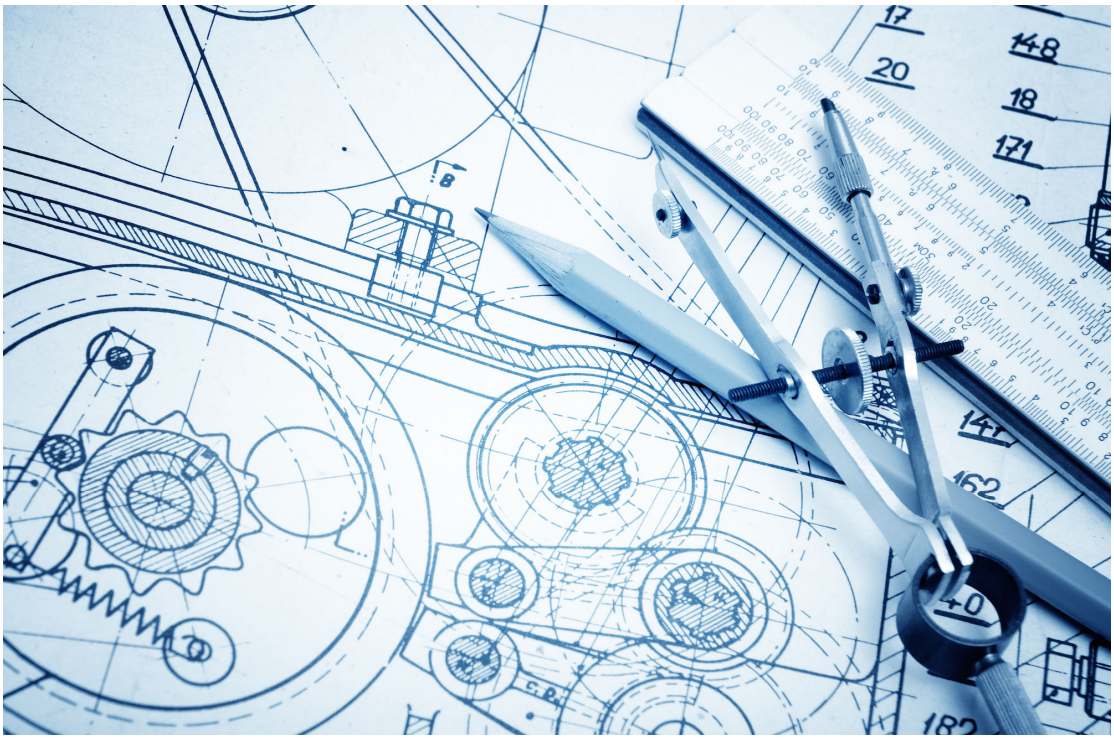
Effective 08/14/2024

US Army Corps of Engineers®

ARCHITECT-ENGINEER GUIDE 65%

SACRAMENTO DISTRICT

USACE



Approved for public release. Distribution is unlimited.

Purpose

The purpose of the Architect-Engineer (A-E) Guides are to inform A-E firms of the general administrative and technical requirements for providing professional services and products relative to their contract(s) with the U.S. Army Corps of Engineers, Sacramento District (SPK). These guides provide guidance for what is required at each DBB submittal stage as well as for DB RFP package development. They are meant to supplement the statement of work in the project task order contract and not replace the specific contract requirements and other applicable codes and guidelines.

USACE Point of Contact

The Statement of Work indicates a Technical Lead assigned to the project who will function as the USACE Primary Point of Contact (POC).

Document Update - Point of Contact

The Quality Assurance, Specifications and A-E Services Section (QASAE, CESPK-EDS-Q) is responsible for coordinating updates to these A-E Guides. The QASAE Section is also responsible for ensuring contents reflect actual practices. Contact the QASAE Section if you have any questions, suggestions, or concerns about any part of these documents.

Chief, Quality Assurance, Specifications & A-E Services (Vincent.G.Andrada@usace.army.mil)

SPK A-E Coordinator (MariaArmiCleo.N.Pascua@usace.army.mil)

SPK District Quality Manager (TBD)

HONG.SAMUEL.JIN.1264321480

Digitally signed by HONG.SAMUEL.JIN.1264321480
Date: 2024.08.27 14:35:40 -07'00'

SAMUEL J. HONG, MSCE, P.E.
Chief, Engineering Support Branch
Sacramento District

Date

Architect-Engineer 65% Design Submittals

Table of Contents

Scope **4**
Distribution (to applicable organizations) **4**
Ownership **5**
References **5**
Definitions **5**
Responsibility **7**
65% Design Submittal **7**
Objective 7
Design Analysis - General 8
Construction Site 8
Economic Summary 8
Sustainable Design and Energy Conservation 8
Hazardous Material Mitigation 8
Drawings - General Requirements 9
Specifications 9
Discipline Specific Guidance 10
Civil Design **10**
Design Analysis - Narrative/Calculations 10
Siting 10
Water Service and Fire lines 10
Water Supply Line and Distribution System 10
Pipeline Plan/Profile 11
Outline a Pipeline Filling and Draining Procedure on the Drawings 12
Water Supply Works 12
Water Treatment 12
Building Sewer Connection 13
Sanitary and Industrial Sewer System 13
Wastewater Treatment 13
Percolation Tests 13
Corrosion Survey 14
Storm Drainage and Grading 14
Roads, Streets 14
Parking, Open Storage, and Hardstand Areas 14
Sidewalks, Fencing, Signage 14
Dust and Erosion Control 15
Railroads 15
NPDES Permit 15
Economic Analysis 15
Environmental Impact 15
Energy Efficiency 15
Surveying 15
Military Airfield Pavements 16
Future expansion 16
Drawings 16
Topography 17
Soil Explorations and Logs 17

Demolition....17
Siting....17
Grading and Paving....17
Utilities, Exterior....18

Landscape Architectural Design....19
Design Analysis - Narrative/Calculations....19
Site Furnishings....19
Site Recreation Equipment....19
Drawings....19

Structural Design....20
Design Analysis - Narrative/Calculations....20
Design Loadings....20
Foundation Design....21
Structural System Selection....21
Additions to Existing Buildings....21
Building Alterations....21
Seismic Evaluation and Rehabilitation for Existing Buildings....22
Seismic Evaluation Submittal Requirements....22
Future Expansion....22
Drawings....22
Foundation Plan....22
Elevated Floor Framing Plan....22
Floor/Roof Framing Plans....22

Architectural Design....23
Design Analysis – Narrative/Calculations....23
Type of Construction....23
Indicate Programmed and Computed Floor Area (for each space or activity)....23
Net Room Areas, Occupant Capacity and Gross Building Areas....23
Functional and Technical Requirements....23
Design Objectives and Provisions....24
Coordination with Installation or Outside Agencies....25
Economy of Building Construction, Operation, and Maintenance....25
Toilet Room Privacy....25
Occupational Safety and Health Act (OSHA)....25
Disability Data....25
Fire Protection Analysis....26
Extinguishing and/or Fire Sprinkler Systems....26
Fire Alarm and Evacuation System....26
Use or Storage of Flammable Liquids and Gases, or Accumulation of Dusts....26
Asbestos....26
Life Safety....27
Physical Security/Anti-Terrorism Features....27
Drawings....27
Floor Plan....27
Provide Interior/Exterior Colors and Finishes in Tabular Form....27
Principal Elevations....27
Building Section....27
Wall Sections....28

Interior Design....28
Design Analysis – Narrative....28
Structural Interior Design (SID)....28
Furniture, Fixtures & Equipment (FF&E)....28
Drawings....29
SID....29

FF&E 29
Color Boards 29
Presentation 30
Samples 30

Mechanical Design 30
Design Analysis - Narrative/Calculations 30
Energy 31
Energy and Economic Analysis Calculation Methods 31
Energy Calculations 32
Compliance Path and Project Documentation 32
Life Cycle Cost Analysis 32
Plumbing System 32
Design Basis 33
Calculations 33
System Type 33
Special Criteria for Humid Areas 33
System Selection 33
Air Handling Units 34
Variable-air-volume (VAV) Units 34
Ventilating system 34
Evaporative Cooling 34
Heat Pumps 34
Radiant Heating and Cooling 35
Cold Storage Projects 35
Service Piping Systems 35
Plumbing 35
Seismic Considerations 35
Hazardous Waste 35
Fuel 35
Energy Monitoring and Control System (EMCS) 35
Fire Protection 36
Drawings 36
Floor Plan 36
Plumbing 36
Mechanical Rooms 36
Additional Drawings 37

Electrical Design 37
Design Analysis – Narrative/Calculations 37
Generating plants 38
Future expansion 38
General 38
Electrical Load Analysis 38
Lighting 39
Miscellaneous 39
Hazardous Classification 39
Power Supply 39
Distribution 39
Fire Alarm and Mass Notification 39
Signal Systems 39
Electronic Security Systems 40
Telecommunications Systems 40
System Control 40
Grounding 40
Hospital Designs 40
Seismic Considerations 40

Raised Floor Systems 40
TEMPEST/EMP Shielding 40
Cybersecurity 40
Commissioning 40
Metering 41
Sustainable Design 41
LEED 41
Emergency Power 41
Renewable Energy Source 41
Additional Calculations 41
Drawings 41
Electrical Legend and Abbreviations Plan 41
Electrical Site Plan 41
Power and Signal Plans 41
One-Line Diagrams 42
Lighting 42
Lightning Protection and Grounding 42
Demolition Plans 42
Additional Drawings 42
Cost Engineering 43

Scope

The purpose of this document is to provide the guidance for the content of the Architect-Engineer (A-E) 65% Design Submittals. This is also called the Intermediate Design Phase.

Distribution (to applicable organizations)

A-E Firm

Chief of Quality Assurance, Specifications and A-E Services (QASAE) Section

Chief of Engineering Division

Assistant Chief of Engineering Division

Chief of Engineering Support Branch

Chief of Military Design Branch

Assistant Chief of Military Design Branch

Chief of Civil Design Branch

Chief of Geotechnical Branch

Chief of Environmental Engineering Branch

Chief of Environmental Resources Branch

Project Management

Safety Office

Ownership

The Quality Assurance, Specifications and A-E Services Section (QASAE, CESPK-EDS-Q) is responsible for the administration and update of this A-E Guide. The QASAE is also responsible for ensuring that this document reflects actual practices. Contact the QASAE if you have issues, questions, suggestions, or concerns about any part of this document.

Chief, Quality Assurance, Specifications & A-E Services (Vincent.G.Andrada@usace.army.mil)

SPK A-E Coordinator Armi Pascua (MariaArmiCleo.N.Pascua@usace.army.mil)

SPK District Quality Manager (TBD)

References

- *Refer to the individual technical disciplines and A-E Statement of Work (SOW) for applicable project specific criteria*
- *UFC (all locations) [http://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc]*

Definitions

A-E	Architect-Engineer - Consulting Firms and their Subcontractors - A vendor hired by the District to provide architectural-engineering services requiring professional and/or architectural license, as defined by state regulatory agencies and laws.
A/E/C	Architectural, Engineering and Construction
BIM	Building Information Modeling
CAD	Computer Aided Design
CFCI	Contractor Furnished-Contractor Installed
COE or Corps	Corps of Engineers a.k.a. USACE
CWE	Current Working Estimate
DDC	Direct Digital Control. This is a building level control system.
ECIFP	Engineering Considerations and Instructions for Field Personnel (a report)
EMCS	Energy Monitoring and Control System. Also known as a Utility Monitoring and Control System (UMCS). This is a base-wide control system.
EPA	Environmental Protection Agency
GFCI	Government Furnished-Contractor Installed
GFGI	Government Furnished-Government Installed
LEED	Leadership in Energy and Environmental Design

NFPA	National Fire Protection Association
PDT	Project Delivery Team
PM	Project Manager - The individual in PPMD assigned to manage a project or program from the inception through completion. The PM is the leader of the PDT. The PM has the responsibility for the development of the PMP, which will include the project QCP.
PPMD	Programs and Project Management Division - PPMD consists of five Branches with Project Managers (PM) who are responsible for project execution within cost and schedules limits.
PMP	Project Management Plan
Project	A unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources. It can be any combination of work (products, services, and so forth.) intended to produce a specific expected outcome or solution to a customer problem or need.
Quality	The degree to which a set of inherent characteristics fulfills requirements.
UFC	Unified Facilities Criteria. UFC documents provide planning, design, construction, sustainment, restoration, and modernization criteria, and apply to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with DoD Directive 4270.5 (Military Construction) and USD(AT&L) Memorandum dated 29 May 2002. UFC are distributed only in electronic media and are effective upon issuance.
UFGS	Unified Facilities Guide Specifications. Unified Facilities Guide Specifications (UFGS) are a joint effort of the U.S. Army Corps of Engineers (USACE), the Naval Facilities Engineering Systems Command (NAVFAC), and the Air Force Civil Engineer Center (HQ AFCEC). UFGS are for use in specifying construction for the military services. The Unified Facilities Guide Specifications (UFGS) are published only in electronic format and are intended to be used with SpecsIntact software. The UFGS Master complies with UFC 1-300-02. SpecsIntact supports the UFGS format. SpecsIntact can still open Masters or Jobs created with older versions of the UFGS format. Updated UFGS are posted quarterly in February, May, August, and November.
65% Design	This is the Intermediate Design phase of a project. It is an opportunity for the A-E Firm to demonstrate full understanding of the scope of the project to the customer and that all the customer's requirements are being considered and incorporated into the design. The Intermediate Design is also another opportunity for the customer to make any adjustments needed to produce what is required. Other agencies may also be part of this review stage to support the customer in whatever way needed.

Responsibility

The A-E Firm is responsible for preparing the Intermediate (65%) Design Documents and will communicate its understanding in the shape of design documents that will include, but not be limited to: Drawings, Design Analysis / Calculations, and Draft Specifications. Submittals will include supporting documentations in any area where other data was used in arriving at the Intermediate Design solution such as Cost Estimates and Geotechnical Reports.

65% Design Submittal

As a minimum, the 65% Design Submittal consists of the following documents:

- Design Analysis (narrative and calculations)
- Drawings
- Marked-up Specifications (redlines with brackets removed)
- Project Safety and Health Requirements
- Results of Value Engineering study (if required by the statement of work)
- Cost Estimate and Construction Schedule per ER 1110-2-1302
- Completed Environmental Permit Matrix (if required by the statement of work)
- Draft Engineering Considerations and Instructions for Field Personnel (ECIFP) Report (if required by the statement of work)
- Other Items as required by the statement of work

Objective

The Intermediate Design data must be presented in sufficient detail to accomplish the following:

- Verify that the Customer's functional and special technical needs have been considered and addressed.

- All reviewing agencies to verify that:

  1) All review comments have been appropriately addressed,

  2) The designer's approach to the solution of the technical aspects of the project is sound and

  3) Appropriate controlling criteria are being adhered to. Justification for non-compliance with criteria must be provided in the Design Analysis Narrative.

- Verify the project-programmed amount has been properly established by preparing an accurate cost estimate.

- Show that appropriate and economical civil, architectural, structural, mechanical, and electrical systems have been selected for the project as needed.

Design Analysis - General

Construction Site

Include a synopsis of the construction site conditions, project requirements and conformance with the master plan.

- Function. Describe the basic functional objective and capacities of the proposed facility and the estimated function life. Describe the types of activities involved.

- Personnel and equipment. Describe the range and number of civilian/ military personnel, equipment and vehicles to be accommodated.

- Constructability. Describe the basic construction systems selected, temporary or permanent, and the estimated structural life of the facility. Provide sample design(s) indicating that the type of structural system chosen has been constructed successfully in the recent past.

- Desired image or visual appearance to include design of the exterior and interior of the building.

Economic Summary

Describe the economic factors influencing the choice of basic materials, and the civil, architectural, interior design, structural, mechanical, electrical and fire safety systems used. The summary must include:

- Results of economic studies, which consider not only the initial construction cost, but costs incurred over the projected life of the facility as determined on the basis of the best information available, and in view of the estimated functional life of the facility.

- Compare Programmed Amount (PA) to Current Working Estimate (CWE) with discussion on reasons for relationship to CWE.

Sustainable Design and Energy Conservation

Sustainable Design and Development (SDD) is an integrated approach to planning, designing, constructing, operating and maintaining facilities in an environmentally-sensitive manner. The main objectives of sustainable design are to avoid resource depletion of energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create built environments that are livable, comfortable, safe, and productive. The Department of Defense embraces SDD principles and has outlined its goals and requirements in UFC 1-200-02.

Hazardous Material Mitigation

Asbestos, lead base paint, and mold removal for all rehabilitation projects when new work ties into existing work, or if demolition must take place before new construction:

If:

- in any earlier correspondence between the A-E and the Corps, the presence of these or other hazardous materials is stated to be known or suspected; or
- during the A-E's field investigation, the presence of hazardous materials is discovered or suspected; or
- the presence of hazardous materials is known to exist in products scheduled for removal,

Then the following becomes a requirement of the project:

- A qualified asbestos abatement professional must prepare an asbestos report and asbestos control plan to meet state and local air quality management regulations in addition to *EPA 340 1-90 018 Asbestos NESHAP Regulated Asbestos-Containing Materials Guidance*
- Prepare plans and elevations indicating the location and extent of all known asbestos containing products, which will require removal, enclosure, encapsulation or encasement.
- Prepare the Asbestos Specification *UFGS SECTION 02 82 00 ASBESTOS REMEDIATION*, as applicable.
- Prepare a specification for the other hazardous material mitigations and abatements.

Removal of asbestos must always be considered the primary goal. When this is not possible, the A-E is to determine the best alternative approach (enclosure, encasement or encapsulation) and modify the guide specification accordingly.

State if the project does not contain asbestos, lead base paint, mold, or other hazardous materials.

Drawings - General Requirements

Drawings must comply with the most recent Architectural, Engineering and Construction (A/E/C) Computer Aided Design (CAD) Standards and A/E/C Graphic Standards at time of award and includes the required fonts, layers, styles, borders, blocks, file naming, and so forth. Utilize the latest A/E/C workspace and the USACE CAD/Building Information Modeling (BIM) templates available from the CAD/BIM Center website.

Specifications

All Specifications should be edited as part of the first draft at this stage of design. All SpecsIntact files (.sec files) are to be submitted to the Corps. The following reports from SpecsIntact are to be included with the submittal: ADDRVER.pdf, BRKTVER.pdf, REFVER.pdf, SECTVER.pdf, SUBMVER.pdf and TTLDIFFS.pdf. The 65% submittal should have most if not all the brackets selected, and Section numbers should be close to being fully reduced.

Discipline Specific Guidance

The following discipline specific guidance is for general information, to give an idea of what is expected to be produced at the 65% level of design. Design disciplines not needed on a specific project will not be applicable. Every discipline item mentioned is determined if it is applicable to a specific project based on the project's scope of work.

Civil Design

Design Analysis - Narrative/Calculations

Siting

Describe site conditions, including existing topographic features and improvements, affecting or relating to the proposed work. Consider any special or unusual conditions such as former refuse dump areas, potential for flooding, ground stability, rock outcrops, drainage features and unusual soil conditions. Note any contaminated soil or groundwater conditions, elevation or grading concerns, existing environmental impacts and mitigation requirements, , NEPA compliance requirements included in completed NEPA documents. Coordination with the Contracting Officer is required when contaminated soils or groundwater conditions exist as a remediation plan may be required. Any other concerns not previously covered in the completed NEPA documents should be coordinated with the Contracting Officer. Discuss reasons for facility orientation. Consider such factors as prevailing winds, existing structures, adjacent site conditions, solar loads, clearance restrictions and future development areas. Generally state building siting reasons: discuss the impact of new construction on existing facilities, considerations for future expansion, requirements for flood protection, set-back requirements or specific clearance requirements or unusual cut or fill requirements.

Water Service and Fire lines

Support with calculations the selection of the water service line to the project; indicate the invert elevation at the point of entry to the building. In those locations where frost penetration is not a factor, describe in the next paragraph the depth of cover for the fire lines. If frost penetration exists, the same criteria still holds, but as a minimum, "the top of the fire line must be buried not less than one foot below the frost line for the locality" - as stated in NFPA 24. If a fire sprinkler system is to be hydraulically designed by the project's contractor, provide in the Civil Design narrative and on the exterior utility drawing the static pressure and the needed available residual pressure at the base of the sprinkler riser for a predetermined flow.

Water Supply Line and Distribution System

Show adequacy of distribution system to supply controlling demands; include information basic to this determination, and support with hydraulic computations. 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 further hydraulic analysis is needed.

Give the friction coefficient, controlling elevations, special material requirements and any special features of the design such as pressure reducing, sustaining and relief valves.

When applicable, discuss the needs of air valves, vacuum valves, combination air vacuum/air release valves (CAV/ARV) and blow-off valves. Discuss the criteria followed for the selection and location of CAV/ARV and blow-off valves. Supplement the Design Analysis with a drawing showing the profile of the entire water distribution system; also discuss the criteria followed for the location and number of gate valves and fire hydrants.

Use a minimum cover over pipes of two and one-half feet in grassed areas, three feet under unpaved driveways or roadways, and four feet under railroad tracks. Areas with deeper frost will require deeper placement. The bottom of the water main must be at least 12 inches above the top of the gravity sanitary sewer, and 24 inches above the top of a pressure sewer pipe. For irrigation systems, discuss types of sprinkler heads, effective coverage, spacing and zoning, automatic flow control valves and back flow prevention units.

For projects that involve supply, collection, and/or distribution utility conduits (rigid or flexible), support with calculations the trench design (bedding, initial backfill, and final backfill) for each one of the pipe options given in the UFGS. The trench design is to be based on American Water Works Association (AWWA) Standards, or American Society of Civil Engineers Manuals and Reports on Engineering practice, as applicable; a trench cross section for each one of the pipe options is to be shown on the drawings. Any deletion of a pipe option, as called for in the COE Guide Specifications, must be supported with complete engineering calculations. The engineering-based justification for the deletion of the pipe option must also be narrated in the Design Analysis. Since controlled compaction is required during construction, hydraulic consolidation of bedding or backfill (initial or final) material is not to be allowed. Thrust block area is to be based on actual bearing soil capacity, and a pressure of not less than one and one-half times the maximum expected pressure including surge; provide the supporting computations.

The pipe embedment detail terminology, shown on the construction drawings, must match exactly that of *Specification Section 31 00 00 EARTHWORK*. For each one of the pipe options, the embedment terminology compatible with AWWA and American Society for Testing and Materials (ASTM) calls for: Foundation (if required), Bedding, Haunching, Initial Backfill (all within the pipe embedment) and Final Backfill.

Provide a compacted, well-graded granular material for the pipe's bedding, and a densely compacted initial backfill. Select the gradation number: depending on the pipe material specified, from ASTM C-33, Table 2, or ASTM D448, Table 1. Tabulate the Sieve Size versus the Percent Passing after the gradation number is selected. Indicate the percent compaction within the pipe embedment and final backfill.

When high water tables are anticipated, embedment materials without substantial voids are required to prevent soil migration. Sand should not be used if the pipe zone area is subject to a fluctuating groundwater table or where there is a possibility of the sand migrating into the pipe bedding or trench walls.

Pipeline Plan/Profile

For water supply lines and distribution systems, longer than a few thousand feet, a special plan/profile drawing must be prepared at a smaller scale, for example, 1" = 100' or 1" = 200' and made part of the construction drawings. These drawings should show pipeline stationing, all appurtenances, and other major physical and design features.

Outline a Pipeline Filling and Draining Procedure on the Drawings

Fill the different water lines from the lowest point in each individual line limiting the flow rate to one foot per second; provide drain valves sized to provide a flushing velocity of two and one half feet per second; show at which locations the pipeline is to be filled from; discuss air evacuation thru the combination air vacuum/air release valves (CAV/ARV).

Show the points of connection to the existing water system as well as valves and appurtenances. The filling and draining operations narrative must consider the physical layout of the existing water system so that it can be isolated properly with a minimum of inconvenience to the consumers during the filling and draining operations.

Water Supply Works

Discuss the selection of the type of units, materials, economy of operation, controls, for example. Provide a statement of sizes or capacities of major components, any critical elevations or dimensions, and essential related items as covered in the computations.

Include data on existing supplies and for new sources such as wells and surface supplies. Provide data for all water wells and test drilling programs with full explanation of factors affecting choice of location, type, diameter, depth, and important related characteristics.

Water Treatment

After analyzing the water characteristics, establish the necessity for and extent of treatment options. The Army potable water is defined in *TB MED 576 Treated Water Quality Standards,* which also spells out the Army water quality requirements.

The selection of one particular type of design, when two or more types of design are known to be feasible, must be based on the results of an economic study. The results of these economic studies are to be included in this Intermediate Design.

The Standards outlined in *TB MED 576 Treated Water Quality Standards* are maximum values and every reasonable attempt should be made to obtain water of better quality. The applicable water quality standards are presented in Appendix H. Waters having physical characteristics exceeding the limits of Appendix H should not, as a rule, be used for drinking.

Appendix H of *TB MED 576 Treated Water Quality Standards* covers both the National Interim Primary Drinking Water Regulations (NIPDWR), in Section I, and the National Secondary Drinking Water Regulations (NSDWR) in Section 11. Note that Army facilities must endeavor to provide drinking water of the highest quality in consonance with NSDWR.

Army Installations must comply with regulations on levels of organic compounds in drinking water and will be required to install removal equipment if these compounds are detected. Reference is made to *ETL 1110-3-367 Trace Organic Compounds in Potable Water Supplies* which supplements *TM 5-813-3 Water Supply-Water Treatment, Supplement 411*, and provides basic information pertaining to the occurrence, detection, and treatment of trace organic compounds that may be found in drinking water. Reference is also made to *TM 5-813-8 Water Desalination*.

List all criteria used for the design of each treatment process and operation. Furnish all calculations showing the design of the processes and operation including the organic loading. Provide a hydraulic profile of the treatment plant. Describe the elements of the design selected including the capacities and number of units, monitoring equipment and controls.

Building Sewer Connection

The minimum pipe diameter for a gravity building sewer connection is six inches with a minimum velocity of two feet per second at average daily flow. Smaller service connections for very low flow facilities with limited fixture units can be four-inch minimum. Calculations are required only for gravity building sewer connections larger than six-inch diameter and for all pressurized building sewer connections.

Sanitary and Industrial Sewer System

Describe the existing system covering particularly the type, capacity, condition, present flow and unsatisfactory elements of component parts for major extensions. Where lift stations are required, state pump type and size, volume of wet well, cycle time and pump controls. Include data concerning state requirements for pollution control. Indicate controlling elevations and compliance with slope and size criteria. Confirm adequacy of existing sewers to carry additional flow.

Wastewater Treatment

Where waste treatment is included in the job, discuss the degree of treatment required to meet the applicable discharge standards. Describe the receiving stream and the elements of the design including the capacities and number of units, monitoring equipment and controls. List all criteria used for the design of the treatment process and operation; furnish all calculations. Provide a hydraulic profile of the wastewater treatment plant. The alternatives that were considered and the reason for selecting the design over the alternatives must 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.

Percolation Tests

Percolation tests are to be used to determine the acceptability of the site and for the design of the subsurface disposal systems. Whenever the Architect-Engineer determines that percolation tests are required for the project, the District will make percolation tests at the request of the Corps Project Manager (PM). Discuss the need for percolation tests, and if required, indicate the

required depth. Whenever periodic high-water conditions are expected, consider another type of absorption field, other than the conventional septic tank-tile field design, such as mounds, fill systems and under drain systems.

Corrosion Survey

For each new project with utilities systems and/or metallic structures that are buried, submerged, or in contact with either the ground or a substance, which may be corrosive, a preliminary survey will be made by the District or Architect-Engineer (depending on contractual provisions) to determine the need for corrosion protection. If the Architect- Engineer determines further tests are required, this recommendation will be presented to the Corps Project Manager. Submit a summary of the conclusions on the need for protection against corrosion. When water utility systems are involved in locations where the soils are known to be very corrosive, it may be desirable to use cathodic protection systems as a supplement to (but not in place of) coal tar or cement mortar coatings.

Storm Drainage and Grading

Discuss the drainage design. The discussion must include the rainfall intensity and return period, concentration times, infiltration rates, the size of the contributing area, method of computation, ponding effects, if any, 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. Identify any local or state requirements for which the storm drainage design must comply. Discuss the existing site features affecting grading such as walks, fences, curbs, buildings, streets, and elevation of high water, as well as unusual cut or fill requirements. Provide all the computations used for determining the design flow and pipe sizes; also drainage area maps for systems that drain into or through the project area.

Roads, Streets

Discuss the geometric features of the paved areas such as widths of traffic lanes and shoulders. Data relating to the design such as vertical and horizontal controls and the class and category of road or street must be included. Include all computations for curves, alignment, sight distance and super elevations.

Parking, Open Storage, and Hardstand Areas

Discuss the derivation of the number of parking spaces. For the parking lot layout: discuss the selection of 90°, 60°, and 45° stalls, aisles, access lanes and stall dimensions, slopes of the surfaced areas, pavement markings, traffic signs, pedestrian access, planting islands, as well as the number and location of handicapped, visitors and staff parking spaces.

Sidewalks, Fencing, Signage

Discuss sidewalk grade, location, and derivation of width, as well as joints, and joint layout. Discuss justification of fencing and describe the type and height of fences and gates. The description must include features such as barbed wire, gate I- controllers, fabric, posts and tension wires. Discuss street name plates, stop, and reserved parking signs and sign posts.

Dust and Erosion Control

Include a statement of the proposed type and method of accomplishing dust and erosion control, reasons for selection and extent of the area to be treated. Consider if erosion control will be required during construction. If no treatment is proposed, justify omission.

Railroads

Discuss the type and depth of the ballast section, weight of rail, use of relayer rail, bumpers, ties, spikes, turnouts and road-bed preparation.

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 Design Analysis.

Economic Analysis

Furnish economic comparisons between feasible alternatives for site layout, facility orientation, utilities systems, paved areas and other site improvements.

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 must be included in the narrative portion of the Design Analysis. If no changes are required to the analysis, the designer must include this conclusion in the Design Analysis narrative.

Energy Efficiency

Where the civil design includes energy consuming processes, provide studies on comparative energy conservation measures.

Surveying

The survey should make reference to the origin of the vertical datum. There should be a note on the drawings indicating that all elevations are based on the National Geodetic Vertical Datum (NGVD) 1929, or whatever datum was used for this project.

The survey should make reference to the origin of the horizontal datum. There should be a note on the drawings indicating that grid coordinates are based on the California State Coordinate System Zone 11, or whatever datum is used for this project.

Provide enough spot elevations on the topography map to support the contours. No point on any topographic map should be more than one inch from either a contour or a spot elevation.

A finished floor of a building should never be used as a vertical point of reference for a survey. If it is necessary to use such a reference, a well-defined point, such as a chiseled square in the south side of main entry door, should be clearly marked in the field and identified on the drawing.

At least two horizontal and vertical control points should be shown on the topography drawings so that the construction contractor can not only initiate a survey but also check it for possible blunders. If aerial photogrammetric methods were used to obtain this mapping, a control diagram should be included with the topography maps.

Tabulation should be shown on the topography mapping that lists each control point together with its coordinates, elevation, and a description of the point.

Coordinates and elevations should only be shown to two decimal places. Elevations on ground surfaces should only be shown to one decimal place. Values displayed to additional decimal places than required, indicate a greater precision than was required or obtained.

If the Sacramento District provided the original topographic mapping for this project, a copy of that mapping should be included with the construction drawings.

The Civil exterior utilities drawing must include a subsurface utility survey.

For water supply and distribution system lines, a set of plan and profile drawings must be prepared, which must show as a minimum the following information:

Survey base line with physical control points
- Existing physical features such as buildings, fences, structures, utilities, trees, and drainage systems.
- Existing and proposed ground elevations along the centerline of the pipe must be shown on the profile.
- In plan, the proposed pipeline bearings and its relationship to the survey base line.
- In profile, the centerline elevation of the proposed pipeline.
- Beginning and ending points of the pipeline and all appurtenances.

Military Airfield Pavements

The District will furnish the section of the pavement structure, a brief description of foundation explorations, materials investigations, field tests, a statement of values used in pavement design, basis for selection of pavement section and a description of the adopted pavement sections. A copy of the Geotechnical Report will be appended to the Design Analysis.

Future expansion

Where buildings are to be designed for future expansion, discuss provisions to be taken to ensure the projected construction will proceed in a trouble-free fashion. State if no provisions have been made for future expansion.

Drawings

Topography

The topography drawing should show only the existing site conditions. Demolition and new construction should not be shown on this drawing. The topography drawing could be screened and used as a base map on which to show features to be demolished, or new features to be constructed on the site. In any event the topography drawing should stand-alone so that the construction surveyor will know where to find control and other necessary information about the site.

Soil Explorations and Logs

The Sacramento District's drawings, showing the boring stations and logs of boring, will be incorporated into the A-E drawings.

Demolition

Provide sufficient dimensions of the structures to be demolished; for pavement structures, identify the type, whether reinforced, and the thickness; indicate if the utility lines are to be removed or abandoned in place; always indicate if the structure is to be removed to grade or to what vertical distance below grade; and show the size of any trees to be removed.

Siting

Show the dimensions of all new work and the relation of new work to existing facilities using offset dimensions from existing structures; show sufficient horizontal and vertical controls to clearly indicate the siting of the facility, if necessary, use coordinates for locating the new work. Only one benchmark will be used, except where a very large area is involved. Indicate the benchmark location, elevation and description. Provide a north arrow and at least two horizontal control points. With airfields, this information must be shown for each separate area of pavement. Clearly locate the on-site borrow and disposal areas. If they are on-post, but away from the construction site, show them on the Location Map of the G-sheet drawings. If there are no on-post borrow and disposal areas, provide a note to that effect on the G-sheet and, if possible, indicate on the Vicinity Map, or with a note, where they would be located. Indicate possible future construction using short, dashed lines. Show the facility superimposed on the existing topography map and the soil borings locations.

Grading and Paving

Provide a north arrow and show the grading and drainage conditions including swales, direction of drainage, point of discharge, and ditches using notes, symbols, spot elevations and contours. Provide finished grades for new work and show existing topography. Provide sections showing the relationship between existing ground and finished grades, pavements, shoulders, ditches, swales, curbs, gutters, buildings and other structures. Provide a minimum of one cross-section in each direction through a building and site development area. Show the finished floor elevation and critical spot elevations; locate or make references to monuments and benchmarks for horizontal and vertical control. For clarity show removal, relocations and new work for all other utilities on separate drawings.

Provide profiles for all storm drains which exceed typical service connections into existing storm drain systems; indicate top and flow line elevations of all drainage structures, storm drain pipe with size and invert elevations, ground profile, and new or existing structures or utilities crossing the new storm drain. Show the location, dimensions, and geometrical layout of all roads, streets, walks, pads, open storage areas, hardstand areas, runways, aprons, taxiways, and over-runs. Indicate different surfaces and pavement sections with symbols and notes. Provide details showing joints, curbs, gutters, signs, sealants, sidewalks, and pavement sections. For rigid pavements, spot elevations must be provided at each joint intersection. Include all elements of the pavement with depths and compaction density requirements. Clearly show joint layout, thickened edges, location of tie-down anchors, markings, and striping.

Other related construction details are parking, fencing, railroads and plan/profile and sections. Show the geometrical layout of the parking stalls including handicapped, visitors, and staff parking stalls, along with aisles, pavement slope and markings, traffic signs and pedestrian access. Provide separate signing and striping drawings when extensive work of this nature is required. Do not show fence lengths. Show the location and dimensions of all railroad tracks and features. Provide details showing switches, turnouts, and road crossings. Include all elements of the track section with depth and compaction requirements for the ballast construction. Provide plan and profile for roads, runways, taxiways, channels, and other work that requires longitudinal layout and grade controls. The drawings must include the new features and alignment superimposed on existing topography. Show stationing and finished grades at 100-foot intervals with intermediate points as required by vertical and horizontal curves and other features. Drawing sheets may be both single or double plan and profile. Provide cross sections at 100-foot intervals, or less, as required by topography and grading. Cross sections can be included in contract documents or as supplements to the plans.

Utilities, Exterior

Show all existing and new pipes with sizes (such as water, sanitary and industrial sewers, storm drain and gas lines), valves, manholes, fire hydrants, service boxes, inlets, culverts, headwalls and cleanouts. Show existing pipe's material if such information is available. Provide a north arrow on the utilities site plan and show the relation between the utilities and roads, buildings, sidewalks, and so forth. Provide the sizes, strengths or classes corresponding to the different material options. Indicate the invert elevations and points of entry to buildings for utility lines. Show the fire sprinkler data required in the civil design analysis. Do not show lengths of utility runs on plan sheets for Lump Sum Bid.

Profiles must be provided for wastewater collection lines, force mains, water supply and distribution lines. Show existing topography on both Plan and Profile. Profiles will also be provided to show adequate cover in areas of varying topography. The profiles must show minimum cover and required excavation and backfill depths, new and existing utilities, invert elevations, stationing, surface features such as roads, curbs, sidewalks, and so forth and appurtenances to the utility systems.

Furnish details of all features such as valves, manholes, fire hydrants, service boxes, inlets, headwalls, cleanouts, thrust blocks, pipe encasements, frames, grates, covers, steps, and so forth. For treatment facilities, provide details for treatment units. Show all inplant lines and process

piping. In congested areas or in areas 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 must be determined by the contractor and reported to the Contracting Officer. When unknown lines are exposed, their location and elevation must likewise be reported."

Landscape Architectural Design

Design Analysis - Narrative/Calculations

State what general type of vegetation exists both on the Installation and in the immediate vicinity of the project. Although this project should be harmonious with adjacent landscape treatments or vegetative communities, the design need not necessarily be identical. Refer to the Base Design Guide or Installation Master Plan for approved Plant Species, if available. The theme must consider future long range design continuity, and compatibility with customer needs and maintenance constraints. Describe how this design satisfies these requirements and provide rationale for the proposed landscape treatment (for example, mitigation, enhancement, erosion control). All new Army irrigation projects require specific authorization from Headquarters, Department of the Army. In general, irrigation systems receive consideration only in arid or semi-arid areas where rainfall is less than 25-inches annually. Indicate if an irrigation system is authorized. If an irrigation system is to be included define type, such as, bubbler, spay and drip. State waterline design pressures, if domestic or reclaimed and possible tap location.

Site Furnishings

Identify, if required, quantities and materials for benches, tables, trash receptacles, ash urns and removable and fixed bollards.

Site Recreation Equipment

Identify, if required, quantities of any volleyball, basketball or tennis courts, running track, PAR course, sports field, and so forth.

Drawings

Provide the following:

- Provide a Landscape Architectural Layout Plan that must include a minimum of all existing building locations, access roads, parking, sidewalks, topography and benchmarks, in a dithered or light pen weight as the base sheet. Overlay existing features with new sidewalk, identify pavement types, hardstand areas, parking layout and islands, water features, shade shelters, barbecue areas, recreation features, interpretive signage location, pedestrian directional signage location and site furniture locations. Determine the number of layout sheets required to show all areas of the site at a legible scale. Where the entire site will not fit unto one sheet, segment site clearly and indicate match lines on the plan.

- Provide a separate Landscape Planting Plan that must include a minimum of all new roads, sidewalks, hardstand areas, parking curb outline, tree and shrub list, general tree locations, turf areas, planting beds, organic and inorganic mulch areas, drainage structures location, preliminary site grading and erosion control features. In situations where the site layout will not fit on one sheet as described in the previous paragraph use the same segmented site plan and scale for all layout sheets.

- Show proposed special design features such as flagpoles, raised planters, benches, trails, and special paving treatments.

- A plant schedule listing both the botanical and common names of species to be used.

- If an irrigation system is required, provide the following:
  - Provide a separate Landscape irrigation plan showing a minimum of all new roads, sidewalks, hardstand areas, parking curb outline, turf area outline, planting bed outline, point of connection to water service and the dynamic head at the point of connection;
  - The main and branch lines; valves and, if an automatic system, the controller location(s).

Structural Design

Refer to the following for the basis for structural design:
- *DoD Building Codes (General Building Requirements)*
- *UFC 3-301-01 Structural Engineering*
- *UFC 4-010-01, DoD Minimum Anti-Terrorism Standards for Buildings*

Design Analysis - Narrative/Calculations

It is extremely important that the A-E's Structural Engineer of Record (EoR), indicate clearly their strategy for an acceptable/appropriate Quality Control of all design effort. As a minimum, it is expected that the project be Peer reviewed by a competent engineer during the development of the design work. Independent Technical Review may be required at some point or may be a strategy that the A-E will consider.

All design analysis, narratives and calculations must clearly indicate that the product has been Peer Reviewed prior to the submittal. The Government will not act as the Peer Reviewer for the A-E and any submittals delivered not meeting these requirements will be returned without any further action. The A-E is fully responsible for any delays in delivering quality product for the Government's review. A-E's Peer Reviewer must be identified at this stage of the project and must initial every sheet of submittal. This requirement also applies to other phases of the project submittal.

Design Loadings

Provide a discussion of all loadings to be used, to include floor loads (dead load and live load), wind, snow, earthquake, and so forth, together with data to justify any proposed deviations from

established criteria. Seismic design must be in accordance with the latest International Building Code (IBC) with any exceptions required per *UFC 3-301-01 Structural Engineering*. Indicate the basic ground motions to be used in seismic design of the building. Provide a narrative describing the planned seismic design and expected structural seismic performance of the building. Provide any applicable design parameter per required criteria.

Foundation Design

Provide a statement referencing the Geotechnical Report, which will be attached as an appendix to the Design Analysis. The Geotechnical Report will normally be provided by the COE. Describe the type of foundation proposed, site class, frost depth, need and type of vapor barrier, estimated depth of bearing, allowable bearing values, compaction requirements, and any other measures mentioned in the Geotechnical Report or recommended by the designer. When the Geotechnical Report recommends two foundation types as being acceptable an economic analysis and comparison between the two methods must be presented and the most cost-effective method must be selected.

Structural System Selection

As much as possible a uniform and consistent structural system must be used in design of the structural system. 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 should be presented on a sketch indicating the sizes of all the framing members for each area of the building with a different framing scheme. Provide calculations used to size members. Investigate various column spacing. For a one-story structure, the cost comparison will be done for the roof structure and the wall system. For a multi-story facility, a cost comparison will be presented for the roof structure, the floor system, and the wall system. Attach the comparison to the Design Analysis as an appendix. Provide a narrative description of all the potential solutions and indicate that the most economical solution has been selected.

Additions to Existing Buildings

For those cases in which additions to existing building(s) are to be constructed, the addition must be physically separated from the existing building so as to avoid interfering and modifying the seismic performance of the existing building. Seismic separation must be accomplished by seismic joints through the height of the building and be compatible with the architectural requirements. When the addition and the existing building(s) are to be physically attached and no seismic separation is possible, the A-E must provide calculations for the “integral structure" (such as, new plus existing). In no case must the strength and performance of the existing structure be compromised. Where practicable, the A-E must upgrade the lateral resistance of the existing system to meet current code.

Building Alterations

In the projects involving alterations and/or modifications, the A-E must be responsible for the investigation and design necessary to strengthen existing structural members, which are structurally affected by the alterations.

Seismic Evaluation and Rehabilitation for Existing Buildings

ICSSC RP 8 / NIST GCR 11-917-12, *Standards of Seismic Safety for Existing Federally Owned and Leased Buildings* (RP 8) identifies trigger situations requiring evaluation seismic evaluation and rehabilitation for existing structures. Refer to:

- *ASCE 41 Seismic Evaluation and Retrofit of Existing Buildings*
- *International Existing Building Code (IEBC)*

Seismic Evaluation Submittal Requirements

The seismic evaluation study, complete with Concept fix (if required) and associated costs, must be submitted. The seismic evaluation study must be performed concurrent with other design work and coordinated with other design work to the maximum degree possible, (such as, be feasible from a functional/architectural standpoint, and so forth). The seismic evaluation study and its impact on the project CWE must be approved by the COE prior to incorporation into the project's bid documents.

Future Expansion

Where buildings are to be designed for future expansion, discuss provisions to be taken to ensure 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.

Drawings

The scale of drawings are to match the Architectural drawings where features are related.

Foundation Plan

Provide overall foundation layout, showing column locations, grade beams, pile locations, slab-on-grade joint pattern, and so forth. Also, provide a representative section, showing a typical foundation element and typical slab-on-grade.

Elevated Floor Framing Plan

Show the type and general spacing of framing members, overall depth of floor structure, proposed column spacing, principal framing dimensions and shape of the building. Indicate any significant openings required in the floor to accommodate other trades and disciplines.

Floor/Roof Framing Plans

Provide overall framing layouts (with dimensions) of the main structural elements. Show horizontal and vertical lateral load supporting system, and seismic joint locations.

Architectural Design

Design Analysis – Narrative/Calculations

State the general type of architectural treatment that exists both on the Installation, and in the immediate vicinity of the 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 ensure 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. If setbacks are involved, establish the relevance of setback design provisions.

Type of Construction

Provide statement as to type of construction per *UFC 3-600-01 Fire Protection Engineering For Facilities* and Architectural/Engineering Instructions, for example, Fire-resistive, protected non-combustible, permanent or temporary, and so forth

Indicate Programmed and Computed Floor Area (for each space or activity)

Gross and net areas must be calculated as indicated in the IBC version as indicated by *UFC 1-200-01*. Indicate occupancy capacities allowed and actual, per criteria.

Net Room Areas, Occupant Capacity and Gross Building Areas

Provide gross floor area computations in accordance with the IBC, version as indicated by UFC 1-200-01, and compare to the authorized scope as shown on DD Form 1391. The net floor area for each room must be presented in tabular form in the computation. These areas will not be shown on the drawings. Break down the areas into two categories, those calculated on the basis of full area and those calculated on the basis of one-half area, and then show the grand total. Also, show the programmed area for each room and criteria data used.

Calculate full areas (including all openings in floor slabs) in accordance with UFC 3-101-01 paragraph 4-2.

Functional and Technical Requirements

Equipment, furniture and furnishings (also see Interior Design Narrative) to include all items required. Provide a tabulation of all equipment in the project to show the following: (If none, so state for each subparagraph below.)

- Contractor Furnished-Contractor Installed (CFCI)
- Government Furnished-Government Installed (GFGI) or not in contract (N.I.C.)
- Energy conservation including solar energy applications and energy budget goals.
- Sound and vibration control
- Interior parking and service areas.

- Physical security: lock and keying, intrusion detection, alarms, restricted access areas, interior guard/canine support and ties to local authorities. Coordinate with Anti-Terrorism requirements
- Signage; directional, informational, and motivational
- Exterior and interior finish materials; textures, colors and resistances (also see Interior Design Narrative)

Design Objectives and Provisions

Adapt the building to the size, shape, and orientation of the site to include benefit from natural warming and cooling effects afforded by the site.

- State how location on the site relative to local climate affects the placement of entries, fenestration, and roof overhangs due to prevailing wind, sun, and noise. Discuss architectural features and relative costs, such as, the use of tinted or thermal glass if required as opposed to glass ordinarily used
- Organization of functional spaces to establish workable adjacency relationships.
- Building layout to establish convenient circulation flows for materials, equipment, services and people and also to include evacuation during emergencies
- Consolidation of spaces into sound compatible zones and protective construction zones, for example, for fire, storm and fallout
- Space layout compatible with modular (structural and environmental) support systems
- Building expandability/changeability: Where buildings are to be designed for further expansion, discuss provisions to be taken to ensure the projected construction will proceed in a trouble-free fashion. If no provisions have been made for future expansion, so state.
- Physical security
- Barrier-free design
- Sustainable Design and Energy conservation
- Building wall and roof construction: Provide statement of required type of construction based on occupancy, area, and height; State required wall and roof "U" values
- Acoustical design from interior and exterior sound sources
- Composition of masses and spaces and architectural details to reflect the desired image, and the scale and nature of the activities involved
- Perception of the building details and volumes (Specific provisions made, for example, an identifiable sequence of viewing positions for experiencing the architectural and interior design).
- Enhancement of materials and systems maintenance and operation
- Economy of building construction, operation and maintenance: Life cycle cost effectiveness. The comparison will only consider systems, which meet the required "U" factors, are suitable to the seismic zone, and meet the durability and esthetic requirements for the project. 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 that was studied. Provide a

section through each wall system and show all components of the wall. Attach the economic comparison to the Design Analysis as an appendix.
- A narrative of the interior design objectives. The narrative must be concise and clearly written and includes the following:
- Delineation of the designer's philosophy and intent relative to the interior design scheme before it is integrated into the contract documents. Refer to *UFC 3-120-10 Interior Design*.
- Discuss how this particular interior design scheme will help humanize our Army environment by fostering desired behavior and eliminating negative responses; coordinate with Installation Design Guide.

Roof mounted equipment is not acceptable to many users. Roof clutter and the trade-off of cost versus acceptable aesthetics must be discussed in the Design Analysis and at the Preliminary Review Conference. Concurrence of the user regarding acceptability of the roof aesthetics will be obtained and documented at the Preliminary Review Conference.

Coordination with Installation or Outside Agencies

- Physical security support
- Occupation safety and health, as required
- Government furnished equipment
- Make up of signage
- Operations and maintenance support
- Nursing Mothers Room

Economy of Building Construction, Operation, and Maintenance

In order to apply life cycle cost effectiveness, an acceptable method of wall and roof construction including roof profiles must be defined as early as possible in the design effort. Therefore, include details of proposed wall and roof construction and an analysis to verify the "U" values. The narrative description will present a discussion of different systems and alternative methods together with the reason for a particular selection. Coordinate with mechanical designer.

Toilet Room Privacy

Provide a statement defining measures taken in the design to prevent persons outside the toilets from viewing into the toilet area including the mirror and sink areas.

Occupational Safety and Health Act (OSHA)

Designs will be consistent with the standards issued by the Department of Labor under Section 6 of the Williams-Steiger Occupational Safety and Health Act. Basic materials, equipment, and functional requirements must be in accordance with the criteria contained in TM and UFGS. Any conflicts discovered will be brought to the attention of the PM, in writing for resolution.

Disability Data

Design for People with Disability must be IAW *UFC 1-200-01 DoD Building Codes (General Building Requirements)*. For purposes of determining handicapped requirements, provide a

completed handicapped checklist. If facility is not designed for physically handicapped, cite the Corps PM written authority to deviate.

Fire Protection Analysis

Must be done in full compliance with *UFC 3-600-01 Fire Protection Engineering For Facilities*. Coordinate with the mechanical and electrical designers and provide the following:

- Basic NFPA occupancy classification and hazard (low, ordinary, high) on which analysis is based; type of construction from International Building Code (IBC); area of ground floor and total floor area; building height in feet, and number of stories.

- Building separation distances and access thereto, as stated above, and in *UFC 3-600-01 Fire Protection Engineering For Facilities*.

- Hour (Fire) ratings (show required and provided) of exterior and interior walls, exit passageways, corridors, stairs, boiler/mechanical rooms, shafts, storage areas, janitor closets, and other hazard areas; fire and smoke floor areas; hourly rating of fire/smoke walls; corridor lengths and dead ends; corridor doors and other rated doors. Provide the UL or other nationally recognized testing laboratory listing for all fire rated walls, floor/ceiling, and roof/ceiling systems.

Extinguishing and/or Fire Sprinkler Systems

Determine the Type (wet or dry system); special systems, such as "Carbon Dioxide," "Deluge," or "Standpipe," **AFFF**, or high density foam Systems. Coordinate with mechanical designer.

Fire Alarm and Evacuation System

Coordinate with the electrical designer on the Type, extent, and zoning.

Use or Storage of Flammable Liquids and Gases, or Accumulation of Dusts

System must be for all designed to comply with NFPA and IBC. Provide the flash point liquids. Describe type of electrical equipment, lighting fixtures, ventilation and other related fire protection features required to minimize hazard(s).

The analysis must list applicable NFPA and IBC number references as well as "required" and "design" conditions.

"Means of egress" sketch must be provided for each floor indicating exit access; door swings in path of egress, required fire separations, stairs and rated exit passageways. In addition, provide a location of exit sign sketch indicating exit lights including direction and locations for which "Not An Exit" signs may be required. Illumination of means of egress and exit markings must comply with NFPA 101 required and provided exit width, maximum distance to nearest exit, common path corridor length, dead-end corridor length, number of exits, and exit capacity.

Asbestos

Refer to paragraph Hazardous Material Mitigation.

Life Safety

Perform a life safety survey to identify existing violations of means of egress and fire separation per NFPA 101, NFPA 220 and the IBC and describe how new work will impact life safety of the existing facility. State the building construction types and occupancy classification. Provide "means of egress" sketches to identify existing violations and recommended corrective actions.

Physical Security/Anti-Terrorism Features

Antiterrorism Threat Protection design considerations must follow DOD criteria, in accordance with the Public Health Security and Bioterrorism Response Act of 2002, PL 107-88 (utility vulnerability assessments), and in accordance with the Public Health Security and Bioterrorism Response Act of 2001 (vulnerability assessments). The DOD criterion is found at the *Protective Design Center*.

Drawings

Floor Plan

For each floor at ¼" = 1' scale (except as stated below), showing: (1) overall dimensions, (2) functional arrangement, (3) label all rooms and spaces, (4) interior colors and finishes and exterior colors in tabular form.

On a case-by-case basis, a smaller scale can be used for large, open structures, subject to discussion at the Pre-Negotiation Conference. If a smaller scale is approved and used, congested areas such as toilet rooms, mechanical or electrical equipment rooms, and so forth, must be enlarged to a minimum scale of ¼" = 1'.

Provide Interior/Exterior Colors and Finishes in Tabular Form

Describe colors by words as well as a standard manufacturer’s designation, so that the customer will have no doubts as to what he will receive.

Indicate all major equipment and show to scale.

Principal Elevations

Provide a minimum of two principal elevations. Coordinate and show exterior mechanical and electrical equipment and penetrations at each elevation. Scale must be not less than 1/8"=1'.

Building Section

Provide at least one principal section showing floor and roof framing, suspended ceilings, floor-to-floor heights, concealed or open ducts, relations of fenestration to support columns or walls, and so forth. Due to special needs, other primary transverse or longitudinal sections may be shown. Provide wall section at ½"=1' minimum scale as required for clarity, and principal section at minimum scale of 1/8"=1'.

Wall Sections

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

Also provide the following:

- Air Barrier Plans and Sections, as required by *UFC 3-101-01*, paragraph 3-6.1
- Door, Window, and Louver Schedules
- Signage Schedule and Plan

Interior Design

Design Analysis – Narrative

Structural Interior Design (SID)

If the Installation has an established design guide, it should be followed to develop the interior color/finish scheme. State the general type of finishes and materials that are going to be needed in this facility, both interior and exterior. Explain the interior design philosophy of the facility. Per the architectural write-up, these finishes must be based on existing elements on the Installation and in the immediate vicinity of the project. The exterior and interior finishes need to be coordinated with the architectural design and requirements on the project. Coordinate interior design narrative with the architectural narrative. In some cases, the two disciples' write-ups are combined, especially if the project is only dealing with Structural Interior Design (SID) and not SID and FF&E, combined.

At this point, additional and more product specific information on the finishes/materials can be provided. The exterior and interior finishes need to be coordinated with the architectural design and requirements on the project. Coordinate interior design narrative with the architectural narrative.

Furniture, Fixtures & Equipment (FF&E)

If the Installation or agency has an established design guide, it should be followed to develop the furniture, fixtures and equipment space planning. State the general furniture function, philosophy, style, and configurations that have been developed and coordinated with the users' requirements. These requirements have been obtained during the interview process with the users. Criteria for furniture selection will include function and ergonomic considerations, maintenance, durability, sustainability, comfort and cost. The design analysis can list the furnishings required for each space within the facility or refer to the drawings. The FF&E package will be developed and coordinated with the architectural design and the structural interior design. Refer to *UFC 3-120-10 Interior Design* for additional information on FF&E packages.

At this point, additional and more product specific information on the furniture and furniture finishes can be provided. The information listed in the Architectural Narrative on CFCI and GFCI can also be provided in the FF& E narrative. See *UFC 3-120-10 Interior Design* for additional information on FF&E packages.

Drawings

SID

Exterior and interior finish schedules must be in tabular form with legends. In the Intermediate Design phase, the finishes can be listed in a more product specific form, so that the user gets a realistic sense of the exterior and interior colors, materials and finishes. Additional drawings that show any wall and/or floor material patterns that have been designed for the project.

FF&E

The furniture footprint plan is developed further per the users' requirements and comments. The furniture footprint plan is to show the furnishings necessary for the user's functional requirements and satisfy applicable life safety codes. The furniture footprint plan will show the appropriate size and type of furnishings and critical or required clearances. The furniture footprint plan must include a furniture legend. When the design of the FF&E package is included in the building design contract, the furniture footprint is the furniture plan and is fully developed, along with the FF&E package. If the FF&E package is not included as part of the building design contract, the furniture footprint plans need to clearly note "Not In Contract". See *UFC 3-120-10 Interior Design* for additional information on FF&E packages. Furniture footprint plans must be included throughout the design delivery process, to ensure coordination of architectural components and engineering disciplines (lighting, power, mechanical, window placement, and so forth) with respect to furniture placement.

Color Boards

Provide one color board for new and altered finishes for projects in which the construction cost exceeds $500,000.

- Color Boards must be submitted in a standard 8-1/2" x 11" three-ring binder. Fold-outs may be employed to 25-1/2" x 33" as long as they refolded with the standard binder. Number of color boards must be as called for in the project scope. If pre-finished textured metal panels are required, samples must be submitted with the boards.

- Actual material samples must be displayed showing color, texture, pattern, finish, thickness, and so forth, for all appearance relate items where choice exists. These samples must 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 must be organized by color schemes with a separate sample for each scheme. The schemes must be coordinated by room names and numbers shown on the architectural floor plans. Colors must be labeled with generic color names.

- Project title and installation must be written in the lower right-hand corner of each module.

Presentation

Color Boards must be submitted in a standard 8-1/2" x 11" three-ring binder. Fold-outs may be employed to 25-1/2" x 33" as long as they refolded with the standard binder. Number of color boards must be as called for in the project scope. If pre-finished textured metal panels are required, samples must be submitted with the boards. At this phase, it is also acceptable to use 16” x 20” presentation color boards (mat board or foam core). It is easier for the users to see all of the finishes on one or two boards. If this option is used it needs to be pre-approved with the project manager and listed in the project scope. Project title and installation must be written in the lower right-hand corner of each module.

Samples

Actual material samples must be displayed showing color, texture, pattern, finish, thickness, and so forth, for all appearance related items where choice exists. These samples must 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 must be organized by color schemes with a separate sample for each scheme. The schemes must be coordinated by room names and numbers shown on the architectural floor plans. Colors must be labeled with generic color names.

Mechanical Design

Design Analysis - Narrative/Calculations

Designs must meet EPA emission standards when No. 5 fuel oil or No. 6 fuel oil is burned as fuel and when other hazardous emissions are produced.

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. Indicate the pieces of equipment and controls that will be tied into a base wide energy system. The A-E must coordinate with the user.

For physically handicapped requirements, state what provisions have been incorporated.

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:

Future Expansion

Where buildings are to be designed for further expansion, discuss provisions to be taken to ensure the projected construction will proceed in a trouble-free fashion. State if no provisions have been made for future expansion.

Meters

State type, number and location of Utility meters.

Design Conditions

State indoor and outdoor design temperatures for heating and cooling, proposed 'U" factors for walls, ceilings, floors, and so forth, personnel load, equipment heat release (if any), outside air or ventilation requirements and any other special conditions.

HVAC System

Indicate type of HVAC system and justification for selection, operating pressure and temperature, and capacity. Briefly discuss temperature control system. Discuss type of system, such as, forced warm air with direct fired furnace or hot water coil, forced hot water or steam with direct radiation or unit heaters. Indicate type of plant distribution outside of buildings - steam or high temperature hot water/chilled water and whether above-ground or underground.

Calculations

Calculations of a limited nature must include heat gain, heat loss, and equipment sizing including the method for handling diversities in the air conditioning load and method for sizing boilers. Show typical air conditioning load calculations, preferably the building peak loads.

Heating Load Calculations

Exclude anticipated internal and solar heat gains from heating load calculations. Increase the calculated size of equipment and distribution system by up to 30 percent where necessary to compensate for morning recovery due to night setback.

Cooling Load Calculations

If necessary, increase the calculated size of equipment and distribution system(s) by up to 10 percent to compensate for morning recovery due to night set forward or by up to 10 percent to compensate for unanticipated loads or changes in space usage. Limit the total combined increase above the size calculated of equipment and distribution system(s) to 15 percent total. List the sensible, latent, and total capacity requirements for each cooling coil specified. For applications where reheat is required for humidity control, the capacity of the reheat will be equal to the total internal sensible heat generated in the area served.

Energy

Refer to *UFC 1-200-02 High Performance and Sustainable building Requirements*.

Energy and Economic Analysis Calculation Methods

All analysis must be performed based on the actual conditions expected over the life of the facility including anticipated occupancies, scheduled hours of operation and process loads.

Realistic energy usage and efficiencies, maintenance cost and repairs and renovations must be included.

Energy Calculations

Energy calculations for new conditioned buildings or for comparing alternative building features and energy conservation techniques or equipment will be determined using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting, and other energy producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads used in the design. The energy savings and any parasitic energy loads associated with the utilization of recovered energy, solar heat, solar photovoltaic energy and other renewable or waste heat applications must be included. Using *UFC 3-400-02 Design: Engineering Weather Data*, or other established and authoritative weather data files, the program will perform 8760 hourly calculations. Programs that "condense" the weather files and number of calculations into several "typical" or average days per month, follow modified bin calculation procedures or other simplified methods described in the Chapter entitled "Energy Estimating and Modeling Methods" of the ASHRAE Handbook of Fundamentals may be used when the features, size or complexity of the building design and alternatives do not demand more sophisticated energy calculations to give accurate results and support design decisions. In addition, the Department of Energy maintains a list of building energy and water conserving tools for design. A number of the programs may be of benefit in performing energy and water conservation calculations, comparing energy and water system alternatives and evaluating specific conservation measures. The web address for additional information is *Advanced building Construction with Energy-Efficient Technologies and Practices*.

Compliance Path and Project Documentation

In addition to the Mandatory Provisions, the path or method selected to ensure compliance with ASHRAE Standard 90.1 must be clearly indicated in the concept design. The reasons and effects, on the energy usage and life cycle cost of the completed facility, of selecting the particular compliance path or method must be presented. The engineering and economic analysis, including computer simulations and program inputs, outputs and assumptions, used to support the HVAC system selection and other concept design decisions must be fully documented and made a part of the concept design package. The forms from the ASHRAE Standard 90.1 User's Manual may be helpful in developing the project and compliance documentation.

Life Cycle Cost Analysis

Life cycle costing must be in accordance with Title 10 Code of Federal Regulations Part 436, Subpart A. A life cycle costing program in full compliance with the Federal Regulation and updated with the latest economic factors is the Building Life Cycle Costing (BLCC) program available from the WBDG *WBDG Energy Tools*. The appropriate cost and savings associated with the utilization of recovered energy, solar heat, solar photovoltaic energy and other renewable or waste heat applications must be included.

Plumbing System

Unless directed otherwise, the design analysis will include the following: *UFC 3-420-01 Plumbing Systems*

Design Basis

Basis for design will consist of:

- Plumbing fixture determination, listing quantity and types of fixtures.
- Fixture units for drainage, venting, cold and hot water piping.
- Roof areas used in determining storm drainage pipe sizes.
- Capacities of all equipment and tanks.

Calculations

Show calculations clearly so that any changes that become necessary during construction or re-siting are made efficiently. When tables used in the design are taken from publications, indicate the title, source, and date of the publication. Provide the model number and manufacturer of each major piece of equipment for which space was allocated.

System Type

Refer to *UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems*

Special Criteria for Humid Areas

Use the following criteria in the design of air-conditioned facilities located in areas where:

- the wet bulb temperature is 67 degrees F (19 degrees C) or higher for over 3,000 hours and the outside design relative humidity is 50 percent or higher, or

- the wet bulb temperature is 73 degrees F (23 degrees C) or higher for over 1500 hours and the outside design relative humidity is 50 percent or higher, based on 1.0 percent dry bulb and the corresponding mean coincident wet bulb temperature

System Selection

HVAC systems will typically consist of a central air-handling unit with chilled water coils or unitary direct expansion-type unit(s) capable of controlling the dew point of the supply air for all load conditions. In addition to life cycle cost considerations, the designer must base system selection on the capability of the air-conditioning system to control the humidity in the conditioned space continuously under full load and part load conditions. System selection will be supported by a psychrometric analysis computer program that will consider the latent-heat gain due to vapor flow through the building structure, to air bypassed through cooling coils, and to the dehumidification performance of the air-conditioning system under varying external and internal load conditions. Peak latent load outdoor design conditions (the design wet bulb temperature and the mean-coincident dry bulb temperature) or low sensible loads and high latent loads (days with low sensible and high latent external loads) will, in some cases, cause inside relative humidity to be higher than desired. If analysis indicates that this condition will occur for

an unacceptable period of time, reheat will be used. Use recovered heat for reheat where possible. Do not use face and bypass dampers for temperature control.

Air Handling Units

Specify draw-through type air-handling units to use the fan energy for reheat. Design the air distribution system to prevent infiltration at the highest anticipated sustained prevailing wind.

Variable-air-volume (VAV) Units

Use air throttling type VAV terminal units with an integral heating coil and a pressure independent air valve that modulates in response to space temperature.

Ventilating system

Gravity ventilation is rarely adequate as a reliable source for comfort ventilation. It can be used in high-bay areas that are rarely occupied, such as storage buildings, or in areas that are difficult to ventilate, such as hangars. Consider nighttime air flushing of spaces, multi-speed fans, increased insulation, improved shading, and building site to improve the effectiveness of comfort ventilation. If a waiver to provide air conditioning in an area not authorized is submitted an hour-by-hour simulation of indoor conditions using comfort ventilation only will be included in the waiver request.

Evaporative Cooling

Use evaporative cooling where the facility in question is eligible for air conditioning, and evaporative cooling can provide the required indoor design conditions based on the appropriate outdoor design conditions. In many locations where evaporative cooling cannot provide the required indoor conditions year round, give further consideration to its use as a supplement to the primary cooling system when preliminary life cycle calculations show the supplementary system to be cost effective. For special applications where close temperature or humidity control is required, consider two-stage evaporative cooling or indirect evaporative cooling in the life cycle cost analysis as a supplement to, not in lieu of, the primary cooling system.

Heat Pumps

When considering the use of heat pumps, perform a thorough engineering analysis. The requirement for possible additional power transmission and substation capacity, the added impact of demand charge power consumption, and peak demands must all be evaluated. Select heat pumps on the basis of life cycle cost effectiveness and include the following types, including combinations, where advantageous:

- ground source heat pumps, using wells or ponds as a heat source or perhaps imbedding a closed-loop heat rejection circuit in a parking lot as a “heat exchanger.”

- where the perimeter spaces of a building must be heated and the interior cooled concurrently, water-to-air heat pumps utilizing a closed-water loop system air source heat pumps

Radiant Heating and Cooling

Radiant heating and cooling systems are gaining wider acceptance among HVAC designers. The designer should carefully review the most current design guidance from both ASHRAE and manufacturers' literature prior to designing these systems, as they have many unique design characteristics.

Cold Storage Projects

Indicate the room holding temperatures and commodities to be held in cold storage. Also, show the approximate equipment sizes.

Service Piping Systems

Include determination and capacity of compressed air, vacuum, or other service piping systems. Refer to *UFC 3-420-02FA Compressed Air.*

Plumbing

Provide plumbing fixture determination listing quantity and types of fixtures. Describe domestic water heating and storage equipment including capacity, materials, piping types, and insulation requirements. Refer to *UFC 3-420-01 Plumbing Systems* and *UFC 3-420-02FA Compressed Air.*

Seismic Considerations

State that design procedure to be used for support and anchorage for mechanical equipment is in accordance with *UFC 3-301-01 Structural Engineering*.

Hazardous Waste

Specify only EPA approved materials, equipment and systems for use.

Fuel

State type, source, whether firm, or interruptible gas and metering arrangements. Indicate adequacy of existing gas distribution system and of existing gas supply to carry additional load. Indicate type of standby fuel for interruptible gas.

Energy Monitoring and Control System (EMCS)

Indicate if base-wide system exists, is under construction, or is planned within 5 years. For an existing system, identify system in operation.

Building system controls are accomplished through Direct Digital Control (DDC). Individual buildings will either connect to the base-wide EMCS or will be connected by a separate construction contract at a later date.

Refer to *UFC 3-470-01 Utility Monitoring and Control Systems UMCS Front End and Integration* and *UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems.*

Fire Protection

Coordinate with the Architect to ensure all aspects of the fire protection plan are addressed.

For sprinkler systems, indicate type (wet or dry) system, provide evidence that the system is in compliance with *UFC 3-600-01 Fire Protection Engineering For Facilities*.

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

Include a fire water flow curve, based on flow test data, and determine if the available water quantities and pressures are adequate to meet project requirements. Conduct water flow tests, in accordance with the procedures contained in NFPA 291, to determine available water supply for the water-based fire extinguishing systems. The preparer of the contract documents (a fire protection engineer or an engineer experienced in water flow testing) must perform or witness the required flow testing prior to the first submission of the project. Advertisement of the project must not be permitted before water flow tests are accepted. Historical water supply information must not be accepted.

Drawings

Floor Plan

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; air distribution duct layout (may be single line); hoods; and other items of major equipment required for the facility.

Plumbing

Show the plumbing fixture layout, floor and area drains, and plumbing equipment layout (hot water generator, storage tanks, pumps, air compressors, and so forth).

Mechanical Rooms

Present a study of floor space in the mechanical room and roof space on roof plan by selecting the largest and heaviest of three competing makes of each piece of equipment to go into the room and to mount on the roof. The Mechanical designer must inform the Structural designer of the selections in order to properly size the roof structure.

Adequate provisions must be made in the mechanical rooms to allow for the removal of tubes from boilers, chillers, and condensers, and the removal of coils and filters from air handling units for maintenance or replacement. To save room space, full use must be made of knockout panels or doors on outside walls for tube and other equipment removal. Equipment must be located to allow ample room for servicing and replacement. Show service clearance required for equipment per manufacturers recommendations. Piping and valves must be arranged so that they will not prevent personnel movement within the equipment room and all valves must be located for ready accessibility. Where necessary because of the location of valves and headers, catwalks

or ladders must be furnished for operating and servicing the valves. Gages and thermometers must be of such size, scale, and location as to be easily read by operating personnel.

If an outdoor Mechanical Equipment yard is enclosed by a solid CMU fence, adequate air movement must be provided by openings in the wall, wall section overlap with air gap between, removing blocks at certain intervals, and so forth.

Additional Drawings

- Show the location of the Control Panel on the plans (in the Mechanical room).
- Prepare a ¼"=1' or ½"=1' scale partial floor plan of the bathroom areas and pipe chases of dormitory type facilities to ensure that sufficient room is available for the plumbing, heating, and air conditioning equipment.
- Coordinate reflected ceiling plan with architectural and electrical designer.
- Show a schematic piping diagram for heating and cooling systems.
- Prohibition of the following types of construction where subterranean termite conditions are known to exist:
  - Buildings with sub-slab or intra-slab heating, ventilation, or air conditioning (HVAC) ducts.
  - Buildings with plenum-type, sub-floor HVAC systems, as currently defined in Federal Housing Administration minimum acceptable construction criteria guidance.
  - Buildings with HVAC ducts in enclosed crawl spaces which are exposed to the ground.
  - Buildings with outer HVAC systems where any part of the ducting is in contact with or exposed to the ground.

Demolition

Indicate if any demolition is required for the product. Determine the extent of the required demolition. Provide demolition drawings with necessary information for contractor to be able to bid the job, such as, size and length of pipe or ducts to be removed or relocated; size and location of equipment to be removed; clear identification of all new, existing to be removed or relocated, existing to remain items.

NOTE: contractor is not obligated to visit the job site before the bid, so all above information must be provided on demolition drawings.

Electrical Design

Design Analysis – Narrative/Calculations

Include the following:

- State and justify type of transformer insulation selected. Show characteristics of any subsequent transformation on the load side of the service entrance and a statement of why the particular voltage was selected. State alternative systems or equipment considered and reasons for selecting a given system.

  - Provide an economic comparison to justify selection of major pieces of electrical equipment. 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 as an appendix to the Design Analysis. The following items must be studied:
    - Transformer types.
    - Main switchboards.
- Provide 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 lift. These costs will then be brought back to the present and combined with the first cost to determine the most economical fixture type. Assume an annual interest rate of 3 percent. Advantages and disadvantages of each will also be noted.
- State type of service entrance equipment (circuit breakers and/or fusible switches) and reason for selection.
- Discuss the following: Lightning protection, motor control centers, standby electric power, special purpose receptacles and outlets, grounding, D.C. or high frequency.
- For airfield lighting projects, state whether cable is to be direct burial or in duct. Discuss provisions for standby power, and comment on type of lighting system (such as high intensity or medium intensity, runway, approach or taxiway lighting), lighting equipment, and any conditions peculiar to the Installation.
- For protective lighting systems, provide a statement of requirements for fence lighting, area lighting, building security lighting, and so forth. Include proposed type of luminary, wattage of lamps, type of lamp beam spread, and how mounted on poles, buildings, and so forth.
- If cathodic protection is required, provide a description of the location, type, and extent of the system to be installed. State the basis for the design proposed.

Generating plants

In addition to a discussion of the design approach, provide the following for generating plants: estimated 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.

Future expansion

Where buildings are to be designed for future expansion, discuss provisions to be taken to ensure the projected construction will proceed in a trouble-free fashion. State if no provisions have been made for future expansion.

General

Provide electrical characteristics (phase, voltage, and number of wires) or circuits.

Electrical Load Analysis

Include estimate of total connected load and demand factors, diversity, and resulting kilowatt demand. Breakdown of the estimated connected and demand load must show: (1) Lighting and convenience outlet load; (2) power load for building equipment such as heating, air conditioning, and so forth, (3) loads for special operating equipment such as air compressors, generators, pumps, and for power receptacles being provided to energize special equipment, (4) appropriate spare load, for future growth. State required power factor and size of transformers.

Lighting

Describe the proposed standards of design for lighting intensities and type of lighting fixtures for functional areas, including controls, both interior and exterior in accordance with design criteria as required in Architectural and Engineering Instructions. Indicate type of emergency lighting system to be provided. Indicate other energy conservation features such as task lighting. Discuss airfield lighting requirements if applicable. Provide interior and exterior lighting calculations.

Miscellaneous

Describe provisions for specialized motor control, cathodic protection, grounding and lightning protection, as applicable.

Hazardous Classification

Provide a description of the physical limits of each hazardous area and the class, division, and group of equipment and wiring. Discuss special fixtures for hazardous areas.

Power Supply

Discuss, electrical characteristics of power supply to base, or portion thereof involved, including circuit interrupting requirements and voltage regulations. State the adequacy of the existing power supply at the point of take-off. If power source is inadequate, state measures proposed to correct the deficiency. If new power source or local/standby generation is required, discuss the various schemes and submit cost comparisons. Provide Motor load calculations.

Distribution

Discuss 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 a justification for underground line.

Fire Alarm and Mass Notification

Discuss proposed fire alarm and mass notification system and means for transmission of signal (if applicable). Discuss any special systems such as fast-acting smoke detection.

Signal Systems

Discuss signal systems, such as: MATV, Public Address/Paging, Intercom, Audio Visual system, and so forth (if applicable).

Electronic Security Systems

Discuss intrusion detection, access control, and CCTV. Discuss if portions of systems are Government provided.

Telecommunications Systems

Discuss the Telephone and Data Systems requirements, such as, telephone instruments/switching equipment, Category of Data system (Cat 6 minimum), list of data networks and classifications (NIPR, SIPR/SECRET, TS, and so forth), and inside (and outside) wiring, Telecommunications Room details, Server Room details (if applicable) cable tray plan, and so forth.

System Control

Discuss special control, such as, generator paralleling, switch gear remote control, telemetering, central supervisory control (if applicable).

Grounding

Discuss special grounding, such as, electronic labs, security communications areas, and data processing (if applicable).

Hospital Designs

Discuss hospital criteria per NFPA, and *UFC 4-510-01 Design: Medical Military Facilities* (if applicable).

Seismic Considerations

Statement of support and anchorage design for electrical equipment in seismic areas must be in accordance with *UFC 3-301-01 Structural Engineering*.

Raised Floor Systems

When raised floor systems are required, state that all stanchions will be made electrically continuous for computer noise with 1 #l/0 BC brought from one point on the stanchions to a computer ground bar located within the raised floor areas. Bond this computer ground bar with 1 C1/0 BC to the service entrance ground bus.

TEMPEST/EMP Shielding

State the frequency spectrum of the installed equipment to be afforded TEMPEST/EMP protection. Coordinate shielded wall systems with architectural and mechanical designers.

Cybersecurity

Discuss the requirement, such as, fire alarm reporting, EMCS, lighting, security controls, and so forth.

Commissioning

Discuss the commissioning process, such as, operation, installation, maintenance, and so forth.

Metering

Discuss the Installation's requirement for metering, such as, smart metering, power consumption, reporting, and so forth.

Sustainable Design

Discuss the features incorporated for compliance with UFC 1-200-02. Provide the LCCA for any renewable energy systems.

LEED

Discuss the certification requirement (if applicable), such as, light pollution reduction, metering, interior lighting, and so forth.

Emergency Power

Discuss generator type requirement or UPS (if applicable).

Renewable Energy Source

Discuss the option (if applicable). Provide LCCA calculation.

Additional Calculations

Provide calculations to backup sizing of major pieces of electrical equipment. The degree of completion must be comparable to that of the narrative and drawings. Provide voltage drop calculations for service entrance, feeders and worst-case branch circuits. Provide short circuit calculations. Update lighting, load and motor calculations.

Drawings

Electrical Legend and Abbreviations Plan

Show all symbols and abbreviations used on electrical plans, with appropriate definitions.

Electrical Site Plan

Provide electrical site plan separate from civil site plan including power and communication service lines to the building and exterior location of proposed electrical equipment. Show all points of connection and associated poles and manholes or handholes. Show exterior lighting not attached to buildings.

Power and Signal Plans

Provide power and signal plans showing location of major pieces of electrical equipment such as transformers, switchgear, motor control center, panel boards, communication equipment, power outlets, communications outlets, cable tray, fire alarm and mass notification equipment, and so

forth. Telecommunications and fire alarm/mass notification equipment may be on separate T- and/or F- drawings.

One-Line Diagrams

Provide one line diagram for the following systems (if applicable):

- Electrical/power (mandatory if power work relating to power one line is in the scope). Show all equipment ratings including all circuit breaker trip and frame sizes and service and feeder sizes.
- Telephone/communications
- Fire Alarm
- Electronic Security Systems (Intrusion Detection, Access Control, CCTV, and so forth)

Lighting

Provide lighting plan and lighting fixture schedule (show lighting switch locations including type such as, single pole, 3-way, and so forth). Provide lighting fixture details for main fixtures used, if not for all fixtures.

Lightning Protection and Grounding

Provide lightning protection (if applicable) and grounding plans showing extent of systems with all symbols. Show grounding counterpoise if one is provided.

Demolition Plans

Provide demolition plans (if applicable) showing all work to be demolished by the contractor

Additional Drawings

- Provide power and lighting branch circuiting on power and lighting plans.
- Provide power panel schedules. For panel boards, switchboards, power switchgear assemblies and motor control centers, provide total connected load, total spare load, main and branch circuit ratings, interrupting ratings, frame sizes for each circuit, number of poles, and description of each load.
- Provide/Update Telephone/communications riser diagram(s).
- Provide/Update Fire Alarm / Mass Notifications System Diagram.
- Provide/Update Electronic Security Systems Diagrams (Intrusion Detection, Access Control, CCTV, and so forth).
- Coordinate with architectural designer in the preparation of facility elevations.
- Coordinate with architectural and mechanical designers for reflected ceiling plan.
- Provide an overall grounding riser diagram indicating the grounding wire sizes.
- Provide supporting details, enlarged plans and layout plans and elevations for all systems to 65% level of design.

Cost Engineering

Engineering Regulations (ER) 1110-2-1302 and (ER) 1110-3-1300 provides policy, guidance, and procedures for cost engineering responsibilities for all projects assigned to the U.S. Army Corps of Engineers (USACE). All cost engineering products required to support USACE managed projects must be prepared in accordance with this regulation and all referenced regulations, policy and guidance, including engineering manuals, pamphlets and USACE memoranda.

Cost engineering products developed by architect-engineer (A-E) contractors or by other offices (i.e., Area Offices, Resident Offices, etc.) must conform to all cost ERs, EMs, and other applicable regulations (shown at Appendix A of ER 1110-2-1302)

The USACE approved estimating software programs, Microcomputer Aided Cost Engineering System (MCACES) and the Cost Engineering Dredge Estimating Program (CEDEP), are the required software programs for the preparation of Civil Works cost estimates throughout USACE.

To support the Civil Works missions addressed in ER 1105-2-100, cost estimates are required for all phases of a project. Detailed cost estimates should be considered For Official Use Only (FOUO) and managed in accordance with AR 25-55 and FAR 36.203.

The cost engineer must prepare reasonable construction schedules that reflect the construction estimates.

–