE, Book of Fundamentals; NFPA 101; Army-TM 5-810-1, AEI Design Criteria, Chapter 13 Force-AFR 88-15, Chapters 15	District will provide additional Guidance on energy budgets.
HVAC, Health Facilities	AFR 88-50 (Air Force)	

MECHANICAL

Subject	Criteria References	Remarks
HVAC, Inside Design	TM 5-810-1/AFR 88-15, Chapter 15	Temperatures
HVAC, Legend of Symbols	ASHRAE Handbook of Fundamentals	
HVAC, Mechanical Design	TM 5-810-1; ASHRAE Equipment Volume, ASHRAE Applications Volume; ASHRAE Systems Volume	
HVAC, Medical Facilities (Army)	TM 5-838-2, Chapter 8	Includes minimum air changes, outside air requirements, etc.
HVAC, Outside Design Temperatures	TM 5-810-1/AFR 88-15, Chapter 15	
HVAC, Perimeter Insulation	AEI Design Criteria, Chapter 13; AFR 38-15, Chapter 7	
HVAC, Seismic Design	TM 5-809-10/AFM 88-3, Chapter 13	Refer to chapters Mechanical and Electrical Elements."
HVAC, Solar	TM 5-810-1, AFR 88-15, Chapter 1	More specific criteria will be provided for each project
HVAC, Special Ventilation Applications	American Conference of Governmental Industrial Hygienist Manual	Use for exhaust hoods, paint spray booths, toxic vapors, etc. Not available from District.
HVAC, "U" Values	AEI Design Criteria, Chapter 13 AFR 88-15, Chapter 7	
Kitchen Equipment, Army Reserve Centers and Army Enlisted Personnel Dining Facilities	Food Service Equipment/Details by USA Troop Support Agency Ft. Lee, Virginia DG 1110-3-135 DG 1110-3-107	

MECHANICAL

Subject	Criteria References	Remarks
Kitchen Equipment (Air Force)	Specific criteria will be provided for each project.	
Occupational Safety and	EM 385-1-1; OSHA, General Industry Standards governs.	More stringent Health criteria
Plumbing, Code Requirements	National Standard Plumbing Code	
Plumbing, Compressed Air	TM 5-810-4/AFM 88-8, Chapter 3	
Plumbing, Design Analysis	TM 5-810-5/AFM 88-8, Chapter 4	
Plumbing, Drawing Requirements	TM 5-810-5/AFM 88-8, Chapter 4	
Plumbing, Fixtures and Piping Materials	TM 5-810-5/AFR 88-15, Chapter 15; Federal Specification WW-P-541; Military Specification T-12295 and H-12322	Proper selection of plumbing fixtures and equipment will require listed military and Federal specifications.
Plumbing, Gas Fittings	TM 5-810-s/AFM 88-8, Chapter 5	
Plumbing, General Requirements	Army-AEI Design Criteria Air Force-AFM 88-15, Chapters 15	
Plumbing, Health Facilities	AFR 88-50 (AF)	
Plumbing, Hot Water Supply	TM 5-810-5/AFM 88-8, Chapter 4	
Plumbing, Interceptors, Backwater Valves and Floor Drains	TM 5-810-5/AFM 88-8, Chapter 4;	
Plumbing, Legend of Symbols	ASHRAE Book of Fundamentals	
Plumbing, Medical Facilities	TM 5-838-2 (Army)	

MECHANICAL

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Subject	Criteria References	Remarks
Plumbing, Physically Handicapped Plumbing, Rainfall for Various Cities	EM 1110-1-103 National Standard Plumbing Code	See notes in rear of guide specifications.
Plumbing, Sanitary Drainage and Vent Systems	TM 5-810-5/AFR 88-15, Chapter 15	
Plumbing, Vacuum Piping	TM 5-810-5/AFR 88-15, Chapter 15	
Plumbing, Water Softening Requirements	TM 5-813-3/AFR 88-10, Volume 3	
Plumbing, Water Supply and Distribution	TM 5-810-5/AFM 88-8, Chapter 4	
Solar Energy Systems	TM 5-804-2	

Guide for  
Architects - Engineers

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## **Addendum**

A-E GUIDE ADDENDUM

A-E QUALITY CONTROL CHECKLIST

The purpose of this checklist is to provide a useful tool for both our offices in assuring a quality contract package. The list points out numerous areas which, when included in the design, will provide a quality project. However, this list should not be taken as a complete checklist covering all aspects of the project.

The drawings and specifications must be reviewed in detail and correlated. Product specifications must be up-to-date. Your designers are required to review their work prior to submittal to the Government. Your check print set of drawings must be reviewed by marking all corrected line work and notes in yellow and incorrect items in red. Your review set of the documents are probably the most important item in assuring a quality end product. This checklist and your check print set shall be included with your final design submittal for District review.

GENERAL CHECKLIST

INITIAL

1. Can work "by others" and "work this contract" be differentiated? \_\_\_\_\_
2. Are locations and vicinity maps complete and up-to-date and do they clearly show location and siting of proposed work, dumping areas, haul routes, etc.? \_\_\_\_\_
3. Are all known existing installations and improvements properly and completely delineated and dimensioned, including tie measurements to proposed work? \_\_\_\_\_
4. Are orientation, horizontal coordinate systems, elevations, and vertical datum properly shown and referenced? Do they show north arrow on each plan view, bench mark, and description. \_\_\_\_\_
5. Are specific locations and limits of proposed work adequately shown on plans and described in specifications in both horizontal and vertical control? \_\_\_\_\_
6. Have adequate subsurface investigations of the site been made and logs and notes thereof clearly shown on plans and referred to in specifications? \_\_\_\_\_
7. Have recommendations of Geotechnical Branch been implemented in establishment of control elevations and foundation treatment and assignment of bearing values for footing design? \_\_\_\_\_
8. Is there an adequate landscaping plan and maintenance program provided in the design? \_\_\_\_\_
9. Has key control been established at construction completion? \_\_\_\_\_
10. Are there provisions for traffic control during construction, including detours for vehicular, pedestrian and tank traffic? \_\_\_\_\_
11. Has adequate provision been made in the specifications for protection and maintenance of access to, and utility services for, existing facilities? \_\_\_\_\_
12. Are all symbols used on the drawings shown in the legend? Does each page using the symbols reference the legend's page location? \_\_\_\_\_

FUNCTIONAL ADEQUACY AND TECHNICAL FEASIBILITY OF DESIGN

INITIAL

1. Are functional requirements in full accord with current applicable criteria and design directions? Has applicable written guidance been referenced in the Basis of Design? (Space allocations for buildings, per capita quantities for utilities, load capacities for floor or pavements, areas for hardstands, widths and lengths of runways, flow rate for fueling systems, etc.) \_\_\_\_\_
2. Have all reasonably possible conditions of loading, operations, and combinations thereof been considered in the design? \_\_\_\_\_
3. Have up-to-date, well established, professionally acceptable procedures and methods been followed in the design, evidenced in detail by design analysis computations and notes? \_\_\_\_\_
4. Is design based on use of economical and proven materials and equipment throughout? \_\_\_\_\_
5. Have local conditions (climate, terrain, isolation, etc.) been given due consideration in the general arrangement and details of design for the project? \_\_\_\_\_
6. Have economic aspects of Government-offered options in materials and methods of construction been evaluated? \_\_\_\_\_
7. Have utility systems been checked with building plans for conformance? \_\_\_\_\_
8. Have grading plans been checked against floor plans for requirement of steps, finish grades, elevations at entrances, etc.? \_\_\_\_\_
9. Have provisions for probable future extensions been considered in the layout, design, and details (if in directive)? \_\_\_\_\_
10. Have cathodic protection features been included in design? \_\_\_\_\_

SUFFICIENCY OF PLANS AND SPECIFICATIONS AS CONTRACT DOCUMENTS

1. Have all required criteria and standards been scrutinized to assure their inclusion in the design? \_\_\_\_\_
2. Have specified codes and standards been adhered to in the details of design and described in the Basis of Design? \_\_\_\_\_
3. Have plans and specifications been carefully cross-checked and cross-referenced to eliminate inconsistencies, assure completeness and consonance in intent and meaning of requirements? Agreement with adjacent utility systems, as-built drawings and other contracts. \_\_\_\_\_
4. Are all necessary details, notes, schedules, and dimensions shown on the drawings and fully consistent throughout? \_\_\_\_\_
5. Are the various design specialty sections of the plans (Elect., Mechanical, Structural, etc.) in accord with Seattle District general layout drawings and other specialty sections? \_\_\_\_\_
6. Are payment items and quantities clearly defined, accurate, and realistic and unit price bid schedules so arranged and sufficiently comprehensive to allow flexibility in award of contract in accord with line item allocation of funds? \_\_\_\_\_

- 7. Are "Basic of Design" summaries shown on the plans? \_\_\_\_\_
- 8. Are drawing titles complete, correct, properly dated, and authenticated and coordinated with the index to the drawing? \_\_\_\_\_
- 9. Are drawing scales, subtitles, and section identification markings properly and completely shown and referenced? \_\_\_\_\_
- 10. Are requirements for installation of Government-furnished equipment clearly delineated? \_\_\_\_\_
- 11. Are ample space allowances available for installation and servicing of equipment? \_\_\_\_\_
- 12. Is responsibility for removal of construction interferences clearly shown on plans? \_\_\_\_\_
- 13. Do technical specifications simply and accurately describe materials and intentions of the designer? (Avoid trite, meaningless expressions such as "as directed by the Contracting Officer, " "predetermined setting, " "suitable for intended service, " etc.) \_\_\_\_\_
- 14. Will construction in strict accordance with the plans and specifications, without further amendment or change, result in an operable economical, functionally adequate facility for the purpose for which intended? \_\_\_\_\_
- 15. Are references to, and quotations from, Standard Specifications from latest addition accurate, directly applicable, and fully supplemented by additional information as required? \_\_\_\_\_
- 16. Are drawings stamped, dated, and signed by A-E (final submittal). \_\_\_\_\_
- 17. Do title blocks conform to:
  - a. Seattle District Standards?
  - b. On military work, is a project number (PN) shown in the title block? \_\_\_\_\_
- 18. Do title of drawings in index agree exactly with actual titles on the individual drawings? \_\_\_\_\_
- 19. Does the terminology used on the drawings agree with that used in the specifications? \_\_\_\_\_
- 20. Do legends include all symbols and abbreviations used on drawings? \_\_\_\_\_
- 21. Do notes on drawings:
  - a. make reference to Contracting Officer, not Architect? \_\_\_\_\_
  - b. not repeat requirements stated in the specifications or state requirements which should be in the specifications? \_\_\_\_\_
  - c. not make reference to pay items? \_\_\_\_\_

22. Are section numbers (page and title) per CSI format? \_\_\_\_\_
23. Closely check "DEMOLITION" specs for information that should be in "GENERAL REQUIREMENTS" (i.e., phasing, safety, etc.). \_\_\_\_\_
24. Verify that "Bidding Schedule" information is in the final submittal. This includes lump sum and additive or optional items. \_\_\_\_\_
25. Check to assure that other paragraphs and sections referred to in the body of the spec actually exists. When that reference is made, it should be by paragraph or section title only (no numbers). Has this been verified? \_\_\_\_\_
26. When a particular segment of the guide spec has not been used, it should be deleted entirely and the final spec renumbered. Has this been verified? \_\_\_\_\_
27. Check that those (and only those) publications referenced in the spec. are listed in the Applicable Publications paragraph. \_\_\_\_\_
28. Specs should not list materials or items by brand names. If there is no other alternative, then several products shall be listed and always with an "or equal" statement. Has this been verified? \_\_\_\_\_
29. Is information that can be shown on the drawings (dimensions, sizes, etc.) not also in spec.? \_\_\_\_\_
30. Submittal of shop drawings, operations and maintenance data, and material and equipment schedules should be in accordance with the provisions set forth in the SPECIAL PROVISIONS and SUPPLEMENTARY REQUIREMENTS. Have conflicting requirements in the TECHNICAL PROVISIONS been resolved? \_\_\_\_\_
31. When reference is made in the Technical Sections to "Borrow or Disposal areas" shown on the drawings, check that they are shown on the drawings. \_\_\_\_\_
32. Are finishes for all rooms or spaces adequately covered by finish schedules and/or notes. Are painting notes adequate and designations in agreement with specifications? \_\_\_\_\_
33. Are color schedules shown and complete, if required? (Both exterior and interior?) \_\_\_\_\_
34. Is floor area shown for each floor and for the entire building? \_\_\_\_\_
35. Does building orientation, finish grade, and finish floor elevations agree with layout drawings? \_\_\_\_\_
36. Are depths of all footings determined and shown, preferably by elevations at bottom of footings? \_\_\_\_\_