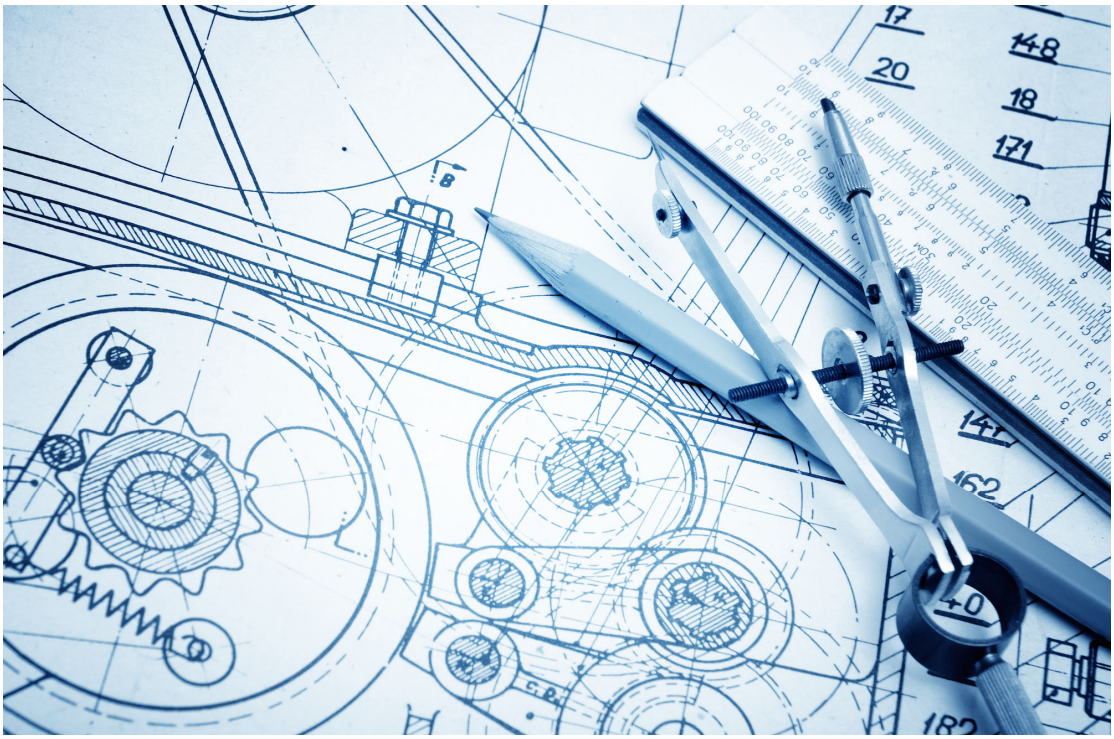
Effective 08/14/2024

US Army Corps of Engineers®

ARCHITECT-ENGINEER GUIDE 95%

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 95% Design Submittals

Table of Contents

Scope

The purpose of this document is to provide the guidance for the content of the Architect-Engineer (A-E) 95% Design Submittals. This is also called the Completed 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]*
- *Architect-Engineer 65% Design Submittals [REFP22L0]*

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.
CCTV	Closed-Circuit Television
COE or Corps	Corps of Engineers a.k.a. USACE
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.
HVAC	Heating Ventilation and Air Conditioning
PA	Programmed Amount
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.
SCIF	Sensitive Compartmented Information Facility
95% Design	This is the Completed 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 Completed 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 Completed 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 Final? Specifications. Submittals will include supporting documentations in any area where other data was used in arriving at the Completed design solution such as Cost Estimates and Geotechnical Reports.

95% Design Submittal

The 95% Design Submittal must include the requirements of the previous stages of design (such as, 65%). As a minimum, the 95% Design Submittal must consist of the following documents which are ready to advertise:

- Design Analysis
- Drawings (including all details)
- Specifications
- Project Safety and Health Requirements
- Cost Estimate and Construction Schedule per ER 1110-2-1302
- DD Form 1354 Data Sheet
- Completed Environmental Permit Matrix (if required by the statement of work)
- ECIFP Report
- Other Items as required by the statement of work

Objective

The completed submittal represents 95% of the design effort and is intended to present a project design that is biddable, constructable and operable, conforming to all the appropriate criteria. Completed design will be accomplished by developing and refining the design as presented in the previously prepared submittals and as modified by the review comments.

Changes to Basic Design

Major changes to the basic design will not be permitted at this time, unless these changes are the result of review comments, changes in criteria, changes in statement of work, or unforeseen problems necessitating the A-E to alter their original design. All the changes must be resolved through the Corps PM before proceeding. If major changes have been made since the last submittal, such changes must be identified and described in the Design Analysis.

Design Analysis - General Requirements

The Design Analysis, prepared for previous submittals, must be expanded and refined into final form to contain that which was required by *Architect-Engineer 65% Design Submittals* plus requirements contained herein.

Drawings - General Requirements

Expand and fully develop the drawings required by *Architect-Engineer 65% Design Submittals* adding new drawings as necessary to meet the requirements stated hereinafter. Include in the drawings, all plans, elevations, sections, wall penetrations, furred spaces, duct and pipe chases necessary for mechanical and electrical systems. Consider spacing of required off-sets of beams, girders, reinforcing steel, joists and truss members. Where space is tight, show unequivocally that the systems will fit in the space provided. Particular attention must be paid to areas of duct branches and cross-overs. Close coordination between all designers must be accomplished to avoid conflicts between the various disciplines‘ drawings. Whenever additive or deductive bid items are required, the limits of work or scope of these items must be well defined on the respective disciplines‘ drawings and clearly defined by word description in the specifications. Make sure adequate details are provided to cover those situations where additive bid items are not awarded such that the drawings present a complete design without the additive bid items.

Specifications - General Requirements

All specification sections are to be fully edited and complete at this stage. All SpecsIntact files (.sec files) are to be submitted to SPK. The following reports from SpecsIntact are to be included with the submittal and must show no issues: ADDRVER.pdf, BRKTVER.pdf, REFVER.pdf, SECTVER.pdf, SUBMVER.pdf and TTLDIFFS.pdf.

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 95% 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

Complete the discussion of civil features that were presented in the *Architect-Engineer 65% Design Submittals*. Update the narrative to include any changes brought about as a result of review comments.

Design Analysis - Calculations

Refer to submittal requirements *Architect-Engineer 65% Design Submittals*. Update the calculations to include any changes required by review comments.

Drawings

Expand and fully develop drawings used in *Architect-Engineer 65% Design Submittals*. Add any new sheets necessary to complete the presentation.

Landscape Architectural Design

Design Analysis - Narrative

Complete the discussion of the landscape treatment that was presented in the *Architect-Engineer 65% Design Submittals*. Update the Design Analysis to include any changes brought about by review comments. If there is no requirement for landscaping, state this.

Design Analysis - Calculations

Provide all calculations used for determining pipe sizes, type of sprinkler head in regard to area of coverage, and number of heads per valve. Define water pressure used in analysis and state how that value was determined:

Drawings

Landscape Architectural Plan

Finalize the Landscape Architectural Layout Plan that was presented in the *Architect-Engineer 65% Design Submittals*. Dimension site features in coordination with the civil site plan. Dimension site features that are to be constructed on the land, such as sidewalks, hardstand areas, locations for all site amenities, and so forth. Update the plan to include any changes brought about by review comments.

Landscape Planting Plan

Finalize the Landscape Planting Plans that was presented in the *Architect-Engineer 65% Design Submittals*. Show location of all shrubs and trees. In case where the shrub layout may be dense and difficult to label, a separate shrub planting plan and tree planting plan must be used. Label all trees and shrubs with plant identification and quantities. Dimension location of any specimen plants that need to be in an exact location. Complete shrub and tree schedule. Update the plan to include any changes brought about by review comments.

Planting Schedule

Provide a plant schedule to include the following:

- Common name.
- Botanical name.
- Quantity of each variety planted.
- Height after planting.
- Container size and kind of container space pattern. Tree size should be a minimum of 15 gallons to improve survivability.

Landscape Planting and Layout Details

Provide typical planting details for shrubs and trees. Provide details that include a minimum of all site furnishings, sections of all paving types, signage, fencing, outdoor structures, mulch placement, cobble placement and drainage details.

Irrigation Layout Plan

The irrigation plan must be drawn on a separate sheet. Show location of all shrubs and trees. Show all irrigation lines, spray heads, bubbler locations and drip emitters. Show coverage of each spray head on the drawing. Show pipe sizes, backflow preventor location, control valves, vacuum breakers and point of connection to water distribution system, including the dynamic head at the point of connection. Label each valve with controller zone number, valve size and zone gallons per minute (GPM's). Show mechanical appurtenances necessary for the proper function of the system. Each item will be indicated by an appropriate symbol. Indicate each kind and size of pipe by symbol. Provide an irrigation schedule indicating types of spray heads, bubblers and drip emitter units, type of coverage, minimum GPM and minimum pounds per square inch (psi) required at each head. Indicate total water requirement and pressure required for each zone.

Irrigation Schedule

Provide an irrigation schedule to include the following:

- Type and size of head, GPM, pressure in psi required and radius.
- Type and size of drip emitter.
- Type and size of bubblers.
- Type and size of valve.
- Type of controller.
- Type and size of pipe.
- Type of backflow preventor.
- Method of tap.

Irrigation Details

Provide Irrigation Details that include a minimum of trenching and pipe burial, spray head installation, bubbler installation, drip emitter unit installation, backflow preventor, gate valve, control valve, controller, automatic drain valve, quick coupling valve.

Structural Design

Refer to the following for the basis for structural design:

- *UFC 3-301-01 Structural Engineering.*
- *UFC 4-010-01 DoD Minimum Anti-Terrorism Standards for Buildings.*

Design Analysis - Narrative

Complete the discussion of structural features that was presented in the *Architect-Engineer 65% Design Submittals*. Update the narrative to include any changes brought about by review comments.

Design Analysis - Calculations

Present complete structural calculations covering analysis and design of all parts of the structure and miscellaneous facilities. All calculations, including the Design Analysis Narrative must be stamped by a professional engineer registered in the state in which the facility is to be built. Calculations must also clearly indicate the name of the person acting in the Peer Review capacity during the life of the design phase of the project.

Design methods must be described, including assumptions, theories, and technical formulas employed in design solutions.

All loads must be combined to produce the most structural effect as required in the governing criteria. Special emphasis must be made to loading scenarios where stress reversals in combination with other loads might produce higher effects.

If special methods of solution, tables, for example, are employed, references should be made in the calculations to the sources of such material. Copies of those tables must be included and readily available in the calculations document.

For addition/alteration projects, provide calculations necessary to verify adequacy of existing structure to support new functional loads or to satisfy any new loading criteria.

When a computer program is utilized to perform engineering calculations, the Design Analysis document (calculations) must include copies of computer input data and output summaries presented in understandable language, accompanied by diagrams, sketches and any drawings which identify joints, members, areas, and so forth, according to the notations used in the data listings. This will form an integral part of the Design Analysis in lieu of manual calculations otherwise required. A complete listing of all computer output will be provided, bound separately, when it is too voluminous for inclusion in the Design Analysis. These listings will be augmented by intermediate results where applicable, so that sufficient information is available to permit manual checks of final results. Include a sample hand calculation of each structural element (such as, a truss) under one loading condition (such as, usually the most critical) for each major system (such as, lateral system, beam framing, and so forth). This will facilitate reviewers who are not familiar with your particular program in spot checking the balance of the submitted computer data.

Drawings

Expand and fully develop drawings used in *Architect-Engineer 65% Design Submittals*. Add any new sheets necessary to complete the presentation.

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

Wall Elevations

Wall elevations must be provided for precast or tilt-up concrete panels, showing typical reinforcing, reinforcing around openings, connections, and so forth. The intent is to show one complete design on the drawings, even though manufacturers may prefer to detail things differently.

Joints

The location and details of all joints must be shown on the drawings. Include control joints in slabs-on-grade, construction joints in walls, floors, roofs, and expansion and seismic joints.

Structural Data

The Corps or A-E prepared Geotechnical Report must not be referenced because it is not part of the contract documents. Check all general structural notes for conflicts with the specifications. The notes should not repeat the specifications. All structural data must appear on the first sheet of the structural drawings. As a minimum state the following:

- Building classification for all aspects of the loading, occupancy and operation of the facility
- Soil bearing parameters and other information from the Geotechnical Report pertinent to the design of foundation, retaining walls, slabs on grade, and so forth
- Design live loads for various areas of the building;
- Snow loads
- Basic and "design" frost penetration depth
- Snow loads and any special considerations for snow drift, for example, that could affect the building
- Design wind speed and any other applicable parameter used to analyze the building structure such as special considerations for tall and slender building, signs, and so forth
- Seismic loads and loading parameters such as ground motions, site class and other information that was used to develop the design basis
- Any other special loading such as loads due to Cranes, for example, must be fully and technically explained and quantified.

Stair Details

Show all structural beams and connections that are shown supporting stairs usually detailed on the Architectural Drawings.

Roof Details

- Show all fastener details of roof deck to supporting members.
- Show all roof framing connections, including Reinforced Concrete and CMU beam seats, column connections, and beam-to-girder connections.
- Show all details that provide slip joints for temperature changes and all details that transfer lateral loads to the vertical shear system.
- Show all additional framing needed to provide for concentrated vertical loads, including both at and between node(s) of roof trusses.

- Show details for any roof system selected.

Connection Design

The A-E, the Engineer of Record (EoR) is responsible for design and detailing of "ALL" connections. Connection designs and details should be clearly indicated on drawings substantiated by calculation documentations.

Force Protection

Refer to *UFC 4-010-01 DoD Minimum Anti-Terrorism Standards for Buildings*. Progressive Collapse Design for Force Protection must be provided for three or more story facilities. Only an external, extraordinary event (explosive threat) must be considered. This must be achieved through an arrangement of structural elements that provide stability to the entire structural system by transferring loads from any locally damaged region to the adjacent regions capable of resisting those loads without collapse. This must be accomplished by providing sufficient continuity, redundancy, or energy dissipating capacity (ductility) or a combination thereof, in the members and connections of the structure. Threat analysis will include removal of one primary vertical load carrying element or one primary lateral load carrying element in any of the floor levels without progressive collapse. All floors will be designed with improved capacity to withstand load reversals due to explosive effects by designing them to withstand a net uplift equal to the dead load plus one-half the live load. The loss of exterior CMU wall length in any of the floor levels is equal to one story height for CMU Buildings. For further guidance, refer to American Society of Civil Engineers, Standard ASCE 7-98, and Minimum Design Loads for Buildings and Other Structures.

Future Expansion

Design for future expansion, if required.

Seismic Evaluation and Rehabilitation for Existing Buildings

ICSSC RP 8 Standards of Seismic Safety for Existing Federally Owned and Leased Buildings identifies trigger situations requiring evaluation seismic evaluation and rehabilitation for existing structures. Refer to:

- *ASCE/SEI 41 Seismic Evaluation and Retrofit of Existing Buildings*
- *International Existing Building Code*

Vaults

Refer to:

- Army Projects use *MIL-HDBK 1013/1A DESIGN GUIDELINES FOR PHYSICAL SECURITY OF FACILITIES*
- AF Projects use *AFI 31-101 THE AIR FORCE INSTALLATION SECURITY PROGRAM (FOUO)*

Architectural Design

Design Analysis - Narrative

Complete the discussion of architectural features presented in the *Architect-Engineer 65% Design Submittals*. Update the narrative to include any changes brought about by review comments.

Design Analysis - Calculations

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

Drawings

Expand and fully develop drawings used in *Architect-Engineer 65% Design Submittals*. Add any new sheets necessary to complete the presentation, including the following:

Construction Details

Detail drawings of all unique conditions.

Interior Design

Design Analysis – Narrative

Structural Interior Design (SID)

Complete the information provided in the *Architect-Engineer 65% Design Submittals*. Update the narrative to include any changes brought about by review comments.

Furniture, Fixtures & Equipment (FF&E)

Complete the information provided in the *Architect-Engineer 65% Design Submittals*. 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.

Finish and Colors

Complete for each space by use of "Finish Schedule, Finish Legend and Color Schemes." Include color of factory finished materials (such as, floor tile) for all interior finishes and for all building exterior finishes.

Drawings

SID

Exterior and interior finish schedules must be in tabular form with legends. In the completed design phase, the finishes can be listed in a manufacturer specific form, so that the user gets an actual sense of the exterior and interior colors, materials and finishes. Each finish sheet needs to have the following general note: "Colors listed by manufacturer are for identification purposes only and are not intended to limit selections to products of the manufacturer indicated. An exact match of the manufacturer's color is not required. The selections serve only to indicate the color and quality which the manufacturer's standard must approach." Complete the wall and/or floor material pattern drawings.

FF&E

The furniture footprint plans are completed per the users' requirements and comments. The furniture footprint plans are 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, from concept to completed submission, to ensure coordination of architectural components and engineering disciplines (lighting, power, mechanical, window placement, and so forth.) with respect to furniture placement.

Color Boards

If interior finishes are being affected, provide one color board to the customer for new and altered finishes for projects in which the construction cost exceeds $500,000. Digital color boards are an acceptable alternative only for remote reviewers (such as, reviewers not located at the Installation).

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 refold 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. 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 manufacture specific information.

Mechanical Design

Design Analysis - Narrative

Complete the discussion of Mechanical features that was presented in the *Architect-Engineer 65% Design Submittals*. Update the narrative to include any changes brought about by review comments.

Design Analysis - Calculations

The completed design must be a continuation and extension of the approved concept design. The engineering and economic analysis performed as part of the *Architect-Engineer 65% Design Submittals* must be updated as necessary and included as part of the complete design package. Each of the systems, features and components considered during the completed design must be identified and the engineering and economic analysis supporting the design decision for implementation or rejection must be included.

Finalize all calculations leading to sizing of distribution systems, selection of equipment, power requirements, controls, and selection of auxiliary equipment.

Equipment selection is restricted to regularly cataloged items of domestic manufacture, in commercial service for at least two (2) years prior to bid opening and supplied by dealers having service organizations supporting the project location. Completely identify each piece of equipment with three manufacturers' names, model numbers, and characteristics. Do not indicate proprietary manufacturers' names and model numbers on the drawings or in the specifications. Provide catalog cuts of selected equipment.

Provide complete tabulation of cooling loads. Psychrometric charts for all the air handling systems with cooling are required.

ASHRAE Standard 90.1 Compliance

Full compliance with the Mandatory Provisions and either the Prescriptive Path or the Energy Cost Budget Method must be clearly demonstrated. Where life cycle cost is effective, the Mandatory Provisions of ASHRAE 90.1 and the selected compliance path or method should be exceeded. The engineering and economic analysis supporting the decisions should be included in the complete design package. In those rare cases where the Mandatory Provisions of ASHRAE Standard 90.1 and the selected compliance path or method are not cost effective and a more energy intensive system, feature or component will provide a lower life cycle cost, a detailed justification with life cycle cost comparisons, including the assumptions used in the analysis and unusual facility features or operations, must be included in the completed design.

Mandatory Provisions

The completed design package must identify each of the required features applicable to the facility and demonstrate compliance. Any deviations must be clearly identified and the engineering and economic analysis supporting the deviation provided.

Prescriptive Path

The Simplified Approach Option for HVAC Systems may be used where the specific system and facility design meets all of the relevant ASHRAE Standard 90.1 criteria. In all other cases the detailed requirements of the Prescriptive Path, as a minimum, must be carefully followed. The completed design package must identify each of the features applicable to the facility and demonstrate compliance. Any deviations must be clearly identified and the engineering and economic analysis supporting the deviation provided.

Drawings

Expand and fully develop drawings used in the *Architect-Engineer 65% Design Submittals*. List the room names and numbers on all plans and partial plans as shown on the architectural plans. Add any new sheets necessary to complete the presentation, including the following:

Plumbing

Provide the following:

- Show water, waste and vent piping
- Provide a schedule of plumbing fixtures and equipment. Coordinate schedule with Table I - Pipe and Fitting Materials for Drainage, Waste, and Vent Piping Systems of *UFC 3-420-01 Plumbing Systems*.

Heating, Ventilating and Air Conditioning (HVAC)

Provide the following:

- Double line air distribution ducts will be required for all cross sections, elevations, and in mechanical rooms. Single line ducts may be used for air distribution layout provided sufficient cross sections are shown for congested areas, and for areas that are subject to potential structural interference.
- If required for clarification of duct sizes and duct runs, show single line riser diagrams for supply, return, and exhaust air systems in multi-story buildings. Provide sections where needed to show special relations and indicate the typical location of lights, structural members, and so forth.
- Locate and detail all fire dampers.
- Provide piping schematics to show all complicated flow processes.
- Provide a sequence of operation and control, and control system schematic diagrams for each Mechanical System.

Fire Protection

Provide the following:

- Minor fire protection work may be shown on the plumbing plan. Title block must indicate that the drawing is for both plumbing and fire protection.

- For detail of sprinkler riser, see Corps Standard Mechanical Detail Drawings.
- Identify all sprinkled areas. Use different identification (symbols) for areas with different density (type of hazard). List each symbol with its pertinent hazard and density in the legend and symbols.
- Show the riser locations on the plans.
- Do not show sprinkler system layout, such as, location of mains, branches, and sprinkler heads.
- For Hydraulically Calculated Sprinkler Systems, show the following information Refer to *UFC 3-600-01 Fire Protection Engineering For Facilities*.
  - Type of hazard.
  - Minimum area of water demand.
  - Minimum rate of water application (density) GPM/sq. ft.
  - Any special sprinkler head temperature rating or classification.
  - Minimum hose stream requirements.
  - Fire Hydrant location and flow data including static and residual pressures
- For projects with several sprinkled areas of different density, provide a table listing the miscellaneous areas, occupancy rating, density, area of demand, and hose stream requirements.
- For warehouses, the following must be shown on the drawings.
  - Commodity classification.
  - Pallet type.
  - Shelf type (open, slatted or solid).
  - Encapsulated or non-encapsulated.
  - Maximum storage height (not rack height).
  - Storage rack configuration (single, double or multiple row).
  - Whether sidewall sprinkler protection of columns is required.
  - Whether in-rack sprinklers are required due to storage height in excess of 25-feet, encapsulation of pallets, or to minimize fire water requirements for storage height of less than 25-feet.
  - Whether in-rack sprinklers are required at one level, two levels or at every tier.
  - In-rack sprinkler water demand
  - Ceiling sprinkler density (GPM/SF)
  - Design area of sprinkler operation
  - Ceiling sprinkler water demand
  - Inside hose stream demand (minimum 100 GPM)
  - Combined inside and outside hose demand (minimum 500 GPM)
  - Duration of water supply required
  - Fire protection riser location(s)
  - Fire wall/partition locations
  - Water flow available at base of riser (GPM flow rate and associated residual pressure)

Energy Monitoring and Control Systems

The designer is required to coordinate with the using agency.

- Provide schematic diagrams and summary as shown in *UFC 3-410-01 Heating, Ventilating, and Air Conditioning Systems*.
- The system schematic diagrams must be separate from the control system diagrams.

Electrical Design

Design Analysis - Narrative

Complete the discussion of electrical features that was presented in the *Architect-Engineer 65% Design Submittals*. Update the narrative to include any changes brought about by review comments.

- Describe any special switching or dimming systems required for any area
- Provide rationale for selection of reduced-voltage starting equipment
- Provide an energy impact analysis
- Discuss Cybersecurity issues

Design Analysis - Calculations

Provide complete design calculations for all interior and exterior electrical systems, completing and updating calculations required/submitted in the previous design submittals.

Provide manufacturers' names and model numbers for each major piece of equipment used in determining dimensional and weight requirements. Do not use proprietary names and model numbers on the drawings or in the specifications.

- Calculations for the maintained foot-candle intensities in all areas must be shown
- Provide calculations for sizing transformer(s) and short-circuit interrupting capacity
- Voltage drops on all service and feeder circuits, and a worst-case branch circuit
- Additional calculations as required to supplement the designs
- Provide protective coordination study and arc-flash analysis when required per the UFC and UFGS.

Drawings

Expand and fully develop drawings used in *Architect-Engineer 65% Design Submittals* adding new sheets as necessary to meet minimum requirements stated hereafter. Show in plan, necessary elevations and sections, all wall penetrations, furred spaces, duct and pipe chases necessary for mechanical and electrical systems. Consider spacing or required off-sets of beams, girders, reinforcing steel, joists and truss members. Where space is tight, show unequivocally that the above systems will fit the space provided. Particular attention should be paid to areas of

duct branches and cross-overs. Close liaison between all designers is necessary here to avoid conflicts in the drawings. Whenever additive or deductive bid items are required, the limits of work or scope must be well defined on the drawings for the respective disciplines unless clearly defined by description in the specifications. Construction phasing requirements must be clearly described and fully coordinated with the PDT.

Outside Distribution System

Provide the following:

Overhead

Show location of new and existing poles, and routing of new lines on an electrical-only site plan. Indicate type and size of existing overhead conductors. Provide all supporting details for poles, pole assemblies, cross arms, fused cutouts, surge arrestors, grounding, down guys, and pole intersection and termination details.

Underground

Show location of new and existing manholes and hand holes on an electrical-only site plan. Locate and show details of major equipment. Show routing of duct line, duct line sections and detail of pole riser. Provide all supporting details. Show adequate detail for complex grounding system (if applicable).

Area Lighting

Show location of street, parking and walkway lighting poles. Provide details of all luminaires, poles and bases. Details of luminaires must only be provided when not covered by Corps Standard Drawing No. 40-06-04.

Floodlighting (on poles)

Provide layout of lighting poles, showing dimensions and aiming angles.

Distribution System Profiles

For overhead and/or underground distribution projects over 2,000 linear feet in total length, profiles must be furnished as described under Civil Design.

Interior Distribution System

Provide the following:

Floor Plan

Define the physical limits of each hazardous area and the class, division and group of equipment and wiring. Show conduit seals IAW NEC Article 500. Show sizes of all conduits including conduit to be wired by others. Indicate number and size of conductors based on copper conductors. See *UFGS SECTION 26 20 00 INTERIOR DISTRIBUTION SYSTEM* for aluminum

conductor options. Provide a numbering system for all circuits. Detail the seismic restraints for all electrical equipment. Show complete fixture, switch, and receptacle arrangement, fixture details and identification of fixture type, special control equipment diagrams and complex switching diagrams. Provide fire rated recessed light fixtures to match fire rating of ceiling.

Electrical Equipment

For all electrical equipment, list the performance characteristics required, complete schematic diagrams, and a written description of operation of complex control systems.

Panel Schedules

For panelboards, 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.

One Line Diagrams

In addition to completing one line diagrams shown at 65%, show a wiring diagram for each of the following systems on the plans: television, intercommunication, public address, and other required special systems. Show locations only of all antennas, service entrances, outlets and major equipment on a floor plan.

Airfield Lighting

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

Cathodic Protection

Where a cathodic protection system is included, show extent of the facilities to be protected, location and type of anode beds, location of test points, details for sectionalizing bonding and insulating (where applicable) an underground piping system, and source and routing of supply for impressed current. Alternatively, if a performance specification is sufficient to address the design, please so state in the design analysis.

Generating Plant

If the project includes a generating plant, provide a one line wiring diagram, fuel oil and coolant piping diagrams, equipment details and layout, and transfer controls in block form.

CCTV

For Exterior CCTV, provide lighting calculations to demonstrate the exterior lighting levels provided will provide adequate sensor illumination on CCTV camera light sensors for sufficient video recording capability and detail recognition to meet CCTV mission requirements.

Fire Alarm / Mass Notification Systems

Provide elevator recall features. Provide fire alarm interface to motorized smoke dampers in the HVAC system. Coordinate mass notification system with base Giant Voice Systems as applicable. Provide fire alarm interface to fire suppression control systems such as for aircraft hangars or for Clean Agent Systems.

TEMPEST and/or SCIF

Ensure thorough review by user and incorporate all comments to update the design.

Cybersecurity

Confirm all cybersecurity requirements in plans and specifications are completed for all impacted systems such as HVAC controls, lighting controls, energy production controls, and other software/network-based control systems.

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 (such as, Area Offices, Resident Offices, for example) 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.