Middle East District

Design Instructions Manual

US Army Corps of Engineers®

January 2022

Revisions from January 2022:
Chapters 1, 2, 3, 6, 7, 20 and 21

Revisions from January 2021:
Chapters 1 and 7

Revisions from December 2020:
Chapters 2, 3, 4, 8, 9, 22 and 2

Revisions from November 2020:
Chapters 2, 3, 4, 8, 22 and 25

Revisions from April 2019:
Chapters 2, 6, 7, and 22

Revisions from December 2018:
Chapters 6, 7, 9, 25 and 26

Revisions from February 2018:
Chapters 9, 13, 14 and 20

Revisions from December 2017:
Chapters 9, 14, 17 and 25

INTRODUCTION

The MIDDLE EAST DISTRICT DESIGN INSTRUCTIONS MANUAL consists of the following:

1 DESIGN INSTRUCTIONS

2 DESIGN CHECKLISTS

Revisions will be issued to this manual as necessary. Specific comments on the contents are requested from the users and should be directed to the MED Engineering (CETAM-DP-E), Attn: Mr. Doug Applegate, e-mail address "douglas.s.applegate@usace.army.mil" (540) 665-3742.

DESIGN INSTRUCTIONS MANUAL presents standard procedures and guidance for the preparation of designs by both Architect Engineer (A-E) firms and U.S. Army Corps of Engineers (USACE) personnel. It presents general instructions as well as detailed requirements for the various design disciplines. All personnel performing design for the Middle East District should thoroughly familiarize themselves with the guidance contained herein.

An electronic copy of this document and all design checklists are posted on the MED Engineering Public Webpage for access by customers outside MED and USACE.
The MED Engineering Public Webpage is:

http://www.tam.usace.army.mil/BusinessWithUs/Engineering/EngineeringFiles.aspx

DISCLAIMER: It is the intent of the Corps of Engineers (CE) to provide quality construction based on U.S. construction standards. By regulation, the Middle East District (MED) has been mandated to use the metric system as the national system of measure. In some instances, English units of measure are still used within this manual. This use of English measurements shall not be construed as, nor constitute a waiver to the requirements to use metric units of measure. It is the sole responsibility of the designers or Architect-Engineer to verify and ensure conversion of all English units of measure to the appropriate metric unit of measure in accordance with Corps of Engineers Guide Specification 01415 entitled METRIC MEASUREMENTS.

CHAPTER COORDINATION RESPONSIBILITIES

CHAPTER	TITLE	SECTION
1	General Instructions	CETAM-DP-EP
2	Systems Administration	CETAM-DP-ET
3	Specifications	CETAM-DP-EP
4	Cost Estimating	CETAM-DP-ET
5	Programming	All Sections
6	Site Planning	CETAM-DP-EI
7	Architecture and Interior Design	CETAM-DP-EI
8	Structural	CETAM-DP-EI
9	Fire Protection and Life Safety	CETAM-DP-EB
10	Heating Ventilation and Air Conditioning	CETAM-DP-EB
11	Plumbing	CETAM-DP-EB
12	Special Mechanical Systems and Equipment	CETAN-DP-EB
13	Safety	All Sections
14	Electrical	CETAM-DP-EB
15	Power Generation	CETAM-DP-EB
16	Power Transmission and Distribution	CETAM-CE-EB
17	Communications	CETAM-DP-EB
18	Water, Waste water and Solid Waste Systems	CETAM-DP-EI
19	Renovation Design	CETAM-DP-EI
20	Corrosion Prevention and Control	CETAM EC-EI
21	Geotechnical	CETAM-DP-EI
22	Computer Assisted Design and Drafting	CETAM-DP-ET
23	Standard Procedures for Design of Minor Projects	All Sections
24	Cost Control During Design	CETAM-DP-ET
25	Force Protection	CETAM-DP-EI
26	SCIF Design	CETAM-DP-EI

MIDDLE EAST DISTRICT ENGINEERING ORGANIZATIONAL CHART

Chief of Engineering

(CETAM-DP-E)

Chief of Site and Building Design (CETAM-DP-EI) Architectural Engineering Interior Design Structural Engineering Civil Engineering Geotechnical Engineering	**Chief of Building Systems** (CETAM-DP-EB) Mechanical Engineering Fire Protection Engineering Electrical Engineering Communications Engineering
Chief of Contingency Standard Design (CETAM-DP-ES-C) Center of Standardization for Contingency Design (MCX-COS)	**Chief of Technical Services** (CETAM-DP-ET) Cost Engineering Specifications Construction Support Advanced Modeling
Chief of Special Projects (CETAM-DP-ES) Special Projects Value Engineering Design Quality Management	**Chief of Design Management** (CETAM-DP-ED) Design Management Design Scheduling
Chief of Planning (CETAM-DP-EP) Planning and Programming A-E Contracts Management Real Estate	

CHAPTER 1
GENERAL CONSIDERATIONS AND INSTRUCTIONS

CHAPTER 1

GENERAL CONSIDERATIONS AND INSTRUCTIONS

1.1. GENERAL

This manual prescribes general procedures and instructions required to program, design, and prepare specifications, drawings, design analyses, and cost estimates for projects under the responsibility of the U.S. Army Corps of Engineers (USACE), Middle East District. This manual shall be used under the direction of U.S. Army Corps of Engineers, Middle East District (CETAM) and will be a part of all Architect Engineer (A-E) contracts. Should this manual and the contract documents conflict, the contract will take precedence. Any conflicts between referenced documents in the contract documents and this manual excluding codes, this manual will take precedence. The PDT members (including A/E firms performing contract work) shall document each conflict in writing and bring it to the immediate attention of the CETAM Design Manager.

1.2. APPLICABLE PUBLICATIONS.

The current edition of the publications listed below, form a part of this manual.

ER 1110-1-8173	Energy Modeling and Life Cycle Cost Analysis
ER 1110-345-100	Design Policy for Military Construction
ER 1110-345-700	Design Analysis, Drawings, and Specifications
ER 1110-1-12	Engineering and Design Quality Management
ER 11-1-321	Value Engineering
ER 415-1-10	Construction, Contractor Submittal Procedures
ER 1110-34-1	Transportation Systems Mandatory Center of Expertise
ER 1110-345-721	Medical Facilities Mandatory Center of Expertise and Standardization
ER 1110-2-8163	Ballistic Missile Defense System Mandatory Center of Expertise
ER 1110-1-8174	Control System Cybersecurity Mandatory Center of Expertise
ER 1110-1-8167	Petroleum Oil and Lubricants Mandatory Center of Expertise
ER 1110-1-8169	Facilities Explosives Safety Mandatory Center of Expertise
ER 1110-1-8168	Inland Navigation Design Mandatory Center of Expertise
ER 415-345-38	Transfer and Acceptance of Military Real Property. ER 1110-345-720
OSHA-CFR, Title 29	Occupational Safety and Health Act. Chapter XVII, Parts 1910 & 1926.
USACE Project Management (Delivery) Business Plan (PDBP) Manual	
UFC 1-200-01	DoD Building Code
UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 1-202-01	Host Nation Facilities In Support Of Military Operations
USACE Army LEED® v4 Implementation Guide	

1.3. INSTRUCTIONS.

1.3.1. Assignment of Project and Design Manager. Program and Project delivery is the responsibility of the CETAM Programs and Project Management Division (CETAM-DP-P). The Project Manager (PM) is responsible for the day-to-day coordination and management of the project scope, budget, schedule and is the assigned point-of-contact for all customer matters.

Technical efforts associated with projects are managed by Engineering Division (CETAM-DP-E). Design Management Branch (CETAM-DP-ED) is responsible for delivery of Engineering Division's technical products necessary for project delivery. An assigned Design Manager (DM) leads the technical project delivery team (PDT) efforts and is the Engineering Division point-of-contact for all technical matters pertaining to the specific project. For work that is accomplished by contracted architect-engineering (A/E) resources, the DM is oftentimes the Contracting Officer Representative (COR) for that contract.

1.3.2. Conduct of Work. In the performance of Engineering work, the PDT shall:

- Perform the work diligently and aggressively, and promptly advise CETAM in writing of all significant developments.

- Prepare a summary, and promptly furnish a copy thereof to CETAM, of significant telephone conversations relating to the technical phases of work under the contract.

- Take appropriate measures to obtain clarification of design criteria requirements, to acquire all pertinent design information, and to incorporate such information in the work being performed.

- Cooperate fully with other firms, consultants and contractors performing work under the program to which this contract pertains, upon being advised by CETAM that such firms or individuals have a legitimate interest in the program, have need-to-know status, and proper security clearance where required.

1.3.3. Quality of Work. Middle East District's customers expect World Class quality products. Quality of design is governed by ER 1110-345-700, and ER 1110-345-100. Overall project quality is governed by ER 1110-1-12. Design quality is managed by a project's Quality Management Plan that includes its Design Quality Management Plan (both of which are a part of the Project Management Plan). Contract drawings and specifications must be sufficient to attract intelligent and competitive proposals or bids and to afford a clear understanding of the construction work required. Work must be organized in a manner that will assure thorough coordination between various details on drawings, between the various sections of the specifications, and between the drawings and specifications.

1.3.4. Design Priorities. The CETAM AOR is characteristically that of the Arabian Gulf, i.e., very high temperature, sparse rainfall, though high humidity is not unusual during the fall months; dust storms and haze are common in the summer. Other regions of the CETAM AOR may be characterized as high desert, mountainous, steppe, or Mediterranean. Regardless of location within the CETAM AOR, design considerations must address remote areas with harsh climates, limited or restricted supply of equipment, materials, and supplies. Successful designs will account for challenges in obtaining replacement parts through the incorporation of low-maintenance elements, necessitating the following design priorities:

- Projects must have a stated minimum useful life.
- Low maintenance materials and systems must be employed.
- Mechanical and electrical systems must be simple to operate and easy to maintain.
- Materials and building techniques must reflect the prevailing culture and industry of the project's location. That is, designs must be constructible, in accordance with the contract requirements, by the local workforce.
- Use of construction materials or techniques which are suitable for overseas work.
- Economical construction details; construction documents must be prepared in due consideration of local requirements and capabilities.
- Complete design.
- Explosives safety and fire protection requirements.

1.3.5. Designer of Record, and Qualified Designers. The following shall serve as minimum requirements for Registered Designers, including engineers and architects acting as Designer(s) of Record (DOR). All Design work shall be performed or supervised by the appropriate qualified designer.

Designers of Record shall be licensed and registered by any of the appropriate Professional Boards of the United States and its territories or equivalent recognized national or international body such as Européene d'Associations Nationales d'Ingénieurs.

Designers of Record shall stamp and sign design documents in accordance with Chapter 22: ADVANCED MODELING.

1.3.6. Design Specialists. Design Teams consist of designers, and technicians, each capable of performing the necessary design tasks necessary to successfully complete a project. The needs of the design team as they pertain to certain technical specialties are ascertained during the earliest stages of a project. Assembling the team is dependent upon the team's availability, capability, and the identified project needs. The services of design specialists may be required in the following specialties:

Stage/Theater Design	Landscape Design
Food Service Design	Irrigation Design (Horticultural)
Medical Design	Fire Protection
Acoustical Design	Interior Design
Educational Design	Physical Security
Telecommunications	Audio Visual, PA, TV, etc.
Geotechnical Design	Hardened Structures/Force Protection
Asbestos Abatement	X-Ray Shielding
EMF Shielding	SCIF Design
Marine Structures	Navigation and Dredging
Corrosion Mitigation	

The above list is a sample. Project requirements could necessitate the inclusion of other design discipline/specialties.

1.3.7. Value Engineering. Middle East District conducts its Value Engineering program in accordance with ER 11-1-321. A project's Value Management Plan is an integral part of the PMP and provides the basic directions regarding VE studies, tailored to the specific project. Designer PDT members contribute to VE studies.

1.3.8. Architectural Studies. The models, perspectives, and color renderings, both interior and exterior, necessary for a visual presentation to the user shall be determined on a project-by-project basis.

1.3.9. Engineering Studies. In addition to project design requirements discussed heretofore, the performance of special studies and the preparation of special estimates may be required.

1.3.10. Project Specific Criteria. Usually these criteria take the form of a Design Directive or a set of approved Basis of Design Documents. Both the Design Directive and the Basis of Design Documents are further described in Chapter 5: PROGRAMMING.

1.3.10.1. Design Directive. Design Directives in the context of this Manual are authorizations to execute design. A design directive may be issued to an in-house design PDT or to a contracted A/E firm. The design directive will include the Scope of Work, as well as pertinent requirements regarding quality and budget. In general, design products meeting or exceeding quality requirements will achieve the best balance between life-cycle cost, acceptable performance, and schedule. That is, CETAM design efforts align with the design-to-cost concept, where cost is a design constraint during the design and development phases and a management discipline throughout the life cycle of the project. Design-to-Cost is discussed in detail in Chapter 24 of this Manual.

The specific Design Directive will clearly indicate the required submittals associated with the respective design phase. The products of the Final design phase are documents completed for use in bidding, construction, and project management. During the Final design phase, two submissions of certain documents will be required for design review (Preliminary and Final reviews). Corrected documents will be provided in the Ready-to-Advertise submittal.

1.3.10.2. Topographic Surveys, Easements, and Utilities. Unless otherwise stated in the contract, CETAM will be responsible for detailed topographic mapping, available easements, and utility information for the project. Also see Chapter 22, paragraph 22.K.8 GIS Minimum Modeling Requirements.

1.3.10.3. Geotechnical Investigation. When required, geotechnical investigation, including subsurface explorations, sampling, field and laboratory testing, and water studies will be conducted by MED or the A-E. The results of geotechnical investigation will be contained in a geotechnical investigation report written by MED or the A-E, whichever applicable. Foundations and pavements and other Geotechnical related designs will be in accordance with the provisions of Chapter 8: STRUCTURAL, and Chapter 21: GEOTECHNICAL.

1.3.10.4. Cathodic Protection and Earth Resistance. Unless otherwise stated in the contract, the A-E will be responsible for determining whether cathodic protection on buried structures and underground utility systems are needed for special electrical grounding and counterpoise systems, and for gathering the field data necessary for design.

1.3.10.5. Water Supply and Quality Data. When specifically stated in the contract, CETAM will provide the A-E with water supply and water quality data. This data will include information on the locations and depths of all viable water supply sources at the sites involved and a water quantity and water quality analysis for each source. Water supply and treatment systems will be designed in accordance with the provisions of Chapter 18: WATER, WASTEWATER, AND SOLID WASTE SYSTEMS.

1.3.11. Design Phases. Design of USACE projects is conducted in accordance with ER 1110-345-100. CETAM design efforts typically comprise three (3) phases: the Programming phase (whose output includes charrette products); the Concept design phase; and the Final design phase. Depending on the Authorization, and more so on the specific Scope of Work, the design phases or stages may be referred to as the 15%, 35%, or 95%, respectively. It is not uncommon that an intermediate submittal, the 65% or Design Development phase submittal, is required.

1.3.12. Design Reviews. All design work will be subject to continuous review in accordance with the project's Quality Management Plan. Additionally, joint design review conferences with representation by all organizations having a direct interest in the items under review will be held.

1.3.12.1. Review Dates. The dates on which the joint review conferences will be held will be indicated in the design schedule. The documents representing the complete product associated that the pertinent design phase will be available when the review period commences. The Design Team Leader (the A-E, for contracted design work, or the DM, for in-house work) shall prepare minutes of all conferences and shall furnish copies to the PDT within 7 days after the conference.

1.3.12.2. Review Comments. Review comments are coordinated in accordance with ER 1110-1-8159 and the project's Design Quality Control Plan. Copies of the design review comments with the action taken on each comment noted, shall be included in all succeeding volumes of the design analysis.

1.3.13. Occupational Safety and Health Act. The facilities, systems, and equipment designed under this contract shall comply with the Occupational Safety and Health Act (OSHA), Code of Federal Regulations, Title 29, Chapter XVII, Parts 1910 and 1926. Any problems in incorporating these standards due to conflicts with other technical criteria shall be submitted to the CETAM Design Manager for resolution.

1.3.14. Asbestos Containing Materials.

1.3.14.1. New Designs. Asbestos containing material (ACM) will not be used in the design of new structures or systems. In the event no other material is available which will perform the required function or where the use of other material would be cost prohibitive, a waiver for the use of asbestos containing materials must be obtained in accordance with EM 385-1-1.

1.3.14.2. Existing Construction. Asbestos containing materials (ACM) presently included in existing construction to be rehabilitated or otherwise modified as a result of this project, shall be removed and a non-asbestos containing material substituted in lieu thereof. All such structures and systems shall be inspected to determine the presence or probable presence of ACM. When ACM is suspected, a documented survey will be performed. The survey will be developed into an abatement design and will be made a part of the design documents. In the event no other material is available which will perform the required function, or the use of a substitute material would be cost prohibitive due to initial cost and tear-out of existing construction, a waiver for the retention of the asbestos containing material must be obtained in accordance with EM 385-1-1.

1.3.15. LEED Requirements

1.3.15.1. US Projects. All vertical US Military projects shall be designed in accordance with the USACE Army LEED Army® v4 Implementation Guide. The design team shall provide the LEED spreadsheet showing how the facility can qualify for a LEED rating. This spreadsheet shall be included in the Design Analysis. The design team shall provide a written statement for any project where is unfeasible to meet a LEED rating stating the reason why the rating cannot be met. The CETAM Project Manager must approve this statement.

1.3.15.2. Non-US Projects. Project for foreign governments shall be addressed on a case-by-case basis for the implementation of LEED or other environmental requirements.

1.3.16. Applicable Codes, Guidance, Standards, and other References

1.3.16.1. US Projects. The governing code for all US MILCON projects is UFC 1-200-01, the DoD Building Code. Other sources for design guidance are described in the chapters to follow.

1.3.16.2. Non-US Projects. Unless specified otherwise, all non-US projects shall conform to UFC 1-202-01, as modified by UFC 1-200-01. When Host Nation sponsors require conformance with their building codes, however, that Host Nation's requirements should govern. The design team (in-house or A-E) is responsible for delivering design products in compliance with host nation building codes. A report recording such code compliance will be included in a project's design analysis.

1.3.17. Authorized Scope of Work for MILCON Projects

1.3.17.1. With enactment of the FY 13 National Defense Authorization Act, Title 10 U.S.C. Section 2853 was amended to clearly state that the scope of work for a military construction project or for the construction, improvement, and acquisition of a military family housing project may not be increased above the amount specified for that project in the justification data provided to Congress. The law was further amended to define "scope of work" as referring to the "function, size, or quantity of a facility or item of complete and useable infrastructure contained in the justification data provided to Congress as part of the request for the authorization of the project, construction, improvement, or acquisition." The justification data provided to Congress as part of the request for authorization of the project is the DD Form 1391 included in the President's Budget submission (refer to Chapter 5 PROGRAMMING).

1.3.17.2. Once final design authority is released by HQ USACE or our Host Nation Proponents, the installation/user and Project Delivery Team (PDT) do not have authority to deviate from the scope of the DD Form 1391. Scope deviations will be measured against the scope of distinct facilities (meaning each distinct facility line item) represented in Block 9 of the DD Form 1391. A Congressional notification will be required for increases to the scope beyond what is stated in the DD Form 1391 or decreases in scope greater than 25 percent for any distinct facility. Any single distinct facility line item that exceeds or is decreased by more than 25 percent will require completion of a Congressional notification of scope reduction before award can be authorized.

1.3.17.3. Project managers, designers and design teams are responsible and accountable for ensuring that plans and specifications, and request for proposal (RFP) documents define the government's requirements in a manner that does not exceed the authorized scope, meaning the function, size, or quantity of any distinct facility or item of infrastructure on the DD Form 1391. Architect-Engineer contracts will include a requirement to design within the authorized scope of work as described by the DD Form 1391. Design-build construction contracts must describe the Government's requirements within the authorized DD Form 1391 scope and shall require the contract to design within the authorized scope of work as described in the DD Form 1391.

1.3.17.4. Requirements to Document Designed Scope: As required by ER 1110-345-700, Appendix B, Part 1, paragraph 1.b. (2), the design analysis for projects within the scope shall include a detailed synopsis of the scope of work authorized under the DD Form 1391. In addition, each design analysis shall include:

1.3.17.4.1. Calculations and discussion for each distinct facility or item of infrastructure to document how scope of the design was calculated with references to the applicable regulations that prescribe how scope is calculated and measured.

1.3.17.4.2. Discussion and documentation demonstrating how the designed facility or item of infrastructure satisfies the authorized function and is within the authorized scope of work using the units of measure of the DD Form 1391.

1.3.17.4.3. Identification and analysis of any variations from the scope of the DD Form 1391, explaining why the full authorized scope of the project is not included in the design, and who approved the deviation. Providing less than the authorized scope of the project requires approval of the national program proponent.

1.3.17.5. Review Requirements to Verify Compliance with Authorized Scope: Design reviews after receipt of final design authority will include review of design scope to verify that each distinct facility or item of infrastructure is within the scope represented in the DD Form 1391. This assessment will include distinct facilities or items of infrastructure described both in Block 9 and elsewhere in the DD Form 1391.

1.4. DEFINITIONS.

1.4.1. Basis of Design. The Basis of Design results from the programming phase of project design and consists of certain documents which are described in Chapter 5: PROGRAMMING.

1.4.2. Charrette. An intensive process where designers, users, installation, and stakeholder/customer decision-makers team together to focus their input on the planning/definition and/or design of a specific project. The process involves the gathering of information and the definition of project requirements both in written and visual form, i.e., a Charrette Report or similar product.

1.4.3. Cost Estimates. The estimate of project cost. Cost estimate level of detail aligns with the design phase. Cost estimates are design products and are required submittals associated with each design phase submittal. Refer to Chapter 4, Cost Engineering.

1.4.4. Design Analysis. The design analysis is submitted for Concept, Preliminary, Final and RTA reviews. The design analysis is a written explanation of project design which is expanded and revised for each submission. The design analysis contains a summary of the Basis of Design; and the criteria for and the history of the project design, including criteria furnished by CETAM, letters, codes, references, conference minutes, and pertinent research. The design analysis contains analyses, such as life-cycle cost analyses, of at least three alternatives for each major building system and material and a constructability analysis. The justification of each major selection and design decision is stated clearly. Design calculations, computerized and manual, are included in the design analysis. Narrative descriptions of design solutions are also included. Written material may be illustrated by diagrams and sketches to convey design concepts. Catalog cuts and manufacturer's data for all equipment items shall be submitted. Copies of all previous design phase review comments and the actions assigned to them shall be included with each submission of the design analysis. Specific requirements for the design analysis, listed by submittal phase, are described in the chapters following.

1.4.5. Drawings. Drawings are a part of each submittal. The Basis of Design Drawings are described in Chapter 5: PROGRAMMING. The drawings submitted for concept review may or may not be used later as working drawings. In either case, the Concept drawings shall be complete, but not complicated by unnecessary detail. The Preliminary drawings are incomplete working drawings which shall be adequately labeled and cross-referenced for review. Complete, thoroughly checked and coordinated contract drawings shall be submitted for Final review. The drawings will be finalized by the incorporation of Preliminary design review comments. Specific drawing requirements are described in the chapters following. Additionally, Chapter 22: ADVANCED MODELING, contains drawing preparation requirements.

Design Analysis’, whether produced by in-house or contracted designers, is for internal use and may not be distributed to construction contractors without the written consent of the TAM Chief of Engineering.

1.4.6. Life-Cycle Cost (LCC) Analysis. Life-cycle costs are engineering economic studies which consider the potential economic impact of time on alternate systems, subsystems, and components over a given life cycle. A life-cycle cost analysis provides a means to determine the total cost of each alternate by considering not only the initial cost of construction but also the cost associated with operation and over a given life cycle. The life cycle cost analysis shall be developed in accordance with UFC 1-200-02, Life Cycle Costing Instructions".

1.4.7. Classification of Equipment and Furnishings. The following is a classification for equipment and furnishings that may be placed by the construction contractor, or other "Contractor Furnished Property (CFP)", or "Government Furnished-Contractor Installed (GFCI)" material and those items to be provided by the government, "Government Furnished Property (GFP)".

1.4.7.1.1. Class 1: Permanently fixed items with permanent utility connections, such as stoves, dishwashers, steam tables, light fixtures, wall switches, water chillers, air handling units, bridge cranes, pumps, electrical generators, transformers, and switchgear; and large fixed shop equipment such as automatic cutting machines, air compressors, jib cranes, large cleaning and plating tanks, and milling machines. Also included are repair parts and spare parts needed for their maintenance.

1.4.7.1.2. Class 2: Portable items with flexible or quick-disconnect utility connections, including office and household items such as typewriters, calculators, electric coffee pots, vacuum cleaners, table lamps, floor lamps, window air conditioner units, household refrigerators, and television sets; and shop equipment such as powered hand drills (electric and pneumatic), powered hand-held saws, air compressors, welding machines, oxyacetylene cutting and welding outfits, and paint sprayers. Also included are repair parts and spare parts needed for their maintenance.

1.4.7.1.3. Class 3: Movable items without utility connections, including office and household furnishings such as chairs, sofas, stands, desks, tables, rugs, beds, and shop equipment such as tool cabinets, work benches, storage racks, storage bins, storage shelves, bench mounted vises, hand powered trucks for handling compressed gas tanks, and A-frame cranes. These items usually have no repair parts and spare parts associated with them, but if they do, this class includes the repair parts and spare parts needed for their maintenance.

1.4.7.1.4. Class 4: Expendable and consumable items, including expendable's such as window curtains, shower curtains, bed linens, uniforms, clothing, brooms, wall mirrors, wall pictures, tableware, crystal ware, kitchen cutlery, cooking utensils, hand tools (pliers, screwdrivers, wrenches), mechanics tool kits, test equipment (small battery powered, hand held voltmeters and multimeters), and storage aids (plastic storage bins and shelf separators); and consumable's such as products with limited shelf life (medicines, chemicals, paints, and food), household supplies (soaps, cleansers, and ammonia solutions), office supplies, shop supplies (nuts, bolts, welding rods, fluxes, electrical tape), janitorial supplies (wiping cloths, paper towels, toilet paper, and oil absorbent sweeping materials). These items do not have repair parts or spare parts.

1.4.7.1.5. Class 5: Permanent powered facility rolling stock and related items, such as trucks automobiles, truck tractors and their trailers, field and garden tractors and their pulled or mounted equipment and attachments (gang lawn mowers, weed sprayers, rollers, harrows, rotary mowers and carts), tracked vehicles, locomotives and their rail cars, and forklifts. Also included are repair parts and spare parts needed for their maintenance.

1.4.7.1.6. Class 6: Construction support equipment and temporary buildings, such as graders, bulldozers, compactors, air compressors, asphalt plants, dump trucks, loaders, housing units, office units, and air conditioning units used in construction support or in mobilization operations as opposed to the end products of construction for the permanent facilities. Also included are repair parts and spare parts needed for their maintenance.

1.4.8. Specifications. Specifications define quality requirements for the construction portion of the project. They are prepared in accordance with ER 1110-345-700 and are discussed in detail in Chapter 3: SPECIFICATIONS.

1.4.9. Transfer and Acceptance of Military Real Property. shall be as required by paragraph 5b(1) of ER 415-345-38. The transfer of real property assets between Services or the non-US Customer is documented by the DD Form 1354. A draft 1354 is a required design product. The A-E's design team leader (for A-E contract work) or the DM (for in-house projects) is responsible for preparation of the draft 1354.

1.4.10. Engineering Considerations and Instructions to Field Personnel (ECIFP). Sometimes referred to as the “Guidance Memorandum,” the ECIFP is a brief document outlining the engineering considerations used to make design decisions. It includes the project discussions on the intent and why specific designs and materials were selected and any features requiring special attention but does not include the calculations and other professional engineering work products contained in the design analysis described in paragraph 1.4.4. The ECIFP is described in ER 1110-1-12.

1.4.10.1. This document also identifies unusual or critical design features and any direct involvement recommended by the designers during construction phase. This will be accomplished for all designs. The memorandum will identify and recommend involvement in certain phases of field inspection and will outline critical areas of the project where more than routine inspection is required. Topics which are anticipated to be covered in the guidance memorandum will be provided as early as possible in project development. At the concept design stage, the need for site visits by geotechnical personnel or other designers will be identified so that the costs can be incorporated into the Project Manager’s budget for the project. Each schedule design Submittal will be accompanied by a draft of the guidance memorandum. After completion of final design, during the RFP solicitation/advertisement period, the final guidance memorandum will be published. Project Managers will assure that field office and MED comments are obtained on the early drafts of the memorandum. Care must be taken to ensure that the memorandum addresses all unusual or critical items.

1.4.10.2. The ECIFP is the transition document from engineering to construction and is required to be published before Ready to Advertise (RTA). The Engineer of Record (Designer of Record) is responsible for providing the necessary input to the Design Manager; the in-house CETAM DM is responsible for the finalized ECIFP.

1.5. SUBMITTAL REQUIREMENTS.

The documents required for review at the completion of each design phase are generally described below. Specific submittal requirements that may contain additional project needs, are described in design requirements memoranda or the specific A-E contract or Task Order, as applicable. Detailed submittal requirements are in Chapters 3 through 19.

Additional Mandatory Centers of Expertise (MCX) reviews may also be required by the subject matter of the project. Consult the Engineering Regulations referenced in paragraph 1.2 for a listing of centers. For each applicable MCX, provide the entire design review set to the MCX at each review stage.

1.5.1. Programming Phase Submittal. The objective of the programming phase of the work is to prepare the Basis of Design, and charrette report(s) and other programming documentation. During this phase of the work the PDT will take an inventory of the existing conditions at each proposed site and of the human activities which will occur at the proposed project. The PDT will analyze these conditions and activities and will coordinate with the CETAM Project Manager to determine the goals, objectives and requirements for the proposed project.

1.5.1.1. The objective of the review for this phase is to evaluate the Basis of Design documents for compliance with USACE requirements outlined in Chapter 5: PROGRAMMING. The emphasis of this review is to ascertain that the PDT has established the most desirable functional relationships possible between the various project elements, the relationship of the project and its surrounding area, and to establish a tentative project budget. Verification that USACE master planning principals and procedures for sound planning and economic development of military installations/facilities were followed is also a required review outcome.

1.5.2. Concept Phase Submittal. The submittal for this design review shall be of sufficient detail (i.e., 35%) to show the user how his functional and technical requirements will be met, to indicate the PDT's approach to the solution of technical problems, to show compliance with the design criteria or to justify noncompliance, and to provide a valid estimate of cost and scope. At the 35% level, MILCON project scope and budget require validation, as described in Chapter 4 COST ENGINEERING.

1.5.3. Preliminary Review Submittal. The review of this submittal is to ensure that the contract documents, design analysis, and cost estimates are on schedule and that the design criteria and previous review comments are being correctly interpreted.

1.5.3.1. The draft specifications submitted for Preliminary review will be the marked-up, appropriately selected Unified Facilities Guide Specifications (UFGS) and any custom, project-specific sections not available from the UFGS templates, draft submittal register, draft Proposal Schedule, an index of the specification sections, and the identification of any aspects of the project that must be addressed in contract clauses to be prepared by CETAM's Contracting Division.

1.5.4. Final Review Submittal. The review of this submittal is to ensure that the design is complete and in accordance with the Basis of Design.

1.5.4.1. The design analysis submitted for Final review shall be in its final form. The design analysis shall include all backup material previously submitted and revised as necessary in accordance with review comments concurred-with previously. All design calculations shall be included. The design analysis shall contain all explanatory material giving the design rationale for any design decisions which would not be obvious to an engineer reviewing the final drawings and specifications. The annotated Design Checklist will be included and will be signed by the designers (A-E or in-house design personnel), verifying that each item on the list has been checked.

1.5.4.2. The contract drawings submitted for Final review shall include the drawings previously submitted which have been revised and completed as necessary. The PDT is expected to have completed incorporation of all constructability and coordination checks and have the drawings in a Ready-to-Advertise condition. The drawings shall be complete at this time, incorporating any design review comments generated by the Preliminary design review. The drawings shall contain all the details necessary to attract intelligent and competitive bids and to assure a clear understanding of the work throughout construction.

1.5.4.3. The specifications submitted for Final review shall be in final form, including all specification sections required for the design. A final Submittal Register, Proposal Schedule, and Index of the specifications sections will be included. The identification of any aspects of the project that must be addressed in the Contract Clauses to be used for the proposed project, shall also accompany this submittal.

1.5.4.4. Transfer and acceptance of military real property, i.e., the draft DD form 1354, submitted for final review shall be in its final form.

1.5.5. RTA Submittal. The A-E shall revise the Contract Drawings by incorporating the design review comments generated during the final design review, finalize the Contract Specifications, prepare a final Proposal Schedule, and update the Cost Estimate, finalize the Submittal Register and complete the construction schedule estimate/Network Analysis System or NAS (see Chapter 4, COST ENGINEERING) to Final status. The A-E shall return the copy of CETAM Review Comments with these documents. Note that the designers are responsible for amending the submittal if deficiencies are identified, or other clarifying revisions are required per accepted Bidder Inquiries during the advertisement period.

1.5.6. Award Set Document. At the end of the bidding and award process the designers will be notified through the appropriate CETAM Contracting Division personnel to assemble and provide an award set for the selected contractor and the CETAM Field Office. The assigned CETAM Design Manager is responsible for coordinating and delivery of the Award Set.

1.5.6.1. Drawings. All amendments shall be incorporated into the drawings package. The amendment triangles and bubbles shall be removed from all amended sheets to create a clean set. Both CAD and PDF files shall be provided Note: the individual designers are responsible for ensuring all amendments have been properly incorporated in this clean or "award" set.

1.5.6.2. Specifications. Specifications shall be provided as a clean copy with all underlines and strikeouts, and Amendments incorporated into the specifications. Both PDF and SPECSINTACT files shall be provided.

1.5.6.3. CAD Files. Digital CAD files and supporting documentation shall be submitted with the final design in accordance with Chapter 22: ADVANCED MODELING.

1.5.7. <u>Submittal Summary.</u> Figure 1 provides an overview of submittals associated with the design phases described above.

Figure 1. Submittal Summary

PHASE	PROGRAMMING 15%	CONCEPT 35%	PRELIMINARY - INTERMEDIATE- 65%	FINAL- 95%	RTA - CORRECTED FINAL- 100%
BASIS OF DESIGN	S				
CHARRETTE PRODUCTS	S				
DESIGN ANALYSIS[1]		S	R	R	
STATEMENT OF WORK/SCOPE OF WORK		S	R	R	R
PLANS/DRAWINGS	S	S[2]	R	R	R
SPECIFICATIONS[3]		S	R	R	R
COST ESTIMATE[4]	S	S	R	R	R
CONSTRUCTION SCHEDULE ESTIMATE (NAS)[5]		S	R	R	R
PROPOSAL SCHEDULE			S	R	R
DRAFT DD 1354				S	R
GFP CANDIDATE LIST			S	R	R

S = ORIGINAL SUBMITTAL R = UPDATED ORIGINAL SUBMITTAL

[1] For concept review, a narrative is provided which is "updated into the more mature design analysis as the design proceeds through the respective Design Phases.

[2] Drawings prepared post-15% generally do not build upon/update those developed for programming efforts.

[3] Refer to Chapter 3. The "index of specifications" is submitted at concept and referred to as "Outline Guide Specifications."

[4] Refer to Chapter 4

[5] Refer to Chapter 4

CHAPTER 1

GENERAL CONSIDERATIONS AND INSTRUCTIONS

1.1. GENERAL

This manual prescribes general procedures and instructions required to program, design, and prepare specifications, drawings, design analyses, and cost estimates for projects under the responsibility of the U.S. Army Corps of Engineers (USACE), Middle East District. This manual shall be used under the direction of U.S. Army Corps of Engineers, Middle East District (CETAM) and will be a part of all Architect Engineer (A-E) contracts. Should this manual and the contract documents conflict, the contract will take precedence. Any conflicts between referenced documents in the contract documents and this manual excluding codes, this manual will take precedence. The PDT members (including A/E firms performing contract work) shall document each conflict in writing and bring it to the immediate attention of the CETAM Design Manager.

1.2. APPLICABLE PUBLICATIONS.

The current edition of the publications listed below, form a part of this manual.

ER 1110-1-8173	Energy Modeling and Life Cycle Cost Analysis
ER 1110-345-100	Design Policy for Military Construction
ER 1110-345-700	Design Analysis, Drawings, and Specifications
ER 1110-1-12	Engineering and Design Quality Management
ER 11-1-321	Value Engineering
ER 415-1-10	Construction, Contractor Submittal Procedures
ER 1110-34-1	Transportation Systems Mandatory Center of Expertise
ER 1110-345-721	Medical Facilities Mandatory Center of Expertise and Standardization
ER 1110-2-8163	Ballistic Missile Defense System Mandatory Center of Expertise
ER 1110-1-8174	Control System Cybersecurity Mandatory Center of Expertise
ER 1110-1-8167	Petroleum Oil and Lubricants Mandatory Center of Expertise
ER 1110-1-8169	Facilities Explosives Safety Mandatory Center of Expertise
ER 1110-1-8168	Inland Navigation Design Mandatory Center of Expertise
ER 415-345-38	Transfer and Acceptance of Military Real Property. ER 1110-345-720
OSHA-CFR, Title 29	Occupational Safety and Health Act. Chapter XVII, Parts 1910 & 1926.
USACE Project Management (Delivery) Business Plan (PDBP) Manual	
UFC 1-200-01	DoD Building Code
UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 1-202-01	Host Nation Facilities In Support Of Military Operations
USACE Army LEED® v4 Implementation Guide	

1.3. INSTRUCTIONS.

1.3.1. Assignment of Project and Design Manager. Program and Project delivery is the responsibility of the CETAM Programs and Project Management Division (CETAM-DP-P). The Project Manager (PM) is responsible for the day-to-day coordination and management of the project scope, budget, schedule and is the assigned point-of-contact for all customer matters.

Technical efforts associated with projects are managed by Engineering Division (CETAM-DP-E). Design Management Branch (CETAM-DP-ED) is responsible for delivery of Engineering Division's technical products necessary for project delivery. An assigned Design Manager (DM) leads the technical project delivery team (PDT) efforts and is the Engineering Division point-of-contact for all technical matters pertaining to the specific project. For work that is accomplished by contracted architect-engineering (A/E) resources, the DM is oftentimes the Contracting Officer Representative (COR) for that contract.

1.3.2. Conduct of Work. In the performance of Engineering work, the PDT shall:

- Perform the work diligently and aggressively, and promptly advise CETAM in writing of all significant developments.
- Prepare a summary, and promptly furnish a copy thereof to CETAM, of significant telephone conversations relating to the technical phases of work under the contract.
- Take appropriate measures to obtain clarification of design criteria requirements, to acquire all pertinent design information, and to incorporate such information in the work being performed.
- Cooperate fully with other firms, consultants and contractors performing work under the program to which this contract pertains, upon being advised by CETAM that such firms or individuals have a legitimate interest in the program, have need-to-know status, and proper security clearance where required.

1.3.3. Quality of Work. Middle East District's customers expect World Class quality products. Quality of design is governed by ER 1110-345-700, and ER 1110-345-100. Overall project quality is governed by ER 1110-1-12. Design quality is managed by a project's Quality Management Plan that includes its Design Quality Management Plan (both of which are a part of the Project Management Plan). Contract drawings and specifications must be sufficient to attract intelligent and competitive proposals or bids and to afford a clear understanding of the construction work required. Work must be organized in a manner that will assure thorough coordination between various details on drawings, between the various sections of the specifications, and between the drawings and specifications.

1.3.4. Design Priorities. The CETAM AOR is characteristically that of the Arabian Gulf, i.e., very high temperature, sparse rainfall, though high humidity is not unusual during the fall months; dust storms and haze are common in the summer. Other regions of the CETAM AOR may be characterized as high desert, mountainous, steppe, or Mediterranean. Regardless of location within the CETAM AOR, design considerations must address remote areas with harsh climates, limited or restricted supply of equipment, materials, and supplies. Successful designs will account for challenges in obtaining replacement parts through the incorporation of low-maintenance elements, necessitating the following design priorities:

- Projects must have a stated minimum useful life.
- Low maintenance materials and systems must be employed.
- Mechanical and electrical systems must be simple to operate and easy to maintain.
- Materials and building techniques must reflect the prevailing culture and industry of the project's location. That is, designs must be constructible, in accordance with the contract requirements, by the local workforce.
- Use of construction materials or techniques which are suitable for overseas work.
- Economical construction details; construction documents must be prepared in due consideration of local requirements and capabilities.
- Complete design.
- Explosives safety and fire protection requirements.

1.3.5. <u>Designer of Record, and Qualified Designers.</u> The following shall serve as minimum requirements for Registered Designers, including engineers and architects acting as Designer(s) of Record (DOR). All Design work shall be performed or supervised by the appropriate qualified designer.

Designers of Record shall be licensed and registered by any of the appropriate Professional Boards of the United States and its territories or equivalent recognized national or international body such as Européene d'Associations Nationales d'Ingénieurs.

Designers of Record shall stamp and sign design documents in accordance with Chapter 22: ADVANCED MODELING.

1.3.6. <u>Design Specialists.</u> Design Teams consist of designers, and technicians, each capable of performing the necessary design tasks necessary to successfully complete a project. The needs of the design team as they pertain to certain technical specialties are ascertained during the earliest stages of a project. Assembling the team is dependent upon the team's availability, capability, and the identified project needs. The services of design specialists may be required in the following specialties:

Stage/Theater Design	Landscape Design
Food Service Design	Irrigation Design (Horticultural)
Medical Design	Fire Protection
Acoustical Design	Interior Design
Educational Design	Physical Security
Telecommunications	Audio Visual, PA, TV, etc.
Geotechnical Design	Hardened Structures/Force Protection
Asbestos Abatement	X-Ray Shielding
EMF Shielding	SCIF Design
Marine Structures	Navigation and Dredging
Corrosion Mitigation	

The above list is a sample. Project requirements could necessitate the inclusion of other design discipline/specialties.

1.3.7. Value Engineering. Middle East District conducts its Value Engineering program in accordance with ER 11-1-321. A project's Value Management Plan is an integral part of the PMP and provides the basic directions regarding VE studies, tailored to the specific project. Designer PDT members contribute to VE studies.

1.3.8. Architectural Studies. The models, perspectives, and color renderings, both interior and exterior, necessary for a visual presentation to the user shall be determined on a project-by-project basis.

1.3.9. Engineering Studies. In addition to project design requirements discussed heretofore, the performance of special studies and the preparation of special estimates may be required.

1.3.10. Project Specific Criteria. Usually these criteria take the form of a Design Directive or a set of approved Basis of Design Documents. Both the Design Directive and the Basis of Design Documents are further described in Chapter 5: PROGRAMMING.

1.3.10.1. Design Directive. Design Directives in the context of this Manual are authorizations to execute design. A design directive may be issued to an in-house design PDT or to a contracted A/E firm. The design directive will include the Scope of Work, as well as pertinent requirements regarding quality and budget. In general, design products meeting or exceeding quality requirements will achieve the best balance between life-cycle cost, acceptable performance, and schedule. That is, CETAM design efforts align with the design-to-cost concept, where cost is a design constraint during the design and development phases and a management discipline throughout the life cycle of the project. Design-to-Cost is discussed in detail in Chapter 24 of this Manual.

The specific Design Directive will clearly indicate the required submittals associated with the respective design phase. The products of the Final design phase are documents completed for use in bidding, construction, and project management. During the Final design phase, two submissions of certain documents will be required for design review (Preliminary and Final reviews). Corrected documents will be provided in the Ready-to-Advertise submittal.

1.3.10.2. Topographic Surveys, Easements, and Utilities. Unless otherwise stated in the contract, CETAM will be responsible for detailed topographic mapping, available easements, and utility information for the project. Also see Chapter 22, paragraph 22.K.8 GIS Minimum Modeling Requirements.

1.3.10.3. Geotechnical Investigation. When required, geotechnical investigation, including subsurface explorations, sampling, field and laboratory testing, and water studies will be conducted by MED or the A-E. The results of geotechnical investigation will be contained in a geotechnical investigation report written by MED or the A-E, whichever applicable. Foundations and pavements and other Geotechnical related designs will be in accordance with the provisions of Chapter 8: STRUCTURAL, and Chapter 21: GEOTECHNICAL.

1.3.10.4. Cathodic Protection and Earth Resistance. Unless otherwise stated in the contract, the A-E will be responsible for determining whether cathodic protection on buried structures and underground utility systems are needed for special electrical grounding and counterpoise systems, and for gathering the field data necessary for design.

1.3.10.5. Water Supply and Quality Data. When specifically stated in the contract, CETAM will provide the A-E with water supply and water quality data. This data will include information on the locations and depths of all viable water supply sources at the sites involved and a water quantity and water quality analysis for each source. Water supply and treatment systems will be designed in accordance with the provisions of Chapter 18: WATER, WASTEWATER, AND SOLID WASTE SYSTEMS.

1.3.11. <u>Design Phases.</u> Design of USACE projects is conducted in accordance with ER 1110-345-100. CETAM design efforts typically comprise three (3) phases: the Programming phase (whose output includes charrette products); the Concept design phase; and the Final design phase. Depending on the Authorization, and more so on the specific Scope of Work, the design phases or stages may be referred to as the 15%, 35%, or 95%, respectively. It is not uncommon that an intermediate submittal, the 65% or Design Development phase submittal, is required.

1.3.12. <u>Design Reviews.</u> All design work will be subject to continuous review in accordance with the project's Quality Management Plan. Additionally, joint design review conferences with representation by all organizations having a direct interest in the items under review will be held.

1.3.12.1. Review Dates. The dates on which the joint review conferences will be held will be indicated in the design schedule. The documents representing the complete product associated that the pertinent design phase will be available when the review period commences. The Design Team Leader (the A-E, for contracted design work, or the DM, for in-house work) shall prepare minutes of all conferences and shall furnish copies to the PDT within 7 days after the conference.

1.3.12.2. Review Comments. Review comments are coordinated in accordance with ER 1110-1-8159 and the project's Design Quality Control Plan. Copies of the design review comments with the action taken on each comment noted, shall be included in all succeeding volumes of the design analysis.

1.3.13. Occupational Safety and Health Act. The facilities, systems, and equipment designed under this contract shall comply with the Occupational Safety and Health Act (OSHA), Code of Federal Regulations, Title 29, Chapter XVII, Parts 1910 and 1926. Any problems in incorporating these standards due to conflicts with other technical criteria shall be submitted to the CETAM Design Manager for resolution.

1.3.14. Asbestos Containing Materials.

1.3.14.1. New Designs. Asbestos containing material (ACM) will not be used in the design of new structures or systems. In the event no other material is available which will perform the required function or where the use of other material would be cost prohibitive, a waiver for the use of asbestos containing materials must be obtained in accordance with EM 385-1-1.

1.3.14.2. Existing Construction. Asbestos containing materials (ACM) presently included in existing construction to be rehabilitated or otherwise modified as a result of this project, shall be removed and a non-asbestos containing material substituted in lieu thereof. All such structures and systems shall be inspected to determine the presence or probable presence of ACM. When ACM is suspected, a documented survey will be performed. The survey will be developed into an abatement design and will be made a part of the design documents. In the event no other material is available which will perform the required function, or the use of a substitute material would be cost prohibitive due to initial cost and tear-out of existing construction, a waiver for the retention of the asbestos containing material must be obtained in accordance with EM 385-1-1.

1.3.15. LEED Requirements

1.3.15.1. US Projects. All vertical US Military projects shall be designed in accordance with the USACE Army LEED Army® v4 Implementation Guide. The design team shall provide the LEED spreadsheet showing how the facility can qualify for a LEED rating. This spreadsheet shall be included in the Design Analysis. The design team shall provide a written statement for any project where is unfeasible to meet a LEED rating stating the reason why the rating cannot be met. The CETAM Project Manager must approve this statement.

1.3.15.2. Non US Projects. Project for foreign governments shall be addressed on a case-by-case basis for the implementation of LEED or other environmental requirements.

1.3.16. Applicable Codes, Guidance, Standards, and other References

1.3.16.1. US Projects. The governing code for all US MILCON projects is UFC 1-200-01, the DoD Building Code. Other sources for design guidance are described in the chapters to follow.

1.3.16.2. Non-US Projects. Unless specified otherwise, all non-US projects shall conform to UFC 1-202-01, as modified by UFC 1-200-01. When Host Nation sponsors require conformance with their building codes, however, that Host Nation's requirements should govern. The design team (in-house or A-E) is responsible for delivering design products in compliance with host nation building codes. A report recording such code compliance will be included in a project's design analysis.

1.3.17. Authorized Scope of Work for MILCON Projects

1.3.17.1. With enactment of the FY 13 National Defense Authorization Act, Title 10 U.S.C. Section 2853 was amended to clearly state that the scope of work for a military construction project or for the construction, improvement, and acquisition of a military family housing project may not be increased above the amount specified for that project in the justification data provided to Congress. The law was further amended to define “scope of work” as referring to the “function, size, or quantity of a facility or item of complete and useable infrastructure contained in the justification data provided to Congress as part of the request for the authorization of the project, construction, improvement, or acquisition.” The justification data provided to Congress as part of the request for authorization of the project is the DD Form 1391 included in the President’s Budget submission (refer to Chapter 5 PROGRAMMING).

1.3.17.2. Once final design authority is released by HQ USACE or our Host Nation Proponents, the installation/user and Project Delivery Team (PDT) do not have authority to deviate from the scope of the DD Form 1391. Scope deviations will be measured against the scope of distinct facilities (meaning each distinct facility line item) represented in Block 9 of the DD Form 1391. A Congressional notification will be required for increases to the scope beyond what is stated in the DD Form 1391 or decreases in scope greater than 25 percent for any distinct facility. Any single distinct facility line item that exceeds or is decreased by more than 25 percent will require completion of a Congressional notification of scope reduction before award can be authorized.

1.3.17.3. Project managers, designers and design teams are responsible and accountable for ensuring that plans and specifications, and request for proposal (RFP) documents define the government’s requirements in a manner that does not exceed the authorized scope, meaning the function, size, or quantity of any distinct facility or item of infrastructure on the DD Form 1391. Architect-Engineer contracts will include a requirement to design within the authorized scope of work as described by the DD Form 1391. Design-build construction contracts must describe the Government’s requirements within the authorized DD Form 1391 scope and shall require the contract to design within the authorized scope of work as described in the DD Form 1391.

1.3.17.4. Requirements to Document Designed Scope: As required by ER 1110-345-700, Appendix B, Part 1, paragraph 1.b. (2), the design analysis for projects within the scope shall include a detailed synopsis of the scope of work authorized under the DD Form 1391. In addition, each design analysis shall include:

1.3.17.4.1. Calculations and discussion for each distinct facility or item of infrastructure to document how scope of the design was calculated with references to the applicable regulations that prescribe how scope is calculated and measured.

1.3.17.4.2. Discussion and documentation demonstrating how the designed facility or item of infrastructure satisfies the authorized function and is within the authorized scope of work using the units of measure of the DD Form 1391.

1.3.17.4.3. Identification and analysis of any variations from the scope of the DD Form 1391, explaining why the full authorized scope of the project is not included in the design, and who approved the deviation. Providing less than the authorized scope of the project requires approval of the national program proponent.

1.3.17.5. Review Requirements to Verify Compliance with Authorized Scope: Design reviews after receipt of final design authority will include review of design scope to verify that each distinct facility or item of infrastructure is within the scope represented in the DD Form 1391. This assessment will include distinct facilities or items of infrastructure described both in Block 9 and elsewhere in the DD Form 1391.

1.4. DEFINITIONS.

1.4.1. Basis of Design. The Basis of Design results from the programming phase of project design and consists of certain documents which are described in Chapter 5: PROGRAMMING.

1.4.2. Charrette. An intensive process where designers, users, installation, and stakeholder/customer decision-makers team together to focus their input on the planning/definition and/or design of a specific project. The process involves the gathering of information and the definition of project requirements both in written and visual form, i.e., a Charrette Report or similar product.

1.4.3. Cost Estimates. The estimate of project cost. Cost estimate level of detail aligns with the design phase. Cost estimates are design products and are required submittals associated with each design phase submittal. Refer to Chapter 4, Cost Engineering.

1.4.4. Design Analysis. The design analysis is submitted for Concept, Preliminary, Final and RTA reviews. The design analysis is a written explanation of project design which is expanded and revised for each submission. The design analysis contains a summary of the Basis of Design; and the criteria for and the history of the project design, including criteria furnished by CETAM, letters, codes, references, conference minutes, and pertinent research. The design analysis contains analyses, such as life-cycle cost analyses, of at least three alternatives for each major building system and material and a constructability analysis. The justification of each major selection and design decision is stated clearly. Design calculations, computerized and manual, are included in the design analysis. Narrative descriptions of design solutions are also included. Written material may be illustrated by diagrams and sketches to convey design concepts. Catalog cuts and manufacturer's data for all equipment items shall be submitted. Copies of all previous design phase review comments and the actions assigned to them shall be included with each submission of the design analysis. Specific requirements for the design analysis, listed by submittal phase, are described in the chapters following.

1.4.5. Drawings. Drawings are a part of each submittal. The Basis of Design Drawings are described in Chapter 5: PROGRAMMING. The drawings submitted for concept review may or may not be used later as working drawings. In either case, the Concept drawings shall be complete, but not complicated by unnecessary detail. The Preliminary drawings are incomplete working drawings which shall be adequately labeled and cross-referenced for review. Complete, thoroughly checked and coordinated contract drawings shall be submitted for Final review. The drawings will be finalized by the incorporation of Preliminary design review comments. Specific drawing requirements are described in the chapters following. Additionally, Chapter 22: ADVANCED MODELING, contains drawing preparation requirements.

Design Analysis', whether produced by in-house or contracted designers, is for internal use and may not be distributed to construction contractors without the written consent of the TAM Chief of Engineering.

1.4.6. Life-Cycle Cost (LCC) Analysis. Life-cycle costs are engineering economic studies which consider the potential economic impact of time on alternate systems, subsystems, and components over a given life cycle. A life-cycle cost analysis provides a means to determine the total cost of each alternate by considering not only the initial cost of construction but also the cost associated with operation and over a given life cycle. The life cycle cost analysis shall be developed in accordance with UFC 1-200-02, Life Cycle Costing Instructions".

1.4.7. Classification of Equipment and Furnishings. The following is a classification for equipment and furnishings that may be placed by the construction contractor, or other "Contractor Furnished Property (CFP)", or "Government Furnished-Contractor Installed (GFCI)" material and those items to be provided by the government, "Government Furnished Property (GFP)".

1.4.7.1.1. Class 1: Permanently fixed items with permanent utility connections, such as stoves, dishwashers, steam tables, light fixtures, wall switches, water chillers, air handling units, bridge cranes, pumps, electrical generators, transformers, and switchgear; and large fixed shop equipment such as automatic cutting machines, air compressors, jib cranes, large cleaning and plating tanks, and milling machines. Also included are repair parts and spare parts needed for their maintenance.

1.4.7.1.2. Class 2: Portable items with flexible or quick-disconnect utility connections, including office and household items such as typewriters, calculators, electric coffee pots, vacuum cleaners, table lamps, floor lamps, window air conditioner units, household refrigerators, and television sets; and shop equipment such as powered hand drills (electric and pneumatic), powered hand-held saws, air compressors, welding machines, oxyacetylene cutting and welding outfits, and paint sprayers. Also included are repair parts and spare parts needed for their maintenance.

1.4.7.1.3. Class 3: Movable items without utility connections, including office and household furnishings such as chairs, sofas, stands, desks, tables, rugs, beds, and shop equipment such as tool cabinets, work benches, storage racks, storage bins, storage shelves, bench mounted vises, hand powered trucks for handling compressed gas tanks, and A-frame cranes. These items usually have no repair parts and spare parts associated with them, but if they do, this class includes the repair parts and spare parts needed for their maintenance.

1.4.7.1.4. Class 4: Expendable and consumable items, including expendable's such as window curtains, shower curtains, bed linens, uniforms, clothing, brooms, wall mirrors, wall pictures, tableware, crystal ware, kitchen cutlery, cooking utensils, hand tools (pliers, screwdrivers, wrenches), mechanics tool kits, test equipment (small battery powered, hand held voltmeters and multimeters), and storage aids (plastic storage bins and shelf separators); and consumable's such as products with limited shelf life (medicines, chemicals, paints, and food), household supplies (soaps, cleansers, and ammonia solutions), office supplies, shop supplies (nuts, bolts, welding rods, fluxes, electrical tape), janitorial supplies (wiping cloths, paper towels, toilet paper, and oil absorbent sweeping materials). These items do not have repair parts or spare parts.

1.4.7.1.5. Class 5: Permanent powered facility rolling stock and related items, such as trucks automobiles, truck tractors and their trailers, field and garden tractors and their pulled or mounted equipment and attachments (gang lawn mowers, weed sprayers, rollers, harrows, rotary mowers and carts), tracked vehicles, locomotives and their rail cars, and forklifts. Also included are repair parts and spare parts needed for their maintenance.

1.4.7.1.6. Class 6: Construction support equipment and temporary buildings, such as graders, bulldozers, compactors, air compressors, asphalt plants, dump trucks, loaders, housing units, office units, and air conditioning units used in construction support or in mobilization operations as opposed to the end products of construction for the permanent facilities. Also included are repair parts and spare parts needed for their maintenance.

1.4.8. Specifications. Specifications define quality requirements for the construction portion of the project. They are prepared in accordance with ER 1110-345-700 and are discussed in detail in Chapter 3: SPECIFICATIONS.

1.4.9. Transfer and Acceptance of Military Real Property. shall be as required by paragraph 5b(1) of ER 415-345-38. The transfer of real property assets between Services or the non-US Customer is documented by the DD Form 1354. A draft 1354 is a required design product. The A-E's design team leader (for A-E contract work) or the DM (for in-house projects) is responsible for preparation of the draft 1354.

1.4.10. Engineering Considerations and Instructions to Field Personnel (ECIFP). Sometimes referred to as the “Guidance Memorandum,” the ECIFP is a brief document outlining the engineering considerations used to make design decisions. It includes the project discussions on the intent and why specific designs and materials were selected and any features requiring special attention but does not include the calculations and other professional engineering work products contained in the design analysis described in paragraph 1.4.4. The ECIFP is described in ER 1110-1-12.

1.4.10.1. This document also identifies unusual or critical design features and any direct involvement recommended by the designers during construction phase. This will be accomplished for all designs. The memorandum will identify and recommend involvement in certain phases of field inspection and will outline critical areas of the project where more than routine inspection is required. Topics which are anticipated to be covered in the guidance memorandum will be provided as early as possible in project development. At the concept design stage, the need for site visits by geotechnical personnel or other designers will be identified so that the costs can be incorporated into the Project Manager’s budget for the project. Each schedule design Submittal will be accompanied by a draft of the guidance memorandum. After completion of final design, during the RFP solicitation/advertisement period, the final guidance memorandum will be published. Project Managers will assure that field office and MED comments are obtained on the early drafts of the memorandum. Care must be taken to ensure that the memorandum addresses all unusual or critical items.

1.4.10.2. The ECIFP is the transition document from engineering to construction and is required to be published before Ready to Advertise (RTA). The Engineer of Record (Designer of Record) is responsible for providing the necessary input to the Design Manager; the in-house CETAM DM is responsible for the finalized ECIFP.

1.5. SUBMITTAL REQUIREMENTS.

The documents required for review at the completion of each design phase are generally described below. Specific submittal requirements that may contain additional project needs, are described in design requirements memoranda or the specific A-E contract or Task Order, as applicable. Detailed submittal requirements are in Chapters 3 through 19.

Additional Mandatory Centers of Expertise (MCX) reviews may also be required by the subject matter of the project. Consult the Engineering Regulations referenced in paragraph 1.2 for a listing of centers. For each applicable MCX, provide the entire design review set to the MCX at each review stage.

1.5.1. Programming Phase Submittal. The objective of the programming phase of the work is to prepare the Basis of Design, and charrette report(s) and other programming documentation. During this phase of the work the PDT will take an inventory of the existing conditions at each proposed site and of the human activities which will occur at the proposed project. The PDT will analyze these conditions and activities and will coordinate with the CETAM Project Manager to determine the goals, objectives and requirements for the proposed project.

1.5.1.1. The objective of the review for this phase is to evaluate the Basis of Design documents for compliance with USACE requirements outlined in Chapter 5: PROGRAMMING. The emphasis of this review is to ascertain that the PDT has established the most desirable functional relationships possible between the various project elements, the relationship of the project and its surrounding area, and to establish a tentative project budget. Verification that USACE master planning principals and procedures for sound planning and economic development of military installations/facilities were followed is also a required review outcome.

1.5.2. Concept Phase Submittal. The submittal for this design review shall be of sufficient detail (i.e., 35%) to show the user how his functional and technical requirements will be met, to indicate the PDT's approach to the solution of technical problems, to show compliance with the design criteria or to justify noncompliance, and to provide a valid estimate of cost and scope. At the 35% level, MILCON project scope and budget require validation, as described in Chapter 4 COST ENGINEERING.

1.5.3. Preliminary Review Submittal. The review of this submittal is to ensure that the contract documents, design analysis, and cost estimates are on schedule and that the design criteria and previous review comments are being correctly interpreted.

1.5.3.1. The draft specifications submitted for Preliminary review will be the marked-up, appropriately selected Unified Facilities Guide Specifications (UFGS) and any custom, project-specific sections not available from the UFGS templates, draft submittal register, draft Proposal Schedule, an index of the specification sections, and the identification of any aspects of the project that must be addressed in contract clauses to be prepared by CETAM's Contracting Division.

1.5.4. Final Review Submittal. The review of this submittal is to ensure that the design is complete and in accordance with the Basis of Design.

1.5.4.1. The design analysis submitted for Final review shall be in its final form. The design analysis shall include all backup material previously submitted and revised as necessary in accordance with review comments concurred-with previously. All design calculations shall be included. The design analysis shall contain all explanatory material giving the design rationale for any design decisions which would not be obvious to an engineer reviewing the final drawings and specifications. The annotated Design Checklist will be included and will be signed by the designers (A-E or in-house design personnel), verifying that each item on the list has been checked.

1.5.4.2. The contract drawings submitted for Final review shall include the drawings previously submitted which have been revised and completed as necessary. The PDT is expected to have completed incorporation of all constructability and coordination checks and have the drawings in a Ready-to-Advertise condition. The drawings shall be complete at this time, incorporating any design review comments generated by the Preliminary design review. The drawings shall contain all the details necessary to attract intelligent and competitive bids and to assure a clear understanding of the work throughout construction.

1.5.4.3. The specifications submitted for Final review shall be in final form, including all specification sections required for the design. A final Submittal Register, Proposal Schedule, and Index of the specifications sections will be included. The identification of any aspects of the project that must be addressed in the Contract Clauses to be used for the proposed project, shall also accompany this submittal.

1.5.4.4. Transfer and acceptance of military real property, i.e., the draft DD form 1354, submitted for final review shall be in its final form.

1.5.5. RTA Submittal. The A-E shall revise the Contract Drawings by incorporating the design review comments generated during the final design review, finalize the Contract Specifications, prepare a final Proposal Schedule, and update the Cost Estimate, finalize the Submittal Register and complete the construction schedule estimate/Network Analysis System or NAS (see Chapter 4, COST ENGINEERING) to Final status. The A-E shall return the copy of CETAM Review Comments with these documents. Note that the designers are responsible for amending the submittal if deficiencies are identified, or other clarifying revisions are required per accepted Bidder Inquiries during the advertisement period.

1.5.6. Award Set Document. At the end of the bidding and award process the designers will be notified through the appropriate CETAM Contracting Division personnel to assemble and provide an award set for the selected contractor and the CETAM Field Office. The assigned CETAM Design Manager is responsible for coordinating and delivery of the Award Set.

1.5.6.1. Drawings. All amendments shall be incorporated into the drawings package. The amendment triangles and bubbles shall be removed from all amended sheets to create a clean set. Both CAD and PDF files shall be provided Note: the individual designers are responsible for ensuring all amendments have been properly incorporated in this clean or "award" set.

1.5.6.2. Specifications. Specifications shall be provided as a clean copy with all underlines and strikeouts, and Amendments incorporated into the specifications. Both PDF and SPECSINTACT files shall be provided.

1.5.6.3. CAD Files. Digital CAD files and supporting documentation shall be submitted with the final design in accordance with Chapter 22: ADVANCED MODELING.

1.5.7. <u>Submittal Summary.</u> Figure 1 provides an overview of submittals associated with the design phases described above.

Figure 1. Submittal Summary

PHASE	PROGRAMMING 15%	CONCEPT 35%	PRELIMINARY - INTERMEDIATE- 65%	FINAL- 95%	RTA - CORRECTED FINAL- 100%
BASIS OF DESIGN	S				
CHARRETTE PRODUCTS	S				
DESIGN ANALYSIS[1]		S	R	R	
STATEMENT OF WORK/SCOPE OF WORK		S	R	R	R
PLANS/DRAWINGS	S	S[2]	R	R	R
SPECIFICATIONS[3]		S	R	R	R
COST ESTIMATE[4]	S	S	R	R	R
CONSTRUCTION SCHEDULE ESTIMATE (NAS)[5]		S	R	R	R
PROPOSAL SCHEDULE			S	R	R
DRAFT DD 1354				S	R
GFP CANDIDATE LIST			S	R	R

S = ORIGINAL SUBMITTAL R = UPDATED ORIGINAL SUBMITTAL

[1] For concept review, a narrative is provided which is "updated into the more mature design analysis as the design proceeds through the respective Design Phases.

[2] Drawings prepared post-15% generally do not build upon/update those developed for programming efforts.

[3] Refer to Chapter 3. The "index of specifications" is submitted at concept and referred to as "Outline Guide Specifications."

[4] Refer to Chapter 4

[5] Refer to Chapter 4

CHAPTER 2
MANAGEMENT OF ENGINEERING PROJECT CONTENT, PRESENTATION OF DATA, AND DESIGN QUALITY

CHAPTER 2

2.1 GENERAL.

The purpose of this chapter is to present the general requirements for Middle East District design submittals products. These products typically comprise Drawings, Specifications, Construction Estimates, Design Analysis as well as Construction Estimates, Operation and Maintenance manuals supporting engineering, construction, and, planning and programming efforts.

2.2 MANAGEMENT AND DELIVERY OF ENGINEERING PROJECT CONTENT

2.2.1 Electronic Delivery. Unless required by specific customer request and/or contract requirement, all design product submittals, regardless of source, must be in electronic format only, delivered to the DM and/or the COR (for A/E-delivered design products).

2.2.1.1 It is a USACE HQ requirement that all USACE districts and USACE Mandatory Centers of Expertise utilize the USACE ProjectWise system to file, transport and synchronize project files.

2.2.1.2 For customers outside the USACE and DoD networks the preferred delivery method for CUI (Controlled Unclassified Information) or lower designated design documents is the DoD SAFE system located at: https://safe.apps.mil/. The system works best with file sizes below 500MB.

2.2.1.3 The CETAM ProjectWise system is not available for access outside certified DoD networks. ProjectWise systems external to the DoD may be utilized by contractors to receive and deliver work products to the USACE provided the servers operate on a secure web server.

2.2.2 Electronic Filing. TAM PDTs are responsible for ensuring that project work products are uploaded/input to ProjectWise. Middle East District manages engineering project content using the ProjectWise system.

2.2.2.1 The CETAM ProjectWise system has a specific folder structure that is organized on a by-country, and by-project basis. Folders for working files, and reviews as provided on a per-project basis.

2.2.2.2. ProjectWise File System. Internal administration and use of the CETAM ProjectWise system is in accordance with the Transatlantic Division (TAD) Quality Management System (QMS) ProjectWise process. Administration of ProjectWise is a CETAM-Internal process that is outside the scope of this Design Instructions Manual.

2.2.3 Electronic File Formats

2.2.3.1 All engineering project files should be maintained and filed in the native electronic format in which they were originally produced, for future reference and manipulation.

2.2.3.2 All electronic files conveyed for review and contracting actions, unless otherwise requested, should be conveyed in portable document format (PDF), to the greatest extent possible. Upon opening, the view of .pdf documents shall conform to the following settings:

a. Bookmarks linked to major chapters/sections/individual drawings must be provided.
b. Set View > Show/Hide > Navigation Panes > Bookmarks.
c. Set View > Zoom To > Magnification > Fit Page
d. Users of .pdf documents produced from this effort shall have the ability to extract pages and sections of text from the document.

2.2.3.3 Note that the term “bound” in the context of a deliverable/product is synonymous with “electronic volume” and refers to a document or set of documents assembled into a single electronic file.

2.3 PRESENTATION OF DATA

2.3.1 <u>Design Analysis</u>.

2.3.1.2 Media and Format. The design analysis shall be presented in 8-1/2 by 11-inch form factor except that larger sheet sizes may be used when required for graphs or other special calculation forms. All volumes and sheets shall be in a print-ready, reproducible form, allowing paper copies to be created on standard printers without individualized adjustments beyond 2-sided printing. When they are voluminous, they shall be split from the narrative part of the design analysis into separately bound parts no larger than 200 sheets, double-sided. The material may be typewritten, hand lettered, handwritten, or a combination thereof, provided it is legible, includes page numbers, and that the finalized product is delivered in electronic (.pdf) format. Each page shall list the project title, P2 number and task order number if applicable. Side margins shall be 1-inch minimum to permit side binding and head-to-head printing. Bottom margins shall be 1-1/4-inches, with page numbers centered 1 inch from the bottom.

2.3.1.3 Organization. The several parts and sheets of the design analysis shall be given a sequential binding-number and bound under a cover indicating the name of the facility and project number, if applicable. The title page shall carry the designation of the submittal being made. The complete design analysis presented for final review with the final drawings and specifications shall carry the designation "FINAL DESIGN ANALYSIS" on the title page.

2.3.1.4 Design Calculations. Design calculations are a part of the design analysis. The design calculations shall be presented in a clean and legible form incorporating a title page and index for each volume. A table of contents, which shall be an index of the indices, shall be furnished when there is more than one volume. The source for design conditions, supplementary sketches, graphs, formula, and references shall be identified. Assumptions and conclusions shall be explained. Calculation sheets shall carry the names or initials of the computer (i.e., person who performed the calculations) and the checker and the dates of calculations and checking. No portion of the calculations shall be computed and checked by the same person.

2.3.1.5 Design Checklists. Where provided by TAM, checklists for each discipline shall be utilized to verify that historical lessons learned have been incorporated into the project design. Checklists shall be included in the design analysis volumes and be marked with the date and signatures or initials of the engineer completing the list.

2.3.1.6 Independent Technical Review (ITR). In-house and Contracted A/E design teams must document and incorporate independent reviews (review by someone other than Designer/Design Engineer) of all drawings, specifications, and other required data prior to each scheduled design review. This review is for the purposes of eliminating errors, interferences, and inconsistencies, and of incorporating design criteria, review comments, guide specifications, and any additional information required by this manual. Documentation of these ITR will take the form of Projnet.com DrChecks printouts of comments entered by independent reviewers, answered by PDT members and closed out or approved third-party checklists. ITR review documentation must be dated prior to design submissions to TAM.

2.3.2 Incorporating Information Systems.

2.3.2.1 Automatic Data Processing Systems (ADPS). When ADPS (i.e., "engineering software", etc.) are used to perform design calculations, the design analysis shall include descriptions of the computer programs used and copies of the ADPS input and output data summaries. When the software output is large, it may be divided into volumes at logical division points.

2.3.2.2 Software Outputs. Each set of software outputs ("printouts") shall be preceded by an index and by a description of the computation performed. If several sets of computations are submitted, they shall be accompanied by a general table of contents in addition to the individual indices.

2.3.2.3 Accompanying each set of ADPS printouts will be a description of each computer program utilized and information that includes the following:

- Software program name and version used.
- Explain the design method, including assumptions, theories and formulae that govern the ADPS calculations.
- Include applicable diagrams, adequately identified.
- State exactly the computation performed by the computer.
- Provide all necessary explanations of the computer printout format, symbols, and abbreviations.
- Use of adequate and consistent notation.
- Provide sufficient information to permit manual checks of the results.

2.3.2.4 Native electronic input and output files may be submitted as an element of any design analysis submittal.

2.3.3 Drawings.

Drawings and similar products utilizing CAD, BIM, and/or GIS will be prepared per the instructions provided in Chapter 22 ADVANCED MODELING.

2.3.4 Specifications.

Instructions, accompanied by examples for the preparation of the contract specifications, are contained in Chapter 3: SPECIFICATIONS.

2.3.5 Cost and Construction Schedule Estimates.

2.3.5.1 Programming and Concept Cost, and Construction Schedule Estimates. The estimates of cost submitted with the Programming Submittals shall be Class 4 or 5 as defined by Chapter 4, COST ENGINEERING as they are a major factor in determining how or if the project is to proceed through the Final design and construction phases. These estimates may be prepared by hand or computer. See Chapter 4: COST ENGINEERING for format, model estimate, and other instructions.

2.3.5.2 Preliminary, Final and Ready To Advertise (RTA) Cost, and Construction Schedule Estimates. The Preliminary, Final and RTA estimates shall be prepared in increasing detail by the use of computer assisted techniques, as outlined in Chapter 4: COST ENGINEERING. These estimates will be used in design control and as a basis to negotiate the construction contract.

2.3.6 Classified Material. Those volumes of the design analysis requiring classified material shall be marked and handled in accordance with applicable security regulations. Where only a minor portion of the criteria or calculations is of a classified nature, every effort shall be made to prepare the design analysis so as to permit it to be an unclassified document with proper references to sources of classified material. Refer to specific project and/or contract requirements regarding material classification instructions.

2.4 OTHER DATA.

2.4.1 Site Adapted Drawings. Construction of various buildings and facilities may be required at sites other than those for which original designs were developed. In order to provide economical reuse of facility designs for any particular site, the project plans must be adapted to conform to the unique site requirements, particularly in relation to foundation and HVAC design. Revisions may also be required of items of design such as utilities or other minor building design changes desired by the user. Such site adaptation shall be made by using the original design drawings to the maximum extent possible. The original title blocks will be retained with appropriate changes to the file. Issue date and sheet numbers. The top line of the revision area shall contain the phrase "Site Adapted For …".

2.4.2 Engineering Reports. Occasionally, in addition to the items previously mentioned, engineering studies that relate to specific problems and engineering reports thereon are required. The necessary instructions regarding the preparation of such reports will be furnished when required. Generally, formatting of reports should conform to ER 25-30-1 Information Management: Publishing and Printing: GUIDANCE FOR PREPARATION AND PROCESSING OF PUBLICATIONS AND FORMS; refer to specific task requirements for further information.

2.4.3 Forms. When required, certain standard forms must accompany engineering products (e.g., Draft DD Form 1354, etc.).

2.4.3.1. Forms will be completed in accordance with their accompanying instructions.

2.4.3.2. Forms that are secure or cannot otherwise be included in a submittal document set, will be submitted as a separate design phase submittal.

2.5 UNITS OF MEASUREMENT.

2.5.1 Drawings. All site layout data shall be dimensioned in meters or labeled with UTM coordinates, as appropriate. All details and pipe sizes shall be dimensioned in millimeters. UTM coordinates shall be expressed in meters and be calculated based on WGS84 data corrected to elevations based on the orthometric elevation, using the WGS84 and sea level (EGM2008) or the local grid system as directed by TAM.

2.5.2 Design Calculations. Unless otherwise required, design analyses, and calculations will be delivered in metric units. Quantities on the contract drawings will be stated in metric units

2.5.3 Specifications.

2.5.3.1 Equipment and Products. Generally, specify equipment and products by U.S. standards and described by metric units. Specification sections and schedules for sizing and manufacturing of air handling units will state all design requirements in metric units. Specification sections for testing and/or balancing of the system after construction will state all figures in metric units.

2.5.3.2 Materials. Generally, construction materials will be specified industry standards as they are stated in the Unified Facilities Guide Specifications (UFGS) templates.

2.5.3.3. Equivalent international standards. When required by a specific project, justification for specifying equipment, products, and materials in accordance with non-US standards will be provided in the Design Analysis.

2.5.3.4. Host Nation Codes, Guidance, References, and Standards. When required by a specific project or program, designs will conform to Host Nation codes, guidance, references, and standards. Such designs must not provide a lower level of quality and/or safety in comparison with US Standards.

2.5.3.5 Certified translations must be provided for all non-English product and host nation code documentation included in the Design Analysis.

2.5.4 Dual Language Requirements.

When dual language is required for a project, the pertinent working files produced in English will always be placed after or below the other language, with the local language prominent.

2.5.5 O&M Manuals. Manufacturers' equipment operation and maintenance manuals will be required in English only, unless otherwise stated by project and/or contract requirements.

2.5.6 Operating Instructions and Signage. Posted operating instructions, schematics, and signage (including building interior traffic and safety signs) shall be in both the Host Nation's national language and English.

2.6 GENERAL NOTES ON PRESENTATION QUALITY

Documents shall be thoroughly checked and coordinated to prevent the omission of vital information, to discover and resolve conflicts, and to avoid repetition.

2.12.1 Design Quality Management Manual. All project work, to include presentation shall be conducted in conformance with the CETAM Design Quality Management (DQM) Manual, CETAM QMS Process 08550.2.

2.12.3 Independent Design Reviews. In-house and Contracted A/E design teams must incorporate independent reviews (review by someone other than Designer/Design Engineer) of all drawings, specifications, and other required data prior to the scheduled Final review. This review shall be for the purposes of eliminating errors and inconsistencies in presentation of design criteria, review comments, drawings, guide specifications, and any additional information required by this manual.

CHAPTER 3
SPECIFICATIONS

CHAPTER 3

SPECIFICATIONS

3.1 GENERAL INSTRUCTIONS.

Specifications are a design product comprising the technical requirements of a construction contract in written form. Specifications provide detailed requirements for materials, equipment, installation, testing, safety and approval documentation necessary to complete items of work.

The term "contract documents" generally refers to the complete package upon which construction firms will prepare bids or proposals in response. The "specifications" portion of the contract documents comprises “contract" specifications and "technical" specifications. Contract specifications, the Division 00 specifications, include administrative requirements/forms, incorporated FAR clauses, and other specific instructions to bidders or offerors. Technical specifications define the qualitative requirements for products, materials, and workmanship for work features that occur in construction projects. The specifications work products referred to in this Design Instructions Manual are technical specifications only.

3.1.1 Guide Specifications. The Unified Facilities Guide Specifications (UFGS) may be referred to as simply “the Guide Specification” throughout this Manual. Taken as a whole, per ER 1110-1-8155, the UFGS, is “…a set of master guide specifications reflecting technical policy that will enhance productivity, quality, and uniformity of construction. Uniformity and consistency of project specifications aid contractors in their preparation of bids, improve quality of construction, and reduce cost to DOD customers.” UFGS are available in a template format from the Whole Building Design Guide (WBDG) website at https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs. The templates are provided in .pdf and .sec format, the latter which are native SPECSINTACT files.

Unless otherwise directed by TAM, all construction specifications will conform with the UFGS in form and content. Where guide specifications allow use of optional materials or methods, options shall be included in the completed specifications to the extent that such material and methods are suitable and available for construction in the country where the project is located. Per FAR 52.236-21, specifications govern over drawings, should there be a difference between the construction contract's specifications and drawings. As specifications are design products, it is the individual designer’s responsibility to deliver construction specifications that align and support the design drawings.

3.1.2 Standard Facility Specifications. When a standard design with specifications has been developed for repetitive type structures, a copy of the specifications for the standard design will be secured by the Design Manager and provided to the appropriate designers. Standard facility specifications must be adapted and edited as applicable for the particular project, and updated to reflect current guide specifications requirements. It is anticipated that standard facility specifications will conform to the requirements of UFC 1-300-02; if the available copy does not, it must be revised accordingly.

3.1.3 District/Local Master Specifications. CETAM has developed various local master specifications addressing specific experiences, needs, and requirements of the several countries, and, in some instances, specific military bases in the CETAM Area of Responsibility. These local masters are administered by the pertinent engineering discipline lead. Local masters must be adapted and edited as applicable to the projects included.

3.1.4 SPECINTACT. The use of SPECTINTACT is mandatory for specifications production. SPECSINTACT is the automated processing tool, administered by NASA that CETAM uses for project specification production. Technical Services Branch is responsible for production of construction specifications using SPECSINTACT at CETAM. The SPECSINTACT program, along with tutorials and other information, is available through its website, https://SPECSINTACT.ksc.nasa.gov/.

From ER 1110-1-8155, "UFGS contain designer notes providing guidance on use of the specifications and the coordination required with the other project specification sections and with the project drawings. UFGS also contain "tailoring options" in many sections that allows SPECSINTACT users to globally delete products or requirements with a minimum of effort. Additionally, through the use of "brackets," the guide specifications identify fill-in blanks and alternative text for selection by Designers."

The workflow that generates specifications consists of individual design disciplines creating edits, tailoring or markups of the pertinent .pdf versions of the UFGS sections and providing these to a specifications technician who edits UFGS *.sec files in accordance with the designer's noted requirements and publishes a compiled set of revised specifications. Specifications produced for initial designs should include all tailoring and edits chosen by designers to enable reviewers a quick understanding of the proposed changes.

3.2 APPLICABLE PUBLICATIONS.

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this Manual to the extent indicated by the references thereto.

Engineering Regulations:

ER 1110-1-8155 Engineering & Design: Specifications.

ER 1110-345-100 Design Policy for Military Construction

ER 1110-345-700 Engineering & Design: Design Analysis, Drawings and Specifications.

ER 415-1-10 Construction Contractor Submittal Procedures.

FAR 11.104 Use of brand name or equal purchase descriptions.

FAR 52.236-21 Specifications and Drawings for Construction.

FAR 6.3 Other than Full and Open Competition

MIL-STD 3007 Standard Practice Unified Facilities Criteria, Facilities Criteria and Unified Facilities Guide Specifications

UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard.

Engineering Manuals:

EM 385-1-1 Corps of Engineers Safety and Health Requirements.

3.3 PREPARATION OF TECHNICAL PROJECT SPECIFICATIONS

3.3.1 Minimum Required Sections.

3.3.1.1 Division 01 – General Requirements. The Division 01 specifications sections essentially form a bridging document between the Division 00 Contract Specifications and the Division 02 – Division 48 specifications; establishing the overall duties and responsibilities between the Corps of Engineers and the Construction Contractor. Primarily the Division 01 sections present how the construction contract will be administered and what procedures will be used to ensure an efficient construction process leading up to successful delivery of a completed construction project.

Preparation of the Division 01 sections is the responsibility of TAM Specifications Technicians with coordination responsibilities for relevant input to the individual Division 01 sections as shown in Table 3-1 below. The sections listed are not all-inclusive, as specific project or design contract requirements may require additional effort. During the design phase, additional sections may be identified and incorporated into the specifications document (some sections may be deleted, as well). The Project Manager, Design Manager, and Construction Division are the lead for CETAM in-house resources. “Designers” refers to CETAM in-house and/or A/E designer resources.

Section (shown to the fifth level when appropriate)	Content Lead
01 11 00 SUMMARY OF WORK	Project Manager
01 14 00 WORK RESTRICTIONS	Construction Division
01 20 00.00 10 PRICE AND PAYMENT PROCEDURES	Project Management[1], Cost Engineering
01 30 00 ADMINISTRATIVE REQUIREMENTS	Construction Division, Design Management, Project Management
01 33 00 SUBMITTAL PROCEDURES	Designers, Construction Division
01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD)[2]	Designers, Design Management
01 33 29 SUSTAINABILITY REPORTING[3]	Sustainability Lead (typ. Arch or Mech Eng)
01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS	Construction Division, CETAM Safety Office
01 42 00 SOURCES FOR REFERENCE PUBLICATIONS	Designers, Specifications[4]
01 42 15 METRIC MEASUREMENTS	Designers, Specifications
01 45 00.00 10 QUALITY CONTROL	Design Management, Construction Division
01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)	Construction Division
01 45 35 SPECIAL INSPECTIONS	Designers[5]
01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS	Construction Division, Design Management
01 58 00 PROJECT IDENTIFICATION	Specifications, Design Management, Construction Division
01 78 00 CLOSEOUT SUBMITTALS	Designers, Project Management
01 78 23 OPERATION AND MAINTENANCE DATA	Designers, Project Management
01 91 00.15 10 TOTAL BUILDING COMMISSIONING	Designers, Design Management

Table 3-1. Division 01 Specification Sections Content Leads.

NOTES:

[1] Rarely used for CETAM projects

[2] For design-build projects only

[3] Mandatory for US MILCON projects

[4] If there is a web-based source for a reference, an active weblink must be included in that reference's location information.

[5] Refer to UFC 1-200-01

3.3.2 Division 02 through Division 48. Preparation of the Division 02 through Division 48 is conducted by the specifications lead on the PDT (i.e., in-house or contracted A/E). The responsible lead for the preparation of the individual specifications sections covered in these divisions is the PDT's lead for that pertinent discipline. Note well: Many specifications require cross-discipline coordination, e.g., §13 34 19 METAL BUILDING SYSTEMS, §26 05 48.00 10 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT, etc.

Specifications sections supplement the project drawings, forming a complete "plans and specifications" package. However, per FAR 52.236-21, specifications govern over plans; nevertheless, the plans describe the project and are used for quantity surveys, development of shop drawings, work plans, and so forth and thus the technical specifications must not introduce potentially contradictory or ambiguous information when combined with the plans. Specifications should not be written which leave the burden of intent (interpretation) on the offerors/bidders, contractor, or construction personnel administering the contract in the field.

The technical specifications, however, must be of sufficient content and detail so that, when used with the project drawings, competitive, reasonable price proposals/estimates or bids can be furnished by offerors or bidders in response to a solicitation. Also, suitably-prepared technical specifications assure that, post-award/during construction phase, contractors can confidently engage material suppliers, or manufacturers from which acceptable materials, supplies, and equipment may be acquired. Adequate specifications assure that construction can be completed without additional specifications except as necessary to deal with unforeseen conditions or to accomplish changes made during construction.

Every effort shall be made to describe (supplemented with drawing details, where applicable), the physical, chemical, or performance characteristics of materials, products, or construction methods in a manner that ensures the fullest participation and free competition of products and labor in the marketplace. The designer responsible for the applicable specification section should identify the salient features that clearly define the essential requirements and appurtenant accessories that will make one product type acceptable and undesirable product types unacceptable under the submittal review described in the specification.

3.3.3 Basic Specification Content.

3.3.3.1. In general, a given UFGS section template is global in its information and the tailoring process of the section to align with a specific project's requirements will most likely deduct material from the template. Specifications, at the very minimum, describe an item's size or capacity, its materials of construction, a detailed description of its function, and how it is to be installed or otherwise constructed.

3.3.3.2. References. If the referenced publications cited in a UFGS section template or in a new specifications section (described below) are inadequate, the appropriate reference must be added to the section. To the extent practicable, codes, standards, guidance documents, and other published criteria must be limited to industry-recognized (national or international) organizations, including professional societies (ASCE, ASME, IEEE, ASHRAE, et al.), standards organizations (ASTM International, ISO, et al.), quasi-public/industry organizations (UL, FM, et al.), industry organizations (ACI, AISC, NACE/SSPC, et al), etc. Country-specific requirements, such as the Kuwait Ministry of Electricity and Water (MEW), Qatar Construction Specifications (QCS), Saudi

Building Code, United Arab Emirates Command of Military Works (CMW) etc. must be included as references in the specifications when appropriate.

3.3.4 Item and Material Descriptions with Brand Names.

3.3.4.1 Proprietary items and/or spare parts that are only available via a sole source, trade or brand names will not be used in the descriptions of any items specified unless a formal, documented Justification and Approval (J&A) documentation process, addressing the requirements of FAR 11.104, and Subpart 6.300, 6.301, 6.302 and 6.302-1, etc. is completed. It is the responsibility of the DOR to identify and document fully the need for any proprietary items as early as possible in the design effort to the Design Manager. Upon technical recommendation of the Design Manager and documentation approval of the Contracting Officer, the Project Manager will initiate and manage the J&A through the appropriate offices of Middle East District.

If a brand name usage is approved, a generic description describing both the acceptable and unacceptable salient features of the item will accompany the trade name. In accordance with Contract Clause 52.236-5 entitled MATERIAL AND WORKMANSHIP

3.3.4.2 Use of “brand name or approved equal.” Unless formally approved by the Contracting Officer, the naming of a particular commercial product with the words "or approved equal", or adopting verbatim a manufacturer's description of a particular commercial article is prohibited. If approved for use, however, no less than three (3) manufacturers with complete contact information (i.e., mailing address, telephone number, fax number, e-mail address, Point of-Contact, etc.) will be included in the specification section. The designer shall describe the needs of the design, or the Government with sufficient clarity to inform prospective bidders/offerors. When the use of “brand name or approved equal“ language is approved for specifying products or equipment, the descriptions in the specification section of concern must be of sufficient detail to permit prospective contractors to offer products other than those specifically referenced by brand name. Bidders/Offerors, and the Construction Contractor are always permitted to propose substitutions and such substitutions need not be exact duplicates of the products specified.

3.3.4.3 Upon approval of proprietary use of the item involved, the make and model number and manufacturer's contract information shall be inserted and followed with the words "no substitutes will be acceptable".

3.3.4.4 The formal approval documentation described above must be included in the designer’s associated design analysis.

3.3.5 Avoiding Ambiguities.

As first indicated in paragraph 3.3.2, ambiguities must be avoided in the preparation of specifications. Included specific directions/instructions shall be included the specifications; avoid using phrases like "as directed (approved) by the Contracting Officer” without specific directions to the contractor regarding achieving successful approval.

If a designer identifies a situation that, unless mitigated, would lead to indefinite or potentially ambiguous language in a specification section, the designer must alert the Design Manager (if the design is being prepared in-house) or the Contracting Officer/Contracting Officer Representative (COR) through the RFI process described in the A/E contract of the issue and work to seek resolution.

For example, when material is to be salvaged and stored, the specifications shall state the disposition of such material, e.g. "to be stored in Building 210" or "in the Base Salvage Yard", rather than "where directed by the Contracting Officer."

When a situation is identified leading to the conclusion that it is impossible to determine a definite outcome prior to final submittal (i.e., a mitigating outcome could not be determined), the specification must provide information that is quantifiable and thus biddable. A possible example scenario would be associated with the disposal of excavated material: if the project sponsor or customer is unable to provide a definite disposal site, stating that the haul will not exceed a certain number of miles when such material can be disposed of on Government controlled property. Or, in the case of disposal sites not being available, state in the specifications, "Waste material shall be disposed of off the Government (or project) premises by and at the expense of the Contractor." Where necessary to demolish or move structures. Note that the formulation of such resolution must be documented and included in the pertinent discipline's design analysis.

3.3.6 Editing Guide Specifications. The guide specifications editing workflow, at its essence, consists of the designer selecting a UFGS section (or writing a new section), editing it, and providing the marked-up section to the PDT member assigned to SPECSINTACT operation, who would then edit the .sec file accordingly. At CETAM, for in-house design work, the generation of specifications using SPECSINTACT is the responsibility of the in-house Specifications Technician assigned to that PDT.

3.3.6.1 Edited guide specifications included in a submittal package must be provided as .pdf and .sec files. Example B shows a portion of properly edited guide specification typical of a preliminary submittal (see paragraph 3.4.2). Edited guide specifications are submitted with the editing marks visible.

a. Deletions: Use <DEL> <DEL> tags in SPECSINTACT, display deleted content with the ~~strikeout format~~ in the .pdf, facilitating a reviewer's understanding of what was deleted.

b. Additions/New Text. Use <ADD> <ADD> tags in SPECSINTACT, display added content with the underscored/underlined format in the .pdf, facilitating a reviewer's understanding of what was added.

c. Citation/Reference to other specification sections must include the specification number and name, with the name in ALL CAPS format, prefixed with the word "SECTION", viz: "…in accordance with SECTION 03 47 13 TILT-UP CONCRETE…".

d. Paragraph Reference. When a paragraph contains a reference to a titled paragraph within the section, the reference will be by paragraph title not paragraph number and in ALL CAPS format, viz, "Work shall be in accordance with paragraph PAINT AND COATINGS."

e. When editing a guide specification for a project, paragraph numbers must be sequential (Avoid applying "Not Used", or "Not Applicable" to otherwise blank paragraphs). An exception would be amendments or change order proposals, where the numbers of paragraphs must remain the same as the advertised package, as discussed below.

f. Bracketed items. UFGS templates accommodate designer input by providing items or blanks encapsulated in brackets “[ ]”. Once a selection is made, other items in brackets, and the brackets surrounding the selected item or filled-in blank must be deleted.

g. Instructions to users. UFGS templates come with extensive instructions, referred to as “NOTES” in the UFGS, to the designer responsible for preparing the specific section. Instructions are in **bold format** and are listed between lines of asterisks “*****”. It is not necessary to mark delete the instructions from the UFGS for deletion; SPECSINTACT will exclude the instructions from the final output by command.

h. Do not change the SPECSINTACT default font (`Courier`).

3.3.7 Submittal Register. A Construction submittal is written and/or physical information associated with a project used to verify that the correct products are installed/utilized on the project. Construction submittals are required per the contract. The construction contractor provides submittal items to the Contracting Officer (KO) for approval, when applicable. Usually, submittals are transmitted to the formally-designated Contracting Officer Representative (COR) via the USACE Resident Management System (RMS); the COR is responsible for verification and validation of the submittals, is tasked with ensuring their review is completed in a timely manager, and provides informed recommendation to the KO for approval.

The Submittal Register is a form (DD 4288-R) listing all construction submittals according to the associated specification section, submittal type, and classification, etc. SPECSINTACT will automatically generate a submittal register from the individual .sec files. See Example D for a sample submittal register.

3.3.7.1 Submittal Types. UFGS templates typically list the necessary associated construction submittals. The designer is responsible for verifying all submittal requirements. Per ER 415-1-10, the types are:

SD-01 - Preconstruction Submittals

SD-02 - Shop Drawings

SD-03 - Product Data

SD-04 - Samples

SD-05 - Design Data

SD-06 - Test

SD-07 - Certificates

SD-08 - Manufacturer's Instructions

SD-09 - Manufacturer's Field Reports

SD-10 - Operation and Maintenance Data

SD-11 - Closeout Submittals

3.3.7.2 Submittal Classification. Classification refers to the function responsible for reviewing the submittal and depends on the construction acquisition method (i.e., design-bid-build, or design-build, etc.). UFGS templates provide classification designations in brackets (e.g., “[G]”), allowing the designer to designate the appropriate review office for specific submittals. Classification of submittals is a collaborative process and the designer must consult CETAM Construction Division personnel (through the DM) regarding which office should be receiving/reviewing what submittals.

The two most basic classifications are “G” signifying “Government Approval,” and “FIO” signifying “For Information Only,” the latter indicating that government approval is not required, though FIO submittals are listed with a blank in a specification section, that is, "FIO" is not shown, that is, the classification is left blank in the pertinent specification section. Additional classifications may refer to the particular office(s) responsible for review (“M” for Middle East District, “R” for Resident Office, “M/R” for both, “S” for sustainability requirements, and so forth), however, these designations must comply with internal CETAM processes which may reflect field office capabilities/capacity for the reviews. Designers are responsible for assuring that the proper classification is designated in that specific specification sections.

3.3.7.3 Table of Contents (TOC). SPECSINTACT generates a TOC on-demand from the .sec files. Include the UFGS TOC with each individual specifications section in submitted .pdfs.

3.3.7.4 Other Content Requirements.

a. Government Furnished – Contractor Installed (GFCI) Property.

1. When GFCI materials or equipment are involved in a contract, the Project Manager is responsible for specifying such in the 01 11 00 SUMMARY OF WORK section. GFCI shall be listed on a separate list and submitted along with specifications at the Final and RTA submittals. The list shall contain the quantity, item description including manufacturer's make and model number if available, dimensions, cube weight, and power source if applicable, e.g. gas, electric, steam, 120V, 220V, 240V, etc.

2. Designers are responsible for coordinating GFCI requirements in the associated technical specifications.

b. Removal of Equipment or Materials at Existing Facilities.

1. Equipment or materials to be removed shall be identified in the 01 11 00 SUMMARY OF WORK section and shall include any special disposal instructions such as store for re-use or return to customer.

2. Designers are responsible for coordinating the requirements of such removals in the associated technical specifications.

c. Services of Manufacturer's Technical Representatives or Subject Matter Experts.

1. It is often critical to the success of project delivery that manufacturer's technical representatives are engaged, when applicable, in construction contracts. Such circumstances could be related to equipment warranty concerns, or, in the case of complex equipment such as flight simulators, operational requirements. Ideally, such matters are identified prior to the concept design phase, but not always.

2. Approval from the Project Manager is required for including contract requirements regarding engagement of manufacture's technical representatives. Designers must bring these matters to the attention of the Design Manager (or A/E design lead), who is responsible for alerting the PM to the need for such services; for A/E-prepared designs, the A/E is responsible for alerting the Contracting Officer of the need for such services.

3. Certain equipment assembly installations are included in contract requirements for projects and equipment when required to ensure proper installation, start-up and/or training of operation and maintenance personnel. Designers are responsible for including the requirements for these services in their specifications sections. The inclusion of these services must be noted in the EICFP (see Chapter 1) and described in the 01 11 00 SUMMARY OF WORK section.

3.4 DESIGN SUBMITTAL REQUIREMENTS

3.4.1 Concept Submittal. An outline specification prepared in accordance with ER 1110-345-700 shall be submitted for the concept design review. An outline specification (See Example A) is required in order to give an overall picture of the systems to be employed in the construction of a project. Along with the outline specification, a list of deviations from the guide specifications shall be included and shall enumerate all design items which are not in accordance with the guide specifications.

3.4.1.1. Outline specifications, essentially a listing (division, and section number, and title) of the pertinent guide specifications selected by the designer for that specific project, is a component of each discipline's design analysis.

3.4.1.2. The Concept Submittal Outline Specifications is a distinct document forming the aggregate listing of each discipline's selected guide specifications. The format of the Outline Specifications submittal shall be in accordance with Example A; 12-point Times New Roman font, top and side margins shall be 1-inch minimum to permit side binding and head-to-head printing. Bottom margins shall be 1-inch, with page number centered at bottom margin.

3.4.2 Preliminary Review Submittal.

3.4.2.1 Marked-up/edited draft specifications including the Project Table of Contents shall be submitted for the preliminary design review (See Example B attached to this chapter). The guide specification mark-ups/edits are submitted in a single, comprehensive document; mark-ups/edits are not typically included in design analyses.

3.4.2.2 When a UFGS section is not available for the subject matter to be specified, the designer shall develop the specification section. See New Sections paragraph for requirements.

3.4.2.3 In accordance with ER 1110-1-8155, the Preliminary Submittal specifications numbers will be reduced to the fourth level. That is, remove agency numbers occupying the fifth level of the specification section number. For example, 03 42 13.00 10 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION would be listed in the Preliminary Submittal (and subsequent design submittals) as 03 42 13.00 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION.

3.4.3 Final Review Submittal. Completely edited draft specifications shall be submitted for the final design review (See Example C attached to this chapter). Final design drawings, specifications, and design analysis constitute the products of a completed design effort. The design process DOES NOT continue beyond FINAL DESIGN. The following items shall be included for review with this submittal:

3.4.3.1. Specification sections with Project Table of Contents and any attachments for the specifications.

3.4.3.2. Submittal Register (ENG Form 4288) which is created with SPECSINTACT (ENG Form 4288).

3.4.3.3. UFGS Sections 01 42 00 SOURCES FOR REFERENCE PUBLICATIONS and 01 42 15 METRIC MEASUREMENTS are mandatory, and thus must be included in all construction specifications.

3.4.3.4. Design Analysis', whether produced by in-house or contracted designers, is for internal use and may not be distributed to construction contractors without the written consent of the TAM Chief of Engineering.

3.4.4. Ready to Advertise (RTA) Submittal. RTA shall incorporate all comments from the final submittal. This submittal will include the technical specifications (See Example C attached to this chapter); the submittal register; a Proposal Schedule and Cost Breakdown Sheet showing bid items, units, and quantities (refer to Chapter 4); and ECIFP or Guidance Memorandum (refer to Chapter 1). CETAM will prepare the bidding information, bid forms, contract clauses, and remaining Division 01 specifications for the intended project.

The RTA specification sections shall be submitted as .sec, and .pdf format file.

3.4.6. Copies Required. Unless otherwise required, submittals are expected in digital/electronic form only. Refer to any specific requirements from the Project Manager regarding hard copies.

3.5 AMENDMENTS

3.5.1 Amendment. During the time a project is being advertised, revisions or corrections to drawings and specifications may become necessary. When formally directed by the Project Manager, the designer shall prepare an amendment to the drawings and/or specifications incorporating the required revisions, accompanied by a written narrative describing what was changed (see example G).

3.5.2 Scheduling of Amendment. Amendment revisions shall be prepared and submitted under a strict time schedule in order that revisions can be issued to bidders at the appropriate time during the advertising period. The in-house Design Manager leading the PDT, along with the Contracting Officer (through the COR, typically, for A/E-prepared designs) must closely coordinate with the Contract Specialist regarding time constraints on issuing amendments.

3.5.3 Preparation of Amendments. Designers are responsible to preparing amendments to the specifications, which can range from deleting a single word to adding a completely new specifications section; paragraph 3.3 is applicable to amendment content, with the addition of the following instructions. "Execution of Revisions" shall be performed in SPECSINTACT prior to editing for amendments as only amended text will be shown. Deleted text will appear as strikeout, and new text will appear underscored. The solicitation number and amendment numbers positioned below the page number of the revised or new specification section Paragraphs shall not be renumbered when making deletions by amendment. For example, if a paragraph is deleted, the paragraph number shall remain and shall be noted as "NOT USED". New paragraphs or subparagraphs should always be inserted at the most logical chronological place between existing paragraphs or subparagraphs. Note that when new paragraphs are incorporated within existing paragraphs the following paragraphs numbers will change accordingly. This is addressed by showing all changed paragraph numbers being amended.

3.5.3.1 Revised Specifications Sections. Revised specification section shall be re-issued in their entirety (see example E). The first page of the revised section shall state “REVISED BY AMENDMENT NO. XXXX” under the section title.

3.5.3.2. New Specification Sections. New sections added by amendment shall be identified as such. The first page of the new section shall state “ADDED BY AMENDMENT NO. XXXX” under the section title (see example F)

3.5.3.3 The table of contents shall be reprinted to reflect the new section added. The Submittal register for the new section shall be printed.

3.6 CHANGE ORDER PROPOSAL (COP)

3.6.1 Change order proposals are initiated by the field Construction Office administering the construction contract, in collaboration with the KO and the PM. Documentation associated with the COP are transmitted to the assigned DM, who is responsible for assembling (or re-assembling) the PDT as needed. For A/E-prepared designs, the COR is responsible for communicating COP requirements, including the proper COP number, to the Designer of Record (DOR).

3.6.2 The designers are responsible for preparing the appropriate specifications (and plans, refer to Chapter 22), when required, addressing the COP. The DM is responsible to ensuring that the most up-to-date awarded contract set of plans and specifications is being revised.

3.6.3 The procedures for specifications preparation related to COPs are similar to those for amendments. Revised specifications sections, and/or new specification sections that are issued with a COP are marked similarly as well, though the word "CHANGE" replaces "AMENDMENT.

3.7. LIST OF EXAMPLES

The examples found at the end of this chapter illustrating the format to be used are as follows:

EXAMPLE A - Typical Outline Specification

EXAMPLE B - Marked-Up Draft Guide Specifications. (Preliminary Section)

EXAMPLE C - Final Submittal

EXAMPLE D - Submittal Register ENG Form 4288

EXAMPLE E - Amendment Revised Section

EXAMPLE F - Amendment New Section

EXAMPLE G - Amendment Narrative

EXAMPLE A - Typical Outline Specification

OUTLINE SPECIFICATIONS

PROJECT NAME
LOCATION, COUNTRY

DIVISION 01 - GENERAL REQUIREMENTS[1]

01 11 00	SUMMARY OF WORK
01 14 00	WORK RESTRICTIONS
01 15 00.12 10	SUPPLEMENTARY REQUIREMENTS
01 30 00	ADMINISTRATIVE REQUIREMENTS
01 32 17.12 10	COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS)
01 33 00	SUBMITTAL PROCEDURES
01 33 19	SUSTAINABILITY REPORTING
01 35 26	GOVERNMENTAL SAFETY REQUIREMENTS
01 42 00	SOURCES FOR REFERENCE PUBLICATIONS
01 42 15	METRIC MEASUREMENTS
01 45 00.00 10	QUALITY CONTROL
01 45 00.15 10	RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)
01 50 00	TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
01 57 19	TEMPORARY ENVIRONMENTAL CONTROLS
01 58 00	PROJECT IDENTIFICATION
01 78 00	CLOSEOUT SUBMITTALS
01 78 23	OPERATION AND MAINTENANCE DATA
	LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 03- CONCRETE

03 30 00	CAST-IN-PLACE CONCRETE
	LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 05- METALS

05 12 00	STRUCTURAL STEEL
	LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

06 41 16.00 10	PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
	LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 05 23	PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS
	LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

[1] The Divisions shown do not represent a complete listing; depending on the specific project, additional/fewer Divisions would be listed.

OUTLINE SPECIFICATIONS Page 1

EXAMPLE A –*continued*.

DIVISION 08 – OPENINGS

08 11 13 STEEL DOORS AND FRAMES
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 09 – FINISHES

09 22 00 SUPPORTS FOR PLASTER AND GYPSUM BOARD
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 10 – SPECIALTIES

10 14 00.20 INTERIOR SIGNAGE
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 12 – FURNISHINGS

12 24 13 ROLLER WINDOW SHADES
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 13- SPECIAL CONSTRUCTION

13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 14 – CONVEYING EQUIPMENT

14 21 23 ELECTRIC TRACTION PASSENGER ELEVATORS

DIVISION 21 – FIRE SUPPRESSION

21 12 00 STANDPIPE SYSTEMS
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 22 – PLUMBING

22 00 00 PLUMBING, GENERAL PURPOSE
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

OUTLINE SPECIFICATIONS Page 2

EXAMPLE A –*continued*.

<u>DIVISION 26 – ELECTRICAL</u>

26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

<u>DIVISION 27 – COMMUNICATIONS</u>

27 05 14.00 10 CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

<u>DIVISION 28 – ELECTRONIC SAFETY AND SECURITY</u>

28 10 05 ELECTRONIC SECURITY SYSTEMS (ESS)
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

<u>DIVISION 31- EARTHWORK</u>

31 00 00 EARTHWORK
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

<u>DIVISION 32 – EXTERIOR IMPROVEMENTS</u>

32 11 20 SUBBASE COURSE
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

<u>DIVISION 33 – UTILITIES</u>

33 11 00 WATER UTILITY DISTRIBUTION PIPING
LIST OTHER PROJECT-SPECIFIC SECTIONS AS REQUIRED

OUTLINE SPECIFICATIONS Page 3

EXAMPLE B - Marked-Up Draft Guide Specifications. (Preliminary Section)

SECTION 05 52 00

METAL RAILINGS
02/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.3.8M	(1981; R 2005) Metric Hex Lag Screws
ASME B18.6.5M	(2000; R 2010) Standard Specification for Metric Thread-Forming and Thread-Cutting Tapping Screws
ASME B18.6.7M	(1999; R 2010) Metric Machine Screws
ASME B18.22M	(1981; R 2017) Metric Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M	(2017) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon

EXAMPLE B – *continued*.

Air Traffic Control Tower, UD 2.4, Jordan 474512

	Steel Structural Tubing in Rounds and Shapes
ASTM A575	(1996; E 2013; R 2013) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 898-1	(2013) Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel – Part 1: Bolts, Screws and Studs with Specified Property Classes – Coarse Thread and Fine Pitch Thread

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 521	(2001; R 2012) Pipe Railing Systems Manual

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Preinstallation Meetings

Within ~~[~~30~~] [______]~~ days of contract award, submit fabrication drawings ~~[~~ to the Contracting Officer~~]~~ for the following items:

c. Steel railings and handrails

e. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

a. Structural-steel plates, shapes, and bars

b. Structural-steel tubing

c. Protective coating

d. Anchorage and fastening systems

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G M

Iron and Steel Hardware; G M

Steel Shapes, Plates, Bars and Strips; G M

SECTION 05 52 00 Page 2

EXAMPLE B – *continued*.

Air Traffic Control Tower, UD 2.4, Jordan 474512

SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars; G M

Structural-Steel Tubing; G M

Cold-Finished Steel Bars; G M

Hot-Rolled Carbon Steel Bars; G M

Protective Coating; G M

SD-07 Certificates

Welder Qualification; G M

SD-08 Manufacturer's Instructions

Installation Instructions

1.4 QUALITY CONTROL

~~1.4.1 Welding Procedures~~

~~[Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.~~

~~] Submit results of welding procedures testing in accordance with AWS D1.1/D1.1M made in the presence of the Contracting Officer and by an approved testing laboratory at the Contractor's expense.~~

1.4.1 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, conduct an immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

2.1 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 to 12 scale. Provide details of sections and connections at not less

SECTION 05 52 00 Page 3

EXAMPLE B – *continued*.

than 1 to 4 scale. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 0.8 millimeter. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

~~2.1.1 Aluminum Railings~~

~~Fabrication: Provide fabrication jointing by one of the following methods:~~

~~a. Use flush-type rail fittings, welded and ground smooth with splice locks secured with 10 mm recessed head set screws.~~

~~b. Ensure that mitered and welded joints made by fitting; post to top rail; intermediate rail to post; and corners, are groove welded and ground smooth. Where allowed by the Contracting Officer, provide butt splices reinforced by a tight fitting dowel or sleeve not less than 150 mm in length. Tack-weld or epoxy-cement the dowel or sleeve to one side of the splice.~~

~~c. Assemble railings using slip on aluminum magnesium alloy fittings for joints. Fasten fittings to pipe or tube with 6 or 10 mm stainless steel recessed head setscrews. Provide assembled railings with fittings only at vertical supports or at rail terminations attached to walls. Provide expansion joints at the midpoint of panels. Provide a setscrew in only one side of the slip on sleeve. Provide alloy fittings to conform to ASTM B26/B26M.~~

~~[Provide removable railing sections as indicated. [Provide toe-boards and brackets where indicated, using flange castings as appropriate.]~~

EXAMPLE B – *continued*.

]2.1.1 Steel Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

a. Flush-type rail fittings of commercial standard, welded and ground smooth, with railing splice locks secured with 10 mm hexagonal-recessed-head setscrews.

b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 150 mm long.

c. Railings may be bent at corners in lieu of jointing, provided that bends are made in suitable jigs and the pipe is not crushed.

[~~Provide removable sections as indicated.~~

][2.1.2 Protective Coating

[Shop-prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

a. steel surfaces encased in concrete

b. steel surfaces for welding

c. high-strength bolt-connected contact surfaces

~~d. crane rail surfaces~~

][~~Provide hot-dipped galvanized steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc dust, zinc oxide primer, or an approved galvanizing repair compound.~~

]]2.2 COMPONENTS

[2.2.1 Structural Steel Plates, Shapes And Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

][2.2.2 Structural-Steel Tubing

Provide structural-steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

][2.2.3 Hot-Rolled Carbon Steel Bars

Provide bars and bar-size shapes conforming to ASTM A575, grade as selected by the fabricator.

EXAMPLE B – *continued*.

Air Traffic Control Tower, UD 2.4, Jordan 474512

~~][~~2.2.4 Cold-Finished Steel Bars

Provide cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.

~~][2.2.5 Cold-Drawn Steel Tubing~~

~~Provide tubing conforming to ASTM A512, sunk-drawn, butt-welded, cold finished, and stress relieved.~~

~~][~~2.2.5 Steel Pipe

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

~~][~~2.2.6 Concrete Inserts

~~[~~ Provide threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive M20 diameter machine bolts; either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M, hot-dip galvanized in accordance with ASTM A153/A153M.

~~][Provide wedge-type concrete inserts consisting of galvanized box-type ferrous castings designed to accept M20 diameter bolts having special wedge-shaped heads, made of either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M and hot dip galvanized in accordance with ASTM A153/A153M.~~

~~][Provide carbon steel bolts having special wedge-shaped heads, nuts, washers, and shims, galvanized in accordance with ASTM A153/A153M. Provide slotted-type concrete inserts consisting of a galvanized 3 millimeter thick pressed steel plate conforming to ASTM A283/A283M, made of box type welded construction with a slot designed to receive M20 diameter square head bolt with knockout cover; and hot dip galvanized in accordance with ASTM A123/A123M.~~

~~]][2.2.7 Masonry Anchorage Devices~~

~~Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:~~

~~[Provide lead expansion shields for machine screws and bolts 6 millimeter and smaller; head out embedded nut type, single unit class, Group I, Type 1, Class 1.~~

~~][Provide lead expansion shields for machine screws and bolts larger than 6 millimeter in size; head-out embedded nut type, multiple-unit class, Group I, Type 1, Class 2.~~

~~][Provide bolt anchor expansion shields for lag bolts; zinc alloy, long shield anchor class, Group II, Type 1, Class 1.~~

~~][Provide bolt anchor expansion shields for bolts; closed end bottom-bearing class, Group II, Type 2, Class 1.~~

~~]~~

~~[Provide tumble-wing-type toggle bolts conforming to ASTM A325M, ASTM A449 and ASTM C636/C636M, type, class, and style as required.~~

SECTION 05 52 00 Page 6

EXAMPLE B – *continued.*

Air Traffic Control Tower, UD 2.4, Jordan 474512

~~[~~
~~[~~2.2.7 Fasteners

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

~~[~~ Provide standard hexagon-head bolts, conforming to ISO 898-1.

~~][~~Provide square-head lag bolts conforming to ASME B18.2.3.8M.

~~][~~Provide cadmium-plated steel machine screws conforming to ASME B18.6.7M.

~~][~~Provide flat-head carbon steel wood screws conforming to ASME B18.6.5M.

~~][~~Provide plain round, general-assembly-grade, carbon steel washers conforming to ASME B18.22M.

~~][~~Provide helical spring, carbon steel lockwashers conforming to ASME B18.2.3.8M.

~~]][~~2.2.8 Steel Railings And Handrails

Design handrails to resist a concentrated load of~~[~~ 890 N~~][ ] [_____]~~ in any direction at any point of the top of the rail or~~[~~ 73 N/m~~][ ] [_____]~~ applied horizontally to the top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts. ~~[Provide series 300 stainless steel pipe collars.]~~

2.2.8.1 Steel Handrails

Provide steel handrails, including inserts in concrete, ~~[~~steel pipe conforming to ASTM A53/A53M~~] [or] [structural tubing conforming to ASTM A500/A500M, Grade A or B of equivalent strength]~~. Provide steel railings of ~~[40] [50]~~ mm nominal size,~~[~~ hot-dip galvanized~~] [and] [shop painted]~~.

~~Provide kickplates between railing posts where indicated, and consisting of 4 millimeter steel flat bars not less than 150 millimeter high. Secure kickplates as indicated.~~

~~[~~ Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components. ~~Provide black steel pipe for interior railings.~~

~~][Provide galvanized exterior and interior railings where indicated, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings not indicated as galvanized.~~

~~][~~Provide galvanized railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

~~]][2.2.9 Aluminum Railings And Handrails~~

~~Provide railings and handrails consisting of[[40] [50] mm nominal schedule 40 pipe ASTM B429/B429M],[45 mm aluminum semihollow tube with~~

SECTION 05 52 00 Page 7

EXAMPLE B – *continued*.

Air Traffic Control Tower, UD 2.4, Jordan 474512

~~rounded corners ASTM B221M]. Provide [mill finish] [anodized] aluminum [[_____] color] railings. Ensure that all fasteners are Series 300 stainless steel.~~

~~]2.2.10 Safety Chains [And Guardrails]~~

~~Provide safety chains of galvanized steel, straight-link type, 5 mm diameter, with at least 12 links per 300 mm, and with snap hooks on each end. Test safety chain in accordance with ASTM A467/A467M, Class CS. Provide snap hooks of boat type. Provide galvanized 10 mm bolt with 20 mm eye diameter for attachment of chain, anchored as indicated. Supply two chains, 100 mm longer than the anchorage spacing, for each guarded area. [Provide corrugated sheet steel beam guardrail conforming to the requirements of AASHTO M 180, Type [_____] of the class specified on the drawings. Provide bolts and nuts as indicated, conforming to the requirements of ASTM A307.] Locate [guardrails] safety chain where indicated. Mount the top chain [rail] 1050 mm [_____] above the [floor] [ground] and mount the lower chain [rail] 600 mm [_____] above the [floor] [ground].~~

PART 3 EXECUTION

3.1 PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. ~~Space posts not more than [2440 millimeter] [_____] on center.~~ Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

~~[~~ a. Anchor posts in concrete by means of pipe sleeves set ~~and anchored into concrete~~. Provide sleeves of galvanized, standard-weight, steel pipe, not less than 150 millimeter long, and having an inside diameter not less than 13 millimeter greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than 25 millimeter greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between the post and sleeve with nonshrink grout ora quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.

~~][b. Anchor posts to steel with oval steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.~~

~~][c. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.~~

~~][d. Anchor rail ends to steel with oval or round steel flanges welded to tail ends and bolted to the structural steel members.~~

~~]~~ Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 75 millimeter projection from the finished wall surface to the center of the pipe, drilled to receive one M10 bolt. Locate brackets not more than 1525 millimeter on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as

SECTION 05 52 00 Page 8

EXAMPLE B – *continued*.

that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

~~[a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.~~

~~][b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.~~

~~] Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.~~

3.2 INSTALLATION

Submit manufacturer's installation instructions for the following products to be used in the fabrication of ~~[~~steel~~] [_____] [stair railing] [and] [hand rail work]~~:

a. Structural-steel tubing

b. Cold-finished steel bars

c. Hot-rolled carbon steel bars

d. Cold-drawn steel tubing

e. Protective coating

f. Steel railings and handrails

g. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications cited in this section.

3.2.1 Steel Handrail

Install handrail ~~[~~in pipe sleeves embedded in concrete and filled with nonshrink grout or quick-setting anchoring cement with anchorage covered with standard pipe collar pinned to post.~~] [by means of pipe sleeves secured to wood with screws.] [by means of masonry with expansion shields and bolts or toggle bolts.] [by means of base plates bolted to stringers or structural steel frame work.]~~ Secure rail ends by steel pipe flanges– ~~[anchored by expansion shields and bolts.]~~ ~~[~~through-bolted to a back plate or by 6 mm lag bolts to studs or solid backing.~~]~~

~~][3.2.2 Aluminum Handrail~~

~~Affix to base structure by [flanges anchored to concrete or other existing masonry by expansion shields] [base plates or flanges bolted to stringers or structural steel framework] [flanges through bolted to a backing plate on the other side of a wall] [flanges lag bolted to studs or other structural timbers]. Provide Series 300 stainless steel bolts to anchor aluminum alloy flanges, of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or concrete, coat the contact surface with a heavy coating of bituminous paint.~~

EXAMPLE B – *continued*.

~~][3.2.3 Touchup Painting~~

~~Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 0.051 millimeter.~~

3.3 FIELD QUALITY CONTROL

3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --

EXAMPLE C – Final Submittal

SECTION 05 52 00

METAL RAILINGS
02/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.3.8M	(1981; R 2005) Metric Hex Lag Screws
ASME B18.6.5M	(2000; R 2010) Standard Specification for Metric Thread-Forming and Thread-Cutting Tapping Screws
ASME B18.6.7M	(1999; R 2010) Metric Machine Screws
ASME B18.22M	(1981; R 2017) Metric Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M	(2017) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon

EXAMPLE C – *continued*.

	Steel Structural Tubing in Rounds and Shapes
ASTM A575	(1996; E 2013; R 2013) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 898-1	(2013) Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel – Part 1: Bolts, Screws and Studs with Specified Property Classes – Coarse Thread and Fine Pitch Thread

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 521	(2001; R 2012) Pipe Railing Systems Manual

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Preinstallation Meetings

Within 30 days of contract award, submit fabrication drawings to the Contracting Officer for the following items:

c. Steel railings and handrails

e. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

a. Structural-steel plates, shapes, and bars

b. Structural-steel tubing

c. Protective coating

d. Anchorage and fastening systems

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G M

Iron and Steel Hardware; G M

Steel Shapes, Plates, Bars and Strips; G M

EXAMPLE C – *continued*.

SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars; G M

Structural-Steel Tubing; G M

Cold-Finished Steel Bars; G M

Hot-Rolled Carbon Steel Bars; G M

Protective Coating; G M

SD-07 Certificates

Welder Qualification; G M

SD-08 Manufacturer's Instructions

Installation Instructions

1.4 QUALITY CONTROL

1.4.1 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, conduct an immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

2.1 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 to 12 scale. Provide details of sections and connections at not less than 1 to 4 scale. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials

EXAMPLE C – *continued*.

indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 0.8 millimeter. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

2.1.1 Steel Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

a. Flush-type rail fittings of commercial standard, welded and ground smooth, with railing splice locks secured with 10 mm hexagonal-recessed-head setscrews.

b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 150 mm long.

c. Railings may be bent at corners in lieu of jointing, provided that bends are made in suitable jigs and the pipe is not crushed.

2.1.2 Protective Coating

Shop-prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

a. steel surfaces encased in concrete

b. steel surfaces for welding

c. high-strength bolt-connected contact surfaces

2.2 COMPONENTS

2.2.1 Structural Steel Plates, Shapes And Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

EXAMPLE C – *continued*.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

2.2.2 Structural-Steel Tubing

Provide structural-steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

2.2.3 Hot-Rolled Carbon Steel Bars

Provide bars and bar-size shapes conforming to ASTM A575, grade as selected by the fabricator.

2.2.4 Cold-Finished Steel Bars

Provide cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.

2.2.5 Steel Pipe

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.2.6 Concrete Inserts

Provide threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive M20 diameter machine bolts; either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M, hot-dip galvanized in accordance with ASTM A153/A153M.

2.2.7 Fasteners

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Provide standard hexagon-head bolts, conforming to ISO 898-1.

Provide square-head lag bolts conforming to ASME B18.2.3.8M.

Provide cadmium-plated steel machine screws conforming to ASME B18.6.7M.

Provide flat-head carbon steel wood screws conforming to ASME B18.6.5M.

Provide plain round, general-assembly-grade, carbon steel washers conforming to ASME B18.22M.

Provide helical spring, carbon steel lockwashers conforming to ASME B18.2.3.8M.

2.2.8 Steel Railings And Handrails

Design handrails to resist a concentrated load of 890 N in any direction

EXAMPLE C – *continued*.

at any point of the top of the rail or 73 N/m applied horizontally to the top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.

2.2.8.1 Steel Handrails

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A53/A53M. Provide steel railings of 40 mm nominal size, hot-dip galvanized.

Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

Provide galvanized railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

PART 3 EXECUTION

3.1 PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

a. Anchor posts in concrete by means of pipe sleeves set. Provide sleeves of galvanized, standard-weight, steel pipe, not less than 150 millimeter long, and having an inside diameter not less than 13 millimeter greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than 25 millimeter greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between the post and sleeve with nonshrink grout ora quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.

Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 75 millimeter projection from the finished wall surface to the center of the pipe, drilled to receive one M10 bolt. Locate brackets not more than 1525 millimeter on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

3.2 INSTALLATION

Submit manufacturer's installation instructions for the following products to be used in the fabrication of steel:

a. Structural-steel tubing

b. Cold-finished steel bars

c. Hot-rolled carbon steel bars

d. Cold-drawn steel tubing

EXAMPLE C – *continued*.

e. Protective coating

f. Steel railings and handrails

g. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications cited in this section.

3.2.1 Steel Handrail

Install handrail in pipe sleeves embedded in concrete and filled with nonshrink grout or quick-setting anchoring cement with anchorage covered with standard pipe collar pinned to post. Secure rail ends by steel pipe flanges through-bolted to a back plate or by 6 mm lag bolts to studs or solid backing.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --

EXAMPLE D Submittal Register ENG Form 4288

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
Air Traffic Control Tower, UD 2.4, Jordan

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG# RAPH	CLASSIFICATION / GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES SUBMIT	CONTRACTOR: SCHEDULE DATES APPROVAL NEEDED BY	CONTRACTOR: SCHEDULE DATES MATERIAL NEEDED BY	CONTRACTOR ACTION ACTION CODE	CONTRACTOR ACTION DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY DATE FWD TO OTHER REVIEWER	APPROVING AUTHORITY DATE RCD FROM OTH REVIEWER	APPROVING AUTHORITY ACTION CODE	APPROVING AUTHORITY DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		05 52 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.2.1	G M												
			Iron and Steel Hardware	3.2	G M												
			Steel Shapes, Plates, Bars and Strips	3.2	G M												
			SD-03 Product Data														
			Structural-Steel Plates, Shapes, and Bars	2.2.1	G M												
			Structural-Steel Tubing	2.2.2	G M												
			Cold-Finished Steel Bars	2.2.4	G M												
			Hot-Rolled Carbon Steel Bars	2.2.3	G M												
			Protective Coating	2.1.2	G M												
			SD-07 Certificates														
			Welder Qualification	1.4.1	G M												
			SD-08 Manufacturer's Instructions														
			Installation Instructions	3.2													

SUBMITTAL FORM, Jan 96 PREVIOUS EDITION IS OBSOLETE PAGE 1 OF 1 PAGES

EXAMPLE E - Amendment Revised Section

Care and Preservation Facility, Camp Arifjan, Kuwait 369882

SECTION TABLE OF CONTENTS

DIVISION 10 - SPECIALTIES

SECTION 10 51 13

METAL LOCKERS
REVISED BY AMENDMENT NO. 0002

-- End of Section Table of Contents --

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AMENDMENT NO. 0002 W912ER20RXXXX

EXAMPLE E – *continued*.

SECTION 10 51 13

METAL LOCKERS
REVISED BY AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-L-00486	(Rev J) Lockers, Clothing, Steel

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

NOTE: M designates Middle East District to receive "G" submittals
R designates Resident Office to receive "G" submittals
M/R designates both offices to receive "G" submittals
No designation implies "For Information Only"

SD-02 Shop Drawings

Types; G M

Location; G M

Installation

Numbering system

SD-03 Product Data

Material

Handles

EXAMPLE E – *continued*

Finish

Locker components

Assembly instructions

SD-04 Samples

Color chips; G R

1.3 DELIVERY, HANDLING, AND STORAGE

Deliver lockers and associated materials in their original packages, containers, or bundles bearing the manufacturer's name and the name of the material. Protect from weather, soil, and damage during delivery, storage, and construction.

1.4 FIELD MEASUREMENTS

To ensure proper fits, make field measurements prior to the preparation of drawings and fabrication. Verify correct location

1.5 QUALITY ASSURANCE

1.5.1 Color Chips

Provide a minimum of three color chips, not less than 75 mm square, of each color indicated.

Government may request performance-characteristic tests on assembled lockers. Tests and results must conform to FS AA-L-00486. Lockers not conforming will be rejected.

PART 2 PRODUCTS

2.1 TYPES

Locker must have the following type and size in the location and quantities indicated. Locker finish colors will be as ~~scheduled~~ indicated on the color material legend in the Construction Documents.

2.1.1 ~~Double~~Single-Tier

~~Double~~Single-tier lockers must be as follows:

Type ~~DTL~~STL-1: ~~Double~~Single-tier locker ~~304.8~~381 millimeter wide, ~~380~~ 457 millimeter deep, and ~~1524~~1829 millimeter high, ~~attached to 152.4 millimeter high legs~~ with a 457 millimeter high and 305 millimeter deep bench drawer.

2.2 MATERIAL

2.2.1 Steel Sheet

ASTM A1008/A1008M, commercial quality, minimized spangle material. Prepare material surfaces for powder-coated finishing in accordance with FS AA-L-00486. Fabricate locker bodies from not less than 16-gauge steel sheet.

EXAMPLE E – *continued*

2.2.2 Finish

2.2.2.1 Color

As ~~selected.~~ indicated on the color material legend on the Construction Documents.

2.3 COMPONENTS

2.3.1 Built-In Locks

Built-in locks are not required.

2.3.2 Coat Hooks

FS AA-L-00486, zinc-plated.

2.3.3 Door Handles

FS AA-L-00486. Provide zinc alloy or steel handles with a chromium coating.

2.3.4 Doors

FS AA-L-00486, not less than 1.5 mm thick steel sheet. Louvered.

2.3.4.1 Hinges

In addition to the requirements of FS AA-L-00486, provide 5-knuckle hinges, minimum 50 mm high. Fabricate knuckle hinges from not less than 2 mm thick steel sheet. Weld or bolt hinges to the door frame. Weld, bolt, or rivet hinges to the door.

2.3.4.2 Latching Mechanisms

FS AA-L-00486.

2.3.5 Latch Strikes

FS AA-L-00486. Fabricate from not less than 2 mm thick steel sheet, except latch strike may be continuous from top to bottom and fabricated as part of the door framing.

2.3.6 Silencers

FS AA-L-00486.

2.3.7 Back and Side Panels, Tops, and Bottoms

FS AA-L-00486, not less than 1.2 mm thick steel sheet.

~~2.3.8 Legs~~

~~FS AA-L-00486.~~

2.3.8 Number Plates

FS AA-L-00486. Aluminum. Provide consecutive numbers starting with 001.

EXAMPLE E – *continued*

2.3.9 Fastening Devices

Provide bolts, nuts, and rivets as specified in FS AA-L-00486.

PART 3 EXECUTION

3.1 ASSEMBLY AND INSTALLATION

Assemble lockers according to the locker manufacturer's instructions. Align lockers horizontally and vertically. Secure lockers to wall with screws as indicated. Bolt adjacent lockers together. Adjust doors to operate freely without sticking or binding and to ensure they close tightly.

3.2 NUMBERING SYSTEM

Install number plates on lockers consecutively~~ with odd numbers on top and even numbers on bottom~~.

3.3 FIELD QUALITY CONTROL

3.3.1 Testing

Government may request performance-characteristic tests on assembled lockers in accordance with FS AA-L-00486. Lockers not conforming will be rejected.

3.3.2 Repairing

Remove and replace damaged and unacceptable portions of completed work with new.

3.3.3 Cleaning

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner. Remove equipment, surplus materials, and rubbish from the site.

-- End of Section --

EXAMPLE F - Amendment New Section

Care and Preservation Facility, Camp Arifjan, Kuwait 369882

SECTION TABLE OF CONTENTS

DIVISION 08 - OPENINGS

SECTION 08 35 13.33

PANEL FOLDING DOORS
ADDED BY AMENDMENT NO. 0002

-- End of Section Table of Contents --

SECTION 08 35 13.33 Page 1

AMENDMENT NO. 0002 W912ER20RXXXX

EXAMPLE F – *continued*.

Care and Preservation Facility, Camp Arifjan, Kuwait 369882

SECTION 08 35 13.33

PANEL FOLDING DOORS
ADDED BY AMENDMENT NO. 0002

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E336	(2019) Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
ASTM E413	(2016) Classification for Rating Sound Insulation
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

1.2 DESCRIPTION

Furnish and install operable partitions to building installed suspension system. Provide all labor, materials, tools, equipment, and services for operable walls in accordance with provisions of contract documents.

1.3 RELATED WORK BY OTHERS

1.3.1 General

a. Preparation of opening will be by General Contractor. Any deviation of site conditions contrary to approved shop drawings must be called to the attention of the Architect.

b. All header, blocking, support structures, jambs, track enclosures, surrounding insulation, and sound baffles as required in 1.04 Quality Assurance.

c. Prepunching of support structure in accordance with approved shop drawings.

d. Paint or otherwise finishing all trim and other materials adjoining head and jamb of operable partitions.

SECTION 08 35 13.33 Page 2

AMENDMENT NO. 0002 W912ER20RXXXX

EXAMPLE F – *continued*.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

NOTE: M designates Middle East District to receive "G" submittals
R designates Resident Office to receive "G" submittals
M/R designates both offices to receive "G" submittals
No designation implies "For Information Only"

SD-02 Shop Drawings

Installation; G M

SD-03 Product Data

Panel Folding Doors

Accessories

SD-04 Samples

Panel Sheet; G R

Suspension System; G R

Finishes; G R

Accessories; G R

1.5 QUALITY ASSURANCE

1.5.1 General

a. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.

b. The partition STC (Sound Transmission Classification) shall be achieved per the standard test methods ASTM E90.

c. Noise isolation classifications shall be achieved per the standard test methods ASTM E336 and ASTM E413.

d. Noise Reduction Coefficient (NRC) ratings shall be per ASTM C423.

e. Rack testing for 10 years. (tensional strength stress test).

f. The manufacturer shall have a quality system that is registered to the ISO 9001 standards.

1.6 DELIVERY, STORAGE, AND HANDLING

Proper storage of partitions before installation and continued protection

EXAMPLE F – *continued*.

during and after installation will be the responsibility of the General Contractor.

1.7 WARRANTY

Partition system shall be guaranteed for a period of two years against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Upon compliance with all of the criteria specified in this section, Manufacturers wishing to bid products equivalent to the product specified, must submit to the architect 10 days prior to bidding, complete data in support of compliance and a list of three past installations of products similar to those listed. The submitting manufacturer guarantees the proposed substituted product complies with the performance items specified and as detailed on the drawings.

2.2 MATERIALS

2.2.1 Panel Folding Doors

Product to be top supported Series 632 paired panels as manufactured by Hufcor Inc.

a. Panels shall be nominally 76 mm thick, to 1219 mm in width, and hinged in pairs.

b. Panel faces shall be laminated to appropriate substrate to meet the STC requirement in paragraph 2.4 Acoustical Performance.

c. Frames shall be of 1.42 mm gauge painted steel with integral factory applied aluminum vertical edge and face protection.

d. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.

e. Horizontal top seals shall be retractable, provide 25 mm nominal operating clearance, and exert upward force when extended. All panels shall have retractable top and bottom seals.

f. Horizontal bottom seals shall be retractable, provide up to 50 mm nominal operating clearance, and exert downward force when extended.

g. Horizontal trim shall be of aluminum.

h. Low profile hinges on basic panels shall be of steel and project no more than 6 mm beyond panel faces. Each pair of panels to have a minimum of three hinges.

2.2.2 Panel Weight

Weight of the panels shall be 27.8 to 49.8 kg/square meter based on panel configuration.

EXAMPLE F – *continued*.

2.2.3 Suspension System

a. Track shall be of clear anodized architectural grade extruded aluminum alloy 6063-T6. Track design shall provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. Track shall be connected to the structural support by pairs of minimum 10 mm diameter threaded steel hanger rods. Guide rails and/or track sweep seals shall not be required.

1. Each panel shall be supported by one 4-wheeled carrier. Wheels to be of hardened steel ball bearings encased with molded polymer tires.

b. Plenum closure (by others): Design of plenum closure must permit lifting out of header panels to adjust track height. Plenum closure required for optimum sound control of partition.

2.2.4 Finishes

a. Face finish shall be factory-applied reinforced vinyl fabric with woven backing. Fabric shall be: Newmor Wallcoverings, Italia Silk.

b. Exposed metal trim and seal color shall be brown (standard).

c. Aluminum track shall be clear anodized.

2.2.5 Accessories

a. Inset marker writing surfaces.

b. Inset eraser pocket.

2.2.6 Samples

Fabrication samples of each framing system intersection and adjacent panels, made from 305 mm lengths full-size framing members and showing details of panel sheet, suspension system, finishes, and accessories.

2.3 OPERATION

2.3.1 General

Panels shall be manually moved from the storage area, positioned in the opening, and seals set.

2.3.2 Retractable Horizontal Seals

a. Retractable horizontal seals shall be activated by a removable quick-set operating handle located approximately 1067 mm from the floor in the panel edge.

b. All retractable seals in each hinged pair shall be operated simultaneously.

c. Seal activation requires approximately 6.8 kilogram of force per panel and approximately a 190-degree turn of the removable handle.

EXAMPLE F – *continued*.

2.3.3 Final Partition Closure

Final partition closure to be by lever closure panel with expanding jamb which compensates for minor wall irregularities and provides a minimum of 113.4 kg seal force against the adjacent wall for optimum sound control. The jamb activator shall be located approximately 1143 mm from the floor in the panel face and be accessed from either side of the panel. The jamb is equipped with a mechanical rack and pinion gear drive mechanism and shall extend 100 mm to 152 mm by turning the removable operating handle.

2.3.4 Stack/Store Panels

Retract seals and move to storage area. Panels shall be stored in a pocket.

2.4 ACOUSTICAL PERFORMANCE

Acoustical performance shall be tested at a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards. Standard panel construction shall have obtained an STC rating of 51.

Complete, unaltered written test report is to be made available upon request.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

The complete installation of the operable wall system shall be by an authorized factory-trained installer and be in strict accordance with the approved shop drawings and manufacturer's standard printed specifications, instructions, and recommendations.

3.1.2 Cleaning

a. All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.

b. Cartoning and other installation debris shall be removed to onsite waste collection area, provided by others.

3.1.3 Training

a. Installer shall demonstrate proper operation and maintenance procedures to Owner's representative.

b. Operating handle and Owners manuals shall be provided to Owner's representative.

-- End of Section --

EXAMPLE G – Amendment Narrative

MIDDLE EAST DISTRICT
U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 2250 WINCHESTER, VIRGINIA 22604-1450

Amendment 0002

SUBJECT: Amendment 0002 to W912ER-19-R-0021 Care and Preservation Facility, Camp Arifjan, Kuwait

1. Specifications: Revised sections are replaced in their entirety. Revisions to the specification pages are shown on the pages in the following manner: New text is underlined and deleted text is shown using strikeout. The amendment number appears in the bottom margin on all pages of the new or revised sections.

The following have been revised/added:

Table of Contents
Replaced in entirety

Section 01 11 00
Paragraph 1.2, pages 2 and 3
Paragraph 1.6.5, pages 9 and 10
Paragraph 1.7.3, page 11
Appendix C, added in entirety

Section 01 50 00
Paragraph 2.2.4, page 4

Section 01 91 00.12 10
Paragraph 1.7.2.b, page 9

Section 03 30 00
Paragraph 1.2, page 9
Paragraph 1.3, page 11
Paragraph 1.6.4.1 and 1.6.4.2, page 13
Paragraph 1.7.1, page 15
Paragraph 2.3.1.4, page 18
Paragraph 2.4.1 and 2.4.1.1, pages 18 – 20
Paragraph 2.4.3, page 20

Section 08 35 13.33
Added in entirety

Section 10 51 13
Paragraph 2.1 and 2.1.1, page 3
Paragraph 2.2.2.1, page 4
Paragraph 2.3.4, page 4
Paragraph 2.3.8, page 4

Page 1 of 4

EXAMPLE G – *continued*.

Paragraph 3.2, page 5

Section 14 21 33
- Paragraph 2.1.1.1, page 10
- Paragraph 2.4, pages 11 and 12
- Paragraph 2.5.2, page 13
- Paragraph 2.5.2.1, page 13
- Paragraph 2.6, page 14
- Paragraph 2.6.2, page 15
- Paragraph 2.5.2.1 e and g, page 15
- Paragraph 2.8.1, page 17
- Paragraph 2.8.8, page 18
- Paragraph 2.10.1 and 2, page 19

Section 23 00 00
- Paragraph 1.3, page 10
- Paragraph 2.10.1, page 16
- Paragraph 2.18 – 2.18.6, pages 29-30

Section 26 51 00
- Paragraph 2.6.3, page 15

Section 27 51 16
- Added in entirety

Section 28 08 10
- Added in entirety

Section 41 22 13
- Added in entirety

2. Revisions to the following drawings are identified by a triangle placed on the drawing near each revision and a "cloud" drawn around both the triangle and change.

General:
- G-011
- G-012
- G-013

Electrical:
- XE-100
- XE-100_A

Page 2 of 4

EXAMPLE G – *continued*.

Structural:
- S-101
- S-501
- S-504
- S-505
- S-506
- S-507
- S-508

Architecture:
- A-110
- A-302
- A-314
- A-514
- A-516
- A-601
- A-602
- A-603

Interior:
- IN-113
- IN-602

Fire Protection:
- FX-116
- FA-116
- FA-117
- FA-401
- FA-501
- FA-503
- FA-601
- FA-602

Mechanical:
- PP-111
- PP-112
- PP-113
- PP-114
- PP-115

Page 3 of 4

EXAMPLE G – *continued*.

PP-116
P-601
MH-411
MH-602
MH-604

Site Electrical:
E-001
E-501

Telecommunications:
T-123
T-401
T-601

CHAPTER 4
COST ENGINEERING

CHAPTER 4
COST ENGINEERING

4.1 GENERAL.

4.1.1 Purpose. The purpose of this chapter is to present the general requirements for Middle East District cost engineering products. These products typically comprise cost estimates, Construction Schedule Estimates, Cost and Schedule Risk Analyses, and other ancillary products, primarily of a financial economics nature, supporting engineering, construction, and, planning and programming efforts.

4.1.2 Products. Cost Engineering products are design products, delivered by qualified professionals, which drive decisions pertaining to project cost and time budgets. Cost Estimates and Construction Schedule Estimates are prepared and submitted in concert with all design submittals.

4.2 APPLICABLE PUBLICATIONS.

§01 32 17.12 10 Cost-Loaded Network Analysis Schedules (NAS) (MED)

AACE International Recommended Practice No. 41R-08, Risk Analysis and Contingency Determination Using Range Estimating

AACE International Recommended Practice No. 56R-08, Cost Estimate Classification System – As Applied for the Building and General Construction Industries

AACE® International Recommended Practice No. 27R-03, Schedule Classification System

DPM 2020-03 Designated Construction Agent Assessment of FY 2022 Budget Estimates.

ER 1110-1-8173, Energy Modeling and Life Cycle Cost Analysis

ER 1110-2-1302, Civil Works Cost Engineering

ER 1110-3-1300, Military Programs Cost Engineering

ER 1-1-11 Project Schedules, 18 Sep 2017

UFC 3-701-01 DoD Facilities Pricing Guide, w/Change 6 July 2020

UFC 3-730-01 Programming Cost Estimates for Military Construction, w/change 2 May 2020

UFC 3-740-05 Handbook: Construction Cost Estimating, w/Change 2 April 2020

UFGS 01 32 01.00 10 Project Schedule

UFGS 01 32 17.00 20 Cost-Loaded Network Analysis Schedules (NAS) 4.3 UNIT PRICE BOOK (UPB).

4.3 DEFINITIONS

Cost Estimate. A cost estimate is a design product that is an estimate of project construction costs, aligned with the maturity of design (i.e., design phase or stage).

Cost and Schedule Risk Analysis (CSRA). A formal process subset of Risk Management that assesses identified project risks.

Construction Schedule. A construction schedule is a diagrammatic presentation showing the logical order in which the construction work will progress, and the dates contemplated for starting and completing the salient features of the work (including acquiring materials, plant, and equipment).

Network Analysis System. A Network Analysis System (NAS) or Cost-Loaded Network Analysis System is a construction schedule containing substantially- enhanced features that is used as a tool to manage the construction project, incorporating progress reporting, resource usage and demand evaluation and, analysis of earned value.

TRACES. Tri-Services Automated Cost Engineering System; comprising a suite of cost estimating tools such as PC Cost, PACES, M2, and others, TRACES is governed by the Department of Defense TRACES Steering Committee.

4.4 COST ESTIMATES.

4.4.1. Accuracy and Precision. The accuracy and precision of a cost estimate aligns with the project's design phase/stage. A cost estimate may be categorized as a concept - , programming -, preliminary-, current working-, final -, or expressed as a design-accomplished percentage (i.e., 15%, 35%, 65%, 95%, 100%, etc.). The same categorization is usually applied to construction contract modification cost estimates. The discussion below on "Estimate and Schedule Classes" provides detail on this matter.

All cost estimates will comply with ER 1110-3-1300 and will be prepared in accordance with UFC 3-740-05.

4.4.2 Programming and Concept Cost Estimates. These cost engineering products are typically the output of charrette (planning, or design) effort and utilize parametric methodologies. At the early programming and planning stages, estimating may be accomplished using project comparison or square meter methods. As the effort matures into a defined project, cost estimating will be accomplished using parametric techniques and tools such as PC Cost and PACES. Parametric estimating will be performed in accordance with UFC 3-730-01. The selection of the tools appropriate to the specific effort may be at the discretion of the PDT's assigned Cost Estimator or dictated as required by contract.

4.4.3 Quantity Take-Off (QTO) Estimates. As the design progresses and/or matures, the estimating methodologies will transition from parametric to quantity take-off. The transition from parametric to QTO estimating is expected to initiate during the 35% effort, with increasing use of detailed unit costs, assembly based unit costs, and more limited use of parametric elements. At the final, corrected final or 100%/RTA phase/stage, all parametric portions of the estimate will have been replaced by QTO from design drawings and other information. QTO estimates will utilize the Microcomputer-Aided Cost Engineering System Second Generation (MCASES/MII or “M2”) software in their preparation.

4.4.4 Government Estimate. The Independent Government Estimate (IGE) or Independent Government Cost Estimate (IGCE), referred to as the “IGE” generally at Middle East District, is the estimate provided to the Contracting Officer prior to proposal or bid opening. The IGE can only be prepared by a Federal employee and is based on the 100% design, and accounts for revisions to the solicitation during the bidding phase resulting in amendments. Note that IGEs are also required for Change Order Proposals (refer to Chapter 3). COP IGEs are based on information that may be gathered from the field as well as new or revised requirements collected by the PM.

4.4.5 Cost Estimate Product Composition.

4.4.5.1 The cost estimate will be prepared such that the all anticipated construction tasks, estimated in terms of labor, material, and equipment necessary to complete the construction project in accordance with its Scope of Work. Cost estimates will account for, at the level of detail appropriate matching the available design information, all labor, material, equipment costs necessary to accomplish the construction project; shipping/transportation costs will be accounted-for as well. Mobilization/demobilization, job office overhead, home office overhead, other determined indirect costs, escalation, and profit will be accounted-for in a quantified manner. Duration of construction, as output by the cost estimating tool, will also be accounted-for.

4.4.5.2 The cost estimate product to be submitted is a stand-alone report that includes an executive summary introducing the work product, a comparison of the current estimate to the programming document (if applicable), a more detailed narrative of the work (i.e., a “design analysis” of the cost estimating effort), the report output from the appropriate cost estimating tool itemizing the costs (i.e., summary and detail report outputs from PC Cost, PACES, or M2 showing the direct labor, material, equipment, and overhead, and total costs for each building, facility, and bid item).Other back-up information such as vendor quotations, catalog cuts, and, market research documentation, should be noted within the design analysis. The documentation should be maintained as part of the estimate project files and available upon request.

4.4.5.3 Additionally, the cost estimate submittal will be accompanied by two separate documents, the Cost Breakdown Sheet, and the Proposal Schedule. Both of these documents, capture the salient elements of the Scope of Work in tabular form. The Cost Breakdown Sheet organizes the primary cost items by unit of measure and quantity, direct costs (labor, equipment, materials), subcontractor cost, Overhead, and profit. The Cost Breakdown Sheet is used by the contractor in the construction of their bid. The Proposal Schedule lists the primary cost items and provides space next to each item for the contractor’s cost for each. Bidders are required to complete these documents and include them with their construction contract proposal/bid/offer. The completed documents are used by the Middle East District during analysis of bids leading up to a contract award.

4.4.6 Sources of Cost Information and Cost Books.

4.4.6.1 Middle East District maintains country-specific cost information. Typically, this collection of cost information is referred to as a “cost book” or “unit price book”. In strictest terms, a Cost Book is not a printed document but a digital database that can be read by the M2 software, though this information is available to PC Cost and PACES. Cost books are generally updated at regular periods (ideally every three years).

Use of the appropriate Middle East District County-specific cost book is mandatory.

4.4.6.2 However, no cost book is comprehensive or should be considered the only source of cost information. If it is determined that current data is lacking in sufficient detail or that it should be changed to reflect current conditions, the cost estimator (either in-house or A/E contractor) is responsible for addressing any such cost data gaps, including user-input of the cost data to that particular cost estimating effort. The results of these information gathering efforts, which could be documented vendor quotes, or market research reports, form a substantial portion of cost estimate backup data and will be included with all cost estimate product submittals. Additionally, sources such as UFC 3-701-01, and/or commercially-published information (i.e., Spon’s, RSMeans, et al.) are appropriate for consideration, based on the estimator’s professional judgement. The project’s cost estimator who prepared this data is also responsible for defending its credibility, and providing a summary report of recommendations for incorporation of the information into future Cost Book.

4.4.7 Cost Books and TRACES Tools. The TRACES cost-engineering tools are externally managed via software license. In-house cost engineering personnel must verify that the latest Cost Book(s) is (are) readily available for use and that the latest software versions are properly installed on their workstations at the beginning of a project effort. A-E contractors are provided with specific guidance regarding Instructions for acquiring these tools in the technical requirements specific to a contract or task order. Instructions for acquiring the appropriate Cost Book from Middle East District are also provided to A-E contractors via the specific contract or task order.

4.5 CONSTRUCTION SCHEDULE ESTIMATES

A construction schedule estimate is a design product that represents an estimate of the temporal requirements (i.e., time) necessary to complete the construction project in accordance with the construction contract.

All construction schedule estimates will be prepared in accordance with ER 1-1-11, with Middle East District-specific requirements described in the sub-paragraph “Construction Schedule Estimate Preparation,” below.

4.5.2 Alignment with the Cost Estimate Product.

4.5.2.1 Construction schedule estimates will align with the cost estimate; that is, those construction tasks considered for the development of the cost estimate effort will be mirrored in the construction schedule estimate. The major elements of work listed in the Cost Breakdown Sheet and Proposal Schedule, which are readily discernable in the cost estimate, will be similarly manifest in the construction schedule estimate. Essentially, the construction schedule estimate will utilize the same Work Breakdown Structure (WBS) as the cost estimate.

4.5.2.2 The construction duration shown in the construction schedule estimate must closely align with the construction duration generated by the MII cost estimating software. These durations will be cross checked during all reviews.

4.5.3 Construction Schedule Estimate Composition.

Construction schedule estimates comprise a Gantt Chart, with critical path shown, illustrating the sequence and interdependence of the work activities/tasks necessary to build the project in accordance with the contract, software files (see below), and an accompanying written narrative providing a summary of the work and production assumptions, overall project summaries/durations and critical path, schedule calendars and working hours/daily work and non-work periods, holidays and weather allowances, and descriptions of specific items deserving of extra attention (i.e., long lead time items).

At a minimum, the following will be displayed on the construction schedule estimate Gantt Chart:

- Major construction features of works (i.e., Mechanical, Electrical, Structural, Civil, Site Work, Utilities, Foundation, etc.).
- Start, and Finish Dates
- Time durations.
- Major equipment interfaces, CFP/GFP.
- Other GFP (i.e., furniture, etc.), if applicable.
- Other contract interfaces (construction packages).
- Pre-construction activities, including Notice to Proceed (NTP)

Detail will be sufficient enough to show or determine logical timing, sequence, and interdependence of the major facilities and activities, including their interfaces, required by the construction contract.

4.5.4 Scheduling Software.

Middle East District construction projects typically require all scheduling work be delivered in a format that can be readily imported into the Resident Management System (RMS). Thusly, the preferred file format is the .xer format, which is output by the Primavera P6 software. Depending on the requirements of the design contract or task order, however, Microsoft Project .mpp files may be required.

Construction schedule estimate submittals will include the associated .xer and/or .mpp file(s), accompanying the printed Gantt chart.

4.5.5 Construction Schedule Estimate Preparation.

4.5.5.1 ER 1-1-11 requires the use of UFGS §01 32 01.00 10 in construction contracts. During the construction contract schedule estimate preparation effort § 01 32 01.00 10 PROJECT SCHEDULE will provide excellent guidance and insight into the construction contractor’s requirements for construction schedule submittals, however, Middle East

District has developed a hybrid specification, §01 32 XX.12 10 COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS) that combines certain elements of §01 32 01.00 10 and the NAVFAC-maintained §01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS) to allow for specialized analysis of progress and to specifically facilitate earned-value analysis during construction. The hybrid §01 32 XX.12 10 utilizes the Standard Data Exchange Format (SDEF) coding structure described in ER 1-1-11, which is not described in the NAVFAC §01 32 17.00 20.

4.5.5.2 Preparation of the construction schedule estimate will be in accordance with ER 1-1-11, including alignment with UFGS §01 32 01.00 10. This product may be prepared in-house or by an A-E contractor.

4.5.5.3 The associated construction specification §01 32 17.12 10 is a Division 01, General Requirements, section and thus the Middle East District Specifications function is responsible for its preparation. That is, §01 32 17.12 10 is typically an in-house product.

4.6 COST ESTIMATE AND CONSTRUCTION SCHEDULE ESTIMATE CLASSES

Classification of estimate products will conform to the AACE Cost Estimate Classification and/or the AACE Schedule Classification systems, see Table 1 below.

The estimate product's "class" is associated with the maturity level of the design: At the programming level, a Class 5 or 4 product(s) is likely the most accurate practicable. As the design develops, the estimate product accuracy will increase from Class 3 through to Class 1. As a point of reference, a 35% estimate product would be recognized as a higher-level Class 3 or a lower-level Class 2 estimate. (Note: per DPM 2020-03, a formal, written validation of scope and cost by the Chief, Engineering Division is a 35% design-level product for new MILCON projects.)

TABLE 1 Estimate product classification

ESTIMATE PRODUCT CLASS	**MATURITY LEVEL OF ESTIMATE PRODUCTS** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**COST ESTIMATING METHODOLOGY**	**SCHEDULING METHODOLOGY**
Class 5	0% to 2%	[Programming] Functional area, or concept screening	SF or m^2 factoring, parametric models, judgment, or analogy	Top down planning using high level milestones and key project events.
Class 4	1% to 15%	[Programming] Schematic design or concept study	Parametric models, assembly driven models	Top down planning using high level milestones and key project events. Semi- detailed.
Class 3	10% to 40%	Design development, budget authorization, feasibility	Semi-detailed unit costs with assembly level line items	"Package" top down planning using key events. Semi-detailed.
Class 2	30% to 75%	Control	Detailed unit cost with forced detailed take-off	Bottom up planning. Detailed.
Class 1	65% to 100%	Check estimate or [RTA], change order	Detailed unit cost with detailed take-off	Bottom up planning. Detailed.
Sources: Cost Estimate Classification Matrix for Building and General Construction Industries, AACE 56R-08, and Schedule Classification system, AACE 27R-03.				

4.7 COST AND SCHEDULE RISK ANALYSES

4.7.1 Cost and Schedule Risk Analysis (CSRA) is a design product output that is aligned with the Corps of Engineers commitment to Risk-Informed Decision Making (RIDM) for Program and Project Delivery. In accordance with ER 1110-1-1300, CSRA is required for all CETAM projects.

Cost and Schedule Risk Analyses will be performed for the project or program utilizing CSRA techniques as outlined in ER 1110-2-1302 (Note: until there is formal guidance for CSRA associated with MILCON projects, the Civil Works CSRA requirements will be followed in accordance with HQUSACE directions).

CSRA work may, depending upon project scope, be combined or augment project Value Engineering efforts.

4.7.2 Responsibilities and Methods

4.7.2.1 The methodology for the CSRA will depend on the total project cost, unless otherwise directed by the project's scope of work. If the total project cost is less than $40 million, an abbreviated risk analysis that utilizes a spreadsheet-based risk register is appropriate. For projects of total project cost $40 million or greater, a formal or detailed CSRA is required. For projects with an authorization year of FY2024 and beyond, the cost limit is $20 million or more. The detailed CSRA includes risk identification, quantitative and qualitative study, and sensitivity analysis using a Monte Carlo simulation method, employing the Oracle Crystal Ball software tool.

4.7.2.2 The cost engineer assigned to the specific project (in-house or A/E contractor) is the lead for all project-specific CSRA efforts, including development of the risk register, establishment of the probability and likelihood of occurrence happening, defining the impact to the project, and compiling and reporting on potential mitigation measures/courses of action should a risk be realized. The CSRA lead is responsible for gathering all input for the risk register. The CETAM Project Manager (and, when appropriate, the CETAM Design Manager) is responsible for ensuring that the input gathering effort, including brain-storming, is collaborative to the maximum extent practicable; i.e., participation of the complete PDT, interagency organizations, and the customer/stakeholder is paramount to delivery of an effective CSRA report that will facilitate risk-informed decision making.

4.7.2.3 The risk register is actively maintained by the CSRA lead throughout the design period, who will sustain regular contact with the CETAM Project Manager regarding risk management. "Input" to the risk register comprises identification of all risks (knowns and unknowns) that will impact the cost, scope, or schedule for the project. Risk identification can occur at any time during the design phase of the project and, depending on the magnitude/impact of the risk, may need to be acted upon as required so as not to have a negative effect on project delivery to the customer.

4.7.3 CSRA Product Requirements

The CSRA product consists of the risk register, and an accompanying comprehensive report.

4.7.3.1 The risk register will address, at a minimum, these main risk categories:

a. Project management,
b. Project scope,
c. Contracting Strategies,
d. Lands and Damages - Real Estate,
e. Regulatory, Environmental and Cultural Resources
f. Major Design features
g. Major Construction features
h. Critical Estimate Assumptions
i. External risks

4.7.3.2 The risk register will address, at a minimum, these major risks:

a. Project Scope Confidence
b. Funding Stream (Fed and non-Fed)
c. Contract Acquisition Strategy
d. Technical Design concerns on each major design feature
e. Construction concerns on each major construction element
f. Construction Mod Potential
g. Estimate Assumption concerns on direct, indirect, major construction elements
h. Bid Climate and Market Conditions (early years – out years)
i. External Risks

4.7.3.3 The CSRA report will contain, at a minimum, the following:

a. Executive Summary describing project scope, features studied, contingency outcome, description of the high and moderate risks, both cost and schedule.
b. Date(s) of meetings, and listing of all CSRA activity participants
c. Report Purpose
d. Project Background
e. Risk Methodology/Process
f. Project Assumptions and any critical exclusions.
g. Results: Contingencies, sensitivity analyses (cost and schedule)
h. Major risk findings (cost and schedule)
i. Risk Mitigation recommendations
j. Risk register output in a readable format

4.7.3.4 Those involved in development of the risk register will include:

a. CSRA Lead (Cost Engineer)
b. Project Manager
c. Design Manager
d. Design discipline leads
e. Construction representative
f. Contracting representative
g. Outside project stakeholders (building owner, DPW representative, etc.)

4.7.3.5 CSRA products will be included with the 35%, 65%, and 95% design submittals. For the 35% submittal, the CSRA effort must be completed prior to the completion of the 35% design. Development of the initial submission of the CSRA requires a full PDT meeting to discuss risks and impacts. Later submittals should consider meeting again if there have been substantial changes to scope or expected risk. Subsequent CSRA products must re-visit each previous CSRA product and address any outcomes resulting in reduction (or potentially, elimination) of identified risks, amplification of identified risks, and/or newly identified risks as the project progresses.

4.8 SUBMITTALS.

Cost Estimates and Schedule Estimates cannot be delivered at the same time as a design phase submittal, for the reason that these products require the complete design as input. Delivery of these specific products is anticipated to be up to ten days (depending upon design complexity and scope) following a primary design phase submittal.

4.9 OTHER COST ENGINEERING PROJECT OUTPUTS

Cost engineering inputs to Life Cycle Cost Analysis per ER 1110-1-8173 (refer to Chapters 1, 7, 8, 15, 17).

CHAPTER 5
PROGRAMMING

CHAPTER 5
PROGRAMMING

5.1 GENERAL.

5.1.1 Summary. Using customer facility performance requirements, a design team of Architects and Engineers will facilitate stakeholder workshops to create program level documents which define the design criteria, scheduling and funding requirements for specific project scopes of work from design to construction. The programming process will define the objective of the facilities and determine the impacts if the projects are not supported. The goal is a functional program with projects that least impact the environment and provide the greatest benefit for the users. Where more than one viable alternative exists, the team will analyze alternatives and make recommendations in partnership with stakeholders which clearly state assumptions.

The objective of the programming phase of the work is to prepare the Basis of Design documents to be used in the design of proposed projects. The major tasks facing the design team during this phase of the work are research and analysis. The design team, in cooperation with others at the Middle East District (MED), shall define in detail the project purpose, including the activities, processes, and events which will occur at the proposed project. The proposed project site(s) shall be examined, and site conditions shall be analyzed to determine their affinity to the proposed project.

5.1.2 Site Selection. For some projects several sites may be considered, in which case the design team will be charged with a site selection recommendation. The design team shall investigate each site and make a recommendation based upon the requirements of the proposed project.

5.1.3 Design Directive. Programming will only be performed when required by the Program Manager. In all cases of work, the design team will consult or work in conjunction with the USACE Center of Expertise for Programming and Planning, Huntsville, AL to integrate subject matter expertise in planning and programming efforts. Where no master plans exist for a site under programming action, the USACE Center of Expertise for Master Planning, Fort Worth, TX will be consulted to integrate mater planning subject matter expertise. Each Center of Expertise may elect to review submittals and / or select design team members for approval.

The design team will be given a design directive which will outline the parameters of the project(s) as completely as possible, including the purpose of the project, the requirements of the user, the expected time schedule, and the project budget, if determined. The design directive will establish three major parameters for the project: quality, cost, and floor area, and it will determine the relative importance of each. Thus, the design directive will determine whether the project should be a monumental facility with a relatively high cost per square meter, a utilitarian facility with a relatively low cost per square meter, or a facility with high quality systems and a subsequent high cost, etc.

5.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below, form a part of this manual.

UFC 1-200-01 DoD Building Code

International Building Code (IBC)

5.3 PROGRAMMING SUBMITTAL REQUIREMENTS.

The design requirements document shall be incorporated into each PMP unedited. The PDT supports this activity.

The Basis of Design documents shall be prepared in accordance with Chapter 2: PRESENTATION OF DATA as applicable. The Basis of Design plans should comply with drawing requirements and the Basis of Design Program should comply with design analysis requirements.

5.3.1 Basis of Design Program. The Basis of Design program is a volume of written material which will constitute the main source of project design criteria to implement the later phases of the facility designs. The Program shall define the type, purpose, intent and goals of each project and shall assign priorities to any of these stated goals that could be in conflict with each other. The Basis of Design Program shall include but not be limited to the following information:

5.3.1.1 General Requirements. The discussion of the program requirements shall include the following:

a. Purpose: The overall customer objectives and goals for individual facility programing together with any background information necessary to clarify the program.

b. Participants: An overview of the major users of the facilities, stakeholders and funding customers.

c. Activities: Identification of the significant activities to be supported by the each project and subsequent projects including relationships between the various activities and any requirements imposed by operational or organizational restrictions.

e. General Criteria: User furnished requirements including time schedule, project budget, area limitation, phasing requirements, future expansion, etc.

f. Design requirements document. The design codes that will control the design methods and construction materials.

d. Facilities: The physical features of each project required to meet the functional requirements.

f. Major Assumptions: Requirements augmenting project directive.

5.3.1.2 Intangible Requirements. Determine and express the principal attitudes of the user concerning the character of the whole project and of the individual parts, including outdoor spaces and facilities. Discover the aesthetic qualities desired by the user, indicating the user's preferences for such items as form, scale, density, composition, texture, color, decoration, and other physical characteristics which evoke psychological or sociological responses. The user's evaluation of aesthetic and functional qualities relative to economies of area, cost, and engineering systems shall be expressed. State how these values are different for different project elements and how the user's desires were determined.

5.3.1.3 Facility Requirements. For each facility in the project, the discussion of the program requirements shall include the following:

a General Requirements as identified in paragraph 5.3.1.1 with the discussion directed toward the specific facility.

b. Individual Space Requirements. Develop the information necessary to plan the spaces within the facility as well as any appropriate, specific criteria to be used in the design development. The discussion shall include the following:

1. Function - the purpose of the space, the activities that take place, how often they occur, how long they last, etc.

2. Participants - the people involved in the activities (staff, users, visitors, etc). Their characteristic's (officer, enlisted, civilian, etc) and their number (maximum, minimum, average, etc).

3. Size - the overall area of the space and any allowable variations in space size.

4. Relationships - the requirements for proximity to or remoteness from other spaces.

5. Special considerations - the important features that support the function of the space, critical dimensions, integral storage requirements, special life safety requirements, etc.

6. Acoustic considerations - the requirements for special sound control measures.

7. Interior requirements - the finishing of the space including identification of major equipment and furniture required to support the activities of the space. Restrictions or requirements on finish, color selection, signage, etc.

8. Structure and Environmental support considerations - requirements relating the building structure; the HVAC, plumbing, fire protection, electrical, and communications systems; etc.

9. Space Development Sketches - any graphic aids necessary to support and/or clarify the space criteria, indicating the important physical features equipment, furniture, etc, required by the activities within the space.

c. Space Allocation Table, relating the functional areas and their programmed space allocations. The table shall include allocations for circulation, mechanical, electrical, and other spaces as necessary to yield the total facility gross area as defined in Chapter 2: PRESENTATION OF DATA.

d. Facility Organization. Functional areas shall be organized to obtain the most economical and efficient use of space. Discuss the reasoning behind major layout decisions including such items as optimization of adjacency relationships, establishment of workable and convenient circulation, flexibility of space use, simplification of visual control, economy of structure and/or environmental support systems, etc. Provide any graphic design aids such as affinity drawings, spatial organization and relationship matrices and building layout sketches as necessary to support or clarify the organization of the facility. Comparative analysis of alternate facility organizations considered may be provided where necessary to establish the relative merit of the recommended solution.

5.3.1.4 Site Peculiar Requirements. Site analysis is required for site selection and for project design on the selected site. The discussion shall include the following items.

a. A description of the project site, including boundaries and total area. Include a discussion of any trees, topographic features, and other physical features on the site.

b. An indication of the present and former use of the project site and of the presence of existing structures on it.

c. A discussion of land use on adjacent properties and the characteristics of any surrounding development. Include photographs of significant topographic features such as groves of trees, wadis, escarpments, buildings, etc.

d. A review of any possible conditions of flooding. Describe any significant drainage courses that cross the site.

e. A discussion and an analysis of the surrounding roads, railroads, airports, harbors, towns, outdoor recreation areas and other areas of interest.

f. An inventory of existing mapping and the public services available including public transportation; fire protection; water supply; waste water collection; solid waste collection; electric power and communication systems; and central plant facilities for heating, cooling, water treatment, wastewater treatment, and electrical power.

g. A description of annual weather conditions at the site: temperatures, rainfall, dust storms, relative humidity, wind conditions, etc.

h. An indication of the orientation of the sun and wind to the site throughout the year. Notes on the wind velocity and wind direction should be included.

i. A summary of the geotechnical conditions at the site; stating the types, elevations, and locations of soils found; the types, elevations, and locations of surface and subsurface rock; soil stability; corrosive elements in the soil; extent and type of subsurface explorations; and any special foundation studies needed for the Concept design.

j. A statement noting the requirements of any existing regional master plan and how the proposed project may comply or conflict with those requirements.

k. A summary of any local zoning regulations, traffic regulations, building restrictions, and any height restrictions due to aircraft landing patterns.

5.3.1.5 Resulting Requirements. The synthesis of the requirements listed above shall be presented. The Basis of Design shall indicate that logical reasoning has been converted into significant design decisions. The information which shall be presented includes the following:

a. Proposed solutions to problems resulting from site conditions.

b. Proposed alternatives for public services which are nonexistent or insufficient, such as water supply and treatment, wastewater treatment and disposal, and power generation and communication systems.

c. Transportation studies, indicating the need, scope and effect of systems for pedestrian, auto, transit, rail and air traffic. From surveys of existing and proposed trip-making, project future trip-making, trip distribution, and modal split.

d. Identification of structures that would have high loading on foundations or excavation for basements.

e. A statement relating to the need to relocate, remodel, or demolish any existing utilities or facilities on the proposed site.

f. If phasing of the project is required, a detailed summary of how the phasing will be handled including how all necessary later phase items will be handled in the initial phase on a temporary basis.

g. An assessment of the impact of the proposed project on the existing environment.

h. Copies of all Corps of Engineers (USACE) standard facility plans or sketches the design A-E is expected to incorporate in the design of the project.

i. A list of all technical publications used to develop this programming information.

5.3.2 Basis of Design Site Plans. The Basis of Design site plans shall provide graphic inventories and analyses of the project site and shall graphically present the proposed project master plan. These site plans shall indicate the major project elements (i.e. structures, circulation, grading and landscaping, and utility services) arranged in accordance with the following parameters: function, appearance, safety, economy, environmental harmony, regional congruity, and future growth. The site plans shall include and shall be limited to the following plans.

5.3.2.1 Existing Site Plan. This plan shall show the existing land use of the site, the existing topography, and the location of any natural or manmade features.

5.3.2.2 Regional and Vicinity Map. This plan shall show the development and other conditions surrounding the site.

5.3.2.3 Site Analysis. This plan shall be the A-E's analysis of the existing site and shall include these items:

a. Best views, poor views, objectionable views.

b. Recommendations for the removal or preservation of any trees.

c. Areas suitable for development, logical points of ingress.

d. Prevailing wind and breezes.

e. Assessment of other natural features.

f. Floor elevations, if pertinent.

5.3.2.4 Preliminary Land Use Plan. This plan shall show how the land area of the site is to be developed in terms of general land use. The plan shall also show what relationships exist between the various land-use elements and how much space is allocated for each use.

5.3.2.5 Traffic Circulation Plan. This plan shall show the modes and relative amounts of expected traffic between various elements of the plan and to locations beyond the site. Graphic devices, such as arrow size and line weight, shall be used to indicate sequence, frequency, and volume.

5.3.2.6 General Site Plan. This plan shall show the location of all required facilities, including buildings, parking areas, and roadways. Buildings shall be shown in outline only with an indication of the number of building floors. Pedestrian and service access points shall be indicated but interior spaces shall not be developed. Parking areas shall be shown only as areas with an indication of the number of parking spaces. Traffic aisles and parking stalls shall not be shown. Only major roads and service access roads shall be shown at this stage. Any major pedestrian routes between buildings shall be shown. Areas with a large number of small buildings such as family housing areas shall be shown only as masses. The probable locations of such facilities as mosques, markets, schools, and major access roads shall be indicated within these mass areas.

5.3.3 Basis of Design Cost Estimate. This estimate shall be used to establish a programming budget to guide the later phases of the facility design. The estimate shall be as described in the Chapter 4: COST ESTIMATING.

Use the latest U.S. Metric MII cost book and update the cost to reflect current market conditions in the locality, including all materials, labor and equipment, including crew productivity. The current version of PACES or PC-Cost, typically used for programming or budgetary cost estimates, may be used for concept estimates.

Estimates shall comply with UFC 3-730-01, Programming Cost Estimates for Military Construction

5.3.4 Basis of Design Building Schematic Drawings shall be developed from the Basis of Design Program. Schematics shall be single line drawings at a scale to clearly show the arrangement of the facilities. Dimensions shall be approximately correct, but not necessarily final.

5.3.4.1 Floor plans shall show functional layout of all elements including circulation spaces, entrances, stairways, elevators, column locations, and mechanical and electrical equipment spaces. All rooms and spaces shall be identified but door swings, windows, plumbing fixtures and materials need not be identified. On the first plan of each facility, the gross areas of the facility with a breakdown by floor shall be shown.

5.3.4.2 Elevations shall be block outlines and breaks to indicate the various masses and how they coincide with the plans. Typical proposed window arrangement and exterior material indication shall be shown only to the extent necessary to suggest a possible design in accordance with the program requirements. Floor to floor dimensions shall be shown.

5.3.4.3 Building sections shall show how the architectural, structural, mechanical and electrical systems will be accommodated. Major rooms identified by name shall be shown, as well as floor to floor dimensions.

5.3.4.4 Perspectives shall be consistent in detail and scale with other sketches and shall be provided where desirable to clarify or highlight exterior features of the facilities.

5.4 TECHNICAL REQUIREMENTS.

Programming shall comply with the requirements of the funding service. For US Army funded programs use Engineering Regulation 1110-3-1300, Military Programs Cost Engineering. For US Air Force funded projects use Air Force Instruction AI 32-1022, Planning and Programming Appropriated Fund Maintenance, Repair and Construction Projects.

CHAPTER 6
SITE PLANNING AND LAYOUT

CHAPTER 6

SITE PLANNING AND LAYOUT

6.1 GENERAL.

6.1.1 Scope. This chapter provides guidance for site planning and layout and directs the preparation of site development drawings, specifications, and the design analysis. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. Drawings, specifications, and the design analysis shall be prepared in accordance with Chapter 2: PRESENTATION OF DATA.

6.1.2 Policy. Good site planning and layout will provide guidance for developing an installation and controlling its orderly growth. Arrangement of facilities must be integrated with the site to achieve optimum land use, good functional relationships, environmental harmony, and a pleasant appearance.

6.1.3 Project Specific Criteria. The Basis of Design Program (See Chapter 5: PROGRAMMING) will provide project specific criteria for the design phases which follow programming. Site information will be provided by the Corps of Engineers Middle East District (CEMED) and will include such data as the following:

a. Site survey showing existing topography.

b. Location of existing roads, utilities, buildings, etc.

c. Survey control monuments for locating new construction.

6.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below, form a part of this manual.

United Facilities Criteria (UFC), and Technical Manual (TM):

TM 5-803-4.	Planning of Army Aviation Facilities.
UFC 2-000-02AN	Installations Master Planning.
UFC 3-210-06A	Site Planning and Design.
TM 5-803-5.	Installation Design.
UFC 3-260-01	Civil Engineering Programming Airfield and Heliport Planning Criteria.

UFC 3-210-03A Planning of Outdoor Recreation Facilities.

TM 5-803-10 Planning and Design of Outdoor Sports Facilities.

UFC 3-210-04 Children's Outdoor Play Areas.

UFC 3-201-01 Civil Engineering

UFC 3-210-10 Low Impact Development

UFC 3-201-02 Landscape Architecture

UFC 4-141-10N Design: Aviation Operation and Support Facilities

UFC 3-230-01 Surface Drainage Facilities for Airfields and Heliports.

UFC 3-230-16FA Drainage and Erosion Control Structures for Airfields and Heliports.

UFC 3-230-17FA Drainage for Areas Other than Airfields.

UFC 3-240-01 Wastewater Collection

UFC 3-230-02 Domestic Wastewater Treatment

UFC 3-250-18FA and UFC-260-02

General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas.

UFC 3-250-01FA and UFC 3-260-02

Pavement Design for Roads, Streets, Walks, and Open Storage Areas.

UFC 3-250-04FA Standard Practice for Concrete Pavements.

UFC 3-270-01 Bituminous Pavements, Standard Practice.

UFC 3-250-10FA and UFC 2-260-02

Pavement Design for Roads, Streets and Open Storage (Elastic Layered Method).

UFC 3-250-11 Soil Stabilization for Pavements.

UFC 3-260-05A Marking of Army Airfield – Heliport Operational and Maintenance Facilities.

UFC 3-260-02 Airfields Other Than Army Airfield Operational and Maintenance Facilities.

UFC 3-260-02 General Provisions for Airfield - Heliport Pavements Design.

UFC 3-260-02 Flexible Pavement Design for Airfields.

UFC 3-260-02 Rigid Pavements for Airfields.

UFC 3-260-02 Rigid Pavement Design for Airfields, Elastic Layered Method.

UFC 3-260-03 Airfield Pavement – Evaluation Concepts Table of Contents.

UFC 3-260-03 Engineering and Design: Airfield Flexible Pavement Evaluation.

TM 5-826-3. Airfield Rigid Pavement Evaluation.

UFC 3-260-17 Dust Control for Roads, Airfields, and Adjacent Areas.

USACE Qualtrax 53441

TAD Explosive Safety Site Plan (ESSP) Execution, Training, and Design (CUI)

6.3 CONCEPT SUBMITTAL REQUIREMENTS.

6.3.1 Concept Design Analysis. The Concept design analysis shall include a summary of the Basis of Design Program to establish project background and criteria. In addition, the Concept design analysis shall indicate the progress of project design as required by the paragraphs below.

6.3.1.1 Buildings and Structures: Discussion of the siting of buildings and structures shall include the following items:

a. Functional arrangement.

b. Relationship to topographic features.

c. Intra-relationship with other project elements, such as circulation systems, drainage patterns, utility networks, and natural and landscaped forms.

d. Availability and adequacy of service access, such as emergency, maintenance and delivery vehicles.

e. Need for and type of fences and walls (e.g., security, privacy, decoration, etc.).

6.3.1.2 Circulation. Basic circulation patterns, traffic volumes, and modes of transportation are established in the programming phase and should be further defined in the Concept design analysis. All calculations which support transportation system design decisions shall be included.

a. Pedestrian. Discuss in general terms the width and route of sidewalks and foot paths, citing functional, topographic, and aesthetic criteria.

b. Vehicular. Provide complete analysis of vehicular traffic, considering automobiles, buses, trucks, taxis, and emergency and military vehicles. The impact of project traffic on the existing transportation systems shall be discussed, as well as onsite traffic. Discuss geometric features, including widths of parking lanes, traffic volumes, pavement design, shoulders, and parking spaces.

6.3.1.3 Grading. Discuss cut and fill procedures, including the necessities and locations of borrow pits and disposal sites, estimated excavation and fill quantities, and estimated aggregate sizes and quantities.

a. Dust and erosion control. Include statement of proposed type and method of providing dust and erosion control, reasons for selection, extent of area treated, etc. If no treatment is proposed, justify omission.

b. Drainage. Discuss the proposed drainage design. Information regarding capacity, elevation, and condition of existing affected drains will be obtained. Topography, size, and shape of the drainage area and location of possible ponding areas will be determined. The location, type, size, elevations, and condition of existing utilities, in addition to drains that may affect or be affected by the new drainage system will be determined. Basic information will include design storm criteria and reasons for selection thereof; rainfall and infiltration rates, source of information, and basis for selection; method of computing runoff, times of concentration and ponding effects, if any; and other items affecting design discharges. A print of the area involved shall be furnished with the design analysis showing the individual drainage areas used in the design. Provide a description of materials considered and a discussion for each alternative, including drainage piping, headwall structures, ditch checks, etc. Establish a general drainage plan which will serve as a basis to be followed in developing contract documents for integral parts of the overall project. Establish drainage patterns to protect existing and proposed facilities from erosion and flooding caused by additional storm runoff.

6.3.1.4 Landscaping. Existing plants shall be described and site features shall be analyzed to determine plant selection criteria. General plant types and locations shall be recommended with justification for their recommendation based on existing site conditions or project criteria.

a. Temperature. Determine the suitability of plants due to temperature range, seasonal changes, and freezing conditions.

b. Water. With regard to plant selection, provide discussion regarding transpiration; moisture dependency for photosynthesis; moisture content of soil; tolerance to saline water; and quantity of water required. Discuss the type and method of proposed irrigation.

c. Function. Discuss the need for and suitability of plantings for wind break; provider of shade and shadow; visual screen or framing of views; or integral part of a design scheme of form and space.

6.3.2 Concept Design Drawings. If available, the Basis of Design General Site Plan shall be submitted with the Concept design submittal. In addition, site plan(s) shall be submitted to present the Concept design. The number of site plan drawings submitted shall depend on the size and complexity of the project. For concept design only, more than one site layout element may appear on one site plan drawing as long as the drawing is not crowded and the information required below is complete.

6.3.2.1 General. Show location of the project, usually by a small scale project location map, indicating only the general relationship between the new facility and major existing structures and/or streets, to facilitate identification of the proposed site. Vicinity maps or location maps will be provided.

6.3.2.2 Buildings and Structures. Floor and grade elevations for buildings and structures will be shown. Indicate setback distances of buildings. Show existing and proposed fencing and walls.

6.3.2.3 Circulation. Indicate major pedestrian paths, major and minor roads, and parking areas. Parking lanes will be delineated and dimensions of parking spaces will be indicated. Denote locations and dimensions of runways, parking aprons, taxiways, and heliport pads for airfields and heliports.

6.3.2.4 Grading, Drainage, and Utilities. Show existing topography and all existing physical features. Provide an exterior utility layout with location of all existing and proposed utility services and points of connection. Locations of underground drainage piping and surface drainage facilities shall be established. Indicate the direction of drainage runoff by use of flow arrows and locate culverts. Sufficient horizontal and vertical control will be shown to clearly indicate the proposed siting of the project elements in relation to existing topographical features.

6.3.2.5 Landscaping. Although specific plantings need not be selected at this time, a discussion of probable species to be used shall be provided and areas of major and minor landscaping shall be indicated.

6.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

6.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any necessary revisions. In addition, the following specific items shall be included when applicable.

6.4.1.1 Buildings and Structures. The siting of all buildings and major structures should be accomplished by the Preliminary review submittal. Submit any calculations and backup information required for the design, equipment, and location of miscellaneous facilities which are highly site related, such as military and training fields and courses, courts and fields for sports, playgrounds, outdoor markets, plazas, and monuments. Determine the material, type, and height of fences and walls.

6.4.1.2 Circulation. Design calculations and analysis shall be provided for all systems and shall include the following.

a. Sidewalks. Determine types, size, material of construction and special features.

b. Curbs. Determine the need for curbs for roads and parking areas.

c. Road configurations. Discuss type, widths, special features and material of construction.

d. Flexible pavement. The design analysis shall consist of the class, category, index, CBR of the subgrade, type and thickness of the various component layers, and a typical cross-section adopted for construction.

e. Portland cement concrete pavements. The design analysis shall consist of the modulus of subgrade reaction, class, category, index, the 28-day flexural strength of the concrete, the total thickness, and a typical cross-section adopted for construction.

6.4.1.3 Grading. Further information on drainage design shall be developed. It is the policy of CEMED in the preparation of contract plans and specifications, to allow the Contractor an option of acceptable materials for drainage piping. Size selection should be based on individual design calculations using Manning "N" values specified in UFC 3-250-17FA. These calculations shall be clearly shown in the design analysis.

6.4.1.4 Landscaping. Plant and tree species shall be finalized at this stage of the project design. The objectives of the landscape design shall be stated and the solutions to anticipated landscaping problems shall be proposed.

a. Describe the natural characteristics of the plants selected; e.g., rate of growth and ultimate size; shape, form, color and texture; and seasonal characteristics (changes in foliage, fruit, bloom).

b. Discuss the plant selection for specific locations due to the following factors:

1. Ecological compatibility, or suitability in terms of hardiness.

2. Nature of root growth.

3. Adaptability to pruning, shaping.

4. Suitability for framing or embellishing specific views or settings.

5. Visual screening or wind breaking capability.

6. Water requirements and irrigation frequency.

6.4.2 Preliminary Design Drawings. Preliminary drawings will be partially completed working drawings. All changes resulting from the Concept design review will be incorporated in the Preliminary design drawings. Separate site drawings shall be provided for grading and drainage; layout; landscaping; and utilities. Some of the items which shall be included on the Preliminary design drawings are listed below.

6.4.2.1 Contours and Spot Elevations. Site plans will show new and existing contours necessary to relate proposed facilities to existing facilities and/or terrain. A contour interval of 0.25 meters is used. Final contours will be furnished to show the full scope of the project. Spot elevations shall be shown at the following locations and as required to complete the grading drawings.

a. Pertinent changes in longitudinal and transverse pavement grades.

b. All corners of parking areas, walk intersections, junctions of walks with curb and gutter.

c. Corners and pertinent points adjacent to buildings.

d. Stoops, ramps, and other structures.

e. Controlling elevations of ditches or drainage courses.

f. Invert and top elevations of drainage facilities.

6.4.2.2 Geotechnical Information. Exploration layout shall be shown on the drawings.

6.4.2.3 Roads, Parking Areas, Railroads, Airfields, and Heliports. Finished surface grades for the pavement on parking areas and other large paved areas shall be shown by contours. Road layouts shall indicate radii of curvatures for street intersections, corners of dividing islands, and curves. Plans and profiles shall be shown with the profile shown directly under the plan. A sufficient number of sections shall be shown for all roads, railroads, parking areas, airfields, and heliports to clearly indicate the construction to be performed. Thickness of each layer of material as well as its composition, shall be indicated on the sections. Widths and slopes will be included on the preliminary drawings.

6.4.2.4 Drainage. Grading plans shall show all transitions essential to positive drainage for any required purpose, in particular pavement depressed for drainage purposes. The location of inlets, manholes, and storm drains shall be shown and fully coordinated for complete grading and drainage control for the area represented. Site drainage and storm sewer ditches, pipes, culverts, retaining ponds, and receiving wadis will be clearly delineated on the drawings, and size and invert elevations of pipes and culverts will be shown. Storm drainage profiles shall be provided for closed pipe systems. Typical and special items such as manholes and retaining basins shall be detailed. The storm water calculations should be based on the 24 hour rainfall duration and 50 and 100 years frequency of occurrences (or return period). Storm water pond shall be designed either with infiltration and evaporation and no outfall structure or with pre development discharge out flow rate. The pond should have a control device to control the flow rate. Storm drainage systems shall be designed in accordance with UFC 3-201-01, para 3-1; however, the designer shall propose to the client that a 25 yr design storm be used as a minimum storm event for non-airfield projects, with a minimum 10-year storm frequency for roads or in accordance with local regulatory agency with jurisdiction over the Installation; whichever is more stringent.

6.4.2.5 Plantings. Areas which were indicated as major or minor landscaping areas in the Concept submittal will now be illustrated on the Preliminary drawings in a more detailed fashion with the aid of symbols and legend which will denote the species of plants, trees, shrubs, or grass to be planted in different locations on the site. Dimensions will be provided for locating plantings.

6.4.2.6 Other Features. Layouts and details of sidewalks, fences, walls, and other site features shall be included.

6.5 FINAL SUBMITTAL REQUIREMENTS.

6.5.1 Design Analysis. The design analysis shall be complete. The sections of the annotated Design Checklist pertaining to site planning and layout will be included.

6.5.2 Drawings. Working drawings for all site work shall be complete, including all revisions resulting from Preliminary design review.

6.6 READY TO ADVERTISE (RTA) SUBMITTAL REQUIREMENTS.

The comments generated during the Final design review shall be incorporated in the documents before they are submitted as RTA.

6.7 TECHNICAL REQUIREMENTS.

Site design should be conducive to pleasant living and working environments by avoiding monotony and regimentation. Topography, more than any other site characteristic, should strongly influence the project design. A conscious and active concern for the values of natural beauty shall be considered in the siting of facilities. Selection and development of a site should take into careful consideration the hazards and nuisance effects created by the land uses adjacent to the project site, which may include excessive noise, odors, smoke, and dust. Guidelines for the planning and layout of specific project elements are listed below.

6.7.1 <u>Buildings and Structures</u>.

6.7.1.1 Siting Parameters for buildings and structures shall be as shown in TM 5-803-5 and shall include the following:

a. Functional relationships to provide for operational efficiency and economical maintenance.

b. Advantageous relationships to site features, such as topography, views, trees, sun, wind.

c. Spacing of buildings to provide adequate light admission; air circulation; fire safety; parking; and pedestrian, vehicular and service access.

6.7.1.2 Relationship to Finish Grade. For proper surface drainage, the finish floor elevation of concrete floor slabs shall be at least 6 inches above the adjacent finish grade.

6.7.2 <u>Fences and Walls</u>.

6.7.2.1 Chain-link fencing will be designed to withstand adverse atmospheric conditions.

6.7.2.2 The type, height, color, and material of fences and walls shall be selected to be compatible with surrounding architecture and landscaping.

6.7.3 <u>Circulation</u>. Circulation patterns will be provided that separate pedestrians and vehicles. General routes and capacities of major elements of circulation systems should be defined in the programming phase of design. (See Chapter 5: PROGRAMMING). Convenience, safety, and adherence to the topography are the major goals of design. Technical requirements for the design of transportation systems are listed below.

6.7.3.1 Pedestrian. Minimum width of sidewalks should be four (4) feet, width being increased in increments of two (2) feet as required to accommodate the anticipated volume. The grades of walks should normally follow the natural pitch of the ground. The use of steps in walks should be avoided where possible; single risers in particular are hazardous and should not be used. When steps are required, they should have at least three risers and one handrail. In lieu of steps, a gradient not exceeding 15 percent may be used, provided that the length of the gradient is short. All stoops, steps, or similar required access to entrances normally built by a building contractor (as differentiated from sidewalks, driveways, etc., which are normally constructed by a paving subcontractor), shall be shown on the architectural drawings.

6.7.3.2 Vehicular. Technical Manuals, UFC 3-250-18FA, UFC 3-250-01FA, UFC 3-250-10FA and UFC 3-260-02, are comprehensive outlines of basic design principles for this type of work and shall be used as applicable.

a. Streets. Convenient and safe vehicular access and circulation should be provided for essential services, such as deliveries, trash and garbage collection, bus transit, fire protection, maintenance, and repair, with through traffic being kept to a minimum.

b. Parking. Off-street parking should normally be provided for both organizational and non-organizational vehicles closely related to the facilities served. This parking should be designed for easy entrance and exit and for safe maneuvering of vehicles. Dead end parking lots shall be avoided. The arrangement and layout of parking spaces will be in accordance with UFC 3-210-06A.

c. Pavements. In general, road and parking area pavement will consist of a subbase course, base course, and hot-mix bituminous concrete surface course. Exceptions to this are areas that require concrete pavement due to their usage; e.g., work racks, grease racks, areas where fuel spillage will occur, and areas subject to tracked vehicles. Curbs, combination curbs and gutters or shallow paved gutters, and attendant underground storm drains will be constructed along streets and around off-street parking areas in built-over areas. Technical Manuals UFC 3-250-01FA, UFC 3-250-04FA, UFC 3-250-03,and UFC 3-250-10FA shall govern the use of rigid pavements and flexible pavements. Curbs and gutters will not be constructed along roads and at remote facilities except as required for drainage and erosion control.

d. Traffic Signs and markings. Roadway traffic control signs and markings shall be included.

6.7.4 Airfield Facilities.

6.7.4.1 General. Criteria for design of airfields and heliports shall be as indicated in UFC 3-260-01. Airfields and heliports will be designed for the intended purpose of the facilities. Specific guidance will be developed during the programming phase.

6.7.4.2 Pavements. In general, airfield pavement design shall follow guidance in UFC 3-260-02.

6.7.5 Grading. The objectives of grading design shall be the following.

a. Balance of cut and fill.

b. Avoidance of excessive earth movements.

c. Preservation of natural site features, such as ground forms, water, rocky ledges, and trees.

d. Proper drainage.

e. Dust and erosion control.

f. Prevention of sand drifts.

g. Maintenance of high finish grades where rock will be encountered close to the surface, reducing the cost of utility trenching.

h. Proper relationships to existing building and adjacent property levels.

i. Adequate depth for utility systems or connecting tunnels and for plant and tree roots.

j. Proper grades for walks, drives, and streets.

k. Gravity flow to existing sanitary sewers, if possible.

l. Careful use of retaining walls and earth banks to minimize seeding, sodding and maintenance costs.

6.7.5.1 Dust and Erosion Control. Measures to prevent dust erosion include terraces, ditch drop structures, coarse graded aggregate, anchored mulch, sprinkler irrigation systems in low rainfall areas, and vegetation. Dust erosion control is particularly important to rehabilitate those areas scarred or disturbed during construction. For dust control, UFC 3-260-17 will be used as a guide.

6.7.5.2 Drainage. To provide positive drainage, slopes of not less than 2 percent in overland areas are desirable; however, more permeable soils may require a lesser slope. Drainage slopes away from buildings should be a minimum of 5 percent. Banks for transitions from one area to another should not be steeper than one (1) foot vertical in four (4) feet horizontal. Consideration must be given to disposal of surface water, either by underground methods, surface methods, or a combination thereof, along with flood proofing of the site and all structures. UFC 3-230-17FA is a comprehensive outline of basic criteria which should be utilized in this design. For airfield and heliport drainage criteria, TM 5-820-1 and TM 5-820-3 shall be used.

6.7.6 Landscaping. Landscaping should be an integral part of the total design scheme, related in terms of shape, form, texture, and color with the visual and functional design of the roads, walks and buildings. Unless otherwise approved, plantings shall be in arrangements as outlined in TM 5-803-13. Plantings should be economical to maintain and chosen from species which have been proven to be locally hardy and tolerant of specific site conditions. Protection of or improvements to existing plantings to be retained shall be an integral part of the design effort. Desert type landscaping should be considered when irrigation quantities are limited. Maximum use should be made of native plants.

6.7.6.1 Water and Salt Criteria. Generally, plants chosen for use in desert landscaping should require low water usage and have high salt tolerance.

6.7.6.2 Provision for Growth. Compromising tree growth by locating utility poles, wires, structural overhangs, and trees in close proximity to each other shall be avoided.

6.7.6.3 Damage by Roots. The location and species of trees to be planted shall preclude roots from damaging sewer lines.

6.7.6.4 Landscape Planting Sub drains. Sub drains may be required when soil conditions do not allow adequate percolation. Where irrigation water is anticipated to create foundation problems, landscaping and irrigation shall be avoided. Design of sub drain system should provide for gravity flow and cleanout provisions.

6.7.7 Outdoor Recreation.

6.7.7.1 Reflect Installation Needs and Desires. The goal of outdoor recreation area planning is the development of facilities to support a complete outdoor recreation program for personnel and their families. The planning should fully consider and reflect their current needs and the scope of activities and facilities required to fill those needs. Each site should have the capability of supporting present requirements and be adequate to provide expansion for possible future requirements.

6.7.7.2 Select Area Compatible With Other Land Uses. The area chosen for outdoor recreation development should be compatible with installation and other surrounding land uses. The location should develop harmonious relationships which minimize land use conflicts. For example: noisy activities should not be adjacent to quiet activities; pedestrian activities should not be combined with vehicular activities; and outdoor recreation activities should not be near industrial activities.

6.7.7.3 Relate Recreation To Participants. Facilities planned for outdoor recreation should be located as close as practicable to the people served to encourage maximum participation. The majority use will be on a short-term, off-duty basis by personnel who will either walk, bike or use privately owned cars.

6.7.7.4 For Outdoor sports Facilities and Children's Play Area criteria, see UFC 3-210-04. Team Handball playing surface shall be a "hard" surface, suitable for bouncing a ball rather than the specified turf.

6.8. Explosive Safety Design: All projects need to consider the Explosive Safety Site Plan (ESSP) requirements. Some projects that do not have explosive safety elements may have been sited adjacent to existing or proposed explosive areas such as armed aircraft or armed vehicle or ammunition storage. Refer to USACE Qualtrax Document 53441, TAD Explosives Safety Site Plan (ESSP) Execution Training and Design (CUI).

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CHAPTER 6
SITE PLANNING AND LAYOUT

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SITE PLANNING AND LAYOUT

6.1 GENERAL.

6.1.1 Scope. This chapter provides guidance for site planning and layout and directs the preparation of site development drawings, specifications, and the design analysis. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. Drawings, specifications, and the design analysis shall be prepared in accordance with Chapter 2: PRESENTATION OF DATA.

6.1.2 Policy. Good site planning and layout will provide guidance for developing an installation and controlling its orderly growth. Arrangement of facilities must be integrated with the site to achieve optimum land use, good functional relationships, environmental harmony, and a pleasant appearance.

6.1.3 Project Specific Criteria. The Basis of Design Program (See Chapter 5: PROGRAMMING) will provide project specific criteria for the design phases which follow programming. Site information will be provided by the Corps of Engineers Middle East District (CEMED) and will include such data as the following:

a. Site survey showing existing topography.

b. Location of existing roads, utilities, buildings, etc.

c. Survey control monuments for locating new construction.

6.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below, form a part of this manual.

United Facilities Criteria (UFC), and Technical Manual (TM):

TM 5-803-4.	Planning of Army Aviation Facilities.
UFC 2-000-02AN	Installations Master Planning.
UFC 3-210-06A	Site Planning and Design.
TM 5-803-5.	Installation Design.
UFC 3-260-01	Civil Engineering Programming Airfield and Heliport Planning Criteria.

UFC 3-210-03A Planning of Outdoor Recreation Facilities.

TM 5-803-10 Planning and Design of Outdoor Sports Facilities.

UFC 3-210-04 Children's Outdoor Play Areas.

UFC 3-201-01 Civil Engineering

UFC 3-210-10 Low Impact Development

UFC 3-201-02 Landscape Architecture

UFC 4-141-10N Design: Aviation Operation and Support Facilities

UFC 3-230-01 Surface Drainage Facilities for Airfields and Heliports.

UFC 3-230-16FA Drainage and Erosion Control Structures for Airfields and Heliports.

UFC 3-230-17FA Drainage for Areas Other than Airfields.

UFC 3-240-01 Wastewater Collection

UFC 3-230-02 Domestic Wastewater Treatment

UFC 3-250-18FA and UFC-260-02 General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas.

UFC 3-250-01FA and UFC 3-260-02 Pavement Design for Roads, Streets, Walks, and Open Storage Areas.

UFC 3-250-04FA Standard Practice for Concrete Pavements.

UFC 3-270-01 Bituminous Pavements, Standard Practice.

UFC 3-250-10FA and UFC 2-260-02 Pavement Design for Roads, Streets and Open Storage (Elastic Layered Method).

UFC 3-250-11 Soil Stabilization for Pavements.

UFC 3-260-05A Marking of Army Airfield – Heliport Operational and Maintenance Facilities.

UFC 3-260-02	Airfields Other Than Army Airfield Operational and Maintenance Facilities.
UFC 3-260-02	General Provisions for Airfield - Heliport Pavements Design.
UFC 3-260-02	Flexible Pavement Design for Airfields.
UFC 3-260-02	Rigid Pavements for Airfields.
UFC 3-260-02	Rigid Pavement Design for Airfields, Elastic Layered Method.
UFC 3-260-03	Airfield Pavement – Evaluation Concepts Table of Contents.
UFC 3-260-03	Engineering and Design: Airfield Flexible Pavement Evaluation.
TM 5-826-3.	Airfield Rigid Pavement Evaluation.
UFC 3-260-17	Dust Control for Roads, Airfields, and Adjacent Areas.

6.3 CONCEPT SUBMITTAL REQUIREMENTS.

6.3.1 Concept Design Analysis. The Concept design analysis shall include a summary of the Basis of Design Program to establish project background and criteria. In addition, the Concept design analysis shall indicate the progress of project design as required by the paragraphs below.

6.3.1.1 Buildings and Structures: Discussion of the siting of buildings and structures shall include the following items:

a. Functional arrangement.

b. Relationship to topographic features.

c. Intra-relationship with other project elements, such as circulation systems, drainage patterns, utility networks, and natural and landscaped forms.

d. Availability and adequacy of service access, such as emergency, maintenance and delivery vehicles.

e. Need for and type of fences and walls (e.g., security, privacy, decoration, etc.).

6.3.1.2 Circulation. Basic circulation patterns, traffic volumes, and modes of transportation are established in the programming phase and should be further defined in the Concept design analysis. All calculations which support transportation system design decisions shall be included.

a. Pedestrian. Discuss in general terms the width and route of sidewalks and foot paths, citing functional, topographic, and aesthetic criteria.

b. Vehicular. Provide complete analysis of vehicular traffic, considering automobiles, buses, trucks, taxis, and emergency and military vehicles. The impact of project traffic on the existing transportation systems shall be discussed, as well as onsite traffic. Discuss geometric features, including widths of parking lanes, traffic volumes, pavement design, shoulders, and parking spaces.

6.3.1.3 Grading. Discuss cut and fill procedures, including the necessities and locations of borrow pits and disposal sites, estimated excavation and fill quantities, and estimated aggregate sizes and quantities.

a. Dust and erosion control. Include statement of proposed type and method of providing dust and erosion control, reasons for selection, extent of area treated, etc. If no treatment is proposed, justify omission.

b. Drainage. Discuss the proposed drainage design. Information regarding capacity, elevation, and condition of existing affected drains will be obtained. Topography, size, and shape of the drainage area and location of possible ponding areas will be determined. The location, type, size, elevations, and condition of existing utilities, in addition to drains that may affect or be affected by the new drainage system will be determined. Basic information will include design storm criteria and reasons for selection thereof; rainfall and infiltration rates, source of information, and basis for selection; method of computing runoff, times of concentration and ponding effects, if any; and other items affecting design discharges. A print of the area involved shall be furnished with the design analysis showing the individual drainage areas used in the design. Provide a description of materials considered and a discussion for each alternative, including drainage piping, headwall structures, ditch checks, etc. Establish a general drainage plan which will serve as a basis to be followed in developing contract documents for integral parts of the overall project. Establish drainage patterns to protect existing and proposed facilities from erosion and flooding caused by additional storm runoff.

6.3.1.4 Landscaping. Existing plants shall be described and site features shall be analyzed to determine plant selection criteria. General plant types and locations shall be recommended with justification for their recommendation based on existing site conditions or project criteria.

a. Temperature. Determine the suitability of plants due to temperature range, seasonal changes, and freezing conditions.

b. Water. With regard to plant selection, provide discussion regarding transpiration; moisture dependency for photosynthesis; moisture content of soil;

tolerance to saline water; and quantity of water required. Discuss the type and method of proposed irrigation.

c. Function. Discuss the need for and suitability of plantings for wind break; provider of shade and shadow; visual screen or framing of views; or integral part of a design scheme of form and space.

6.3.2 Concept Design Drawings. If available, the Basis of Design General Site Plan shall be submitted with the Concept design submittal. In addition, site plan(s) shall be submitted to present the Concept design. The number of site plan drawings submitted shall depend on the size and complexity of the project. For concept design only, more than one site layout element may appear on one site plan drawing as long as the drawing is not crowded and the information required below is complete.

6.3.2.1 General. Show location of the project, usually by a small scale project location map, indicating only the general relationship between the new facility and major existing structures and/or streets, to facilitate identification of the proposed site. Vicinity maps or location maps will be provided.

6.3.2.2 Buildings and Structures. Floor and grade elevations for buildings and structures will be shown. Indicate setback distances of buildings. Show existing and proposed fencing and walls.

6.3.2.3 Circulation. Indicate major pedestrian paths, major and minor roads, and parking areas. Parking lanes will be delineated and dimensions of parking spaces will be indicated. Denote locations and dimensions of runways, parking aprons, taxiways, and heliport pads for airfields and heliports.

6.3.2.4 Grading, Drainage, and Utilities. Show existing topography and all existing physical features. Provide an exterior utility layout with location of all existing and proposed utility services and points of connection. Locations of underground drainage piping and surface drainage facilities shall be established. Indicate the direction of drainage runoff by use of flow arrows and locate culverts. Sufficient horizontal and vertical control will be shown to clearly indicate the proposed siting of the project elements in relation to existing topographical features.

6.3.2.5 Landscaping. Although specific plantings need not be selected at this time, a discussion of probable species to be used shall be provided and areas of major and minor landscaping shall be indicated.

6.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

6.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any necessary revisions. In addition, the following specific items shall be included when applicable.

6.4.1.1 Buildings and Structures. The siting of all buildings and major structures should be accomplished by the Preliminary review submittal. Submit any calculations and backup information required for the design, equipment, and location of miscellaneous facilities which are highly site related, such as military and training fields and courses, courts and fields for sports, playgrounds, outdoor markets, plazas, and monuments. Determine the material, type, and height of fences and walls.

6.4.1.2 Circulation. Design calculations and analysis shall be provided for all systems and shall include the following.

a. Sidewalks. Determine types, size, material of construction and special features.

b. Curbs. Determine the need for curbs for roads and parking areas.

c. Road configurations. Discuss type, widths, special features and material of construction.

d. Flexible pavement. The design analysis shall consist of the class, category, index, CBR of the subgrade, type and thickness of the various component layers, and a typical cross-section adopted for construction.

e. Portland cement concrete pavements. The design analysis shall consist of the modulus of subgrade reaction, class, category, index, the 28-day flexural strength of the concrete, the total thickness, and a typical cross-section adopted for construction.

6.4.1.3 Grading. Further information on drainage design shall be developed. It is the policy of CEMED in the preparation of contract plans and specifications, to allow the Contractor an option of acceptable materials for drainage piping. Size selection should be based on individual design calculations using Manning "N" values specified in UFC 3-250-17FA. These calculations shall be clearly shown in the design analysis.

6.4.1.4 Landscaping. Plant and tree species shall be finalized at this stage of the project design. The objectives of the landscape design shall be stated and the solutions to anticipated landscaping problems shall be proposed.

a. Describe the natural characteristics of the plants selected; e.g., rate of growth and ultimate size; shape, form, color and texture; and seasonal characteristics (changes in foliage, fruit, bloom).

b. Discuss the plant selection for specific locations due to the following factors:

1. Ecological compatibility, or suitability in terms of hardiness.

2. Nature of root growth.

3. Adaptability to pruning, shaping.

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The location of inlets, manholes, and storm drains shall be shown and fully coordinated for complete grading and drainage control for the area represented. Site drainage and storm sewer ditches, pipes, culverts, retaining ponds, and receiving wadis will be clearly delineated on the drawings, and size and invert elevations of pipes and culverts will be shown. Storm drainage profiles shall be provided for closed pipe systems. Typical and special items such as manholes and retaining basins shall be detailed. The storm water calculations should be based on the 24 hour rainfall duration and 50 and 100 years frequency of occurrences (or return period). Storm water pond shall be designed either with infiltration and evaporation and no outfall structure or with pre development discharge out flow rate. The pond should have a control device to control the flow rate. Storm drainage systems shall be designed in accordance with UFC 3-201-01, para 3-1; however, the designer shall propose to the client that a 25 yr design storm be used as a minimum storm event for non-airfield projects, with a minimum 10-year storm frequency for roads or in accordance with local regulatory agency with jurisdiction over the Installation; whichever is more stringent.

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Site design should be conducive to pleasant living and working environments by avoiding monotony and regimentation. Topography, more than any other site characteristic, should strongly influence the project design. A conscious and active concern for the values of natural beauty shall be considered in the siting of facilities. Selection and development of a site should take into careful consideration the hazards and nuisance effects created by the land uses adjacent to the project site, which may include excessive noise, odors, smoke, and dust. Guidelines for the planning and layout of specific project elements are listed below.

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6.7.1.1 Siting Parameters for buildings and structures shall be as shown in TM 5-803-5 and shall include the following:

a. Functional relationships to provide for operational efficiency and economical maintenance.

b. Advantageous relationships to site features, such as topography, views, trees, sun, wind.

c. Spacing of buildings to provide adequate light admission; air circulation; fire safety; parking; and pedestrian, vehicular and service access.

6.7.1.2 Relationship to Finish Grade. For proper surface drainage, the finish floor elevation of concrete floor slabs shall be at least 6 inches above the adjacent finish grade.

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6.7.2.1 Chain-link fencing will be designed to withstand adverse atmospheric conditions.

6.7.2.2 The type, height, color, and material of fences and walls shall be selected to be compatible with surrounding architecture and landscaping.

6.7.3 Circulation. Circulation patterns will be provided that separate pedestrians and vehicles. General routes and capacities of major elements of circulation systems should be defined in the programming phase of design. (See Chapter 5: PROGRAMMING). Convenience, safety, and adherence to the topography are the major goals of design. Technical requirements for the design of transportation systems are listed below.

6.7.3.1 Pedestrian. Minimum width of sidewalks should be four (4) feet, width being increased in increments of two (2) feet as required to accommodate the anticipated volume. The grades of walks should normally follow the natural pitch of the ground. The use of steps in walks should be avoided where possible; single risers in particular are hazardous and should not be used. When steps are required, they should have at least three risers and one handrail. In lieu of steps, a gradient not exceeding 15 percent may be used, provided that the length of the gradient is short. All stoops, steps, or similar required access to entrances normally built by a building contractor (as differentiated from sidewalks, driveways, etc., which are normally constructed by a paving subcontractor), shall be shown on the architectural drawings.

6.7.3.2 Vehicular. Technical Manuals, UFC 3-250-18FA, UFC 3-250-01FA, UFC 3-250-10FA and UFC 3-260-02, are comprehensive outlines of basic design principles for this type of work and shall be used as applicable.

a. Streets. Convenient and safe vehicular access and circulation should be provided for essential services, such as deliveries, trash and garbage collection, bus transit, fire protection, maintenance, and repair, with through traffic being kept to a minimum.

b. Parking. Off-street parking should normally be provided for both organizational and non-organizational vehicles closely related to the facilities served. This parking should be designed for easy entrance and exit and for safe maneuvering of vehicles. Dead end parking lots shall be avoided. The arrangement and layout of parking spaces will be in accordance with UFC 3-210-06A.

c. Pavements. In general, road and parking area pavement will consist of a subbase course, base course, and hot-mix bituminous concrete surface course. Exceptions to this are areas that require concrete pavement due to their usage; e.g., work racks, grease racks, areas where fuel spillage will occur, and areas subject to tracked vehicles. Curbs, combination curbs and gutters or shallow paved gutters, and attendant underground storm drains will be constructed along streets and around off-street parking areas in built-over areas. Technical Manuals UFC 3-250-01FA, UFC 3-250-04FA, UFC 3-250-03,and UFC 3-250-10FA shall govern the use of rigid pavements and flexible pavements. Curbs and gutters will not be constructed along roads and at remote facilities except as required for drainage and erosion control.

d. Traffic Signs and markings. Roadway traffic control signs and markings shall be included.

6.7.4 Airfield Facilities.

6.7.4.1 General. Criteria for design of airfields and heliports shall be as indicated in UFC 3-260-01. Airfields and heliports will be designed for the intended purpose of the facilities. Specific guidance will be developed during the programming phase.

6.7.4.2 Pavements. In general, airfield pavement design shall follow guidance in UFC 3-260-02.

6.7.5 Grading. The objectives of grading design shall be the following.

a. Balance of cut and fill.

b. Avoidance of excessive earth movements.

c. Preservation of natural site features, such as ground forms, water, rocky ledges, and trees.

d. Proper drainage.

e. Dust and erosion control.

f. Prevention of sand drifts.

g. Maintenance of high finish grades where rock will be encountered close to the surface, reducing the cost of utility trenching.

h. Proper relationships to existing building and adjacent property levels.

i. Adequate depth for utility systems or connecting tunnels and for plant and tree roots.

j. Proper grades for walks, drives, and streets.

k. Gravity flow to existing sanitary sewers, if possible.

l. Careful use of retaining walls and earth banks to minimize seeding, sodding and maintenance costs.

6.7.5.1 Dust and Erosion Control. Measures to prevent dust erosion include terraces, ditch drop structures, coarse graded aggregate, anchored mulch, sprinkler irrigation systems in low rainfall areas, and vegetation. Dust erosion control is particularly important to rehabilitate those areas scarred or disturbed during construction. For dust control, UFC 3-260-17 will be used as a guide.

6.7.5.2 Drainage. To provide positive drainage, slopes of not less than 2 percent in overland areas are desirable; however, more permeable soils may require a lesser slope. Drainage slopes away from buildings should be a minimum of 5 percent. Banks for transitions from one area to another should not be steeper than one (1) foot vertical in four (4) feet horizontal. Consideration must be given to disposal of surface water, either by underground methods, surface methods, or a combination thereof, along with flood proofing of the site and all structures. UFC 3-230-17FA is a comprehensive outline of basic criteria which should be utilized in this design. For airfield and heliport drainage criteria, TM 5-820-1 and TM 5-820-3 shall be used.

6.7.6 Landscaping. Landscaping should be an integral part of the total design scheme, related in terms of shape, form, texture, and color with the visual and functional design of the roads, walks and buildings. Unless otherwise approved, plantings shall be in arrangements as outlined in TM 5-803-13. Plantings should be economical to maintain and chosen from species which have been proven to be locally hardy and tolerant of specific site conditions. Protection of or improvements to existing plantings to be retained shall be an integral part of the design effort. Desert type landscaping should be considered when irrigation quantities are limited. Maximum use should be made of native plants.

6.7.6.1 Water and Salt Criteria. Generally, plants chosen for use in desert landscaping should require low water usage and have high salt tolerance.

6.7.6.2 Provision for Growth. Compromising tree growth by locating utility poles, wires, structural overhangs, and trees in close proximity to each other shall be avoided.

6.7.6.3 Damage by Roots. The location and species of trees to be planted shall preclude roots from damaging sewer lines.

6.7.6.4 Landscape Planting Sub drains. Sub drains may be required when soil conditions do not allow adequate percolation. Where irrigation water is anticipated to create foundation problems, landscaping and irrigation shall be avoided. Design of sub drain system should provide for gravity flow and cleanout provisions.

6.7.7 Outdoor Recreation.

6.7.7.1 Reflect Installation Needs and Desires. The goal of outdoor recreation area planning is the development of facilities to support a complete outdoor recreation program for personnel and their families. The planning should fully consider and reflect their current needs and the scope of activities and facilities required to fill those needs. Each site should have the capability of supporting present requirements and be adequate to provide expansion for possible future requirements.

6.7.7.2 Select Area Compatible With Other Land Uses. The area chosen for outdoor recreation development should be compatible with installation and other surrounding land uses. The location should develop harmonious relationships which minimize land use conflicts. For example: noisy activities should not be adjacent to quiet activities; pedestrian activities should not be combined with vehicular activities; and outdoor recreation activities should not be near industrial activities.

6.7.7.3 Relate Recreation To Participants. Facilities planned for outdoor recreation should be located as close as practicable to the people served to encourage maximum participation. The majority use will be on a short-term, off-duty basis by personnel who will either walk, bike or use privately owned cars.

6.7.7.4 For Outdoor sports Facilities and Children's Play Area criteria, see UFC 3-210-04. Team Handball playing surface shall be a "hard" surface, suitable for bouncing a ball rather than the specified turf.

6.8. Explosive Safety Design: All projects need to consider the Explosive Safety Site Plan (ESSP) requirements. Some projects that do not have explosive safety elements may have been sited adjacent to existing or proposed explosive areas such as armed aircraft or armed vehicle or ammunition storage. Refer to current TAD OPORD, **ESSP Execution Training and Design,** attached here after as Appendix A

.

US Army Corps of Engineers Transatlantic Division	**TAD Explosive Safety Site Plan (ESSP) Execution, Training, and Design**	

Table of Contents

1.0 Scope.

Foreign Military Sales (FMS) projects and Host Nation (HN) projects on military bases in contingency areas often have sites encumbered with explosive arcs due to ammunition and explosives (AE) type facilities. Such facility siting requires coordination and review with the District Design Team/ Designer of Record (DoR) and the U.S. Army Corps of Engineers (USACE), Engineering and Support Center, Huntsville (USAESCH), Facilities Explosives Safety Mandatory Center of Expertise (FES-MCX) to ensure no facilities exposed (ES) are constructed within known Explosives Safety Separation Distances (ESSD) and AE facilities potential explosion sites (PES) are constructed within known design standards. ER 1110-1-8169 U.S. ARMY CORPS OF ENGINEERS FACILITIES EXPLOSIVES SAFETY MANDATORY CENTER OF EXPERTISE, for projects outside the United States, paragraph 9c.(1)a requires the Districts to comply with the more stringent DoD or Host Nation safety standards unless standards applicability is mandated by international agreement. The overall intent is to ensure FMS and contingency area facilities provide an acceptable risk to both US and Host Nation personnel and property.

TAD requires explosives safety planning due diligence for all projects involving the design, construction, or modification of facilities that manufacture, store, handle, maintain, develop, demilitarize, test, or dispose of ammunition or explosives (AE), and facilities within the DoD ESSD of AE facilities.

2.0 Procedure and Flowchart.

2.1 Procedure.

a. Commander's Intent. FMS and HN projects, regardless of funding shall follow this procedure. Projects will be designed and constructed to comply with the most stringent DOD or Host Nation explosives safety standards unless standards applicability is mandated by international agreement. All projects require approval by the FES MCX, however, for FMS and HN projects, when all of the following conditions are met, Department of Defense Explosives Safety Board (DDESB) approval will not be required:

(1) The project is not on a Department of Defense (DoD) installation.

(2) The AE is not DoD titled.

(3) DoD personnel and/or property are not endangered by the HN AE hazard.

b. Concept of Operations. This mission will be accomplished by understanding when ESSPs are required and when not, and, of equal importance, the required coordination with the customer and key facility organizations (the Project Delivery Team (PDT)). Even though, ESSPs are required to be developed and coordinated by the facility using agency (UA) or installation Commander through their Service Chain of Command (CoC), USACE shall coordinate all aspects of the project for the Service Commander to know of their project responsibilities. However, TAD Contingency District could be asked by the UA to assist with the entire ESSP process. This mission can be successfully accomplished by defining the requirements (defined by the Commander's Intent) and responsibilities (see below) for ESSP, and the roles of those involved.

(1) USACE organizations will not begin construction of a PES nor an ES facility unless the project has been coordinated with the project PDT (paragraph 2.1.b. (7) (f) (i) or 2.1.b (7) (g)). At a minimum this PDT consists of USACE FES MCX, District design team/DoR and Stakeholder Safety Office, Master Planner and UA. Also, DDESB has approved the ESSP or an interim approval is received from the U.S. Service (Army, Navy or Air Force) Technical Center for Explosives Safety owning the project unless DDESB approval is not required (see paragraph 2.1.a)

(2) Conditions when an ESSP requires DDESB approval:

(a) At a DoD installation regardless of AE (DoD, HN or Commercial);

(b) DoD-titled AE wherever it is located;

(c) DoD personnel and/or property potentially endangered by known HN on or off-Installation AE hazards.

(3) Types of construction requiring approval by DDESB (life expectancy of greater than 1 year):

(a) A PES is a facility or location of a quantity of AE that will create a blast, fragment, thermal, or debris hazard in the event of an accidental explosion of its contents. Some of these facilities or locations are known as: Ammunition Supply Point (ASP); Ammunition Holding Areas (AHA); Basic Load Ammunition Holding Area (BLAHA), Forward arming and refueling points (FARP); Combat Aircraft Parking Areas (CAPA); Hot Cargo Pads, Ammunition Storage Area (ASA); Intelligence/Surveillance and Reconnaissance (ISR) facilities, and Munitions Storage Areas (MSA); and Explosives Ordnance Disposal (EOD) Support facilities; and laboratories, PESs with a life expectancy of 1 year or less require a ESSD map be developed for siting (but not for DDESB approval) to ensure nothing is built within their ESSD.

(b) Refer to DA PAM 385-65 paragraphs 2.3 and 2-8a for situations that require the development of an ESSP.

(4) Refer to DA PAM 385-65 paragraph 2-8b for situations that do not require the development of an ESSP.

(5) When facility QD can't be met refer to the requirements stated in DA PAM 385-65, paragraph 2-7

(6) ESSP Approval Coordination:

(a) USATCES is responsible for ESSP Army review and approval.

(b) DDESB is responsible for ESSP review and final approval.

(c) ESSPs are approved by DDESB through command safety channels to Director, U.S. Army Technical Center for Explosives Safety (AR 385–10, paragraph 5–6), Air Force Safety Center (AFSC), or Naval Ordnance Safety and Security Activity (NOSSA). Approval is to be received prior to construction start. DESR 6055.09-M requires that all ESSPs, as specified on paragraph 2.1.b (2) (b) be approved by the DoD component (HQUSACE or installation DRU/ACOM/ASCC), the service component (USATCES, AFSC, or NOSSA) and DDESB before activities begin.

(d) HQUSACE delegated Direct Reporting Unit review and approval of ESSP to the Commander, U. S. Army Corps of Engineers, Engineering and Support Center, Huntsville through CEHNC FES MCX. HQUSACE and CESO retained the authority to review and approve ESSPs for certain high risk or high visibility projects and to provide dispute resolution with respect to issues that cannot be resolved between USACE FES MCX and the concerned party.

(7) The following process will be followed (or electronic transmittal, if available) in the preparation and review of ESSP for installations (active, BRAC, Excess and/or off-post (other than USACE)) or the installation may request that USACE prepare the ESSP.

(a) USACE prepares:

(i) District prepares ESSP and forwards two (2) copies to the Division.

(ii) Division reviews and comments, and forwards one (1) copy to USACE FES MCX.

(iii) USACE FES MCX reviews and provides DRU concurrence, and forwards five (5) copies to the District with a copy of the memo to the Division.

(iv) District forwards five (5) copies to the Installation.

(v) Installation reviews and comments, and forwards four (4) copies through their Command chain to their DRU/ACOM/ASCC.

(vi) Installation DRU/ACOM/ASCC reviews and provides their approval, and forwards two (2) copies to USATCES (AFSC or NOSSA).

(vii) USATCES (AFSC or NOSSA) reviews and provides Army approval, and forwards 1-copy to DDESB (including a copy of the Army, DRU/ACOM/ASCC and USACE approval memos).

(viii) DDESB reviews and provides final approval back through the same chain:

(FLOW: District (prepare) → Division (review and comment) ↔ USACE FES MCX (review and comment and concur) and return to the District with a copy of the memo to the Division. District (forward) → Installation (review and comment) → Command chain to the DRU/AFSC/ASCC (review and approval) → USATCES (review and Army approval) ↔ DDESB (review and final approval). DDESB approval is return in the same order to the Installation/District).

(b) Installation prepares:

(i) Installation prepares and forwards three (3) copies to the District.

(ii) District reviews and comments, and forwards two (2) copies to Division.

(iii) Division reviews and comments, and forwards one (1) copy to USACE FES MCX.

(iv) USACE FES MCX reviews, comments and forwards three (3) copies to the District with a copy of the memo to the Division.

(v) District forwards to the Installation.

(vi) Installation reviews and comments, and forwards three (3) copies through their Command chain to their DRU/AFSC/ASCC. If installation makes changes to the USACE FES MCX document, it should be sent back to USACE FES MCX for further review and concurrence.

(vii) DRU/AFSC/ASCC reviews and provides their approval, and forwards two (2) copies to USATCES.

(viii) USATCES reviews and provides Army approval, and forwards one (1) copy to DDESB (including a copy of the Army, DRU/ACOM/ASCC and USACE concurrence memos).

(ix) DDESB reviews and provides final approval back through the same chain.

(x) FES MCX may conduct concurrent reviews of ESSP with installation DRU/AFSC/ASCC prior to submittal to USATCES:
(FLOW: Installation (prepare) → District (review and comment) → Division (review and comment) → USACE FES MCX (review, comment and concur) ↔ back in the same order to the Installation → Command chain to DRU/AFSC/ASCC (review and their approval) → USATCES (review and Army approval) ↔ DDESB (review and final approval). DDESB approval is return in the same order to the Installation/District).

(c) The Transatlantic Middle East District (TAM), the Afghanistan District (TAA) and/or Reachback districts (RBDs) supporting TAM or TAA projects shall be in close coordination with the project PDT to ensure knowledge of any changes to the plan (changes to the plan will always be coordinated with USACE FES MCX).

(d) Addresses for Routing and Approval of ESSPs.

(i) DDESB: Chairman, Department of Defense Explosives Safety Board (DDESB-KO), 4800 Mark Center, Suite 16E12, Alexandria, VA 22350.

(ii) USATCES: U.S. Army Defense Ammunition Center, U.S. Army Technical Center for Explosives Safety, ATTN: SJMAC-ES, 1 C Tree Road, Bldg. 35, McAlester, OK 74501-9053.

(iii) AFSC: Air Force Safety Center, 9700 Avenue G SE, Kirkland AFB, NM 87117-5670.

(iv) NOSSA: Commanding Officer, Naval Ordnance Safety & Security Activity (NOSSA), Farragut Hall, 3817 Strauss Avenue Suite 108, Indian Head, MD 20640-5151.

(v) CESO: USACE Headquarters, ATTN: CESO, 441 G Street, NW, Washington, DC 20314-1000.

(vi) USACE FES MCX: U.S. Army Corps of Engineers, Engineering and Support Center, Huntsville, ATTN: CEHNC-EDC-S, P.O. Box 1600, Huntsville, AL 35807-4301.

(e) ESSP Submittal Mode. Plan shall be submitted thru electronic mode (DDESB requirement as of Oct 2011).

(f) ESSP Planning and Coordination (refer to DA PAM 385-65, paragraph 2-9):

(i) These plans shall be coordinated during the first planning charrette and throughout the process with installation/site PDT. The project PDT should consist of USACE FES MCX, District Design Team/DoR, Stakeholder Safety Office, Master Planner, UA, Public Works, Logistics, Environmental and Health, Explosives Operations Ammunition Surveillance, Range Control (if the facility is range-related), Fire Department and Security. Due to theater conditions we may not be able to have a complete PDT, however at a minimum the PDT shall consist of: USACE FES MCX, District Design Team/DoR, Stakeholder Safety Office Explosives Safety Professional, Master Planner and UA.

(ii) Coordination with the Installation Master Planner (IMP) to properly coordinate and assess the impact on other ongoing and future construction projects and plans. Every approved ESSP with the required QD arcs must be included on the IMP. References #3 and 11.

(iii) Obtain current installation and site maps. The importance of current accurate maps cannot be overstated. The key element for a good site plan is good maps that show the location of the facility and its relationship to surrounding installation boundaries, facilities, utilities, roads, railroads, waterways, ponds, lakes, recreation, fire stations, laboratories, storage magazines, outdoor storage, water tanks, fuel tanks,

historical sites, equipment, maintenance, production and other operations. The sited facility map should be scaled 1" = 400' or measurements specified on the drawings.

(iv) Refer to DDESB Technical Paper 26, Paragraph 2.5 for site plan categories.

(v) Refer to DA PAM 385-65, Appendix B to help the ESSP preparer identify the correct quantity distance relationship between common exposed sites (ES) and potential explosion sites (PES).

(vi) Explosives Safety Siting Software (ESSS) is a software application that automates the development of conventional ESSP. USACE FES MCX has the system, related training and experience with it. Integration of the software into the installation's GIS mapping system will be the installation's responsibility. Reference #.9, Appendices I and J are examples of ESS output report. ESSS is the preferred method of ESSD analyses and should be used.

(vii) Refer to DA PAM 385-65, paragraph 2-13 and Appendix C as an ESSP manual worksheet guide with a completed sample form, and a blank template. The US Army Technical Center for Explosives Safety (USATCES) has established a website on AKO titled DAC Explosives Safety Ammunition Toolbox. The reference can be accessed at https://intranet.tad.usace.army.mil/site/cetad/SiteDirectory/BusinessTechnical/EN%20Library/Forms/AllItems.aspx

(viii) DDESB developed an Excel spreadsheet that will calculate allowable NEW based on a given separation distance or the required separation distance for a given NEW. The Automated QD Calculator is on the AKO DAC Explosives Safety Toolbox: https://www.dau.mil/cop/ammo/Pages/Topics/Explosives%20Safety.aspx. The spreadsheet is designed for either English or metric calculations. Using agency (UA) should input the desired NEW or DISTANCE in the appropriate yellow cell and hit “Enter.” (Entries shall be input on the yellow cells only). Entering the NEW or DISTANCE will populate the spreadsheet. Call USATCES for help using this QD Calculator. USATCES updates the websites as new versions of the Automated QD Calculator are disseminated.

(g) Projects not requiring DDESB approval (see Flowchart Tab A.2): Project design and construction shall meet DoD explosives safety standards. The formal explosives safety approval process accompanying a project that requires DDESB approval is not required; as such an ESSP document is not required. However, coordination, review and concurrence of the QD arcs map and electrical and mechanical explosives safety requirements with USACE FES MCX, District Design Team/DoR and Stakeholder Safety Office, UA and Master Planner is required. Even though a complete ESSP is not required, the ‘Tab’ format per DA PAM 385-65 for the required explosives safety information stated above is required. In the project documentation submitted for coordination and review/concurrence, the District Design Team/DoR shall clearly demonstrate DoD explosives safety standards are met. HN personnel shall be included in the PDT for HN projects.

(h) TAM/TAA/RBD District PM: Project Managers (PM) must ensure that prospective projects are vetted for existing and proposed QD arcs. Will coordinate with PDT members to include engineering and USACE FES MCX at project initiation. Turn-key responsibilities include notifying USACE FES MCX of schedule milestones, notifying the PDT of potential site problems, ensuring all explosive arc issues are resolved. PM will require UA to make a decision if explosives safety issues require further action.

(i) USACE FES MCX shall review site plans within two weeks, make comments, concur or approve, and send through TAD to executing districts for incorporation. Provide guidance at project start up. Work with engineering to resolve technical siting issues. USACE FES MCX does not provide site plan approval, but concurrence when projects are not USACE owned projects.

(j) District engineering staff shall review initial site plan by the UA in regard to explosive arc issues. Staff will solicit guidance from USACE FES MCX as needed, including incorporation of USACE FES MCX design instructions. Staff will provide site drawings to USACE FES MCX during design for review to include coordination of comments (typically a two week review period by USAESCH). Staff will offer mitigation solutions to the UA for explosive arc issues. Staff will incorporate USFOR safety manager comments, if applicable. District engineering staff have overall technical responsibility for the site, but this does not include site approval.

(k) Using Agency (UA): responsible for the project scope to include known explosives arcs. Responsible for master planning efforts to include coordination with USFOR command safety managers (USFOR) for their review (see list of explosives safety reference documents at Paragraph 3). Responsible for ESSP development, approval and transmittal through their Chain of Command to their Service Explosives Safety Center for approval, whom in-turn will transmit to DDESB for final approval to construct. Must make determination on site for mitigation, if required. UA is responsible for final site approval and any reviews or approvals as required by the USFOR Safety Manager. Contingency Districts will provide technical assistance when requested.

(l) USFOR Safety Manager: responsible for explosives safety review of the proposed site. Comments shall be transmitted to the UA.

(m) TAD-PDE (Programs Directorate, Engineering and Technical Support Division) shall serve as focal point for coordination with executing districts and USACE FES MCX regarding the site review process and criteria used. PDE shall be the decision authority for disputes, and must elevate to USACE FES MCX and to HQUSACE if support is required to resolve.

(n) The TAD executing district PM is responsible for the site review process. Must ensure no projects go forward with known explosive arc encumbrances. The PM shall coordinate with UA on prospective sites. Inform UA and Stakeholder Safety Office if there are encumbrances. Upon being informed, the UA must: re-site, obtain more land, reduce Net Explosive Weight (NEW) of project, introduce Engineering Controls or protective design/construction, request a CCR from the Service Secretariat, accept the risk through a waiver or exemption, or cancel the project. PM coordinates site issues with engineering, USACE FES MCX and Stakeholder Safety Office, Master planner and UA.

(o) TAD executing district (TAM/TAA/RBD) Engineer staff review site plan from UA with the USACE FES MCX provided guidance to: review NEW for facilities, determine QD arcs, plot on site plan, and review for encumbrances on new and existing facilities, and determine suitability of site. Send to USACE FES MCX for review. Receive USACE FES MCX comments and revise. Advise PM of final determination of site suitability (GO or NO-GO determination).

(p) USAES FES MCX shall review site plans from TAD districts within two weeks of receipt. Proffer comments on site and facilities.

c. Tasks to Subordinate Units.

(1) TAM Safety Officer.

(a) Provide safety and health oversight, through the Safety and Occupational Health Office (SOHO), to ensure ESSP are in compliance with USACE, Army and DDESB policy and procedures.

(b) Collaborate and share health and safety staff resources located at the districts or request assistance from the USACE FES MCX to ensure PDT are appropriately staffed for the design and construction of ESSP.

(c) Ensure full and proper integration of safety and health requirements into the ESSP process (PDBP 8016G) to include facility system safety (DA PAM 385-10).

(d) Coordinate all projects ESSP requirements with USACE FES MCX.

(2) TAM/TAA/RBDs.

(a) Ensure a PES site is a real property master plan (RPMP) approved site prior to conducting a planning charrette. An RPMP approved site conforms to land use, and sustainable design and development (SDD) planning principles, the planned development of the installation, and any special criteria (such as safety or environmental) have been considered and deficiencies either have been or will be rectified, or a deviation therefore will be obtained.

(b) Ensure all projects, at a minimum, are coordinated with USACE FES MCX District Design Team/DoR and U.S. Forces (USFOR) Safety Office, Master Planner and the UA, however a project PDT should be in placed per paragraph 2.1.B.(7)(f)(i).

(c) Ensure ESSPs are prepared and coordinated in compliance with this Appendix.

(d) Ensure all documents pertaining to the ESSPs are included on the project file.

(e) Coordinate with TAD Engineering & Technical Services and TAM Engineering Section for review and maintaining of project documents.

(f) Ensure full and proper integration of safety and health requirements into the ESSP process (PDBP 8016G) to include facility system safety (DA PAM 385-10).

(g) Ensure timely submittal of the ESSP through the established review and coordination process (paragraph 3.c). Take into consideration the additional time required by each entity to review the plan, at least 60 days each.

(h) Provide funding to USACE FES MCX and timely request for ESSP development /transmittal of prepared plans for review, and DRU approval/concurrence, and when the final DDESB approval is required.

(i) Provide technical safety and health support (such as guidance documents and accident investigation, and committee participation) as requested by HQUSACE Safety Office (CESO).

(j) Provide mandatory review and comment as well as written concurrence or non-concurrence of ESSP documents.

(k) Ensure preliminary plan (per Reference 9, paragraph IV.B.03.a.) is prepared as soon as possible and maintain a total control of project schedules to ensure ESSP is prepared, reviewed and approved (paragraph 2.1.b.(6)) in order to have an effective and efficient review process for a timely project construction or start-up.

(l) Do not begin construction of the ESSP design until DDESB final approval is received at the installation where the project is to be constructed and coordinated with Stakeholder Safety Office, or a deviation is received from the Commander in charge of the facility.

(m) Coordinate with all impacted DoD forces see paragraphs 2.1.a.(3) and 2.1.b.(2)(c).

(3) The executing District shall be responsible for and comply with all of the requirements of this process.

d. Coordinating Instruction (USACE FES MCX).

(1) Design ESSPs (AR 420-1, Appendix H-3 and DA PAM 420-1-2 Section III, 2-17, and Chapter 3-1.e(6) and 3-5) for USACE executed projects in support to USACE organizations and customers (AR 385-10, Chapter 5-6.c(4)), as requested.

(2) Serve as Direct Reporting Unit (DRU) lead for the approval/concurrence of ESSPs and deviations.

(3) Provide and maintain state-of-the art trained personnel to conduct ESSPs functions and advise district personnel involved in ESSP projects.

(4) Review, approve or concur and transmit ESSP waivers to USATCES for Army approval, as appropriate, or return through the chain to the TAD Chief of

Engineering & Technical Services for projects where ESSP is returned to the customer for submission through their chain of command (e.g., Base Realignment and Closure (BRAC) and active installations).

(5) Develop ESSP safety awareness training as needed to support USACE mission needs and provide instructors as required.

(6) Ensure full and proper integration of safety and health requirements (PDBP 8016 G) into the ESSP process to include facility system safety (DA PAM 385-10).

(7) Maintain a database of ESSP exemptions and conditions for not complying with the DESR 6055.09.

(8) Be the Army technical agent for review, provision of DRU approval or concurrence, and submission of design packages to DDESB for standard protective construction designs. Such designs that are proposed for use on ESSP projects must have DDESB approval before construction begins. Approved standard protective construction designs are incorporated in DDESB TP 15.

(9) Maintain close coordination with USATCES through the preparation and review process of the ESSP.

(10) Maintain proficiency and utilize available tools for preparation and review of ESSP (for example, Composite Risk Management (DA PAM 385-30), Geospatial Information System (GIS) and the Explosive Safety Siting Software program (ESSS)).

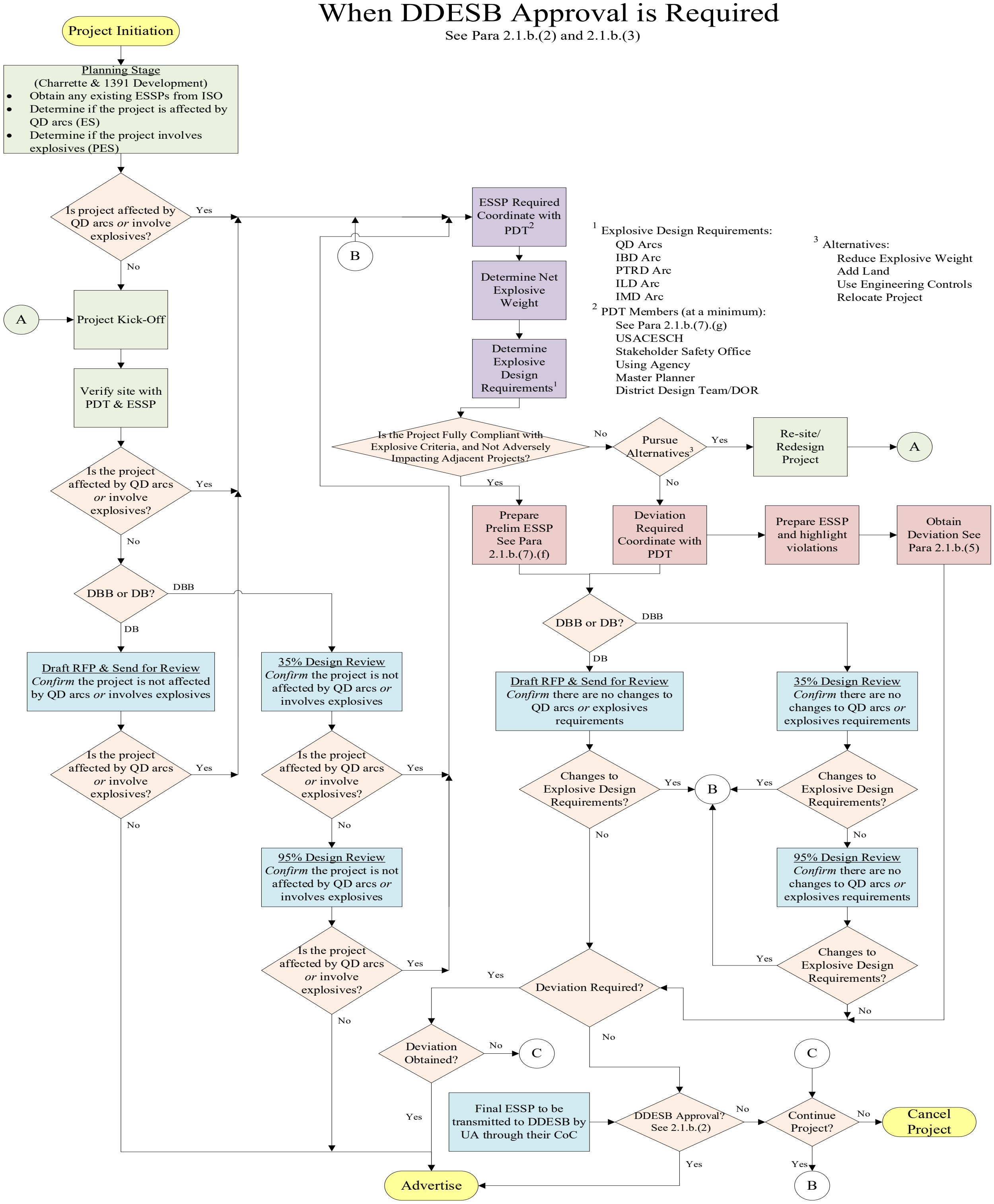
e. Sustainment.

(1) TAD will provide overall guidance for explosives safety on contingency area projects (not on individual projects, which is the executing district responsibility).

(2) Districts execute. Executing district advises UA to forward project site plans and documentation for DDESB approval, if applicable. District advises UA to determine potential site explosive hazards and to coordinate with installation commander and Stakeholder Safety Office. District coordinates all HN sites with the PDT when HN projects encroach on DoD personnel and property. District makes recommendation to UA if project sites are feasible, require mitigation or other measures. District ensures UA coordinates with installation commanders and USFOR for master planning and explosives safety review and site approvals.

2.2 Design Flowcharts

Tab A.1
When DDESB Approval is Required
See Para 2.1.b.(2) and 2.1.b.(3)

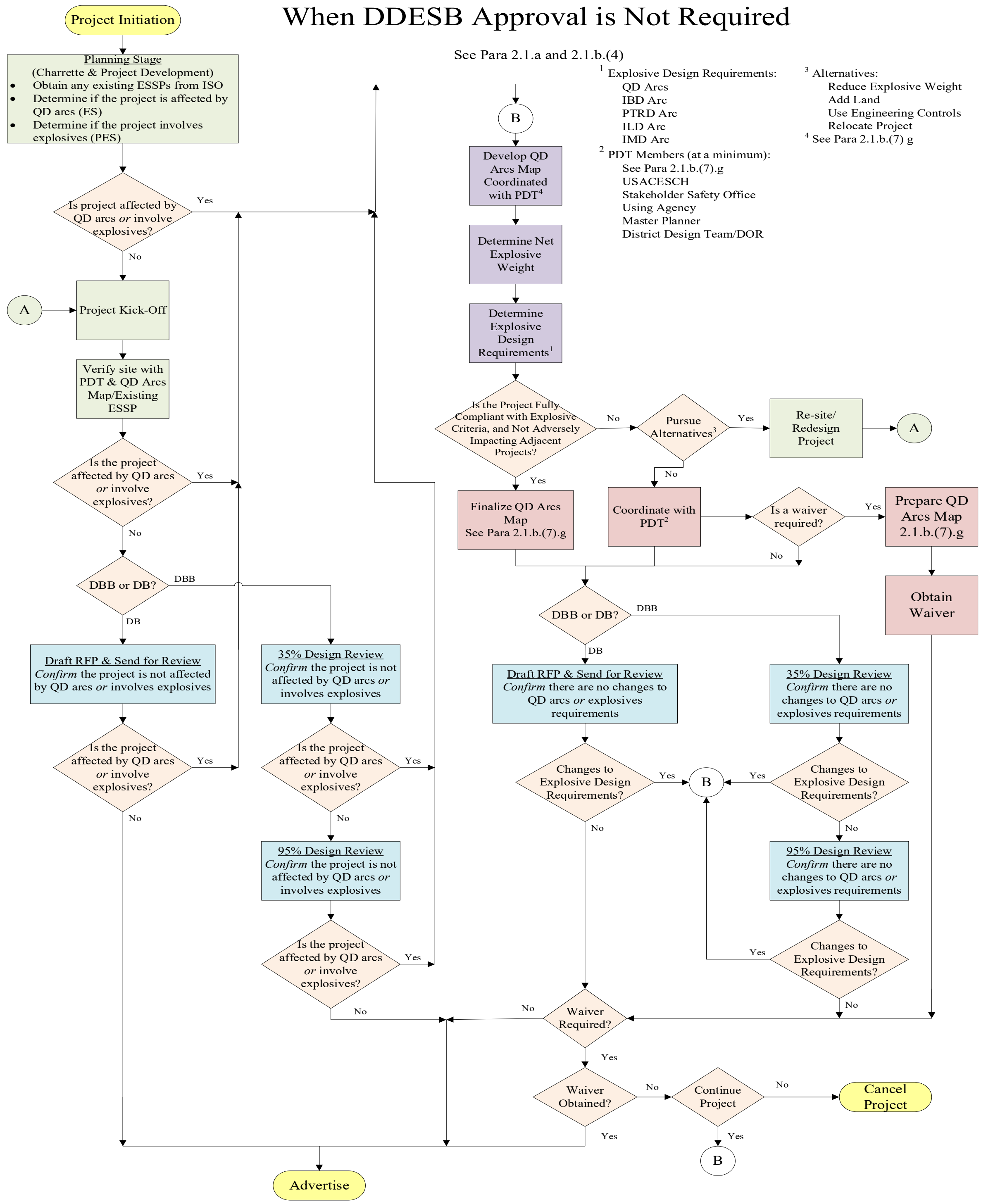


OPR: CETAD-PDE
02 Dec 2020
11 in. x 17 in.

Notes:
1. Any changes during design and construction must be coordinated with the PDT.
2. DB projects often receive a Preliminary ESSP Approval. Final ESSP approval is required prior to construction (See Par...

Tab A.2
When DDESB Approval is Not Required

See Para 2.1.a and 2.1.b.(4)



OPR: CETAD-PDE
02 Dec 2020
11 in. x 17 in.

3.0 References.

1. DESR 6055.09, Edition 1, Defense Explosives Safety Regulations. 13 Jan 2019

2. AR 420-1, Army Facilities Management, 12 Feb 2008

3. DA PAM 420-1-2, Army Military Construction and Non-appropriated-Funded Construction Program Development and Execution, 2 Apr 2009

4. AR 385-10, The Army Safety Program, 24 Feb 2017

5. DA PAM 385-10, Army Safety Program, Rapid Action Revision (RAR) Issue Date: 19 Jan 2010

6. DA PAM 385-30, Risk Management, 2 Dec 2014

7. DA PAM 385-64, Ammunition and Explosives Standards, 24 May 2011, Rapid Action Revision (RAR) Issue Date: 10 Oct 2013

8. DA PAM 385-65, Explosives and Chemical Site Plan Development, 1 February 2008, Rapid Action Revision (RAR) Issue Date: 20 July 2009

9. EM 385-1-97, Explosives Safety and Health Requirements Manual, 17 May 2013

10. USCENTCOM FRAGO 07-718 Mod 4 US Command and Control Relationships in CJOA-AFG, 241210Z Nov 2011

11. USFOR-DCDR-S, Policy Letter #28, Explosives Safety Compliance for New Construction Projects, 1 Oct 2016

12. CJCSI 4360.01B, Chairman of the Joint Chiefs of Staff Instruction (CJCSI)- Explosives Safety and Munitions Risk Management for Joint Operations Planning, Training and Execution, 31 Aug 2018

13. USACE PDBP Manual Reference Document-8016G, Safety and Occupational Health Plan, May 2009, Version 1.0

14. Engineering and Construction Bulleting (ECB) 2017-21, Establishment of the Facilities Explosive Safety Mandatory Center of Expertise, 01 November 2017

15. Engineer Regulation (ER) 1110-1-8169 U.S. Army Corps of Engineers Facilities Explosives Safety Mandatory Center of Expertise, 01 October 2018

4.0 Responsibilities.

Primary Point of Contact is Gregory Taylor, Engineering and Construction Division, at 540-667-3432, DSN: 312-265-3432, Gregory.D.Taylor2@usace.army.mil.

Alternate Point of Contact is Glenn Hordusky, PE, Engineering Branch, Civil Section, at 540-665-4030, DSN: 312-265-4030, Glenn.L.Hordusky@usace.army.mil.

5.0 Related Procedures.

None

6.0 Definitions.

AE - Ammunition and explosives

AFSC – Air Force Safety Center

AHA – Ammunition holding area

ASA – Ammunition storage area

BLAHA – Basic load ammunition holding area

CA – Chemical agent

CAPA – Combat aircraft parking areas

CCR – Certificate of compelling reason

CESO - USACE Safety and Occupational Health Office

CORA – Certificate of risk acceptance

DB – Design-Build

DBB – Design-Bid-Build

DDESB – Department of Defense Explosive Safety Board

DOR – Designer of Record

EOD – Explosive ordnance disposal

ES – A location exposed to the potential hazardous effects (e.g., blast, fragments, debris, or heat flux) from an explosion at a PES

ESAV – Explosive safety assistance visit

ESSP – Explosive safety site plan

FARP – Forward arming and refueling points

HD – Hazard class/divisions

HN – Host Nation

ILD – Intraline Distance

IMD – Intermagazine Distance

ISO – Installation Safety Office

IMP – Installation Master Planner

ISR – Intelligence/surveillance and reconnaissance

LPS – Lightning protection system

MSA – Munitions storage areas

NEW – Net explosive weight

NOSSA – Naval Ordnance Safety & Security Activity

OPR – Office of primary responsibility

PDT – Project delivery team[2]

PES – Potential explosive site

PTRD – Public transportation route distance

RFP – Request for proposal

SDW - Substantial dividing walls

USATCES – US Army Technical Center for Explosives Safety

UA – Using agency

USACE FES MCX- US Army Corps of Engineers Facilities Explosives Safety Mandatory Center of Expertise

USAESCH – US Army Corps of Engineers, Engineering and Support Center Huntsville

USFOR – United States Forces

QD – Quantity-Distance

7.0 Records and Measurements.

All records will be filed in accordance with “Records Management.” Required records are listed in the following table; there are no specific measurement requirements associated with this procedure.

Type	Description	Location and/or Responsible Office	Record Media	Retention	Disposition
R	Explosive Site Plan Analysis	LR, IA	E	LR, IA	LR, IA
R	QD Arcs Map	LR, IA	E	LR, IA	LR, IA
M	Not Applicable (N/A)	N/A	N/A	N/A	N/A

Description of Terms

Type:		Location/Retention/Disposition		Record Media	
R	Record	LR	Local Requirement	E	Electronic
M	Measurement	IA	Intra Agency	P	Paper

8.0 Appendix.

None

CHAPTER 7
ARCHITECTURAL/INTERIOR DESIGN

CHAPTER 7

ARCHITECTURAL/INTERIOR DESIGN

7.1 GENERAL.

7.1.1 Scope. This chapter states criteria, requirements, and guidance for architectural/interior design. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including the drawings and the design analysis, shall be prepared in accordance with Chapter 2: PRESENTATION OF DATA, and Chapter 22: COMPUTER ASSISTED DESIGN AND DRAFTING. If Building Information Modeling (BIM) technology is to be used on the project, the requirements shall be obtained from the CADD Coordinator at MED. Renovation design shall comply with the requirements of Chapter 19: RENOVATION DESIGN. Furniture, Fixtures and Equipment (FF&E) shall follow the requirements of Chapter 7 when FF&E design is required.

7.1.2 Architectural/Interior Quality. The objective of the Middle East District (CETAM) is to obtain attractive structures which are designed using sound technical knowledge and which are constructed using recognized, good commercial building industry practices, as well as being cost effective. The design and construction program shall incorporate those characteristics which will provide structures with present and continuing utility, durability, and desirability, incorporating the harmonious and discriminating use of color, materials, texture, finish and style using aesthetic judgment; and which will be economical to maintain for the life of the structure. The design shall be such that will provide a safe and healthy environment.

7.1.3 Design Character. Unless otherwise directed, facilities shall be austere in character. The design shall reflect an Architectural style or theme appropriate to the function of the facility and in conformance with the Installation Design Guide (IDG) for the installation. The application of superfluous ornamentation is not appropriate. In general, facilities interrelate with other facilities or complexes in terms of appearance and features according to their function and the status of the occupants. The design character should be consistent with the "status" of the facility in this hierarchy.

7.1.4 Local Material Procurement. Locally manufactured materials and products may be utilized in facility designs to the extent their use will result in a suitable, quality product, and is approved in accordance with the BALANCE OF PAYMENTS PROGRAMS, when applicable.

7.1.5 Design Criteria and Standards. Designs shall follow normal industry practice for similar facilities except when modified by specific design criteria established in this document, and by supplemental criteria provided with the project scope of work (SOW). Host nation building codes and regulations, and international agreement requirements identified in the project SOW or as determined as the result of the SOW, apply when they are more stringent than the criteria and standards noted above. Designs shall meet the requirements of the client, utilize locally available skills and materials to maximum advantage, and be of the most economical and serviceable type. Any problems in incorporating these standards due to conflicts in the criteria shall be submitted to CETAM for resolution.

7.1.6 Special Studies. Except as identified in the project SOW, rigorous economic analyses or formal life cycle cost studies are not required in conjunction with the architectural features of the project. Likewise, models, perspectives, renderings and other special presentation material are not required except as specifically identified in the project SOW.

7.1.7 Vending Facility Program for the Blind is not applicable except as specifically identified in the project SOW.

7.1.8 Provisions for Physically Handicapped Individuals. All buildings and facilities designed for civilian use shall ensure access to disabled individuals in compliance with the Architectural Barriers Act (ABA) of 2008. All buildings and facilities designed for active-duty service members in a contingency environment are not required to comply with the ABA.

7.1.9 Force Protection. Applicability of force protection design criteria to the project shall include perimeter stand-off distances to the primary occupied facilities and a clear definition of the assigned occupancy category – uninhabited, inhabited or billeting & primary gathering structures – for each facility in the project. See Chapter 25: Force Protection.

7.1.10 Leadership in Energy & Environmental Design (LEED). The applicability of LEED Certification to the project shall be clearly identified and the required level of certification (Certified, Silver, Gold or Platinum) shall be noted in the design analysis.

7.1.11 Energy. Applicability of LEED requirements. All buildings are to achieve energy consumption reductions in accordance with UFC 1-200-02 below the consumption of a baseline building meeting the requirements of ASHRAE 90.1. For host nation funded design activities, comply with Host Nation Agreements before applying UFC 1-200-02 requirements.

7.1.13 SCIF Design. Sensitive, Compartmented Information Facility requirements are governed by UFC 4-010-05 SCIF Facilities Planning Design and Construction and ICD/ICS 705 Technical Specifications for Construction and Management of SCIF. See Chapter 26: SCIF Design.

7.2 APPLICABLE REFERENCE PUBLICATIONS.

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this Manual to the extent indicated by the references thereto.

Enterprise Standard (ES) – 08010 Life Safety / Fire Protection Design and Review Requirements

Unified Facility Guide Specifications (UFGS)

UFC 1-200-01 General Building Requirements

UFC 3-120-01 Sign Standards

UFC 3-600-01 Fire Protection Engineering for Facilities

UFC 3-120-10 Interior Design

UFC 4-021-01 Design and O&M: Mass Notification Systems

American Society for Testing and Materials (ASTM)

National Fire Protection Association (NFPA)

International Building Code (IBC)

Occupational Safety and Health Administration (OSHA) Standards

Air Force Manuals and Engineering Technical Letters (ETLs)

American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE) - Handbook of Fundamentals

7.3 CONCEPT REVIEW SUBMITTAL REQUIREMENTS.

7.3.1 Concept Design Analysis.

The designer shall state the criteria, assumptions and rational behind all major facility design decisions. The following specific items shall be included when applicable.

7.3.1.1 Basis of Design Program. Except where programming has been accomplished in accordance with Chapter 5: PROGRAMMING, a Concept Design Narrative shall be developed which meets the requirements of Chapter 5 paragraphs 5.3.1.1, 5.3.1.2 and 5.3.1.3, and shall be provided as a part of the design analysis. Where programming has been prepared in accordance with the referenced paragraphs, a summary of the Basis of Design shall be provided.

7.3.1.2 Basis of Design Summary. Provide a summary of the Basis of Design including, but not limited to, the purpose, function, and capacities in sufficient detail to delineate and characterize the features and the desired image or visual appearance of the project as a whole and of the individual structures within the project.

Individual Space Criteria. For the individual spaces, provide the general information necessary to plan and conceptualize the space as well as appropriate, specific criteria to be used in the design development. The description shall include the following:

a. Function: The purpose of the space, the activities that take place, how often they occur, how long they last, etc.
b. Participants: The people involved in the activities (staff, users, visitors, etc), their characteristics (officer, enlisted, civilian, etc.) and their number (maximum, minimum, average, etc.).
c. Size: The overall area of the space and allowable variations in space size.
d. Relationships: The requirements for proximity to or remoteness from other spaces. Provide bubble diagrams that show discovered space adjacencies. Show both primary and secondary space relationships. Provide square footage bubble diagrams that show the space adjacencies drawn to scale with the allowed square footage.
e. Special Considerations: The important features that support the function of the space, critical dimensions, integral storage requirements, special life safety or security considerations, access flooring, overhead lifting capability, demolition, Sensitive Compartmented Information Facility (SCIF) , etc.
f. Acoustic Considerations: The requirements for special sound control measures. Sound Transmission Coefficient (STC) ratings should be identified.
g. Space Development: Any graphic aids necessary to sketches support and/or clarify the space criteria, indicating the important physical features, equipment, furniture, etc. required by the activities within the space.

Provide initial charrette report notes that spells out all client interviews that uncover the facility and staff requirements for space and FF&E.

a. Space allocation table for each structure, relating the functional areas, their programmed space allocations and their as-designed area. The table shall include allocations for circulation, electrical/mechanical and other spaces as necessary to yield the complete gross area as defined in Chapter 2: PRESENTATION OF DATA. Significant variation between programmed and as-designed areas shall be justified. Create adjacency bubble diagrams that show all departmental relationships. Develop this adjacency diagram into a scaled square footage adjacency diagram. Both the adjacency bubble diagram and the square footage adjacency diagram are to be submitted with the Design Analysis for the initial floor plan submittal.

b. Building organization Analysis. Submit any graphic design aids such as affinity drawings, spatial organization and relationship matrices, and building layout sketches, together with sufficient narrative to indicate the reasoning and justification for major layout decisions. Any provisions for future expansion should be indicated, including schedules for phasing.

c. List the Technical Criteria used to guide the design work. This might include Design Guides, Technical Manuals, site adapted drawings, etc.

d. Building Systems Analysis. Include any explanatory material required to support the selection of architectural materials or systems. Indicate the rationale utilized in the selection of the various systems. The analysis shall be sufficiently complete to show that the Architect-Engineer (A-E) has adequately conceived the project as a whole and that the systems utilized represent the maximum value which can be obtained for the result intended. The following are some, but not necessarily all, of the systems that should be investigated.

1. Exterior wall systems.
2. Solar screen systems.
3. Fenestration.
4. Roof systems.
5. Interior partition systems.
6. Openings in interior walls.
7. Ceiling systems.
8. Floor systems.
10. Exterior finishes.
11. Building signage systems.
12. Noise and/or acoustical control measures.
13. Special equipment.
14. Vertical transportation (elevator)

7.3.1.3 Statement of Interior Design Objective. Provide a narrative explaining the interior design philosophy of the facility. Where applicable, included desired psychological and functional impact of the interior environment on its inhabitants and proposed method of accomplishing same by using space planning, shapes, forms, color, patterns, textures, fabrics and furnishings. Explain how the design integrates functional, visual, interior, and architectural design requirements. Include this narrative in the Design Analysis for the Comprehensive Interior Design of the project.

7.3.1.4 Design Calculations. Submit complete calculations for the following:

a. Gross building areas in accordance with Chapter 2: PRESENTATION OF DATA, paragraph 2.4.8.2.

b. "U" values for each exterior construction assembly.

c. Calculations for toilet fixture count using UFC 1-200-01 General Building Requirements for fixture allowances in concert with the building occupancy projections.

d. Projected building occupancy using the occupant load factors from NFPA 101 Life Safety Code, Table 7.3.1.2.

7.3.2 Concept Design Drawings. The following specific items shall be shown when applicable.

7.3.2.1 Composite Floor Plans. If the main floor plans must be drawn in segments in order to comply with the requirements on the proper scales, provide a composite floor plan for each floor level. These plans shall show the following:

The general building layout showing exterior walls, interior partitions, and circulation elements drawn to scale.

The identification of significant areas.

a. Overall building dimensions.
b. Planning grid or column lines.
c. Cross-references for enlarged floor plans and building sections.
d. Gross area tabulations as required in Chapter 2: PRESENTATION OF DATA.

7.3.2.2 Floor Plans. Provide a floor plan for each floor showing functional arrangements and circulation elements to scale, as well as the following:

a. Planning grid and/or column lines.
b. All major dimensions.
c. Functional identification of each area.
d. Finish floor elevations. (show height above ground floor. Ground floor is assumed elevation 100.00).
e. Openings in walls.
f. All major fixed equipment, casework, and built-in specialties.
g. Adjacent site related features such as stoops, patios, flag poles, dumpster pads, equipment screens, etc.
h. Gross floor area tabulations as required in CHAPTER 2.
i. Cross references for elevations, sections, and details.
j. Structural columns and building expansion joint locations.

7.3.2.3 Roof Plan. Provide a roof plan showing the following:

a. Planning grid and/or column lines.
b. Overall dimensions.
c. Indication of roof drainage, scupper and downspout locations, etc.

d. Major roof-mounted equipment, skylights, etc.
e. Expansion joint locations.

7.3.2.4 Building Elevations. Provide building elevations showing the exterior design of all major elevations. Elevations shall be designated by letter: shall not be designated as north, east, south, or west. Each elevation shall show the following:

a. Planning grid and/or column lines.
b. Building masses and fenestration.
c. Identification of all major building materials.
d. Major roof-mounted equipment.
e. Building expansion joints

7.3.2.5 Building Sections. Provide no less than two building cross sections cut along perpendicular axes demonstrating the coordination of the structural, mechanical, and electrical systems. In addition, the following shall be shown:

a. Planning grid and/or column lines.
b. Structural system.
c. Changes in floor levels.
d. Finish ceilings.
e. Floor-to-ceiling and floor-to-floor heights.
f. Identification of major spaces.
g. Spaces to be used by the lighting and HVAC systems.
h. Adjacent grades (shown, but not dimensioned).

7.3.2.6 Typical Wall Sections. Provide at least one unbroken, typical exterior wall section. This section shall show the following:

a. Structural system.
b. Exterior wall and roof assemblies.
c. Ceiling systems.
d. Significant story and ceiling heights.
e. Spaces to be used by the lighting and HVAC systems.
f. Typical window openings and solar screening assemblies.

7.3.2.7 Details. In addition to the above requirements, show details of any design significant features and any sections necessary to demonstrate the required coordination of the various building systems.

7.4 PRELIMINARY REVIEW SUBMITTAL REQUIREMENTS.

7.4.1 <u>Preliminary Design Analysis.</u> The preliminary design analysis shall include all items in the concept design analysis and any refinements or revisions necessary. In addition, the following specific items shall be included when applicable.

7.4.1.1 Design Calculations. Provide complete calculations for the following:

a. Economic analysis of materials, equipment, furnishings, and systems (comparative cost analysis, life-cycle cost analysis, or other techniques) where required by the A-E project SOW to support the selection of those items.

b. Acoustic analysis for spaces requiring special acoustic control measures.

7.4.2 Preliminary Design Drawings. These drawings shall include, but will not necessarily be limited to, the following items.

7.4.2.1 Architectural Floor Plans. Provide plans for each floor showing dimensions, functional arrangement, and fixed equipment for all areas, including corridors, exits, stairs, and utility spaces. The relationship of the building to exterior access, vehicles parking, service areas, etc. shall be indicated on the floor plans. Individual treatment shall be given to special design or items involving deviation from normally accepted standards. Gross floor areas shall be shown for each floor and for the entire building, and tabulation of floor areas shall be shown on the first architectural sheet of the structure. All column lines shall be designated to aid in location of project components and any phased construction shall be shown. Fire rated construction shall be identified, unless indicated on Fire Protection drawings.

7.4.2.2 Building Elevations and Sections. Provide elevations of all building faces and sections showing story heights, fenestration, suspended ceilings, with heights, partitions, and relation to finish grades. Building materials and significant roof mounted equipment shall be shown and identified. Building sections shall show the structure and how it is coordinated with the mechanical and electrical systems.

7.4.2.3 Roof Plans. Roof plans shall show roof slope and drainage, roof mounted equipment, membrane penetrations, walkways, expansion joints and any special ballasting requirements.

7.4.2.4 Reflected Ceiling Plans. Except for buildings with minimal ceiling finish requirements, the design shall provide plans for each floor indicating ceiling materials with grids and showing the tentative locations of light fixtures and HVAC grilles and diffusers, shafts, pipe chases, stairwells, room numbers, references to typical sections, , etc.

7.4.2.5 Wall Sections and Details. Typical exterior wall sections shall be provided showing materials, thicknesses, methods of attachment, and relation of fenestration to supporting columns or walls. Details of all major or typical conditions such as stairs, roof conditions, entryways, etc. shall be shown. Details of unique design conditions shall be shown.

7.4.2.6 Schedules. The drawings shall include door, window, equipment, finish, and color schedules. Schedules need not be complete at this point; however, they should be sufficient to indicate the door and window sizes, major equipment items, and the interior and exterior finishes and color schemes

7.5 FINAL REVIEW SUBMITTAL REQUIREMENTS.

The design analysis and the drawings submitted for Final review shall include all such items in the preliminary submittal including necessary revisions, and shall be complete, thoroughly checked and coordinated as described in Chapter 1: GENERAL INSTRUCTIONS. The Design Checklist shall be annotated and submitted as part of the design analysis. Color and finish boards shall be revised if required and resubmitted. 200mm by 250mm professional quality custom color prints and (2) DVDs with JPG/TIF and PDF files of each board shall *also* be submitted.

7.6 READY TO ADVERTISE (RTA) REQUIREMENTS.

The comments generated during the Final design review shall be incorporated in the documents before the documents are submitted as Ready to Advertise.

7.7 TECHNICAL REQUIREMENTS.

In addition to the criteria contained herein, the architectural design details, terminology, materials, and construction methods shall comply with the text and instructional notes inserted in the applicable guide specifications as well as the appropriate elements of the Design Checklist. The work shall be technically sufficient, comply with all instructions provided in the course of design development, be feasible, clear, accurate in detail and consistent with related architectural and engineering features.

7.7.1 <u>General Considerations</u>.

7.7.1.1 Permanent construction. Buildings and facilities shall be designed for a life expectancy of not less than 25 years. Finishes, materials and systems shall be selected for low maintenance and low life cycle costs over that 25 year period. Furniture warranties shall be as described in paragraph 7.7.12

7.7.1.2 Materials, equipment and construction methods incorporated into designs must provide overall economy consistent with functional and aesthetic requirements, reasonable comfort, and sound architectural and engineering practice. Their use shall result in low overall costs consistent with economical maintenance for the required use and life expectancy of the facility. While low initial cost is always desirable, life cycle cost must be considered. Products with low initial cost that require frequent maintenance, care, cleaning and replacement, will not prove to be cost effective, in the long term. Products must be strong and durable, not easily marred, discolored, or vandalized, and capable of withstanding regular cleaning. Factory finished products not requiring refinishing are desirable. Materials requiring new finishes or frequent replacement should be avoided. Selection of products must consider not only initial availability, but future availability for maintenance and replacement. Similarly, the level of local technology must be considered with respect to construction, operation and maintenance of the facility. Stock items should be used in lieu of special products where possible. The variety of materials and finishes should be limited to create a unified building appearance, to minimize the initial labor costs, and to minimize the number and types of different maintenance equipment and processes involved. Products with highly decorated or simulated finishes can appear substandard and should not be used.

7.7.1.3 Exposed metals must be carefully selected and appropriately protected against corrosion. The Middle East generally has corrosive soils, constant winds and limited rainfall. The result is wind-blown chloride containing dust, which lodges in joints, welds, and condensation on metal surfaces. Corrosive attack is activated by the condensation, and the limited rain provides no periodic rinsing of the surfaces. The problem is aggravated by wind-blown sand and dust which abrades the protective coatings. At coastal sites, wind driven salt laden water particles compound the problem. Especially at sites exposed to monsoon conditions. In the vicinity of large cities, atmospheric pollution also poses a significant threat to metallic surfaces. It has been our experience that Types 302 and 304 stainless steels perform marginally in exterior exposed locations in the island nation of Bahrain due to its close proximity to salt water and salt laden atmosphere. Accordingly, Type 316 should be utilized in harsh climates such as this.

7.7.1.4 Assure exterior facade and massing of new buildings are visually compatible with adjacent existing structures. A marked difference in appearance should be avoided.

7.7.1.5 Energy Conservation.

7.7.1.5.1 Glass area including glass doors shall not exceed 15 percent of the total wall area. Fully glazed doors, large windows, and window walls are energy intensive and must be held to a minimum. The use of glass must be carefully studied in relation to energy conservation and building function. For any air-conditioned space, all windows and other glazed areas exposed to the sun shall be completely shaded on the exterior, not less than 80 percent of the time between 0730 and 1630 (solar time), daily during the summer (1 June through 30 September) in the northern hemisphere. Partial shading all of the time is an acceptable alternative provided the total solar gain does not exceed that achieved by compliance with criteria noted in this section, based on actual solar studies.

7.7.1.5.2 Shading may be achieved by various architectural solutions, such as horizontal and vertical building projections; awnings; deep reveals; or external solar screens which completely shade the glass area and have a solar heat rejection of not less than 70 percent. The shading coefficient used for louvered shade screens or awnings shall be determined using a profile angle of 30 degrees, as found in the ASHRAE Handbook of fundamentals.

7.7.1.5.2 The use of "heat absorbing tinted glass" is also acceptable, provided the total heat gain based on specific studies does not exceed that permitted under the criteria in this section, and provided the glass is readily available on the local market. The use of factory manufactured fully reflective glass is also acceptable for external shading, provided it is readily available on the local market. Sheet applied films are not acceptable. Many locations in which MED does work are remote and thermal glazing may not be readily available.

7.7.1.5.3. The shading coefficient (sc) for glazed areas must be obtained from the chapter entitled "Fenestration" of the AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE) Handbook of Fundamentals, or from manufacturers' test data.

7.7.1.6 Airlock vestibules shall be provided to reduce air and dust infiltration at all primary entrances and exits in multi-story buildings, and in all single-story air-conditioned buildings, at sites subject to windblown sand and dust. Vestibules do not require double wide entry doors. Recessed floor mats are recommended for vestibules.

7.7.1.7 Doors, stairs, and corridors shall be of adequate size to accommodate the installation and removal of furniture and equipment.

7.7.1.8 In multi-story buildings, mechanical and electrical rooms should be on the ground floor wherever possible. Grade level mechanical rooms shall normally be provided with doors to the outside of the building only. Doors shall be of adequate size to accommodate the installation and removal of equipment.

7.7.1.9 Alcoves for drinking fountains shall be sized to permit easy installation and maintenance of the units.

7.7.1.10 Roof access (stair or permanent ladder) must be provided on all building sections over one story in height requiring periodic equipment or roofing system maintenance. Access stairs and ladders shall be configured to support the roof top activities and designed to restrict access to authorized persons (i.e., interior access to roof by way of a ladder and roof scuttle).

7.7.2 Regional Considerations. The location of a project influences various aspects of the design. Failure to properly consider the local climate, traditions, customs, living standards, construction materials, technology, and laws, could result in poor design. The designer, therefore, shall carefully examine all design assumptions to establish their validity for the project.

7.7.2.1 Privacy is a key consideration in the traditional Middle East culture. Individual privacy is essential in toilets, showers and similar facilities. Activities involving a state of undress (swimming, athletic events, etc.) require segregation of the participants and bono fide spectators from the general public. Outside the immediate family, the sexes normally do not mix socially; therefor any social and recreational facilities provided for women, are to be separate from those of the males. In the traditional Middle Eastern home, reception areas separate from the family quarters are provided, where the man of the family entertains male guests. Ensure that project specific guidance is obtained regarding facilities for women and families.

7.7.2.2 Women are often a very limited part of the Host Nation military work forces in the Middle East. In some countries however, such as Kuwait and Jordan, they are present in significant numbers within the civilian engineering and administrative staff. The extent to which they should be accommodated in the design must be established for each project. Any general criteria regarding women must be adapted accordingly.

7.7.2.3 Separate toilet facilities are commonly provided in the Middle East for officers and for enlisted men, for instructors and for students, and similarly for other groups. To accommodate future changes in facility use, it is more desirable to provide multiple smaller toilets, than fewer large ones.

7.7.2.4 Urinals and western style water closets are not used in the traditional Middle East culture. However, as a result of wide spread travel and foreign education, many Middle-Easterners are comfortable with them. Ensure that appropriate toilet fixture criteria is used.

7.7.2.5 The typical Middle Eastern diet requires slightly different food service equipment than that required by a western diet. Preparation of large quantities of rice, roasting of whole lambs, and baking of flat bread are among the areas of difference which must be accommodated.

7.7.2.6 Tea is consumed frequently during the day in the Middle East. A tea preparation area, equipped with at least a surface range, counter, refrigerator, and sink is required in most work areas and on each floor of multi-story buildings.

7.7.2.7 American style ground coffee is not used in Middle East facilities. In lieu of the typical United States (U.S.) commercial type coffee urns, hot water dispensing units should be specified.

7.7.2.8 Residential roofs in the Middle East are often used in the evening for informal gatherings. To accommodate this need, roof areas on both accompanied and unaccompanied housing for Middle Eastern customers shall be designed to be accessible by the building occupants and finished using precast concrete pavers. Ensure the structural system will accommodate the higher roof load and that appropriate safety considerations are incorporated. On family housing, provide for the privacy necessary for the women.

7.7.2.9 Ceiling heights in the Middle East are traditionally higher than in the United States. In general a height of 2600 mm to 2750 mm is an appropriate alternate to the standard U.S. 2400 mm ceiling height.

7.7.2.10 Floors in the Middle East are often cleaned using large amounts of water rather than damp mopping. Spaces subject to frequent cleaning (kitchens, toilets, showers, laboratories, etc.) require a hard surface floor, floor drains with the entire floor sloping to drain, marble saddles to contain the water in the space, and where located above occupied spaces, shall be provided with membrane waterproofing under the setting bed. Floor slope shall be indicated on the architectural plan and require slope on the entire room.

7.7.3 Site Work.

7.7.3.1 Access to Entrances. All stoops, steps, or similar required access to entrances that will be normally built by a building contractor as differentiated from sidewalks, driveways, etc., which are normally constructed by a paving subcontractor, shall be shown on the architectural drawings. Surfaces shall be sloped to drain.

7.7.3.2 Guard posts shall be provided where necessary at jambs of service doors to protect concrete, masonry and stucco finish, from vehicular traffic damage. Coordinate details and specifications with the site development.

7.7.3.3 Aggregate Blanket shall be provided at the base of exterior walls subject to splashing by rainwater or irrigation, to reduce staining. The aggregate shall be washed crushed stone, 10 mm to 50 mm across, applied 100 mm deep, and 1500 mm wide. Coordinate rock mulch requirements with the site design drawings and integrate into the landscaping design.

7.7.4 Masonry.

7.7.4.1 Concrete masonry unit (CMU) walls and partitions are commonly used in the Middle East. In contrast to common locally used block, Corps of Engineers specifications for CMU require relatively close dimensional tolerances and dense, sound and well cured concrete. Material meeting these specifications (ASTM), can generally be obtained at major cities in the Middle East. In 1990, experience in Morocco indicated specification grade block was not available in Tangier, and if CMU is to be used, local block should be reinforced and plastered in order to provide satisfactory strength and finish. Hollow clay tiles are more commonly used in Morocco than CMU.

7.7.4.2 Concrete masonry design shall be based on locally available units. Commonly local units are metric modular, 400 mm long, 200 mm high, with widths of 100, 150, 200, and 300 mm nominal, and with actual dimensions 10 mm less. In general, bond beam and lintel block as well as concrete brick are available. Sash, bullnose, half height, and other special units are usually not available. Lightweight aggregate is not available. Design shall be in accordance with the applicable requirements of Chapter 8: STRUCTURAL.

7.7.4.3 Interior Walls and Partitions. Concrete masonry units in interior masonry walls and partitions shall be not less than 150 mm in nominal thickness.

7.7.4.4 Pipe Chase Walls. Concrete masonry unit walls which support wall-hung plumbing fixtures shall be not less than 200 mm in nominal thickness with the following exception: pipe chase walls may be 150 mm in nominal thickness if the two walls are tied together so that they act as a single wall structurally.

7.7.4.5 Coursing. Concrete masonry unit coursing shall be coordinated with metric door and window heights, and structural bay spacing to reduce the need for a cutting block.

7.7.5 Miscellaneous Metals.

7.7.5.1 Access panels required to service concealed electrical and mechanical items shall be shown on the architectural drawings and specified in Miscellaneous Metals sections.

7.7.5.2 Cover Plates in finish floor surfaces shall be designed and constructed so that the top surface of the cover plate will be flush with adjoining finish floor surfaces.

7.7.5.3 Ferrous metals exposed to corrosive environments shall be appropriately protected. Stair safety nosing shall be non-ferrous.

7.7.5.4 Louvers which are necessary for the proper operation of air-conditioning and ventilation systems and which are to be furnished and installed by the non-mechanical trades, shall be shown on the architectural drawings and specified in Metal Louvers section of specifications.

7.7.6 Wood and Plastics.

7.7.6.1 Wood usage overseas should be approached with caution since quality control and availability vary greatly according to the region.

7.7.6.2 Extreme climatic conditions may adversely affect wood products, including laminated materials, during shipment and storage as well as while in use at the project site. Materials should be selected and specified with care to assure that deterioration will not occur. Particular attention must be paid to the characteristics of laminating glues and to the moisture content of the wood products. The use of wood in exterior exposed conditions is not advisable if another material can be used.

7.7.6.3 Architectural Woodwork. Built-in counters, cabinets, casework, reception desks, and other architectural woodwork items shall generally be designed around the Architectural Woodwork Institute (AWI) Quality Standards, Custom Grade. Simple clean forms, standard detailing, and simple sturdy hardware shall be used.

7.7 7 Thermal and Moisture Protection.

7.7.7.1 "U" values for building components shall be coordinated with the mechanical engineer and in concert with UFC 3-400-01 Energy Conservation. In our AOR it is recommended that roofs on air-conditioned facilities in permanent construction have a U-value of .025 and walls have a U-value of .05. Non-air conditioned building should have a U-value of .05 for roofs and .077 for walls. For contingency construction, air conditioned buildings should have a U-value of .05 for roofs and .077 for walls; and non-air conditioned buildings should have U-value of .077 for roofs and .15 for walls. Roofs of metal shade structures intended for human occupancy (training, maintenance, etc.) shall be insulated as for weather region 9 to reduce the downward heat radiation from the roof.

7.7.7.2 Moisture Migration. All buildings shall be designed to prevent moisture migration and condensation of water vapor within the envelope assembly that decreases insulation performance and/or contributes to structural deterioration. Designs shall incorporate the principles of the chapter titled "Thermal Insulation and Vapor Retarders" of the AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE) Handbook of Fundamentals.

7.7.7.3 In areas of high humidity, insulation for air conditioned buildings shall be of sufficient thickness to maintain the exterior surface temperature above the ambient dew point temperature.

7.7.7.4 Roof and Wall Insulation, except when required for refrigerated spaces, shall be drawn at a nominal thickness consistent with the insulation requirements of the particular building or project. The thickness of roof or wall insulation shall not be dimensioned nor the thickness indicated on the drawings. General standards for insulation, as indicated in the applicable guide specifications, require insulation thickness as determined by the established "U" or "R" value for total roof or wall thickness, and the typical of material utilized. Details shall allow for possible differences in insulation thickness.

7.7.7.5 Sprayed-on insulation and fire proofing shall not be used unless requirements for flammability are addressed in accordance with IBC Chapter 26. Provide required thermal and ignition barriers and details in accordance with IBC requirements and compatible with adjacent construction.

7.7.7.7 Membrane roofs shall be designed to provide not less than a 4% slope to drain the field of the roof. Where possible the basic slope shall be provided by sloping the roof deck. Methods of providing slope through applied lightweight materials (fluid applied fill, tapered insulation board, etc.) are more expensive and introduce complications e.g., entrapment of moisture, requirement for fasteners of various lengths, need for high piles of wood nailers at the perimeter, etc. In addition, when these applied slope-providing components are damaged (and when the roofing membrane is replaced), the cost of providing slope will be borne again. Crickets shall be applied to provide positive drainage and on concrete decks shall be formed of standard weight concrete or similar, durable product. Lightweight fill (less than 25 MPa compressive strength) is not usually available and in any event shall not be used as a base for adhered membrane roofing systems due to its potential for crushing under traffic. Crickets on steel decks may be tapered insulation.

7.7.7.7 Roofing. The basic roofing specification may be "Elastomeric" Roofing (EPDM)", "Modified Bitumen Roofing" or "Protected Membrane Roofing" using either single ply membrane as appropriate for intended use, and as recommended by the designer and approved by CETAM.

7.7.7.9 Roof Drainage. Even in arid climates, the rain often falls in heavy, short duration thunderstorms. The drainage system must be sized to accommodate the anticipated flow. Rain leaders shall be used where control of rainwater is necessary. Water draining onto open ground shall be diverted to prevent erosion by utilizing splash blocks. For roofs with parapets which are drained through interior drainage systems, overflow scuppers shall be provided as a secondary means of drainage if the interior drains become blocked. Scuppers should be designed to penetrate the parapet eight to ten cm above the level of the primary drains. The structural roof deck must be designed to accommodate such ponding.

7.7.7.10 Flashings shall be located above the roof water line where possible. If it is impractical, flashings must at least be kept out of areas of water ponding. Parapets and curbs for expansion joints, area dividers, equipment mounting and similar purposed shall be high enough at the high point of the roofing to provide a base flashing height of at least 20 cm.

7.7.7.11 Venting of the roofing system, either in the field or at the perimeter, is normally not desirable nor required. Likewise, vapor retarders are only required in the most unusual conditions (See paragraph 7.7.7.2).

7.7.7.12 Roofing penetrations should be minimized or eliminated to preclude potential leakage. Where penetrations are necessary, they should be located out of the valleys, and curbs and equipment supports must be properly secured and flashed.

7.7.7.13 Mounting of mechanical and electrical equipment on the roof should be kept to an absolute minimum. Rooftop equipment creates difficult flashing details, obstructs drainage paths, increases repair and maintenance traffic, accelerates corrosion and equipment weathering, and negatively affects maintainability of both the roof and the equipment thereon.

7.7.7.14 Concrete pavers used for ballast shall be locally formed materials. Interlocking, factory formed ballast is not available in the Middle East and cannot be economically shipped there. Assure that the roofing system design accommodates local pavers.

7.7.7.15 Concrete canopies over unoccupied spaces, regardless of size and whether or not the outer edge is supported by columns, shall be sloped to drain, shall have a dense troweled finish, and shall not be covered with roofing. Any slabs over a patio or area of similar use that will be occupied, as opposed to a protection over a door opening, shall be covered with roofing membrane. Canopies are not to be confused with roof overhangs.

7.7.8 Doors and Windows.

7.7.8.1 Metal doors and frames are recommended for general use. Wood doors and frames may be used at interior locations where appropriate in family housing construction, to match existing conditions, or in administrative facilities where appearance is important. Aluminum doors and frames or storefront systems are generally recommended for building entrances. Entrance doors, windows and frames should be weather resistance, protected from the weather and of sufficient strength to resist constant use. Wood entrance doors should be avoided. Service (overhead, etc.) doors in air-conditioned facilities should be insulated.

7.7.8.2 Personnel doors shall be 2100 mm or 2150 mm high except in family housing where they shall be 2050 mm. Door openings shall, in general, be 900 mm in width, except for special purpose doors, toilet rooms, closets, family housing, etc. Where practical door frames in masonry walls shall be detailed such that standard door sizes will fit the metric modular opening.

7.7.8.3 Horizontal sliding doors and windows shall not be used in circumstances where dusty conditions contribute to a build-up of dirt in the tracks.

7.7.8.4 Special Purpose Doors such as rolling doors shall be adequately designed to safely resist the required wind pressures. Rolling steel or aluminum doors shall be designed to permit operation of the door at maximum wind velocities defined in the area where used. Rolling service doors shall generally be electrically operated with manual override but smaller doors may be manually operated.

7.7.8.5 Colors of painted door frames and doors shall be indicated in the Finish Schedule.

7.7.8.6 Overall Size of Return Air Louvers located in doors shall be indicated in the Door Schedule. The designer shall size the door louvers based on the type of louver specified and the air flow required. Minimum bottom rail dimension shall be 250 mm and the minimum stile dimension shall be 125 mm. Variable louver dimension shall be in height only, for simplicity and appearance. Stamped open lattice grilles shall not be used.

7.7.8.7 Weather stripping. Except where louvered doors are used, exterior doors shall be provided with weather stripping to reduce heating and cooling losses, as well as dust infiltration.

7.7.8.8 Hardware set designations should be identified in the door schedule. The specification on builder's hardware shall provide the necessary hardware set designation numbers and description of each hardware group. Where exterior doors are relatively heavy due to site-specific force protection criteria it may be necessary to utilize continuous hinges or pivots to support the weight of the door.

7.7.8.9 Door closers should be surface mounted on the doors. Door pivots, recessed below the door threshold, that will collect dirt and sand and should not be used unless required to support a particularly heavy door. When selecting hardware sets, limit the use of closers to reasonable locations. Parallel arm closers are required when the hinged jamb is less than 7 inches from the adjacent wall. Door locations should be studied in the design stage to eliminate the need for parallel arm closers.

7.7.8.10 Locks, which are not local products, need to be provided with spare key blanks.

7.7.8.11 Instructions for developing the keying system shall be provided in the specification by the designer. Actual development of the keying schedule will be by the construction Contractor. Assure cylinder lock source and keying is coordinated with existing facilities and on-going construction, where applicable.

7.7.8.12 Aluminum framed windows are recommended for most applications although compliance with force protection criteria in some locations has dictated the use of blast resistant steel windows. Windows should be factory finished.

7.7.8.13 Provide blinds or shades on all windows that are appropriate for the space's function. It may be necessary to provide a dual Shade specification for rooms with both room darkening and light filtering requirements. (ie sleeping rooms and conference rooms)

7.7.8.14 Operable Windows. All habitable spaces shall have at least one operable window. Operable sash shall provide emergency egress where required by fire code. Light and natural ventilation shall be provided in all designs. Ensure that outward projecting window vents do not create a hazard in walking areas where someone can run into them, and that inward projecting windows do not interfere with window coverings and furniture placement.

7.7.8.15 The use of reflective or mirror glass should be avoided due to possible deterioration of the coating. Tinted glass is preferable for solar reflection, but if used it must be available for replacement in kind from local sources. In lieu of thermal glazing, window louvers and awnings may provide an equivalent UV light rejection capacity as described in 7.7.1.5

7.7.8.16 Tempered glass is required where personnel safety is involved: including entrance doors, glazed panels nearer than 45 cm to the floor, sliding glass doors, fully glazed doors, and enclosures for bathtubs.

7.7.8.17 Insect Screening Devices shall be provided on windows of all habitable spaces.

7.7.8.18 Glass Cleaning. Provide both interior and exterior access for cleaning glass and minimize horizontal or canted glass because it collects dirt and is difficult to clean.

7.7.9 Finishes.

7.7.9.1 Finish selection shall be appropriate for the function of the building. Selection of materials and finishes must consider aesthetic requirements, suitability and availability in the geographic area, anticipated use, life-cycle coat, fire and safety requirements, maintenance, comfort, and sound control. The color, texture and pattern of materials shall complement the overall building design. Color shall be used to stimulate positive human physical and emotional reactions and to enhance the overall function of the building. Exterior Color/finish schedules, exterior elevations, shall coordinate building features with related furnishings and equipment. The specifications shall require submittal for approval of key exterior color/finish items to assure design continuity through construction.

7.7.9.2 CMU walls and partitions are commonly used in the Middle East and are traditionally finished with portland cement plaster/stucco to conceal irregular blockwork. In contract to common locally used block, USACE specifications for concrete masonry units require relatively close dimensional tolerances and dense, sound and well cured concrete. Material meeting these specifications can generally be obtained at major cities near USACE construction sites in the Middle East. This "specification" grade block results in masonry partitions that can be used "exposed" (with block filler and paint finish) where image is not a prime consideration, where austerity is a major concern, or where a low degree of maintenance is desired. Areas requiring a smooth, uniform finish, for either aesthetic, functional or maintenance reasons, should have a plaster/stucco finish.

7.7.9.3 Plaster and stucco in the Middle East is almost exclusively portland cement based. Gypsum plaster is not commonly used; likewise, resin based synthetic stucco and its associated application skills are not readily available: both should be avoided in CE projects. The most common application of plaster and stucco (and the most successful) is directly on masonry and concrete. On occasion, isolated problems with inadequate bonding to cast-in-place concrete have required the use of metal lathe.

Stucco is the most common exterior finish in the Middle East. It shall be integrally colored: either white (using white cement) or finished using a factory-mixed colored finish coat. Paint applied over stucco creates an ongoing maintenance problem and its use should be avoided. Achieving color uniformity using integrally colored stucco is a significant problem: dark colors being more of a problem than light colors. Textured stucco surfaces collect dust which in turn streaks the walls in the infrequent rains of the arid Middle East.

Plaster partitions constructed with light gauge metal framing are less commonly used than masonry in the Middle East. This type of construction is relatively new there and successful application of plaster on metal lath requires experience and special skills which are not yet well developed. For that reason, use of light gauge metal framing is discouraged in favor of masonry. Where the lower dead weight or other advantages of metal framing over masonry partitions make its use preferable, the design must be complete and fully detailed to compensate for limited local experience.

Plaster and stucco expansion joint and control joint conditions shall be shown on the plans and elevations. For plaster/stucco applied to metal lath, crack control joints must be provided to limit sections to approximately 13 sq. m. On solid base (concrete, masonry, etc.), plaster/stucco crack control joints must be provided at all joints and changes in the substrate material.

7.7.9.4 Gypsum wall board partitions and ceilings are not appropriate to some Middle East locations, but its use is becoming more prevalent in the more developed locations. Skilled labor is often not readily available to install and finish the wallboard, the material frequently must be imported, durability is low, and maintenance and repair can be a problem.

7.7.9.5 Ceilings exposed to the structure above are appropriate for maintenance, service, or utility functions, and in areas such as mechanical and equipment rooms. Coordinate any low ceiling reflectance with the lighting design.

7.7.9.6 Acoustical tile ceilings shall be installed on a metal suspension system or on metal furring; no adhesive shall be used. In electronic and communications facilities in which avoidance of dust is a major consideration, acoustical treatment shall be limited to acoustical tile with non-dusting characteristics.

7.7.9.7 Lay-in ceilings. Suspended acoustical tile ceilings are an economical solution to concealing ducting and other utility systems, and they provide excellent acoustical properties. Their use is appropriate for most finished ceiling applications.

7.7.9.8 Suspended ceilings in kitchens and food preparation areas of dining facilities should be in compliance with applicable criteria intended to improve sanitation.

7.7.9.9 Suspension system for suspended acoustic and plaster ceilings must include provisions appropriate for seismic conditions.

7.7.9.10 Portland cement plaster ceilings (suspended or applied directly to concrete overhead) should be provided in spaces requiring a finished ceiling and subject to high humidity or wetting (food preparation areas, gang toilets, shower/locker areas, etc.), areas subject to abuse or vandalism (corridors of dormitories, etc.), and areas where an exposed or lay-in ceiling is not appropriate.

7.7.9.11 Suspended plaster ceilings shall be designed as unrestrained ceilings. Plaster control joints shall be shown on the reflected ceiling plan.

7.7.10 Specialties.

7.7.10.1 For privacy, all toilet enclosures and all showers for Middle Eastern customers must be designed so that vision from outside the stall is not possible. Shower stalls, toilet enclosures at western water closets, and their doors should extend to within 100 mm of the finished floor. All cracks between panels, at door jambs, etc., shall be covered for complete privacy.

7.7.10.2 Solid doors (not curtains) are required on shower and dressing cubicles for

Middle Eastern customers.

7.7.10.3 Manufactured toilet enclosures should not be used for shower, dressing and eastern water closet compartments. Because of the frequent water spray, masonry with ceramic tile is required for durability.

7.7.10.4 Access flooring should generally be a stringer-type system unless directed otherwise by the customer. The system should utilize a metric 600mm x 600mm grid.

7.7.10.5 Exterior signage shall be provided and designed in accordance with UFC 3-120-01 SIGN STANDARDS. Economy, flexibility, ease of installation and maintenance are important considerations. Insofar as possible the signage should be a commercially available, nonproprietary system capable of being maintained and/or extended from locally available sources. As a minimum the building signage shall be provided per the customer requirements.

7.7.12 <u>Metal Buildings.</u>

7.7.12.1 Metal building systems must be appropriately selected and protected against corrosion. Recommended systems follow:

a. Coastal installations (within 500 meters of the coastline) shall use aluminum or aluminum coated panels and accessories protected with not less than a 3.5 mil film of a high performance polyvinylidene fluoride (PVDF) resin. The wall and roof system shall have concealed fasteners and panels shall be without splices.

b. Inland locations with low corrosive environments shall use aluminum coated panels and accessories protected with not less than a 1.8 mil film of a high performance polyvinylidene fluoride (PVDF) resin. The roof system shall have concealed fasteners and roof panels shall be full length.

c. Inland locations which are not considered to have corrosive environments may use galvanized steel panels and accessories protected with not less than a 0.9 mil film of a high performance polyvinylidene fluoride (PVDF) resin. The system may have exposed fasteners. Ensure that all exposed metal components (including those which are not a part of the metal building system have protection equivalent to that of the building panels. Consider the need for protection of interior surfaced, particularly on buildings having many or large doors and those using outside air for ventilation.

7.7.12.2 Metal siding is often terminated 3 meters above grade in Middle East construction to avoid (or reduce) abrasion of the finish by wind-blown sand/dust near the ground level. A masonry skirt is provided for the lower 3 meters.

7.7.12.3 In humid coastal regions, nightly condensation on the cool surfaces of metal buildings results in runoff, which if not controlled can promoting the growth of mildew on north exposures, resulting in the staining of the siding and lower wall finish. Metal building accessories such as formed drips can alleviate the impact of condensation.

7.7.12.4 Ensure that exposed (not concealed behind liner panels, masonry, etc.) insulation is shown and specified to be rigid or semi-rigid board insulation. Compliance with IBC Chapter 26 must be assured where closed cell insulation is used.

7.7.13 Elevators.

7.7.13.1 Elevators should be provided only where required by the functional program. Hydraulic elevators should generally be used for buildings up to four or five stories, and electric elevators generally should be used for all others. The U.S. Navy has a subject matter expert on elevators and the design of any elevator on Navy projects must be coordinated with that office.

7.7.13.2 Use of plunger type, hydraulic elevators must be coordinated with the soil and foundation conditions.

7.7.14 Plumbing.

7.7.14.1 Toilet fixtures shall be provided in the quantities required by UFC 1-200-01 General Building Requirements, except as modified herein and/or by project specific guidance. Facilities utilizing only eastern style water closets shall have fixtures based on the criteria for females (resulting in a higher water closet and lavatory fixture count than a typical western male toilet, and without urinals). Facilities requiring a mix of eastern and western water closets shall have eastern closets based on the male water closet criteria, additional western closets based on the urinal criteria, and lavatories based on the female criteria. Urinals, if considered appropriate by the client, may substitute for up to one third of the western closets and shall be located in enclosed cubicles. In straight western style facilities for Middle Eastern customers, the lavatory count shall be increased using the female criteria and urinals need not be enclosed, but shall be separated by tall screens. Water wash hoses are required for all eastern water closets as well as for western water closets for most Middle Eastern customers.

7.7.14.2 Floor drains and slopes, hose bibs and shower heads, shall be shown on architectural drawings as well as on mechanical drawings, and shall be closely coordinated. All floors in areas requiring drains shall be sloped toward the drains.

7.8 GENERAL INTERIOR DESIGN

Provide interior design services as directed by the project scope of work (SOW). Performance of interior design and reviews must be conducted by professional Interior Designers or Architects with significant interior design experience and certification. See UFC 3-120-10 Interior Design for requirements.

The Interior Designer shall be engaged at the onset of the project with the programming, space planning and sustainability requirements. The interior design shall provide professional excellence and industry standard 'best-practices'. Interior design shall meet the program requirements for the project in accordance with the building classification and the mission partners' (End-User's) agency standards. Interior design criteria shall incorporate health, life and safety, functionality, anthropometrics, ergonomics, energy efficiency, sustainability and ease of maintenance.

Performance of interior design and reviews must be conducted by professional Interior Designers or Architects with significant interior design experience, that shall be, at a minimum, 10 years of documented design in equivalent projects. Qualification is based on education, experience and examination. Interior Designers or Architects must have completed a program accredited by the Council for Interior Design Accreditation (CIDA) or equal accreditation program of academic training in interior design.

For contracted interior design services, the Interior Designer or Architect shall have also attained National Council for Interior Design Qualification (NCIDQ) certification or state licensure. Certification or registration and shall not be affiliated with a furniture dealership, vendor or manufacturer.

The design shall comply with applicable codes (IBC or Host Nation) and standards and shall be consistent with the aesthetic and architectural character of the facility. Design excellence shall not add substantial project costs and shall balance functionality, quality, sustainability and ease of maintenance.

The Interior Designer shall coordinate with the project architect, electrical engineer, communications engineer and other disciplines to provide necessary space planning, building finish selections, schedules, elevations, specifications and details to complete the deliverables for the SID and FF&E interior design documentation.

The Interior Design package submittal consist of two separate and distinct submittals:

1. A structural interior design submittal, referred to as SID, consists of all applied finishes, such as paint and flooring; and equipment that is affixed (dead load) to the structure such as ceiling systems, lighting, signage, cabinets, millwork, casework, tile, countertops, floor grilles/integral mats, roller shades, blinds, lockers, locker room benches, high density (mobile track) shelving, sinks, toilets, showers and any items that require bracing to the structure for stability, (i.e., seismic requirements.)

2. The Furniture, Furnishings and Equipment submittal, referred to as FF&E, consists of modular furniture, furnishings and equipment that is movable (live load) and is not affixed to the structure. Please note that furnishings include items such as floor mats, mattresses, pillows, etc.

Reference the current edition of UFC 3-120-10, Interior Design and the applicable facility specific UFC's for interior design criteria addressed in the following paragraphs:

- 7.9 FF&E Delivery and Acquisition
  - 7.9.1 FF&E Submittal Deliverables
  - 7.9.2 FF&E Submittal Requirements
- 7.10 SID Submittal Deliverables
  - 7.10.1 SID Submittal Requirements
- 7.11 FF&E Selection and Specification

7.9 FF&E DELIVERY AND ACQUISITION

The FF&E package is generated for furniture acquisition in new construction or renovated facilities. In addition, the FF&E package serves as a record and resource document for Facility Management in repairing, replacing and reordering FF&E items.

FF&E may be procured as part of an overall design package or it may be under a separate contract and funding source. FF&E deliverables are based on the contract scope of work. Therefore, it is essential that FF&E be properly delineated at the inception of the project and clearly defined in the SOW.

7.9.1 FF&E Submittal Deliverables

a. FPR Document

The FPR document shall establish the basis of FF&E provision. The FPR shall consist of an itemized, coded listing of all FF&E, as identified in the pre-conference, design charrette and/or client interviews. The document shall annotate the building location, floor, room/area function and room occupancy count along with basic product descriptions and quantities.

The authorized End User will review the FPR and act as a signatory for all FF&E requirements to ensure all components have been identified; any requirements not identified may impact project timelines.

The FPR document is not to be confused with the Design Analysis or program data sheets. The FPR is a separate and distinct document pertaining only to FF&E. However, the Design Analysis or program data sheets may be used as a tool to extrapolate information that is relevant to the FF&E requirements: i.e., item descriptions and quantities.

Adhere to the Unified Facilities Criteria, UFC 3-120-10 Interior Design and the required USACE Furniture Item Descriptions and Standard Nomenclature document for guidance on FF&E coding and product descriptions.

A copy of the Furniture Item Descriptions and Standard Nomenclature document may be located at the Whole Building Design Guide website at link below.

USACE Furniture Item Descriptions and Standard Nomenclature | WBDG - Whole Building Design Guide

or

https://www.wbdg.org/ffc/army-coe/policies-and-guidance-army-design-and-construction/usace-furniture-item-descriptions-and-standard-nomenclature

See Exhibit 7.9.1.a.1 for a sample FPR document.

b. Performance Specifications

Unified Facilities Guide Specifications (UFGS) are mandatory for all FF&E design projects. UFGS shall serve as the minimum acceptable performance standard. The specification(s) shall be revised for the respective project and shall be inclusive of, but not limited to the following: applicable codes and regulations, product construction and materials, required ANSI/BIFMA, ASTM testing, sustainability, level certifications and, if required, LEED documentation.

UFGS, Division 10, 11 and 12 specifications shall be provided as applicable for the FF&E.

For example:

- UFGS Division 10: 10 56 13 Steel Shelving
- UFGS Division 11: 11 31 Electronic Kitchen Equipment
- UFGS 12 50 00.13 10 Furniture & Furniture Installation, shall always be included.
- UFGS 12 59 00 Systems Furniture, shall be included when systems furniture is utilized.

Additional UFGS division specifications may be required based on the FF&E provision.

c. FF&E Narrative

Provide a written document that defines the general character, quality, aesthetics and design features of the FF&E. The narrative shall describe the space utilization, functionality, durability, sustainability relevant codes, and testing standards that are required for the projects' furniture, furnishings and equipment deliverables. Provide a brief description for each functional area. The FF&E narrative is not to be confused with the Design Analysis. The FF&E narrative is a distinct document pertaining only to the project's FF&E.

d. FF&E Plan Drawings

Develop FF&E plans in accordance with the MED drawing requirements per Chapter 22 and interior design best practices to demonstrate that the required FF&E for the End Users' functional requirements have been accommodated within the spaces. The FF&E plan drawings shall be generated with the accurate size and type of FF&E and shall include code, BIFMA G1, and ICC A117.1 'Accessible and Usable Building and Facilities' clearances, as required.

If project has classified data communication networks, the furniture plan shall incorporate the separation, visibility and inspection as verified with the USACE Communications Engineer.

FF&E shall be coordinated with locations of items such as fixed equipment and casework, lighting, power, communication, electrical/data receptacles, panels, j-boxes, thermostats, switches, fire protection panels, fire protection systems/sprinkler heads, etc. Items that are government furnished, government installed (GFGI) such as computers, secure shredders, copiers, safes, etc., are to be located on the plan and noted as not in contract (NIC). Locate furniture in front of windows only if the top of the item falls below the window sill. Do not attach furniture, including systems furniture, to the building.

Adhere to the USACE Furniture Item Descriptions and Standard Nomenclature document for guidance on coding and product descriptions for FF&E design projects.

FF&E plans shall be coded and keyed to the FF&E legends on each drawing.

Reference: UFC 3-120-10 (current edition)

Refer to Chapter 22 for drawing requirements.

e. FF&E Data Sheets

Data sheets shall be provided for each item of furniture, furnishings and equipment.

Per Department of Defense, acquisition regulations, (DFARS), the use of brand names and manufacturers are prohibited in all FF&E package documentation. Reference MED DIM Section 3.3.4 for additional information.

Data sheet items shall be coded and keyed per the drawings and FF&E legends in accordance with the USACE, Furniture Item Descriptions and Standard Nomenclature, document.

Please note that item descriptions in the Furniture Item Descriptions and Standard Nomenclature document are not to be construed as a complete data sheet specification as additional information may be required.

Data sheets shall include the project name, project number, date and item code. Data sheet item descriptions shall be comprehensive and shall state the required salient characteristics, product construction, materials and methods, product dimensions, technical features, codes, testing and safety standards, i.e., ANSI/BIFMA and ASTM, NFPA; warranty, sustainability features and any other information that is relevant to the procurement of the product. For example: The weight and size of the crating/carton may be necessary for the bidder to properly assess shipping.

The use of sustainable resources and sustainability reporting is a policy directive for military procurement and is required on all projects that are federally funded. All FF&E specifications, shall at a minimum, be comprised of low emitting materials, bio-based content, recycled content and recyclable content to the greatest extent possible. It is encouraged that the products' end of life cycle disposal process be factored in the selections.

A product photo or illustration and finish sample(s) information shall be included in the data sheets that is representative and consistent with the product and finish descriptions or it must be noted that the photo is representative or similar.

See Exhibits 7.9.1.e.1 and 7.9.1.e.2 for sample data sheets.

f. FF&E Product & Finishes Boards/Presentation
g. A finish board is required, beginning at the 65% level of completion and for all subsequent levels of Interior Design, FF&E submittals. Provide a photo and finish of the FF&E items in the project. The product and finishes board shall identify within the heading of the data sheet the following: the building name/number and the room name/number location that the item(s) are provided. The product and finishes presentation may be electronic, except where actual sample boards are required per the contract. The finish and fabric samples on the boards must be labeled and keyed to the item codes and product descriptions used in the FPR, data sheets and the furniture plans. FF&E Binder

The FF&E package is used for purchasing furniture for new or renovated facilities. It is a record and resource document for facilities management personnel to reference in the repair or replacement of FF&E and when re-ordering items.

An electronic FF&E package submittal is required for all submittals, beginning at the 65% level submittal. The electronic submittal shall be labeled with the following information: Furniture, Furnishings and Equipment (FF&E), design stage, date, design firm, project title and number, location and volume number.

All pages in the FF&E package will include the following: project name, project number, project location, design submittal level and page number.

The FF&E package submittal is a compilation of all required deliverables for the project and shall include the following: Table of Contents, FF&E narrative, FPR, coded drawings and legends, specifications, data sheets, product and finishes board, points of contacts. The submittal shall be properly sectioned and bookmarked.

In addition to the electronic binder, a physical binder submittal is required at the 95% FF&E submittal. The physical binder shall be labeled on the outside spine and front cover with the following information: Furniture, Fixtures and Equipment (FF&E), design stage, date, design firm, project title and number, location and volume number. All pages in the binder will include the following: project name, project number, project location, design submittal level and page number.

The physical FF&E binder is a compilation of all required deliverables of the project and shall include the: table of contents, FF&E narrative, FPR, coded drawings and legends, specifications, data sheets, product and finishes board, finish and fabric samples and points of contacts. The documentation shall be consolidated into a binder with tabs denoting each section. The 95% binder will be revised as required for the final submittal.

Provide the actual finishes and fabric samples in the physical binder. Samples must indicate true color, pattern, and texture of the finish and fabric. Samples must be large enough to depict a complete pattern or design. Photographs or color photocopies of materials or fabrics shall be used in conjunction with the actual finish samples to illustrate overall patterns.

Interior Design information and samples are to be submitted in accordance with the MED Design Instruction Manual Chapter 2 and supplied in duplicate hard copy as directed. Copies of the FF&E package on compact disk (CD) are required. Reference the contract for the quantity and distribution schedule.

Hard copy submittals will be supplied in double-sided paper 8 1/2 inch x 11 inch (216 mm x 279 mm) format using three ring binders with pockets on the inside of the covers. Fold-out items may only have a maximum spread of 25 1/2 inches (635 mm). When submittals have numerous pages with thick samples, use more than one binder and provide cover and spine labels as well as index sheets to indicate binder contents.

h. FF&E Cost Estimate

An FF&E cost estimate shall be provided for every project. The required cost information is dependent on the acquisition method defined by the customer. FF&E cost estimates shall be provided in formats approved by MED Cost Engineers. Provide cost estimates in a separate submittal, not in the FF&E binder. Cost estimates shall be provided in a spreadsheet, annotating and itemizing all cost and totals. Codes and product descriptions used in the FF&E package shall be used for identification.

When the procurement method is ‘Open Market’, provide the following cost legend columns:

- List Price
- Extended List Price
- Manufacturer’s Sell

- Discounted List Price
- Discounted List Price - Extended

Note: Extended pricing is the item price multiplied by the quantity. The Manufacturer's Sell price is the percentage off of the list price. The Manufacturers' representative will be able to provide a percentage off discount based on the total product quantity in determining the Manufacturer's Sell.

When the procurement method is GSA, provide the following cost legend columns:

- GSA Unit Price
- GSA Unit Price Extended

Factors such as shipping, freight, storage, installation, profit, etc., is on a per-project basis.

Allowable percentages supplied by MED shall be applied for these factors.

Include base cost, profit margin, shipping, installation, taxes and additional categories as required by the MED Cost Engineer.

Please note that FF&E and Mission Unique Equipment are from different fund control points and will be purchased independent of each other. Therefore, separate contract line-item numbers (CLINS) may be provided for FF&E and Mission Unique Equipment in the cost documents.

Coordinate and configure cost information as directed by the MED Cost Engineer. For further questions regarding cost information contact the Middle East District Technical Services Branch: email: DLLCETAM-DP-E-COST@usace.army.mil

i. FF&E Checklist

Provide a completed Interior Design Checklist.

j. FF&E Point of Contacts List

Provide a Points of Contacts (POCs) listing to include the project team members, user contacts, interior design representatives and contractors involved in the project. The POC information shall contain the name, address, phone number, email, job title and description.

k. FF&E ProjNet Review and Evaluation

A submittal review is conducted at each design submittal level by the appropriate USACE discipline. Initial review comments relevant to the design deliverables: i.e., FF&E narrative, specifications, coded plan drawings and legends, data sheets and product and finishes binder are entered in ProjNet by the USACE reviewer. Once input, the review comments require a response from the contracted Interior Designer or Architect within a prescribed timeframe.

In response to review comments, there are four status heading selections in ProjNet:

- Concur: To signify agreement; Documents will be revised accordingly.
- Non-Concur: Provides justification when not in agreement.
- FIO (For Information Only): Clarifies with additional information.
- Check and Resolve: Reviews to resolve as necessary.

Comments shall be 'back-checked' by the contracted Interior Designer or Architect contingent on the acceptance or denial of the response from the USACE reviewer and may require that revision or additional information be submitted by the contracted Interior Designer.

Based on the status field selection and/or explanation input by the contracted Interior Designer or Architect, the comment will be rectified in a timely manner, to the satisfaction of the USACE reviewer and the comment will be closed.

All comments must be closed prior to the final design submittal and issuance of the ready to advertise (RTA) package.

ProjNet may also be a mechanism to initiate and document request for information (RFI) and Bidder Inquires that will be under a separate 'RFI' or Bidder Inquiry heading.

7.9.2 FF&E SUBMITTAL REQUIREMENTS

The following is an outline of the Interior Design, FF&E submittal deliverables that are due at indicated design submittal levels.

Please note that the submittal requirements may differ in accordance with the contract. Examples: A design-build project delivery may require, in addition to a 35% design effort, a 65% level of FF&E design submittal; Renderings may be required per the contract.

a) Pre-Design Conference/Design Charrette
   - FPR document, signed by the client.
b) Design Build (DB) RFP
   - FF&E Narrative
   - FPR
   - Performance Specifications, if required
   - 01 33 00, Submittal Procedures
   - 01 80 00, Technical Requirements
   - FF&E, Coded Plan Drawings and Legends
   - FF&E Point of Contacts List
c) Conceptual Design: 35% Submittal
   - FF&E Narrative

- FPR
- Performance Specification List
- FF&E, Plan Drawings
- FF&E Point of Contacts List
- Cost Estimate

d) Preliminary Design: 65% Submittal

- FF&E Narrative
- FPR
- Performance Specifications
- FF&E, Coded Plan Drawings and Legends
- Data Sheets
- FF&E Point of Contacts List
- Product & Finishes Boards/Presentation
- FF&E Binder (Electronic Only)
- FF&E Cost Estimate
- FF&E Checklist
- ProjNet Review and Evaluation

e) Construction Documentation: 95% Submittal

- FF&E Narrative
- FPR
- Performance Specifications
- FF&E, Coded Plan Drawings and Legends
- Data Sheets
- FF&E Point of Contacts List
- Product & Finishes Boards/Presentation
- FF&E Binder (Electronic and Hard-copy)
- FF&E Cost Estimate
- FF&E Checklist
- ProjNet Review and Evaluation

f) Final 100% Submittal

- FF&E Narrative
- FPR
- Performance Specifications
- FF&E, Coded Plan Drawings and Legends
- Data Sheets
- FF&E Point of Contacts List
- Product & Finishes Boards/Presentation
- FF&E Binder (Electronic and Hard-copy)
- FF&E Cost Estimate
- FF&E Checklist
- ProjNet Review and Evaluation
- FF&E package CDs

g) Ready to Advertise (RTA)

- Performance Specifications
- FF&E, Coded Plan Drawings and Legends
- Data Sheets
- CD's of the FF&E package

h) Award Set

The Award set includes the same documents as RTA; however, documents shall incorporate any modifications necessary due to Bidder Inquiries and/or Amendments.

For a graphic representation of the FF&E deliverable requirements, please reference charts in Exhibit 7.9.2.

7.10 SID SUBMITTAL DELIVERABLES

Prepare and submit for approval an interior finish scheme for an interim design submittal. The DOR shall meet with and discuss the finish schemes with the appropriate Government officials prior to preparation of the schemes to be presented. Present original sets of the schemes to reviewers at an interim design conference.

At the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers, the DB Contractor may proceed to final design with the interior finishes scheme presented.

The SID information and samples are to be submitted in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover. When there are numerous pages with thick samples, use more than one binder. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Structural Interior Design" package and include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

a) Facility & Personnel Requirements (FPR) Document

The FPR shall establish the basis of SID provision. The FPR shall consist of a narrative description of each functional area, as identified in the pre-conference, design charrette and/or client interviews. The document shall annotate the building location, floor, room/area function. Basic descriptions of each functional area shall be provided. Include a bubble diagram that show functional space adjacencies.

The FPR will reviewed by the authorized End User who will act as a signatory that all known SID requirements have been identified as additional requirements may impact project timelines.

The FPR is not to be confused with the Design Analysis. The FPR is a separate and distinct document pertaining only to SID. However, the Design Analysis or SID plan documents may be used as a tool to extrapolate information that is relevant to the design.

b) Structural Interior Design (SID) Narrative

The SID shall include a narrative that discusses the building related finishes. Include topics that relate to base standards, life safety, sustainable design issues, aesthetics, durability, and maintainability, discuss the development and features as they relate to the occupant's requirements and the building design.

Include in the initial charrette report notes that spells out all client interviews that uncover the facility and staff requirements for space.

Include in the preliminary design a bubble diagrams that show discovered space adjacencies. Provide square footage bubble diagrams that show the space adjacencies drawn to scale with the allowed square footage.

c) SID Plan Drawings

SID related drawings must indicate the placement of extents of SID material, finishes and colors and must be sufficiently detailed to define all interior work. The following is a list of minimum requirements.

i. Finish Color Schedule

Provide finish color schedule(s) in the contract documents. Provide a finish code, material type, and color design. Per Department of Defense, acquisition regulations, (DFARS), the use of brand names and manufacturers are prohibited in all SID package documentation. Reference MED DIM Section 3.3.4 for additional information.

ii. Interior Finish Plans

Indicate wall and floor patterns and color placement, material transitions and extents of interior finishes. Copies of any of these elements shall be duplicated into the interior design binder as is necessary for clarity.

iii. Interior Signage

Include interior signage plans or schedules showing location and quantities of all interior signage. Key each interior sign to a quantitative list indicating size, quantity of each type and signage text. Signage shall be provided and designed as an overall building system and shall be in accordance with UFC 3-120-01 SIGN STANDARDS. Economy, flexibility, ease of installation and maintenance are important considerations. Insofar as possible the signage should be a commercially available, nonproprietary system capable of being maintained and/or extended from locally available sources. As a minimum all regulatory and safety related signs, together with signs identifying basic operational features of the building (stairs, toilets, housekeeping spaces, etc.) shall be provided and shall use pictographic symbols to the greatest extent possible.

iv. Interior Elevations, Sections and Details

Interior Elevations, Sections and Details: Indicate material, color, and finish place.

d) SID Color Board Binder

Each item on the color boards shall be identified and keyed to the contract documents to provide a clear indication of how and where each item will be used. To the maximum extent possible, finish samples shall be arranged by room type in order to illustrate room color coordination. All samples shall be labeled on the color boards with the name, patterns and colors name and number. Samples shall also be keyed or coded to match key code system used on contract drawings.

Material and finish samples shall indicate true pattern, color and texture. Photographs or colored photocopies of materials or fabrics to show large overall patterns are required in conjunction with actual physical samples to show the actual colors. Finish samples must be large enough to show a complete pattern or design where practical.

Color boards shall include but not be limited to original color samples of the following:

- All wall finishes, ceiling finishes, including information regarding tile patterns.
- All flooring finishes, including information regarding tile patterns.
- All signage, wall base, toilet partitions, accordion/operable/folding partitions and trim
- All millwork materials and finishes (cabinets, counter tops, etc.)
- All window treatments (sills, blinds, etc.)

Color board samples shall reflect all actual finish textures, patterns and colors required as specified. Patterned samples shall be of sufficient size to adequately show pattern and its repeat if a repeat occurs.

7.10.1 SID SUBMITTAL REQUIREMENTS

The following is an outline of the Interior Design, SID submittal deliverables that are due at indicated design submittal levels.

Please note that the submittal requirements may differ in accordance with the contract. Examples: A design-build project delivery may require, in addition to a 35% design effort, a 65% level of SID design submittal; Renderings may be proviso per the contract.

i. Pre-Design Conference/Design Charrette
    - FPR signed by the client.

ii. Design Build (DB) RFP
    - SID Narrative
    - FPR
    - Performance Specifications, if required
    - 01 33 00, Submittal Procedures
    - 01 80 00, Technical Requirements
    - SID, Plan Drawings and Finishes
    - Point of Contacts List

iii. Conceptual Design: 35% Submittal
    - SID Narrative
    - FPR
    - Performance Specification List
    - SID Plan Drawings
    - Point of Contacts List
    - Cost Estimate
    - d. Preliminary Design: 65% Submittal
    - SID Narrative
    - FPR
    - Performance Specifications
    - SID Plan Drawings
    - Product & Finishes Boards/Presentation
    - Point of Contacts List
    - Cost Estimate
    - Interior Design Checklist
    - ProjNet Review and Evaluation
    - SID Binder (Electronic and Hard-copy)

iv. Construction Documentation: 95% Submittal
    - SID Narrative
    - FPR
    - Performance Specifications
    - SID Plan Drawings
    - Point of Contacts List
    - Product & Finishes Boards/Presentation
    - SID Binder (Electronic and Hard-copy)
    - Point of Contacts List
    - Cost Estimate
    - Interior Design Checklist
    - ProjNet Review and Evaluation

v. Final 100% Submittal

- SID Narrative
- FPR
- Performance Specifications
- SID, Plan Drawings and Legends
- Point of Contacts List
- Product & Finishes Boards/Presentation
- SID Binder (Electronic and Hard-copy)
- Interior Design Checklist
- Point of Contacts List
- SID package CDs
- ProjNet Review and Evaluation

vi. Ready to Advertise (RTA)

- Performance Specifications
- SID Plan Drawings
- SID package CDs

vii. Award Set

- The Award set entails the same documents as RTA; however, documents shall incorporate any modifications necessary due to Bidder Inquiries and/or Amendments.

For a graphic representation of the SID deliverable requirements, please reference charts in Exhibit 7.10.1.

7.11 FF&E SELECTION AND SPECIFICATION

Please note that the information provided in this section does not incorporate all components. Reference the Standard Nomenclature and Product Descriptions for guidance on product codes and product specifications.

FF&E selections shall be “A” grade contract furniture, which indicates well-constructed, quality furniture that meets or exceeds ANSI/BIFMA testing standards.

Although selections shall be aesthetically pleasing, high style or “cutting edge” furniture is not required. Furniture, furnishings and equipment selections shall be of high durability, stability and strength. Be cognizant of the products’ construction, materials, finishes; i.e., grades/gauge of steel, case construction, low volatile organic compounds (VOC), etc. as lower grades of furniture take production shortcuts that will prove to be inferior over the life of the product. Fabrics and finishes shall be specified to perform under heavy duty commercial contract usage.

Provide furniture selections from the GSA Schedules if the FF&E procurement will be via GSA, although this is atypical for Middle East District (MED) projects, unless a waiver allowing access to GSA procurement has been provided. If using the GSA Schedules, FF&E that is available on the open market may be specified only if the item is not available on the

GSA Schedule and a justification stating that the item was not available on GSA Schedule shall be provided.

Whether electing design standards for GSA or open market procurement, maintain consistency in style, finish and color. Provide design selections that represent a broad and widely available product offering in the FF&E industry.

Adhere to the Unified Facilities Criteria, UFC 3-120-10 Interior Design and the required USACE Furniture Item Descriptions and Standard Nomenclature document for guidance on FF&E coding and product descriptions.

A. Furniture Warranties

Provide manufacturer's performance guarantees or warranties to include parts, labor and transportation, as listed in this section**,** ***unless*** the End Users' requirement is more stringent.

Warranties must be included in the data sheets.

Where the warranty for the specified item exceeds the MED DIM requirements, state the warranty as 10 year minimum, 12 year preferred. This will allow the vendor to meet the minimum warranty requirement without undue restrictions, given all other specification requirements have been satisfied.

Minimum warranty requirements are as follows:

- Furniture Systems - 10 year minimum
- Furniture System Task Lights - 2 year minimum (excluding bulbs)
- Furniture System Fabric - 3 year minimum
- Pedestals – 10 year minimum
- Desks - 10 year minimum
- Seating - 10 year minimum
- Seating Mechanisms and Pneumatic Cylinders - 10 year minimum
- Fabric - 3 year minimum
- Filing and Storage - 10 year minimum
- Tables - 10 year minimum
- Table Mechanisms - 5 year
- Table Ganging Device - 1 year
- Electronically powered equipment - 3 year minimum
- Items not listed above - 1 year minimum

Please note: Products that are not maintained per the manufacturer's care instructions may void the testing standards and warranty.

B. Testing

Components shall contain recycled content and shall be tested and compliant with the following, as applicable:

- ANSI/BIFMA e3 Furniture Sustainability
- BIFMA G1 Ergonomics Guideline
- ANSI/BIFMA X5.1-Office Chairs
- ANSI/BIFMA X5.3-Vertical Files
- ANSI/BIFMAX5.4- Lounge Seating
- ANSI/BIFMA X5.5-Desk Products
- ANSI/BIFMA X5.6- Panel Systems
- ANSI/BIFMA X5.9- Storage Units
- ANSI/BIFMA X7.1- VOC Emissions from Office Furniture Systems, Components and Seating
- ANSI/BIFMA M7.1
- ASTM D4157- Abrasion Resistance of Textile Fabrics
- TB 117- Smolder Test

Exhibit 7.9.1.a.1

XYZ PROJECT			
BUILDING C- SECOND FLOOR			
ROOM NO/ NAME	ITEM	DESCRIPTION	QTY.
ENCLOSURE 200 **STAIRWELL 1**			
ROOM 201 **MAINTENANCE CONTROL ROOM / OFFICE 1** OCCUPANTS: 1			
	C-1	TASK CHAIR, ERGONOMIC	1
	TP-4	U-WORKSTATION, MANAGER TO INCLUDE WARDROBE LED TASKLIGHTING TACKBOARD OVERHEAD STORAGE/HUTCH LOCKING GROMMETS BBF/FF PEDESTALS	1
	M-2	DUAL MONITOR ARM	1
	KBT	KEYBOARD TRAY & MOUSE PAD	1
	C-3	GUEST CHAIRS	2
	CL-2	CLOCK, BATTERY OPERATED	1
	WB	TRASH RECEPTACLE	1
	MB-1	MARKERBOARD	1
ROOM 202 **MAINTENANCE CONTROL ROOM / OFFICE 2** OCCUPANTS: 1			
	C-1	TASK CHAIR, ERGONOMIC	1
	TP-4	U-WORKSTATION, MANAGER TO INCLUDE WARDROBE LED TASKLIGHTING TACKBOARD OVERHEAD STORAGE/HUTCH LOCKING GROMMETS BBF/FF PEDESTALS	1
	M-2	DUAL MONITOR ARM	1
	KBT	KEYBOARD TRAY & MOUSE PAD	1
	C-3	GUEST CHAIRS	2
	CL-2	CLOCK, BATTERY OPERATED	1
	WB	TRASH RECEPTACLE	1
	MB-1	MARKERBOARD	1
ROOM 203 **MAINTENANCE CONTROL** OCCUPANTS: 3			
	TP-1	L-WORKSTATIONS TO INCLUDE LED TASKLIGHTING TACKBOARD OVERHEAD STORAGE/HUTCH LOCKING GROMMETS BBF/FF PEDESTALS	2
	C-1	TASK CHAIR, ERGONOMIC	3
	CL-1	6 ZONE CLOCK	1
	WB	TRASH RECEPTACLE, INDIVIDUAL	3

Chapter 7 Architecture and Interior Design
Exhibit 7.9.1.e.1

US Army Corps of Engineers® Middle East District	PROJECT NAME: PROJECT NUMBER:	
	Item	**Item Code**
DATE:	Guest Chair, Metal Frame	CG01-99

Item Description
(proposed products must meet the salient features outlined herein to be acceptable)

Image: (shown for illustration purposes only and is not an exact representation of the requirement)

Finishes:

Seat Finish:
XXXXX

Back Finish:
XXXXX

Frame Finish:
XXXX

Warranty Requirements:

- 10 year minimum– Frame and glides or casters
- 5 year – Thermoplastic/Polypropylene
- 3 year—Fabric and upholstery
- Warranty shall cover users up to [300} pounds

General Requirements:

Dimensions**:**

Seat Width: 17” minimum (457.2 mm)

Seat Depth: 17” minimum (457.2 mm)

- Fully upholstered seat and back; nonupholstered outer back
- [2-Piece seat and back][Seat and back shall meet]
- [Open]] [Cantilevered] arms [Armless]
- Metal [4-leg] [cantilevered] [sled] [base] frame with glides
- Metal 4-leg frame with glides

Construction Requirements-

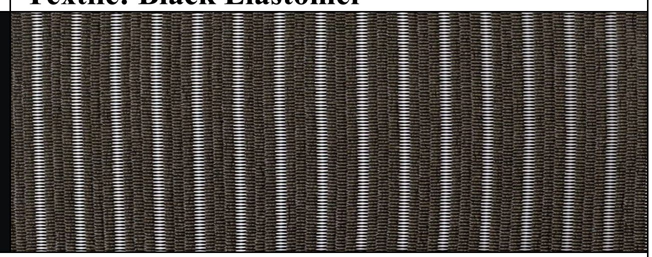
- Seating, Metal Frame, [Thermoplastic/Polypropylene] [Upholstered] [Mesh]
- Frame shall be tubular steel or die-cast aluminum welded frame construction.
- Sled base frame shall be ½” diameter wire rod.
- Joints shall be welded.
- Legs shall have welded supports.
- End caps shall be molded plastic, finished to match frame color, if present.
- Non-marring floor glides.
- Chair shall have a reinforced back, arms and legs.
- The seat shall have a waterfall edge.
- Seats shall flip up to allow chairs to nest.
- Back flex mechanisms shall gradually increase resistance with applied pressure. Backrests shall have welded steel supports that attach to the back flex mechanism.
- The back attachment to the frame shall be concealed.
- Mesh back fabrics shall have elasticity elongation properties that will not allow the mesh to sag, sink, cradle, or hammock.
- Table arm shall have a plywood core with high pressure laminate surface and clear lacquer edge or similar construction.
- Table arm support shall match frame.
- Table arm shall fold down.

Sustainability:

- ANSI/BIFMA e3 Furniture Sustainability Standard, Section 7.6.2
- All proposed products shall be certified as compliant with Indoor Air Quality (IAQ0 requirements and have a certification for IAQ (GREENGUARD or equivalent)

Finish:

- Upholstery: Manufacturer’s standard, woven, stain resistant, mid-grade solid selection; 100,000+ double rubs shall include color
- Vinyl: Manufacturer’s standard stain resistant selection; 100,000+ double rubs shall include color
- Wood: Manufacturer’s standard hardwood stain selection shall include color
- Metal: Manufacturer’s standard powder coat paint selection shall include color

U.S. Army Corps of Engineers Transatlantic, Middle East District Site and Building Branch	DATA SHEET
Project: UAE: 2D-1	**Project Number: 472410**
Description: Task Chair, Ergonomic	**Item: CT01**
	
Frame Finish: Black	**Textile: Black Elastomer**
	

Textile:

▪ Content: 56% elastomeric, 44% polyester ▪ Abrasion: 200,000 DR (Wyzenbeek)	▪ Lightfastness: Grade 4, 160 hours ▪ Flammability: TB 117; NFPA 260

Features:

▪ Suspension textile: Tensile strength, comfort ▪ Pneumatic height adjustment ▪ Contoured, adjustable seat - waterfall front ▪ Synchronized, tilt tension adjustment ▪ Forward seat tilt, tilt lock	▪ Adjustable Lumbar Support ▪ Fully Adjustable Arms ▪ Function controls, labeled ▪ 5 Star base-360-degree swivel ▪ Dual Wheel, Universal, Casters

Dimensions:

▪ Overall: 718 W x 470 D x 1092 H (mm) ▪ Seat Height Range: 406-521 H (mm) ▪ Seat Dimensions: 464 W x 470 D (mm)	▪ 28.25" W x 18.5" D x 43" H ▪ 16"-20.5" H ▪ 18.25" W x 18.5" D

Weight Capacity:

▪ 159 kg.	▪ 350 lbs.

Specific Compliance:

▪ ANSI/BIFMA X5.1 ▪ ANSI/BIFMA X5.11 ▪ ANSI/BIFMA X7.1 ▪ BIFMA Level 3	▪ ANSI/BIFMA M7.1 ▪ Greenguard Certified, Silver ▪ Cradle-To-Cradle Certified, Gold ▪ ANSI/HFES 100

Recycled Content: 39 %

▪ Post-Consumer:38%	▪ Pre-Consumer: 1%	▪ Recyclability: 91%

Warranty: 10 Year, Minimum

Exhibit 7.9.2

Pre-Award **Design-Bid-Build** **FF&E Submittal Requirements**	**35 % Concept Design**	**65% Preliminary Design**	**95% Final Design**	**100% Final**
Facility & Personnel Requirements (FPR Document) • Establish basis of FF&E provision • Consists of itemized and coded listing of all FF&E • To include building location, floor, room/area function, room occupancy count, and basic product descriptions and quantities	X	X	X	X
Performance Specifications List	X			
Performance Specifications • UFGS Division 10, 11, 12 as applicable		X	X	X
FF&E Narrative • Defines general character, quality, aesthetics and design features of FF&E • Describes space utilization, functionality, durability, sustainability and code/testing standards	X	X	X	X
FF&E Plan Drawings • Provide appropriate size and type of FF&E • Include critical and required clearances • Coded and keyed to the FF&E legends (65%, 95%, 100%) • FF&E plans shall be coded and keyed to the FF&E legends on each drawing (Refer to USACE Furniture Item Descriptions and Standard Nomenclature document)	X	X	X	X

Exhibit 7.9.2

FF&E Data Sheets • Provide for each item of FF&E • Code/key items per the drawing(s) and FF&E legend (s) To Include: • Project Name • Project Number • Date • Item Code • Product descriptions—salient characteristics, product construction, materials and methods, product dimensions, technical features, testing and code standards (ANSI/BIFMA and ASTM, NFPA), warranty, and sustainable features. • Sustainability information (low emitting materials, bio-based content, recycled content, recyclable content) • Product photo (notate representative or similar) • Finish Information, including sample • Use of brand names and manufacturers are prohibited (Reference MED DIM Section 3.3.4)		**X**	**X**	**X**
FF&E Product & Finishes Boards/Presentation (Digital/Electronic)		**X**	**X**	**X**
FF&E Product & Finishes Boards/Presentation (Hard Copy with tangible FF&E finish samples)			**X**	**X**
FF&E Binder (Digital/Electronic) An electronic compilation of all required deliverables. Label with the following: • Furniture, Furnishings, and Equipment • Design Stage • Date • Design Firm • Project Title/Project Number		**X**	**X**	**X**

Exhibit 7.9.2

FF&E Binder (Hard Copy with tangible FF&E finish samples) A hard copy compilation of all required deliverables. Spine and front cover to include: • Furniture, Furnishings, and Equipment • Design Stage • Date • Design Firm • Project Title/Project Number • Project Location • Volume Number All pages to include: • Project Title/Project Number • Project Location • Design Submittal Level • Page Number To include actual finishes and fabric samples. See MED DIM for additional information.			**X**	**X**
FF&E Cost Estimate • Submitted separately from FF&E Binder	**X**	**X**	**X**	**X**
FF&E Checklist		**X**	**X**	**X**
FF&E Point of Contacts List	**X**	**X**	**X**	**X**
FF&E ProjNet Review and Evaluation		**X**	**X**	**X**
CDs of FF&E Package				**X**

Exhibit 7.9.2

Pre-Award Design - Build FF&E Submittal Requirements	35 % Concept Design
FF&E Narrative	X
Facility & Personnel Requirements (FPR Document)	X
Performance Specifications, if required	X
01 33 00, Submittal Procedures	X
01 80 00, Technical Requirements	X
FF&E Coded Plan Drawings and Legends	X
FF&E Point of Contacts List	X

Chapter 7 Architecture and Interior Design

Exhibit 7.10.1

Pre-Award Design-Bid-Build SID Submittal Requirements	**35 % Concept Design**	**65% Preliminary Design**	**95% Final Design**	**100% Final**
Facility Requirements Document (FRD) • Establish the basis of SID provision • Describe each functional area • Include space adjacency bubble diagrams • To include the building location, floor, room/area function	X	X	X	X
SID Narrative • Discuss building related finishes • Include base standards, life safety, sustainable design issues, aesthetics, durability, and maintainability as it relates to project requirements • Include initial charrette report • Include space adjacency bubble diagrams, drawn to scale with square footage (at Preliminary Design Submittal)	X	X	X	X
SID Plan Drawings • To include legends at 100% Final • Finish Color Schedule • Interior Finish Plans • Interior Signage • Interior Elevations, Sections and Details	X	X	X	X
Point of Contacts List	X	X	X	X
Performance Specifications List	X			
Performance Specifications		X	X	X
Interior Design Checklist		X	X	X
ProjNet Review and Evaluation		X	X	X
Cost Estimate			X	

Chapter 7 Architecture and Interior Design

Exhibit 7.10.1

<table>
<tr><th>Pre-Award

Design-Bid-Build
SID Submittal Requirements</th><th>35 % Concept Design</th><th>65% Preliminary Design</th><th>95% Final Design</th><th>100% Final</th></tr>
<tr><td>SID Product & Finishes Boards/Presentation (Digital/Electronic)</td><td></td><td>X</td><td>X</td><td>X</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SID Product & Finishes Boards/Presentation (Hardcopy)</td><td></td><td>X</td><td>X</td><td>X</td></tr>
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<tr><td>SID Color Board Binder (Digital/Electronic)
An electronic compilation of all required deliverables.</td><td></td><td>X</td><td>X</td><td>X</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SID Color Board Binder (Hard Copy)
A binder with tangible samples of all required deliverables.</td><td></td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>(Digital/Electronic) and (Hard Copy) Binders:
Spine and front cover to include:
• Structural Interior Design Package #
• Submittal Stage
• Date
• Design Firm/Contractor Name
• AE Name and Phone numbers
• Project Title/Project Number
• Project Location
• Volume Number
All pages to include:
• Project Title/Project Number
• Project Location
• Design Submittal Level
• Page Number</td><td colspan="4">• Each item to be identified and keyed/coded to the contract documents and key code system to provide a clear indication of how and where each item will be used
• Finish samples shall be arranged by room type in order to illustrate room color coordination
• All samples shall be labeled on the color boards with pattern and color descriptors
• All wall, ceiling, and floor finishes, including installation patterns, wall base, toilet partitions,
• All signage
• All millwork materials and finishes (cabinets, countertops, etc.)
• All window treatments</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CDs of SID Package</td><td></td><td></td><td></td><td>X</td></tr>
</table>

Chapter 7 Architecture and Interior Design

Exhibit 7.10.1

Pre-Award Design - Build SID Submittal Requirements	**35 % Concept Design**
SID Narrative	**X**
Facility Requirements Document (FRD)	**X**
Performance Specifications, if required	**X**
01 33 00, Submittal Procedures	**X**
01 80 00, Technical Requirements	**X**
SID Plan Drawings and Finishes	**X**
Point of Contacts List	**X**

CHAPTER 8
STRUCTURAL

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STRUCTURAL

8.1 GENERAL.

This chapter specifies design criteria and submittal requirements for development of structural systems. Specific submittal requirements in this chapter supplement those given in Chapter 1, GENERAL INSTRUCTIONS. All documents shall be prepared in accordance with Chapter 2, PRESENTATION OF DATA.

8.2 APPLICABLE PUBLICATIONS.

The current editions of the publications listed below form a part of this Manual.

Department of Defense (DoD)

UFC 1-200-01, General Building Requirements

UFC 1-201-01, Non-Permanent DoD Facilities in Support of Military Operations

UFC 3-301-01, Structural Engineering

UFC 3-301-02, Design of Risk Category V Structures, National Strategic Military Assets

UFC 3-320-06A, Concrete Floor Slabs on Grade Subjected to Heavy Loads

UFC 3-340-01, Design and Construction of Hardened Structures to Conventional Weapons (CUI)

UFC 3-340-02, Structures to Resist the Effects of Accidental Explosions

UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings

UFC 4-020-01 DoD Security Engineering Facility Planning Manual

American Society of Civil Engineers (ASCE):

ASCE 7 Minimum Design Loads for Buildings and Other Structures.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

ASTM C 90 Load-Bearing Concrete Masonry Units

ASTM A615M Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

American Concrete Institute (ACI) Standards:

ACI 318 Building Code Requirements for Reinforced Concrete.

ACI 360R Guide for Design of Slabs on Grade.

ACI SP-66 ACI Detailing Manual.

American Institute of Steel Construction (AISC) Publications:

AISC 325 AISC Manual of Steel Construction.

Metal Building Manufacturer's Association (MBMA) Publications:

Metal Building Systems Manual with Current Supplements.

Precast/Prestressed Concrete Institute (PCI)

MNL-120 PCI Design Handbook

Steel Deck Institute (SDI):

Pub. No. 24 Design Manual for Composite Decks, Form Decks and Roof Decks.

Steel Joist Institute (SJI) Publications:

SJI Specifications and Tables

The publications listed above form a portion of the documents which are available for use in the design of structures and components thereof. Such publications provide recognized engineering principles and are intended for general information. While such publications provide information that is believed to be accurate, such information should not be used or relied upon without examination and verification of accuracy, suitability, and applicability by a licensed professional structural engineer.

8.3 CONCEPT SUBMITTAL REQUIREMENTS.

8.3.1 Concept Design Analysis. The following specific items shall be included.

8.3.1.1 Design Loads. State the service live loads for which the structures are to be designed, including roof and floor loads. State the basic wind speed, seismic criteria, risk category, seismic design category, etc. Define what portions of these loads are allowances for future loadings, if any. Coordinate with Project Manager the potential need for Structural Observations during construction if facility is Seismic Design Category D, E, or F and meets IBC requirements. Additionally, coordinate with Project Manager and CETAM-EN-Structural the approach to Special Inspections for the project.

8.3.1.2 Blast/Radiation Resistance. Indicate the structures and areas to be blast or radiation resistant and the level of resistance for which each is to be designed.

8.3.1.3 Antiterrorism and Force Protection. Indicate the structures and areas to be designed to meet antiterrorism and force protection requirements in accordance with UFC 4-010-01 and UFC 4-020-01. Indicate level of protection and design base threat. See also Force Protection Chapter 25..

8.3.1.4 Foundation Analysis. For requirements, refer to Chapter 21, GEOTECHNICAL, of this Manual.

8.3.1.5 Structural System Selection Analysis. When required by the Scope of Work, provide a study and comparative analysis of at least three apparently competitive structural systems. All Costs for Comparative estimates shall be based upon the Middle East District (MED) Unit Price Book. See Chapter 4, COST ESTIMATING. A portion of each facility, large enough to be representative of the entire structure, shall be designed in enough detail to provide for a labor and materials estimate that will be the basis of the structural system selection. The portion of the structure selected for comparing alternate system costs shall include framing for at least one interior and exterior bay of the roof, floor, and foundation systems. Additional costs due to nonstructural systems but attributable to a structural alternative shall be included in the comparative cost estimate for that alternative. Determination of these additional costs must be based upon a concept of the complete building configuration, including architectural, mechanical, electrical, and other systems. The inherent costs of an exposed structural system, as a result of establishing and maintaining an acceptable architectural appearance, shall be included. The method of providing the required degree of fire resistance shall be determined for each alternative, and the costs included. These additional costs shall be developed as life-cycle costs whenever possible. The submittal shall include the following items:

a. A complete description, with sketches, of each structural system considered.

b. Design calculations supporting the member sizes used for the cost estimate.

c. A comparative cost for each system, clearly showing all costs and quantities used.

d. An analysis of the study results, with justification for the spans, materials, and system selected.

8.3.1.6 Design Methods. State the method to be used in the design of the selected structural system in terms of the following:

a. Concrete design shall be in accordance with ACI 318.

b. Steel design shall be in accordance with the AISC Manual of Steel Construction using Allowable Stress or Ultimate Strength Design. Clearly indicate which method is used.

c. Any technique or reference not included among but compatible with those publications listed in paragraph: APPLICABLE PUBLICATIONS.

8.3.1.7 Lateral Stability Analysis. Describe the method of providing lateral stability for the proposed system.

8.3.1.8 Sound/Vibration Control. State any sound or vibration control requirements for the selected structural system and the measures proposed to meet them.

8.3.1.9 Design Criteria. Indicate applicable design criteria and codes for the project. Some projects require adherence to Host Nation design criteria and/or European Codes.

8.3.2 <u>Concept Design Drawings</u>. In general, the design drawings required in Chapter 7, ARCHITECTURAL/INTERIOR DESIGN are adequate to describe the structural system. For unusual or complex structures, it may be necessary to include structural drawings to assure these structures are completely defined.

8.3.3 <u>Concept Design Specifications</u>. Provide concept design specifications in accordance with Chapter 3: SPECIFICATIONS.

8.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

The preliminary design submittal shall incorporate those comments generated by the concept design review.

8.4.1 <u>Preliminary Design Analysis</u>. The preliminary design analysis is a continuation of the Concept work done on the approved structural framing scheme. Describe the method of design, including assumptions, theories, formulas, and references used. Provide calculations, including comprehensive thermal analyses, as required. Provide calculations for design of typical framing members under the most critical loading conditions. Include load, shear, and moment diagrams for complex loading situations. Identify analysis techniques utilized. Provide a sketch of the transverse and/or longitudinal member cross section where needed for clarification. If Automatic Data Processing Systems (ADPS) are used to perform design calculations, provide native format of ADPS data as well as pdf copies of the ADPS input data and output summaries. The pdf information shall be accompanied by diagrams which identify the joints, members, areas, etc. which correspond to the notations used in the data listings. The ADPS native format data shall be compatible with Bentley Systems, Inc or AutoDesk Robot software."

8.4.2 <u>Preliminary Design Drawings</u>. Provide structural foundation, floor, wall, and roof framing plans with sizing of typical members indicated. Include typical sections showing the methods of framing. Service live loads shall be shown on drawings. Indicate locations of joints and provide details of same.

8.4.3 <u>Preliminary Design Specifications</u>. Provide preliminary design specifications in accordance with Chapter3 Specifications

8.5 FINAL SUBMITTAL REQUIREMENTS.

The final design submittal shall include the completed design analysis and 100 percent design structural drawings, incorporating those comments generated by the Preliminary design review. The design analysis shall contain complete structural calculations of all structural systems such as foundations, frames, floors, roofs, stairways, equipment supports and ancillary structures. All structural elements shall be designed and detailed. The drawings shall be complete with all intended sections, elevations, details, and notes. All calculations shall be checked and initialed by the checker at this stage. Provide final design specifications in accordance with Chapter 3: SPECIFICATIONS.

8.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the Final Review shall be incorporated in the documents before they are submitted as Ready to Advertise.

8.7 TECHNICAL REQUIREMENTS.

8.7.1 System Selection Factors. Certain construction and environmental conditions may exist at the construction location which influence the erection and performance of structures. Some of the more pertinent conditions which may influence the structural system selections are as follows:

8.7.1.1 Range and Climatic Conditions. Local climatic conditions need to be considered in selection, design and detailing the structural system. For example, high temperatures combined with low humidities produce excessive shrinkage and thermal contraction of building materials such as wood, concrete, and masonry; and amplified creep deflection of concrete members. Stresses and movement from temperature change shall be thoroughly analyzed and provisions made to accommodate thermal loadings when proposed joint spacings exceed the values recommended in this Manual and the references listed herein.

8.7.1.2 Local Absence or Shortage of Materials. Due to the absence or shortage of structural materials in some locations, importing materials must be considered.

8.7.1.3 Logistics. Where in-country or local area transportation is difficult due to a limited road network and lack of service facilities, materials and system selection may be affected.

8.7.1.4 Water. In locations where water is scarce or not usable, concrete construction must be well planned.

8.7.2 Design Loads.

8.7.2.1 Seismic Loads. The seismic design data for the project location shall be taken from the applicable tables in UFC 3-301-01 or shall be established through geotechnical investigation conducted in accordance with Chapter 21, GEOTECHNICAL of this Manual.

8.7.2.2 Wind Loads. Wind loads shall be determined in accordance with UFC 3-301-01 and ASCE 7.

8.7.3 Foundation Design. For further foundation design requirements, refer to Chapter 21, GEOTECHNICAL, of this manual. In the case of mat foundations, dead, live and blast loads should be furnished with a discussion of the load distribution and uniformity or non-uniformity of foundation pressure. Foundation design and contract drawings should show elevations of any basements, elevator pits or other below grade items, including top elevations of all footings, mats, slabs, or pile caps. In the case of pile foundations, the contract drawings shall show the type, capacity, and distribution of all piles.

8.7.3.1 For concrete foundations, standard practice at some locations entails the use of Type I or Type V cement, silica fume and a High Range Water Reducer (HRWR), with a water/cement ratio of 0.45 maximum when high concentrations of sulfates are contained in the foundation soils. Additionally, concrete protection may be required such as a bituminous coating applied to all surfaces below grade. Coordinate with CETAM-Construction and CETAM-EN-Structural for typical practices at the project location.

8.7.3.2 Blinding slabs are typical at all locations within the Middle East District Area of Responsibility (AOR).

8.7.4 Concrete Design shall be in accordance with ACI 318 except as indicated below.

8.7.4.1 Maximum Spacing of Expansion Joints shall be forty-five (45) meters for regularly shaped rectangular structures unless a thermal analysis is submitted showing that a greater spacing is acceptable. The maximum spacing of expansion joints for use in Egyptian Air Force related projects, shall be thirty-five (35) meters. Slab-on-grade systems for buildings do not require expansion joints but do require control and construction joints as specified elsewhere. Structures with characteristics that cause high thermal stresses shall be analyzed to determine expansion joint spacing. Any departures from the above must be approved in writing by CETAM-EN-Structural and must be requested prior to progressing beyond the Concept Phase.

8.7.4.2 Control of Long Term Deflection. Where the environment tends to amplify long term deflection, such as hot, dry, windy conditions, the deepest section feasible should be used for concrete flexural members. The use of camber and additional reinforcing steel in the compression zone for these members shall also be considered.

8.7.4.3 Congested Reinforcement. Particular attention should be given to the prevention of congested reinforcement, especially at splices and at intersections of beams and girders with columns in order to ensure proper concrete cover and clearance between bars.

8.7.4.4 The necessity for joints in slabs-on-grade, and elimination of large re-entrant corners in slabs shall be considered during the design. Sawed control joints should be avoided.

8.7.4.5 Keyed joints generally should not be used in 300 mm thick or less reinforced concrete walls unless justified by analysis.

8.7.4.6 Slabs-on-grade systems shall be designed in accordance with Corps of

Engineers methods given in ACI 360R.

8.7.4.7 Avoiding Rigid Edge Support. Slabs-on-grade shall be isolated from adjoining structural elements to avoid rigid edge supports for most conditions. If any differential movement would be objectionable, such as at main entrances, the slab shall be detailed and adequately reinforced to prevent cracking.

8.7.4.8 Concrete floor slab finishes are specified in the Unified Facilities Guide Specifications for concrete construction.

8.7.4.9 Precast Concrete. Describe the proposed method of anchorage and supporting precast concrete units. Detail all aesthetic and functional requirements. Specify the required structural performance of the precast unit. Specified performance shall include all limiting combinations of loads together with their points of application. This information shall be supplied in such a way that all details of the unit can be designed without reference to the behavior of other parts of the structures. If desired by performance specifications, define all limiting factors such a minimum and maximum thickness, depths, weights, and any other limiting dimensions. Give acceptable limits of any other requirements not detailed. Precast demolding, handling and erection stresses will be the responsibility of the construction contractor and shall be noted on the drawings.

8.7.4.10 Prestressed concrete, either pre-tensioned or post-tensioned, shall be detailed and specified in accordance with the PCI Design Handbook to include the following:

a. For post-tensioning, the maximum tensile stress in the concrete and minimum effective prestress force after all losses shall be specified for each member.

b. For all prestressed concrete, the required camber before and after application of the prestress force shall be specified.

c. Specifications shall require shop drawings to indicate short and long term prestress losses, deflections at time of de-tensioning and deflection when installed.

d. Specifications shall require the contractor to measure the deflection of members after application of prestress force.

8.7.4.11 Verify available concrete testing procedures local to the project site. Modify testing requirement in Specifications as required to align testing methodology with locally available testing. For example, British Standard cube testing for compressive strength may only be available versus ASTM cylinder testing.

8.7.4.12 Silica fume and fly ash are prohibited at some locations within Middle East District AOR. Coordinate with CETAM Construction and CETAM-EN-Structural before specifying silica fume or fly ash in concrete mixes.

8.7.5 Masonry Design shall be in accordance with UFC 3-301-01 and TMS 402/602:

8.7.5.1 Design of concrete masonry walls shall be based on the use of Type S mortar and concrete masonry units, according to ASTM C 90, having a minimum compressive strength of 6.89 MPa over the average gross area.

8.7.5.2 Control Joint Spacing Control joint spacing should give consideration to conditions of climate. Spacing of control joints may be increased with use of additional reinforcement as provided in bond beams. Maximum control joint spacing should not exceed 7.2 meters.

8.7.5.3 Control joints shall be provided as defined in the Masonry Specifications or as shown on the Structural Standard Design Drawings.

8.7.5.4 Lateral Stability. Masonry wall systems should be carefully designed to resist lateral loads due to seismic activity or wind. Lateral stability of walls may be developed considering simultaneous transverse support from both horizontal and vertical elements, resulting in a two-way distribution of loads and stress.

8.7.5.5 All required reinforcement shall be determined, and the type and location of joints shall be identified by the structural engineer.

8.7.5.6 Joint locations shall be reviewed with the architect to assure they are properly integrated into the aesthetic features of the structure, such as exterior finish joints.

8.7.5.7 All joints for masonry may be detailed by the architect and may be shown on the architectural drawings.

8.7.5.8 In designing masonry walls, all loads must be considered, including but not limited to thermal, shrinkage, wind and seismic.

8.7.5.9 Enough details shall be shown on the structural and architectural drawings to fully cover all conditions and provide clear intent to the contractor.

8.7.6 Structural Steel Design shall be in accordance with the AISC Manual except as follows:

8.7.6.1 Nondestructive weld inspection methods shall be coordinated with CETAM Consturction personnel to ensure that required equipment and expertise are available in the field.

8.7.7 Steel Joists shall conform to SJI Specifications and Tables.

8.7.8 Steel Decking. Design and selection of composite steel floor deck, form deck, and roof deck shall be in accordance with the provisions of the Steel Deck Institute Design Manual. The minimum required depth, gage and sectional properties of deck sections shall be provided on the drawings.

8.7.9 Hardened Construction. Hardened construction, in this manual, is defined as any structure that must resist the effect, to any degree, of shock and/or blast from a nuclear or conventional weapon or accidental explosion. Personnel protective structures shall be designed for moderate damage as described in UFC 3-340-01. Command post structures and structures housing equipment critical to operations, such as communications equipment, will normally be designed to a higher degree of protection. Design for hardened construction may be subject to review and/or approval by the USACE Center of Expertise, the Protective Design Center (PDC) in Omaha Nebraska. The degree of protection and PDC review/approval requirements for all hardened facilities must be agreed to, in writing, by CETAM-EN-Structural prior to the start of design.

8.7.9.1 Concrete Construction. Concrete structures that are to be hardened shall be designed to provide continuity, ductility, and resistance to loading and rebound. Reinforcement shall be lapped or welded adequately to assure continuity. Reinforcement to resist diagonal tension shall be placed normal to the axis of the member at a maximum spacing of 300 mm on center. Pure shear reinforcing, if required, shall be inclined. To increase ductility, members shall be doubly reinforced with a maximum steel percentage of 2 percent of the cross sectional area of the member. Joints shall be detailed so as to insure ductile behavior of the entire element and, if practical, to develop the ultimate strength of the weakest connected element. Structures to resist accidental explosions shall be designed and detailed in accordance with UFC 3-340-02.

8.7.9.2 Structural Steel Construction. Steel construction shall be used primarily for support of suspension systems, blast doors, hardened fences, and other similar elements. The use of steel framing is also acceptable for major structures where economically feasible. Steel construction, where practical, shall be designed and detailed to achieve continuity and full plastic strength of the weakest connected members at joints. Bolted connections shall be designed as bearing type, as opposed to slip-critical type.

8.7.9.3 Other Material. The use of steel joists and masonry as structural systems for hardened construction shall be allowed only with approval from CETAM-EN-Structural and/or the PDC prior to start of design.

8.7.9.4 Shock Analysis and Design. The design of equipment and structural components shall be as complete as possible during the design stage. When shock analyses must be left to the contractor, due to insufficient knowledge of exact equipment configuration during design, the specifications shall be very specific in stating analysis methods and criteria for acceptance. The master submittal register, to be bound in the contract, must list the type and size of each item for which the contractor is to perform and submit shock analyses. Design of shock mountings shall give consideration to strength of connections to resist forces caused by accelerations and to allowances of proper space for relative displacements of structure and equipment. Shock must be attenuated to a level that is acceptable to the isolated equipment.

8.7.10 Drawings.

8.7.10.1 General.

a. Details of joints shall be carefully and fully developed on final drawings.

b. Final framing drawings should be coordinated with mechanical work and shall show details at openings, supports, and roof curbs around openings.

c. Foundation or structural floor plans shall show location of floor trenches and openings. Direction and amount of slope to drains shall also be shown.

d. Drawings shall have notes indicating the assumed live loadings, design stresses, and maximum foundation pressures. Forces on truss members shall be shown on the drawings.

e. All building floor elevations shall be given as reference elevations to the finished ground floor elevation. A reference floor elevation of 100.00 or 0.00 shall be used for the finished ground floor. Elevations in terms of height above sea level shall be indicated only on site plans.

f. Dimensions and material descriptions shall be as follows unless otherwise directed:

1. Dimensions provided in sections, details, plans and elevations shall be shown in millimeters.

2. Plate sizes are given in millimeters. Thus PL 19 x 200 x 600 LG.

3. Rolled steel shapes are indicated by AISC metric notation. Thus, W 200 x 150.

4. Angle sizes are given in millimeters. Thus, 100 x 100 x 10 x 600 LG.

5. Reinforcing bar sizes are given in accordance with European designation. Spacing and length are given in millimeters. Thus, D20 @ 300 x 2000 LG.

6. Welding notation, size, length, and spacing are given in millimeters with welding symbols in accordance with AWS.

7. Bolt diameters are given in millimeters. Length is given in millimeters. Thus, 20 dia. x 300 LG.

8.7.10.2 Concrete shall be detailed in accordance with ACI SP-66 except as follows:

a. Reinforcing shall be designated using ASTM A615M standard notation and a chart provided (Fig. 1) equating bar numbers to equivalent Imperial diameters. The thickness of concrete cover over reinforcing, location of splices, length of lap required for tension and compression splicing, and minimum embedment for all discontinuous bars shall be clearly indicated. The size, number, and placement of all reinforcing shall be shown on the drawings.

b. The paragraphs of the specifications pertaining to finishes for concrete shall be carefully checked against the drawings to verify that all conditions have been covered and that finishes not used in the job are deleted from the specifications. A Class A finish should only be specified when needed to meet architectural requirements.

c. Drawings shall show all joints in concrete necessary to assure a serviceable facility. Water stops shall be provided at all joints that occur below the ground level where the entrance of water into the adjacent area could have a detrimental effect on the function of the area.

d. Where concrete slabs are depressed to receive quarry, or ceramic tile and insulation, structural plans shall indicate the extent of the lowered area and the amount of offset. For slabs-on-grade, applied finishes shall be coordinated with floor joints. Changes in surface elevation shall be shown. Membrane waterproofing or vapor barrier where provided under slabs-on-grade, pits, and trenches shall also be identified on drawings.

e. Locations and details of step footings under continuous walls shall be indicated on drawings.

8.7.10.3 Masonry Construction.

a. The location and details of bond beam units, control joints, and joint reinforcement for crack control in both exterior and interior walls shall be identified on drawings.

b. Lintels for all openings in masonry walls such as windows, doors, and mechanical work shall be identified on drawings.

c. In the design of frame structures, either concrete or steel, non-structural masonry walls and interior partitions shall be independent elements. The main structural framing system shall be isolated from walls and partitions to allow movement of the framing system without imposing stress on the wall elements.

8.7.10.4 Steel Joists. Spacing of all joists shall be dimensioned on framing plans. Location of bridging lines shall be shown on framing plans. Details of joist connections to beams, columns, and walls shall be shown for each applicable condition. Joists and bridging shall be checked against mechanical requirements such as duct openings and equipment support, and modifications made as required.

8.7.10.5 Structural Steel. All bolted connections of any type other than AISC Standard connections are to be detailed on the drawings. Notes shall indicate whether the bolted connection is slip-critical or bearing type. Normally, bearing type connections are the most economical. Symbols shall clearly differentiate between shop and field welding. When welds are to be examined by radiographic or magnetic particle inspection, a paragraph shall be added to the appropriate structural steel section of the specifications covering the extent and type of inspection required. Additionally, per UFC 3-301-01, all lateral connections shall be detailed.

8.7.11 Bonding and Grounding. Certain facilities may require bonding and grounding of metal work to eliminate interference with radio or radar operations, or for lightning protection. When necessary to meet these requirements, the structural engineer shall coordinate facility criteria with the design so that bonding and grounding of reinforcing, structural steel, and other metal work can be accomplished in detail on the drawings, and so that it will be in complete agreement with the appropriate electrical section of the specifications. For some usages, floors may be required to be spark proof or electrically non-conductive.

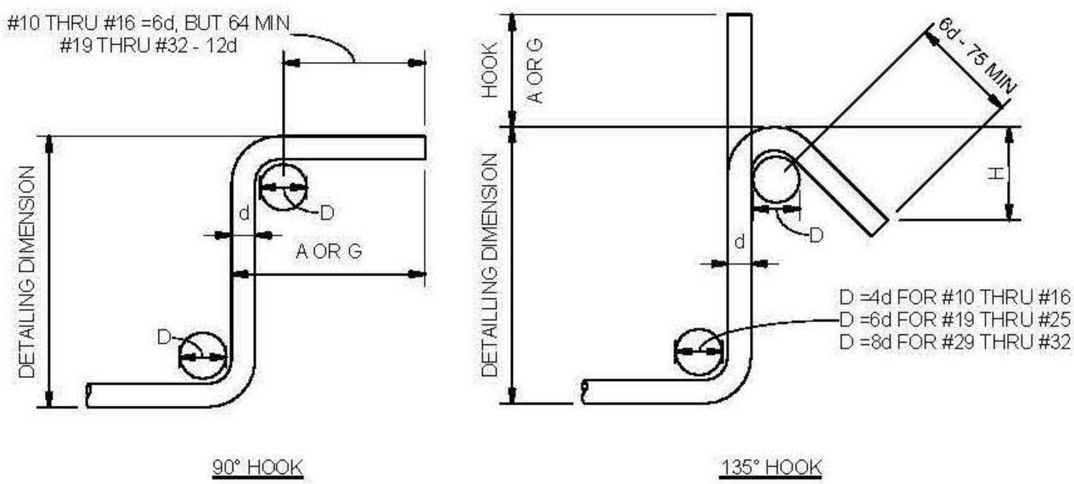
8.7.12 Future Expansion. Where future expansion of buildings is planned, it is especially important that provisions made for the later extension be carefully developed and shown on drawings. This is necessary information for future design work so that the projected construction may be added without unusual or troublesome operations and with minimum interference with the use of the structure being enlarged.

8.7.13 Deviations. If compliance with provisions of the referenced applicable publications or this manual cannot be met, such deviations shall be noted, explanations given for them, and a request for waiver submitted. This shall be done prior to preliminary submittal.

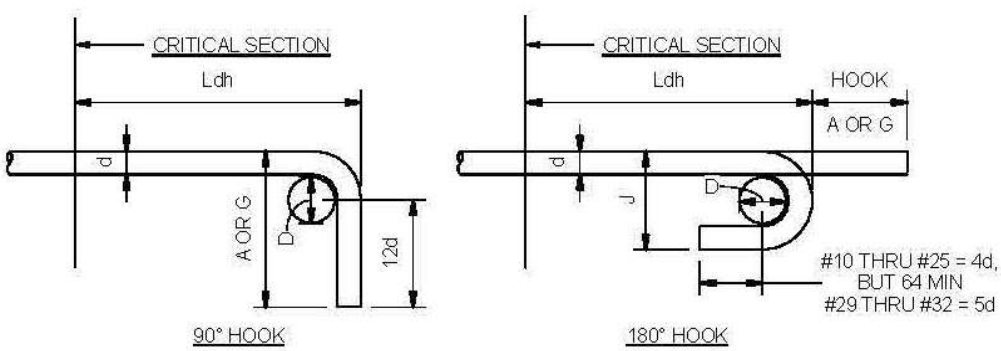
FIGURE 1 - BAR BENDING DETAILS

STANDARD REINFORCEMENT BAR NOMENCLATURE

ASTM A615 BAR SIZES	ALT METRIC BAR SIZES	STANDARD HOOK				STIRRUP AND TIE HOOKS		
		INSIDE DIA BAR BEND	180° HOOK		90° HOOK	135° HOOK		90° HOOK
			A OR G	J	A OR G	A OR G	H	A OR G
#10	10mm	60	130	80	160	130	82	90
#13	14mm	72	144	96	195	156	98	108
#16	16mm	96	176	128	256	206		144
#19	20mm	120	220	160	320	DO NOT USE		
#22	22mm	132	242	176	253	DO NOT USE		
#25	26mm	150	275	200	400	DO NOT USE		
#29	30mm	224	363	280	476	DO NOT USE		
#32	32mm	256	416	320	544	DO NOT USE		



STIRRUP - TIE HOOKS



STANDARD HOOKS

EQUIVALENT STEEL WELDED WIRE FABRIC SIZES		
WIRE REINFORCING INSTITUTE DESIGNATION	METRIC SIZES (mm)	
	WIRE SPACING	WIRE DIAMETER
6 x 6 - W1.4 x W1.4	150 x 150	3.0 x 3.0
6 x 6 - W2.1 x W2.1	150 x 150	4.0 x 4.0
6 x 6 - W2.9 x W2.9	150 x 150	5.0 x 5.0
6 x 6 - W4.0 x W4.0	150 x 150	6.0 x 6.0

ASTM STANDARD INCH-POUND REINFORCING BARS			
BAR SIZE DESIGNATION	NOMINAL DIMENSIONS		
	AREA (in^2)	WEIGHT (lb/ft)	DIAMETER (in.)
#3	0.11	0.376	0.375
#4	0.20	0.668	0.500
#5	0.31	1.043	0.625
#6	0.44	1.502	0.750
#7	0.60	2.044	0.875
#8	0.79	2.670	1.000
#9	1.00	3.400	1.128
#10	1.27	4.303	1.270
#11	1.56	5.313	1.410
#14	2.25	7.65	1.693
#18	4.00	13.60	2.257

ASTM STANDARD METRIC REINFORCING BARS			
BAR SIZE DESIGNATION	NOMINAL DIMENSIONS		
	AREA (mm^2)	WEIGHT (kg/m)	DIAMETER (mm)
#10	71	0.560	9.5
#13	129	0.994	12.7
#16	199	1.552	15.9
#19	284	2.235	19.1
#22	387	3.042	22.2
#25	510	3.973	25.4
#29	645	5.060	28.7
#32	819	6.404	32.3
#36	1006	7.907	35.8
#43	1452	11.38	43.0
#57	2581	20.24	57.3

CHAPTER 9

FIRE PROTECTION AND LIFE SAFETY

CHAPTER 9
FIRE PROTECTION AND LIFE SAFETY

9.1 GENERAL.

This chapter prescribes fire protection and life safety design requirements necessary to ensure adequate protection of personnel and facilities from fire hazards. Specific submittal requirements in this chapter supplement those given in this document, Chapter 1, General Instruction.

9.1.1 Master Planning. UFC 3-600-01, Section 1-12 Planning (Contract Development) criteria shall be used in the planning phase to certify that adequate installation infrastructure exists for proposed projects. The DoD is responsible to determine if installation infrastructure is adequate to support the proposed project(s). When determining installation infrastructure capabilities, the Designated Fire Protection Engineer (DFPE) is responsible to perform fire flow testing, determine the adequacy or augmentation needed for fire pumps, determine the reliability of power sources, and required fire suppression and alarm systems. The DFPE is defined as The DoD fire protection engineer that oversees the Area of Responsibility for the project(s). This is sometimes referred to as the “cognizant” fire protection engineer. For USACE, this is usually the district or Center FPE.

9.1.2 Basis of Design. Design requirements shall be based upon applicable criteria contained in Unified Facilities Criteria’s, the International Building Code (IBC), referenced to a specific edition of the National Fire Codes published by the National Fire Protection Association (NFPA), specific host nation codes and standards, and/or international agreements.

9.1.2.1 Compliance with this chapter’s design criterion is mandatory.

9.1.2.2 Fire protection and life safety design requirements shall be coordinated with all other disciplines to include analysis of existing constructed elements unaffected by renovation design.

9.1.2.3 For projects outside the United States and its territories and possessions, a Host Nation Code Compliance certification must be performed by a Host Nation fire protection consultant. The certification shall identify code/criteria conflicts and the authority holding jurisdiction (*AHJ)* approved design solutions or equivalencies to DoD or Host Nation criteria necessary to resolve.

9.1.2.4 Projects outside the United States and its territories and possessions must comply with provisions of UFC 3-600-01 and the host nation fire protection requirements. For conflicts between UFC 3-600-01 and the host nation fire protection requirements, the AHJ must be consulted.

9.1.2.5 Identification of seismic zone and provisions for seismic design shall be identified and included in accordance with NFPA standards. Unusual situations not specifically addressed by the above criteria shall be referred, in writing, to the DFPE.

9.1.3. Definition of Qualified Fire Protection Engineer (QFPE) Services.

9.1.3.1 The term Qualified Fire Protection Engineer (QFPE), and Life Safety Specialist and Fire Protection Specialist in this document are interchangeable in terminology.

9.1.3.2 A QFPE is defined by UFC 3-600-01 and Unified Facilities Guide Specifications (UFGS) as a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience.

9.1.3.3 A registered professional engineer (PE) is defined as an individual having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program recognized by the National Fire Protection Association at the website location: https://www.nfpa.org/News-and-Research/Resources/Fire-education-programs and a minimum of four years' work experience in fire protection engineering.

9.1.3.4 Relevant experience in fire protection engineering is defined as a registered, professional fire protection engineer (FPE) with a minimum of four years' experience dedicated to fire protection engineering that can be verified with documentation.

9.1.3.5 When a project is not governed by DoD design requirements, the minimum qualifications of the QFPE shall be IAW NFPA Standards and Host Nation code as follows:

a. If the Host Nation code does not provide qualifications of the QFPE, UFC 3-600-01 shall be used as the guide, and a QFPE shall be defined as a registered Professional Engineer (P.E.) with at least five of the last eight years' work experience in the design of the fire protection and detection systems documented.

b. Unless the project scope of work specifically states to the contrary, all projects shall also require the services of a specialist, qualified and experienced in designing and specifying installed fire protection systems. The specialist shall perform an in-depth analysis of the overall facility configuration to verify that the design complies with all applicable provisions of the Life Safety Code (NFPA 101), as well as other applicable NFPA standards and the IBC. The final design submittal documents shall include certification signed by the specialist, stating that the design complies with all applicable codes.

9.1.3.6 Installations requiring completion of drawings/specifications or modifications of existing fire detection, fire alarm, mass notification systems, fire suppression systems, or fire pumps shall require the services and review of a QFPE.

9.1.3.7 Life safety elements include, but are not limited to design of egress and exiting, smoke control, fire resistance ratings and related systems, in addition to suppression, and fire alarm systems.

9.1.3.8 Qualifications of the proposed QFPE shall be submitted to and approved by the USACE DFPE through the design manager no later than 14 days after the Notice to Proceed, and prior to the submittal of the fire suppression systems drawings and hydraulic calculations.

9.1.3.9 Failure to submit qualifications for approval prior to start of work shall not relieve the A-E of responsibility to comply with this requirement, and design work shall not proceed until this requirement is fulfilled. Designs submitted for review shall be certified as compliant with the governing codes in this manual by the QFPE.

9.2 APPLICABLE PUBLICATIONS:

Specific editions of these publications shall be defined in design development unless directed in UFC to use the most current edition. This list is not all-inclusive. Consult the Middle East District Building Systems Design Branch for resolution and direction.

Air Force Engineering Technical Letter (ETL's)

International Building Code (IBC)

National Fire Codes as published by National Fire Protection Association (NFPA):

US Army Corps of Engineers (USACE) Engineering Construction Bulletins (ECB)

United Facilities Criteria (UFC):

UFC 1-200-01 "DoD Building Code"

UFC 1-200-02 "High Performance and Sustainable Building Requirements"

UFC 1-201-01 "Non-Permanent Facilities in Support of Military Operations"

UFC 3-230-01 "Water Storage and Distribution"

UFC 3-600-01 "Fire Protection Engineering for Facilities"

9.2.1 UFC 3-600-01 supersedes NFPA and other industry standards, except where not specifically addressed by UFC 3-600-01.

9.2.2 For conflicts between UFC 3-600-01, the local municipal jurisdiction, or the host nation, the DFPE must be consulted.

9.2.3 Where criteria are not included in UFC 3-600-01, fire protection criteria shall conform to the requirements of the latest editions of the National Fire Codes.

9.2.4 Where criteria are not included in UFC 3-600-01 or the National Fire Codes, a fire protection design analysis must be submitted to the DFPE for approval.

UFC 3-600-02 "Operation and Maintenance: Inspection, Testing, and Maintenance of Fire Protection Systems"

UFC 4-010-01 "DoD Minimum Antiterrorism Standards for Buildings"

UFC 4-021-01 "Design and O&M: Mass Notification Systems"

UFC 4-211-01 “Aircraft Maintenance Hangars”

UFC 4-211-02 “Aircraft Corrosion Control and Paint Facilities”

Unified Facilities Guide Specifications (UFGS)

9.3 CONCEPT REVIEW SUBMITTAL REQUIREMENTS:

9.3.1 Concept Design Analysis: The Concept Fire Protection and Life Safety design analysis employing criteria set forth in paragraph 9.1.2, “Basis of Design” shall include (as they pertain to facility requirements), but not limited to the following:

9.3.1.1 Use the information outlined in the document associated with this section at: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables to provide the minimum requirement for development of Fire Protection and Life Safety Code submittals for all building projects. Additional and supplemental information may be used to further develop the code review. Insert N/A after criteria, which may be "not applicable".

9.3.1.2 Building Code Analysis.

9.3.1.3 Classification of Occupancy (Both IBC and NFPA 101).

9.3.1.4 Requirements for fire-resistance rated construction.

9.3.1.5 Requirements for penetrations and openings.

9.3.1.6 Separation from hazards per NFPA 101.

9.3.1.7 Interior Finish Rating.

9.3.1.8 Means of egress provisions and components.

9.3.1.9 Water supplies, Water distribution, location of fire hydrants, fire flow calculations.

9.3.1.10 Location of Fire Department Connections (FDC), Post Indicator Valves (PIV) and/or other control, isolation, indicating valves.

9.3.1.11 Analysis of automatic sprinkler and suppression systems and protected areas. Include supporting calculations used to establish system performance requirements such as hydraulic analysis of water demand or agent concentration and quantity.

9.3.1.12 Standpipe systems.

9.3.1.13 Portable fire extinguishers.

9.3.1.14 Fire detection (the type of detection and type/location of detectors).

9.3.1.15 Fire alarm system (the type of alarm system, location of the fire alarm equipment and mass notification).

9.3.1.16 Smoke management or control methods.

9.3.1.17 Connection to and description of base Fire Alarm Reporting System.

9.3.1.18 Coordination with security and antiterrorism requirements, including connection to Installation wide Mass Notification System.

9.3.1.19 Fire department access.

9.3.1.20 AHJ approved equivalencies.

9.3.1.21 Initial, or draft, integrated performance verification and testing plan(s).

9.3.1.22 Capacity and number of occupants using each major means of egress component.

9.3.1.23 Maximum travel distance, dead-end corridor, common path of travel, accessible means of egress, and exit components for each floor and occupancy classification.

9.3.1.24 IBC and NFPA occupancy classification of each room, area or compartment (on the drawings or in tabular form). Include occupant load of each room, area or compartment. Similar occupancies can be grouped together for occupant load calculations.

9.3.1.25 Location of hazardous materials storage, handling and use that exceed the maximum allowable quantities.

9.3.1.26 Structural fireproofing locations and associated ratings.

9.3.2 <u>Concept Design Drawings.</u> The concept Fire Protection and Life Safety design drawings employing the criteria set forth in paragraph 9.1.1.a, “Basis of Design”, shall include, but not necessarily be limited to plans indicating the following:

9.3.2.1 The location and rating of any fire-resistive construction such as occupancy separations, area separations, shaft and stair enclosures, corridors, exit passageways, separation of hazardous areas, etc.

9.3.2.2 Life safety plans of each floor of each building identifying occupancy classifications, occupant loads, probable exit routes, required exit capacity vs. exit capacity provided, travel distances from each area of each floor, and other details as required demonstrating compliance with all provisions of NFPA 101.

9.3.2.3 Identification of all areas to be sprinklered including occupancy hazard classifications per UFC 3-600-01 and NFPA 13.

9.3.2.4 Identification of fire alarm/mass notification requirements per UFC 3-600-01, NFPA 101 and NFPA 72.

9.3.2.5 Identification of all areas to be provided with other types of installed fire suppression systems including gaseous, dry or wet chemical, etc.

9.3.2.6 Location and classification of standpipes and hose systems, and portable fire extinguishers.

9.3.2.7 Identification of smoke compartments associated with smoke control systems.

9.3.2.8 Characteristics of the water supply for fire protection.

9.3.2.9 Code Compliance Site Plans and Summary Sheet (where applicable per DFPE):

a. Line of encroachment identifying assumed property lines and minimum separation distances from adjacent buildings.

b. Building perimeter used for frontage increases.

c. Fire department access.

d. Fire lane width, marking and locations, approach roads, and turn radius and location.

e. Type and quantity of antiterrorism secure access.

f. Intended fire department main entrance to facility.

g. Location of fire department connections.

h. Fire hydrants, post indicator valve or valves, and their connected water distribution mains serving facility.

i. Fire pump room.

j. Water storage tanks.

k. Hazardous material spill containment tanks.

l. Backflow prevention assembly or assemblies serving water-based fire protection systems (if located outside of building).

m. Any approved exemption and any exemptions being sought

9.3.2.10 Other drawings shall be provided as necessary to clearly define and explain all fire protection and life safety features and requirements.

9.3.3 Concept Design Specifications. Provide design specifications as described in Chapter 3 “Specification” of this document.

9.3.4 Certification of Review. Written Code Compliance Summary that the Concept Fire Protection and Life Safety Design has been reviewed by the QFPE and that the design complies with all applicable codes and criteria determined at the time of the Concept Review

Submittal.

9.4 PRELIMINARY REVIEW SUBMITTAL REQUIREMENTS:

9.4.1 Preliminary Design Analysis. The Preliminary Fire Protection and Life Safety design analysis shall include all items in the Concept Review Submittal Requirements incorporating all necessary revisions. In addition, the following specific items shall also be included:

9.4.1.1 Complete and revised basis of design, design analysis, and calculations for determination of occupant load by floor area and fire area, number of exits, required egress capacities, maximum allowable travel distances, and other features required for compliance with NFPA 101, *Life Safety Code*.

9.4.1.2 Complete and revised basis of design, design analysis for fire suppression systems, and equipment to be provided.

9.4.1.3 Complete and revised water system analysis including calculations, existing water supply test results, water supply, and demand curves to demonstrate capability of water system to satisfy fire protection requirements of UFC 3-600-01 and other applicable criteria.

9.4.1.4 Complete and revised calculations to determine other fire suppression system requirements, e.g. capacity of foam concentrate storage tanks, quantities of CO_2, size of air compressors for dry-pipe sprinkler systems, fire pumps, and similar requirements.

9.4.1.5 Fire alarm/detection/MNS system details as identified in NFPA 72, Design (Layout) Documentation.

9.4.1.6 Types, ratings, and location of portable fire extinguishers to be provided.

9.4.2 Preliminary Design Drawings. The Preliminary Fire Protection and Life Safety design drawings shall consist of all design features of the Concept design, incorporating all necessary revisions. In addition, the following specifications shall also be included:

9.4.2.1 All fire protection system design requirements specified under paragraph 9.7.2 "System Design".

9.4.2.2 Complete and revised basis of design, design analysis, and operating sequences for all fixed fire suppression systems.

9.4.2.3 Complete and revised layouts of all fixed fire suppression systems including locations and mounting details of agent storage containers, control panels, test connections, hose cabinets, etc.

9.4.2.4 Complete and revised locations of all fire doors, fire/smoke dampers, fire alarm system devices, and similar equipment related to the overall fire protection scheme of each facility.

9.4.2.5 Complete and revised location, type, rating, and mounting details of portable fire extinguishers to be provided.

9.4.2.6 Complete and revised schematics, isometrics, and other details as necessary to clearly delineate the arrangement and operation of all fire suppression systems.

9.4.2.7 Complete Fire alarm/detection/MNS system configuration as identified in NFPA 72, Design (Layout) Documentation.

9.4.2.8 Design (layout) documents contain information related to the system that should include specifications, shop drawings, input/output matrix, battery calculations, notification appliance voltage drop calculations for visual notification appliances and loudspeakers, and product technical data sheets.

9.4.3 Preliminary Design Specifications: Complete and up to date design specifications IAW Chapter 3 of this document

9.5 FINAL REVIEW SUBMITTAL REQUIREMENTS:

9.5.1 The Final Fire Protection and Life Safety Design Analysis shall include all the items from the Concept & Preliminary design review submittals with all required revisions as well as completed calculations on fire suppression system, fire alarm/mass notification, and fire pump system(s) (including water storage and distribution). The Final Fire Protection and Life Safety design drawings shall be expanded to include all revisions and refinements necessary to complete the design. The design analysis and drawings submitted for Final review shall be complete, as described in Chapter 1, GENERAL INSTRUCTIONS.

9.5.2 Certification of Review. The QFPE must review the complete 100 percent design drawings and specification submission (all disciplines), and document in writing that the design is in compliance with UFC 3-600-01 (or governing document if not a UFC designed facility) and all applicable fire protection and life safety design criteria. The review must provide verification that all items listed in the design analysis are correctly shown on the drawings and in the specification and list any approved equivalencies or deviations from UFC 3-600-01 (or governing document if not a UFC designed facility). This design compliance document must be submitted with the final design submission as part of the design analysis and must bear the signature and professional seal of the QFPE.

9.5.3 Design submittals: When the design does not follow the normal Concept, Preliminary and Final Design Submittal's, the final design shall be corrected before RTA's.

9.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS:

9.6.1 RTA Fire Protection and Life Safety Design Submittals shall reflect incorporation of the comments generated during the Concept, Preliminary and Final design reviews. The RTA Design shall be a complete design forming an integral part of the construction package that can be utilized with enough details that can be used for bidding, solicitation, or for obtaining permits.

9.6.2 Construction Phase Submittals.

Upon contract award fire alarm, fire water supplies (Includes fire pumps, water storage, and distribution) and fire suppression systems Construction Submittals shall contain shop drawings for (proposed until approved) construction, sufficient cut sheet documentation to verify the material qualities expressed in the design specifications, up to date calculations, all items noted in applicable NFPA Standard(s), and satisfy operation and maintenance data for closeout.

9.6.2.1 Fire Alarm / Mass Notification Systems

a. For new or modified systems, construction (shop) drawings and calculations must be prepared by an individual that has obtained National Institute for Certification in Engineering Technologies, Fire Alarm Systems, Level III certification, at a minimum.

b. The QFPE must review the shop drawings, calculations and material submittals. The shop drawings must bear the Review Stamp of the QFPE prior to submitting the fire alarm system shop drawings to the DFPE.

c. For the Army, construction (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with their signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the fire alarm system shop drawings to the DFPE. The QFPE must monitor the installation of the fire alarm system, and certify in writing that the fire alarm system has been constructed and operates as intended in the design plans and specifications.

d. Shop Drawings shall include items identified in UFC 3-600-01 (as Applicable) and NFPA 72

9.6.2.2 Fire Suppression Systems

a. Working (shop) drawings, regardless of the type of fire suppression system, must meet the drawing requirements in the specific NFPA standard and UFC 3-600-01, as applicable, for Working Drawings or system specific standard working drawings.

b. For new or modified systems, construction (shop) drawings and calculations must be prepared by an individual that has obtained National Institute for Certification in Engineering Technologies, Fire Alarm Systems, Level III certification, or Special Hazards Suppression Systems, Level IV certification, as applicable to the project.

c. The QFPE must review the shop drawings, calculations and material submittals. The shop drawings must bear the Review Stamp of the QFPE prior to submitting the fire alarm system shop drawings to the DFPE.

d. For Army, construction (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations and material data sheets, indicating approval prior to submitting the fire alarm system shop drawings to the DFPE. The QFPE must monitor the installation of the fire alarm system and certify in writing that the fire alarm system has been constructed and operates as intended in the design plans and specifications.

d. The preparer of the shop drawings must perform calculations (i.e. hydraulic calculations, agent flow calculations) in accordance with the applicable NFPA standard, demonstrating that the design will provide an adequate supply for the fire suppression systems. Calculations must be submitted no later than the first shop drawing submission.

9.7 TECHNICAL REQUIREMENTS FOR ALL DESIGNS:

9.7.1 <u>Elements of Design.</u> Fire Protection and Life Safety review submittals for each facility shall be provided as a <u>separate</u> discipline and shall include the following in accordance with the requirements of the scope of work and regulations utilized:

9.7.1.1 A narrative that identifies all occupancy group(s), allowable floor areas, construction types, interior finish ratings, fire protection systems, and other pertinent factors related to the facility being designed.

9.7.1.2 A narrative that identifies all criteria and rationale referencing the sections of UFC 3-600-01 requirements for the facilities under design as supported by the IBC and NFPA standards used to determine each fire protection feature and system to be provided.

9.7.1.3 A description of any existing or proposed water distribution system supplying proposed water-based fire protection systems, including sprinkler systems and hose streams. Include calculations and flow test data from the source (elevated storage, pump station, etc.) to the system(s) under design.

9.7.1.4 Calculations of all water-based fire suppression system designs including fire pumps, sprinkler systems, standpipes, etc. Calculations of automatic sprinkler systems shall be computer generated and shall follow methods and procedures outlined in NFPA 13. Feed waters to be used for fire protection systems shall be verified by water distribution system flow tests. These tests should be performed prior to Concept Design, but not later than Preliminary Design. Hydrant flow tests or other equivalent means shall be conducted and test reports prepared in accordance with NFPA 291. (Refer to para.9.3).

9.7.1.5 A description of how fire detection and alarm systems function as an integral part of the proposed fire suppression systems. For example, smoke detectors provided in air handling units shall be included as part of the building fire alarm system. The requirements driving the installation of such systems shall be described and specified. State the types of detectors that will be used and where they will be used. The design analysis shall specifically indicate rationale for selecting types of detectors and alarms proposed for use. Define the source of power for the detectors, alarms, and associated control panels.

9.7.1.6 Catalog cuts of pertinent fire protection equipment, e.g. portable extinguishers, fire pumps, foam proportioning equipment, monitor nozzles, deluge and other special water control valves, fire hose and nozzles, hose storage devices, sprinklers, food preparation equipment fire suppression systems, etc., shall be included. Portable fire extinguishers shall be specified for all facilities in accordance with NFPA 10. Extinguishers will generally be multi-purpose dry chemical type with a minimum rating of 2A:10B:C.

9.7.1.7 Life Safety Plans of each floor of each building showing various occupancy classifications, occupant loads, units of exit capacity required vs. provided, exit routes, travel distances, and other details to demonstrate compliance with the applicable provisions of the *Life Safety Code* (NFPA 101). Identification of construction requiring fire resistance ratings of 1-hour and greater. Identification of the locations of all openings in fire-rated construction requiring protection, and the level of protection required. Note: Unless otherwise directed, separate life safety plans will be included in the design analysis (only), not with the contract drawing package.

9.7.1.8 Drawings indicating pertinent details of all existing fire protection systems in the project area.

9.7.1.9 Schematics and isometric piping diagrams clearly identifying intended configuration and operation of all fire suppression system components. This is particularly applicable to more complex fire suppression systems such as hangar foam systems, clean agent systems, multiple fire pump installations, etc.

9.7.1.10 Floor plan schematics of detectors, alarms and control panels shall be included indicating the zoning of all initiating devices. Generally, a separate zone plan shall be provided for each major building area or floor, suppression system, air handling unit (duct-mounted smoke detectors), etc., as appropriate for the size and complexity of each facility to assure prompt identification of alarm source.

9.7.2 <u>Systems Design</u>

9.7.2.1 Fire Alarm Reporting: Fire Alarm Reporting System. Fire Alarm Reporting Systems must conform to NFPA 72 and NFPA 70. The Facility fire alarm system must be connected to the Fire Alarm Reporting System. The following signals, at a minimum, must be transmitted via the Fire Alarm Reporting System:

a. Alarm signal by device type (e.g., water flow, manual pull station, sleeping room smoke detector).

b. General supervisory signal.

c. General trouble signal

9.7.2.2 Criteria Specified Systems: Water-based fire suppression systems shall be hydraulically designed by a fire protection engineer. All designs shall include the following:

a. Location and type(s) of all sprinklers and/or nozzles.

b. Routing and sizing of all sprinkler piping.

c. Details of sprinkler risers, fire hose stations, test connections, drains, etc.

d. Hydraulic calculations complying with NFPA 13. Computer generated calculations are required. Calculation data files shall be compatible/equivalent with the latest version of "HASS" fire protection software produced by HRS Systems, Inc., Atlanta, GA. Printed reports shall be similar in format to that of "HASS". Submittals shall include a CD or DVD containing all applicable data files. This shall be in addition to required hardcopy. Calculations shall use metric units, unless otherwise indicated.

e. Gridded systems shall be considered for use and employed where appropriate for high demand systems where the use of such piping configuration will result in a more efficient piping system. For example, gridded systems are usually appropriate for warehouses with high-piled storage.

f. Demand and supply curves depicting sprinkler demand requirements and water supply available as verified by actual flow testing on existing systems or calculations carried to the source of storage and pressure for newly designed systems. Appropriate hose stream allowances shall also be indicated.

g. Deviations from the above requirements will be authorized on an exception basis for relatively small or simple designs. In such cases, the A-E shall stipulate design criteria to be followed and prepare a "performance specification" requiring the contractor to design and calculate systems (Refer UFC 3-600-01).

h. When gaseous, wet or dry chemical, and other special suppression systems are provided, the design analysis shall identify protected areas, indicate the locations and quantities of suppression agents, and operating circumstances for each system.

i. “Pre-engineered” equipment and systems shall be submitted for approval.

9.7.2.3 Performance Specified Systems: Where specifically stated in a contractor’s scope of work, fire suppression system design will be accomplished on a "performance specification" basis whereby sprinkler locations, piping plans, pipe sizing, as well as system calculations, will be the responsibility of the contractor. In such cases, a design supervised by a fire protection engineer shall provide the following:

a. Occupancy classification and applicable criteria upon which sprinkler performance requirements shall be based. (Note: Requirements of UFC 3-600-01 are generally more stringent than NFPA 13).

b. Sprinkler discharge requirements in terms of density in lpm/m^2 (gpm/ft.^{2}) and corresponding area of application in m^2 (ft.^{2}) for each occupancy classification.

c. Maximum allowable sprinkler coverage in m^2/sprinkler (ft.^{2}/sprinkler).

d. Sprinkler riser size and water supply in terms of pressure, flow and residual pressure available at the base of the sprinkler riser (identified as being required to be verified by the Contractor as in para. 9.3.1-f).

e. Sprinkler riser details and other details related to the sprinkler installation.

9.7.3 Installation requirements of fire protection systems

9.7.3.1 Fire Alarm with or without Mass Notification Systems:

a. A NICET Fire Alarm Technicians shall perform the installation of fire alarm systems. A NICET Level 3 Fire Alarm Technician shall be required to supervise the installation of the fire alarm system/mass notification system.

b. Fire Alarm Technicians shall have a minimum of four years of experience utilized to install and terminate fire alarm/mass notification devices, cabinets and panels. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

9.7.3.2 Fire Suppression Systems:

a. Fire Suppression Installers shall have a minimum of four years of experience utilized to install and terminate the type of fire suppression system being installed to include devices, cabinets and panels. The Fire Suppression Installers installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified.

b. The QFPE must monitor the installation of the fire protection systems and certify in writing that the fire protection systems have been constructed and operate as intended in the design plans and specifications.

CHAPTER 10

CHAPTER 10 HEATING, VENTILATING, AND AIR CONDITIONING

CHAPTER 10

HEATING, VENTILATING, AND AIR-CONDITIONING

10.1 GENERAL.

The major requirements for the design of space heating systems, central heating and air-conditioning plants, central chilled water distribution systems, ventilating systems, central air conditioning systems, and, unitary air-conditioning systems for permanent construction are discussed in this section. For specific projects, supplemental guidance may be provided. These additional requirements will also be incorporated in the design effort. Engineering practices recommended in ASHRAE Handbooks shall be followed in regard to special conditions and problems not specifically covered herein. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including drawings and design analysis, shall be prepared in accordance with Chapter 2: PRESENTATION OF DATA.

10.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below form a part of this Manual.

Unified Facilities Criteria:

UFC 3-310-04. Seismic Design for Buildings.

UFC 3-400-02. Design: Engineering Weather Data.

UFC 3-410-01FA. Heating, Ventilating and Air Conditioning Systems.

UFC 3-401-01. Mechanical Engineering

UFC 3-410-04N. Industrial Ventilation

UFC 3-450-01. Noise and Vibration Control.

UFC 4-510-01. Design: Military Medical Facilities

American National Standards Institute, Inc. (ANSI) Standards:

A 13.1. Scheme for the Identification of Piping Systems.

B31.1 Power Piping. & B31.1a & B31.1b

American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) Inc. Standards:

ASHRAE Handbooks, Latest Editions.

ASHRAE 90.1 Energy Standard for Building except Low-Rise Residential Buildings.

ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality

American Society of Mechanical Engineers (ASME) Codes:

Boiler and Pressure Vessel Codes: Section I. Rules for Construction of Power Boilers. Section IV. Rules for Construction of Heating Boilers. Section VIII-D. Rules for Construction of Pressure Vessels.

National Institute of Occupational Safety and Health (NIOSH):

NIOSH 76-130. Lead Exposure and Design Consider rations for Indoor Firing Ranges.

National Fire Protection Association (NFPA) Publications:

No. 70. National Electric Code.

No. 90A. Standards for Installation of Air Conditioning and Ventilating Systems.

No. 31. Standards for Installation of Oil Burning Equipment.

No. 54. National Fuel Gas Code.

No. 91. Blower and Exhaust Systems for Air Conveying of Materials.

Sheet Metal and Air-Conditioning Contractors National Association, Inc (SMACNA):

HVAC Duct Construction Standards - Metal and Flexible.

American Conference of Government Industrial Hygienists:

Industrial Ventilation, A Manual of Recommended Practice.

10.3 CONCEPT SUBMITTAL REQUIREMENTS.

10.3.1 General Considerations.

a. At the Concept design stage of project development it is recognized that all calculations are tentative for analysis purposes and only indicate approximate capacities of equipment. Any dimensions and sizes required are order-of-magnitude figures, conservatively stated, to assure adequate space for installation and maintenance of equipment and utility elements such as piping, ductwork, etc., in congested areas.

b. Equipment shown in plans and sections is not shown in great detail but is shown merely as simple geometric forms with approximate correct dimensions.

c. Piping layouts shown are simple main pipe runs showing general location, routing and, when applicable, approximate order-of-magnitude sizes. Control valves, check valves, etc., are shown only as required to indicate function of the system. Only routing of pipe mains feeding batteries of water coils are shown, not individual lines to coils unless required for clarity of the system.

d. System flow diagrams, layouts, and one of each type of take-off, branch, or feed must be shown but not all individual branches. Purpose of the flow diagram is only to show system design intent and the basic principle of system operation.

e. Drawings and sketches. Scale of concept drawings will generally be smaller than the working drawings. Plans and sections need be only large enough to properly show pertinent information. Sketches will be acceptable when sufficient to show pertinent information or convey basic system concepts. Quantity of concept drawings are to be kept to the minimum number required to convey basic systems information. Some mechanical information required in the Concept submission may logically be included on other discipline drawings or in sketch form in the design analyses and need not be indicated on formal drawings.

10.3.2 Concept Design Analysis. The following specific items shall be included, as applicable.

10.3.2.1 Heating, Ventilating and Air-Conditioning (HVAC).

a. For air-conditioning, give a statement citing applicable specific references (DOD, TM's Programming Data, etc.) used to the extent air-conditioning is authorized and to any authority for waiver of these criteria. State whether for comfort cooling or according to technical requirements or both. For technical requirements, show the authorized tolerance for temperature and humidity control, the degree of air cleaning or purity required, and any other special considerations involved.

b. For evaporative cooling, cite applicable references as to the extent authorized and to any authorized waiver of these criteria. Note if single or two-stage process.

c. For cold storage facilities, indicate room holding temperatures, commodities to be held in cold storage and the quantity of commodity to be stored. (May be indicated on drawings.)

d. State the indoor and outdoor design temperatures for heating and cooling and proposed "U" factors for walls, ceilings, floors, etc.

e. Prepare tentative heating and cooling block load calculations for heating and cooling systems.

f. Prepare tentative ventilation calculations for ventilated areas.

g. For air distribution, prepare tentative calculations for each typical zone of control, fan type and unit sections required.

h. Prepare overall tentative air balance calculations with a flow diagram showing quantities of air handled and circulated throughout each building as a whole including quantities for outside and exhaust air.

i. Describe the proposed heating ventilation and air-conditioning systems and their associated air distribution systems and provide rationale used for selection of the recommended systems.

j. Describe ventilating systems. Provide statements whether gravity or mechanical systems are proposed. If mechanical systems, indicate whether supply or exhaust. State requirements for outside air and the basis for determination of quantity, i.e., number of air changes per hour, of CFM per person, or other.

k. Describe the control system for each major typical air distribution system. Control system descriptions may be provided on plans or as part of the narrative.

10.3.2.2 Central Chilled Water Systems.

a. Describe the proposed type of chilled water plant and justification for selection, operating pressure and temperature, and approximate capacities. Describe the type of chilled water distribution system outside buildings, pumping schemes and capacities, routing and type of system, and whether aboveground, tunnel or underground piping will be used. Include soil investigations and survey, and materials evaluation with recommendations for selection of piping materials.

b. Develop a failure mode analysis of each chilled water plant and distribution system to minimize service interruptions, equipment damage, and hazards to personnel. Failure mode analysis will be limited to those conditions that may result in a hydraulic pressure wave propagation. Loss of electrical power, control signals, and equipment failures, as well as human error or lack of skill, shall be included in the analysis. Maximum use of computer methods shall be made during the analysis. Input and output data, as well as a user-oriented description of the programs involved shall be provided as part of the documentation. The analysis shall follow the normal design sequence and shall be updated as the system design effort continues and additional information becomes available.

10.3.3 Concept Design Drawings. The following specific items shall be shown on the HVAC Concept design drawings when applicable.

10.3.3.1 Tentative schematic flow diagrams along with system descriptions of all systems considered, including air distribution, chilled water distribution and pumping. The rationale for systems recommended shall be clearly documented.

a. Tentative control description of operation to clearly indicate general features sufficient to define method of control of each typical major equipment and system. (May be shown in design analysis.)

10.3.3.2 All Systems Recommended for Project Inclusion.

a. Flow diagrams of all systems proposed. These diagrams shall be an accurate schematic representation of each system showing proposed equipment, primary control valves, dampers and control loops, as applicable.

b. Provide single line layouts of heating and air conditioning systems showing equipment and contemplated zoning for each building. Drawings shall identify rooms and be sufficiently complete to show the location, arrangement, and approximate capacities of all major items of equipment and space allocated for servicing and maintenance. The following items shall be included as a minimum.

(1) Single line layouts of typical HVAC systems with approximate representative duct sizes of main runs and air quantities. This includes exhaust systems and make-up air systems.

(2) Layout of major mechanical equipment, to determine space requirements, and adequacy of mechanical room sizes.

(3) Component parts of air handling equipment should be indicated, i.e., fan, coils, filters, etc.

(4) Show required maintenance space for all major equipment, preferably with dotted lines and backed up by xerox copies of typical manufacturers' cataloged maintenance space in design analysis. A minimum 30-inch clearance around equipment shall be shown to allow "squatting" for the maintenance purposes.

(5) Show major piping single line with approximate size.

(6) Indicate approximate capacities of all major equipment including horsepower of motors and kw of major electric heating elements, CFM of major air handlers, etc.

c. Show the approximate routing of site chilled water piping, size and location of valve boxes, drain and vent points. Include a piping and valve layout for each typical valve box, air vent and drain point.

10.4 PRELIMINARY REVIEW SUBMITTAL REQUIREMENTS.

10.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any necessary revisions. In addition, the following specific items shall be included when applicable.

a. Detailed calculations for sizing equipment, piping, ductwork, control valves, etc.

b. Schematics for the control schemes used.

c. Any other information or computations required to permit verification that the design complies with the design criteria, codes, and standards and is satisfactory for the intended purpose.

10.4.2 Preliminary Design Drawings. The following specific items shall be shown when applicable.

10.4.2.1 Flow Diagrams of All Systems. These diagrams shall show all the information given on the Concept drawings but in greater detail. The diagrams shall include equipment, all ductwork and piping including sizes and flow rates, all dampers, valves, and miscellaneous accessories for the duct and piping systems, and the instrumentation and control devices for the systems.

10.4.2.2 Plans showing layout and details of the final version of all HVAC systems. The location, arrangement, capacity, and space requirements of all equipment shall be indicated. Selected zones of air distribution shall be sufficiently completed to indicate the solution of the design for the remainder of the system and the precautions taken to coordinate the design with the architectural, structural and electrical phases of construction. Equipment room and chilled water plant layouts shall be sufficiently complete to show piping and duct layouts and access for maintenance. Since equipment rooms represent the most congested areas for both equipment and piping, the following guidelines should be followed when drawings are being prepared.

a. Single line ducting layouts are not sufficient to adequately plan major installations and check interferences.

b. All piping shall be shown by single line layouts and symbols. However the designer shall assure that the space allotted for installation of the piping, including insulation, valves, fittings and accessories, is adequate.

c. All ductwork and fittings in equipment rooms and other congested areas, shall be drawn to scale by double line layouts.

d. All equipment shall be outlined to scale, and maintenance or removal space shall be indicated by dotted lines.

e. Removal, replacement, or moving space must be considered for the largest and heaviest equipment when a drawing is made.

f. In plans, sections, and details, these same rules should apply.

g. Vertical control for horizontal runs of piping, ductwork, etc. shall be clearly delineated on the drawings. The drawings, by sections, elevations, or notes, shall show vertical control of piping and ductwork. The design shall ensure sufficient vertical clear height has been provided. This includes site chilled water piping.

10.4.2.3 Equipment Schedules. The final form of all equipment schedules which will be included in the project shall be shown with Preliminary equipment data filled in.

10.4.2.4 Catalog Cuts. Catalog cuts shall be submitted for all major items of equipment. Catalog cuts shall be a part of the design analysis.

10.5 FINAL REVIEW SUBMITTAL REQUIREMENTS.

10.5.1 Design Analysis. The design analysis shall include all of the information required in the Preliminary submittal but in its final form, also any additional information required, and the information listed below when applicable.

a. All textbooks, handbooks, and other references used in the design analysis shall be cited, giving page and/or paragraph numbers from which data are obtained.

b. Heat transmission calculations shall be shown for all heat transmission coefficients not directly obtained from a standard reference book.

c. Cooling load and heat gain calculations shall, in general, conform to the procedure given in the latest issue of the ASHRAE Handbooks. All corrections and assumptions, such as time of day, outdoor daily temperature range, wall color, building orientation, latitude, etc., shall be stated. Where computerized calculations are submitted, a complete description of the method and formulas used, column headings and data output or results, and index to the computer printout shall be furnished.

d. The basis for determining the quantity of all ventilation air shall be indicated.

e. A psychometric chart, including a plot for all processes, shall be included in the analysis.

f. The determination of air distribution shall be made to include the total air cfm and the individual room cfm.

g. Water pump gpm, TDH, and horsepower calculations shall be shown for condenser and chilled water circuits. The friction losses in the water circuits and pipe sizing shall be tabulated.

h. The method of sizing cooling towers shall be shown.

i. The humidification or dehumidification requirements shall be stated.

j. Equipment sizing calculations to support the selection of all equipment shall be shown in the design analysis.

k. Major items of gas equipment shall be selected from manufacturers' catalogs and the model numbers shall be stated in the analysis. This information will not appear on the drawings.

l. Schematic diagrams shall be shown and a control sequence of operation for each typical system shall be described with all control points and settings defined.

m. The method for achieving air balance in systems for supply air, return air, outside air, exhaust air, and exfiltration shall be described.

n. The method for maintaining positive pressure relative to outside air to prevent the entrance of windblown dust shall be described.

o. Explanatory notes shall be included in the design analysis covering all rationale for design which would not be obvious to an engineer reviewing the analysis. Methods of air-conditioning and controls for air-conditioning systems shall generally be confined to those in common use in the industry. The A-E shall review the prepared plans and specifications and determine that they are in accordance with the Manual and all other criteria and instructions furnished by the CE. It will be the responsibility of the A-E to coordinate the HVAC systems with the other trades involved in the building design and to eliminate interference between HVAC equipment and other components of the building.

p. The design analysis shall show calculations for all items listed under paragraph: Equipment and Design Data Schedules. (10.7.5)

10.5.2 Drawings. Flow diagrams and plans containing all the necessary details to attract accurate and competitive bids and to afford a clear understanding throughout construction shall be included in the drawings. Plans shall be complete in all respects, showing location of all equipment, ductwork, piping, and accessories. Sections and details shall be provided as required to clearly show all aspects of the system design. The following specific items shall be included when applicable.

a. Schematic flow or riser diagrams of all systems. Information shall be as required on preliminary submittal, but in greater detail.

b. Equipment room layouts and appropriate sections and details.

c. Duct and pipe sizes.

d. Vertical control for horizontal runs of piping, ductwork, etc. shall be clearly delineated on the drawings. The drawings, by sections, elevations, or notes, shall show vertical control of piping and ductwork. The design shall ensure sufficient clear vertical height has been provided.

e. Registers, diffusers, grilles, dampers, turning vanes, transitions, flexible connections, valves, etc. shall be shown and identified.

f. Controls schematic diagrams and control sequences of operation for all systems.

g. Equipment to be furnished and/or installed by others.

h. Equipment schedules giving capacities, working temperatures and pressures, and other pertinent data necessary to give a clear and concise description of all equipment.

10.5.3 Catalog Cuts. Complete catalog cuts and data sheets shall be submitted for all major items of equipment. Catalog cuts shall be a part of the design analysis.

10.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the Final design review shall be incorporated in the documents before they are submitted as Ready to Advertise.

10.7 TECHNICAL REQUIREMENTS.

10.7.1 General Considerations.

10.7.1.1 Packaged Equipment. Standard manufactured packaged type equipment shall be used to the greatest extent possible to simplify specifying, purchasing, installation, spare parts procurement and maintenance of equipment.

10.7.1.2 Soil Surveys shall be conducted to determine the electrical resistivity and percolation characteristics of the soil and to acquire ground water information along the alignment of all proposed buried piping systems.

10.7.1.3 Seismic Design for the mechanical systems shall conform to the requirements of TM 5-809-10. Seismic zone determinations shall be in accordance with Chapter 8, STRUCTURAL.

10.7.1.4 Dust Control. In addition to providing air filtration, which is described hereinafter, conditioned spaces must be maintained at a positive pressure relative to the outside air in order to prevent windblown sand and dust from entering. Backdraft dampers or louvers should be used on all mechanical system openings to the exterior.

10.7.1.5 Noise Control. All noise control design work shall be in accordance with TM-805-4. The sound levels for various applications for both centrifugal and propeller type fans shall be as set forth in the ASHRAE Handbooks. Specialized areas such as conference rooms, theaters, etc. shall be evaluated to ensure that proper acoustic treatment has been provided. An acoustical analysis shall be included in design analysis to support acoustical design requirements.

10.7.1.6 Design Temperatures.

a. Indoor design temperatures shall be in accordance with UFC 3-410-01, and as described hereinafter.

(1) Equipment Rooms: Unoccupied mechanical and electrical equipment rooms shall be provided with mechanical ventilation or relief heating and/or cooling as required to limit the maximum room temperature to 32°C in summer and minimum temperature to 4.5°C in winter. Unoccupied equipment rooms for critical switchgear or controls may be provided with 100 percent backup air-conditioning if required by the user or viewed as mission critical.

(2) Stationary Work Stations shall be spot cooled with mechanical refrigeration if the facility is not centrally air conditioned and the space temperature is determined to exceed 32°C.

(3) Control rooms shall be air-conditioned for normal comfort conditions (25.5°C, 50% RH).

(4) Kitchens and Laundries: In geographical areas where mechanical ventilation would result in inside temperatures higher than 35°C., mechanical cooling shall be provided. Either spot cooling or cooling of the entire area to 32°C shall be used depending on the requirements of the

particular facility. Refer to paragraph: Spot Cooling. (10.7.2.11)

(5) Transformer Rooms: When transformers are located, as determined by electrical requirements, within an enclosed space, the room shall be air conditioned to limit the maximum room temperature to 32°C. Return air may not be ducted to the central air conditioning systems.

b. Weather design conditions shall be in accordance with UFC 3-400-02, ASHRAE Fundamentals Handbook or in accordance with data supplied by Middle East District (MED). Outdoor winter design temperatures shall normally be selected based upon the 97 1/2% dry bulb column temperature. Summer outside design temperatures shall normally be selected based upon the 2 1/2% dry bulb and the 5% wet bulb column temperatures. Critical systems shall be selected based upon the 1% column temperatures, as defined in UFC 3-410-01.

10.7.1.7 Smoke Detection. Smoke detection and emergency automatic controls shall be in accordance with NFPA 90A and NFPA 72.

10.7.1.8 Fire and Smoke Dampers. Dampers shall be provided for protection of openings in walls, partitions or floors in accordance with NFPA 90A.

10.7.1.9 Sand Screening: Where windblown sand is a problem, screening around exterior mounted equipment shall be provided as follows:

a. "Screen" must be louvered, semi-open block (decorative), or of a design to allow air circulation to the equipment.

b. Where solid walls are required, a minimum distance of 3 meters shall be maintained between wall and condenser coil intakes.

c. Movable access shall be provided in "screen" for condenser coil/radiator removal and other maintenance functions hindered by "screen".

10.7.1.10 System Segregation. Piping systems shall contain sufficient isolation valves to allow segregation of the system for maintenance, draining, and/or testing. Piping systems, which may be extended by another contractor or at some future date, shall be terminated with blind-flanged valved connections.

10.7.2 Ventilation.

10.7.2.1 Hazardous Areas. The exhaust system discharge point shall be such that the vapors cannot enter other areas through open windows or the fresh air system. The capacity of the exhaust system shall be sufficient to prevent flammable or toxic vapors from escaping into areas surrounding the hazardous areas. Direct recirculation shall not be permitted. Mechanical ventilation and exhaust systems for flammable and toxic gases shall follow the codes of practice of the National Fire Protection Association, TM 5-810-1, Industrial Ventilation Standards and the ASHRAE Handbooks.

10.7.2.2 Special Process Spaces. Special process areas require a greater degree of ventilation to remove dust, fumes, gases, or vapors harmful to personnel. Therefore, special consideration shall be given to these areas, and the ventilation system shall be designed, installed, and protected in accordance with ASHRAE Handbooks and "Industrial Ventilation Manual".

10.7.2.3 Special Buildings. Ventilation requirements for special buildings will be evaluated, and recommendations and calculations will be submitted for approval to the CE prior to commencement of design.

10.7.2.4 Air Distribution System. Air distribution systems for ventilation systems shall be as described in paragraph: Air Conditioning.

10.7.2.5 Kitchen Exhaust Hoods, Filters, and Accessories. The hoods shall be of an approved design for a particular application. They shall be a minimum of approximately 600 mm high in order to provide a reservoir to confine sudden puffs of smoke, fumes, or steam until they can be evacuated by the system The hood shall extend beyond the equipment surface by 150 mm for every 600 mm of height above the equipment. The minimum overhang for the hoods shall be approximately 300 mm. The transformation from hood face to duct shall be gradual to avoid turbulence and inefficiency of air flow. The hood shall be dimensioned to facilitate the use of standard size filters and to be readily accessible for cleaning.

a. Whenever outside air is required as make-up for the exhaust air quantity in the kitchen, the exhaust hood shall be of the air curtain type in which the hood supply air is fed to the work area by means of slots in the hood perimeter. If possible a packaged unit consisting of a hood, supply air fan with filters, and exhaust fan shall be used for this application. Supply air quantity shall be approximately 80 percent of the exhaust air quantity.

b. Make-up air filtration. For make-up air filtration requirements see paragraph: Air Filtration.

10.7.2.6 Fans. The fan bearings, belt, and pulleys shall be fully protected from the fumes. Fan wheel and shaft shall be constructed of non-sparking material where required. Laboratory exhaust fans shall be coated with an appropriate material to protect them from corrosive fumes, etc.. Because of the tendency of the filters to clog, the fan shall be capable of operating efficiently at static pressure in excess of those calculated. Non-overloading fans are preferred so that they may be operated effectively when filters are removed or contaminated. Discharges of grease hood ventilation systems shall be vertical.

10.7.2.7 Laboratory Fume Hoods. Hoods shall be of a manufacturer's standard design constructed of materials suitable for the contaminants involved. Discharges of fume hood ventilation systems shall be vertical above the building roof.

10.7.2.8 Battery Rooms and UPS Rooms. Each room where hydrogen is generated shall be exhaust ventilated to the exterior of the building in accordance with NFPA 70. Each room shall be air conditioned to not less than 26.5^{o}C.

10.7.2.9 Indoor Firing Ranges shall be ventilated in accordance with NIOSH 76-130.

10.7.2.10 Fuel Burning Appliance Combustion and Ventilation Air shall be in accordance with the recommendations of NFPA No. 54 for Gas or NFPA No. 31 for Oil.

10.7.2.11 Spot Cooling. When spot cooling systems are employed, they shall be of the mechanical refrigeration type designed in accordance with the latest ASHRAE Handbooks. Evaporative cooling may be used where practical and shall be approved by Middle East District (MED). Terminals shall be swivel type with adjustable air discharge patterns.

10.7.3 Air Conditioning.

10.7.3.1 Equipment.

a. Water chillers/condensers.

(1) Air cooled packaged chillers shall be utilized for decentralized, small tonnage, space cooling applications wherever possible because of their superior record of reliability and because they require considerably less maintenance than other water chilling systems. Only chillers rated for condenser entering air temperatures of 12.2^{o}C higher than the outdoor design dry bulb temperature shall be used and chillers shall be sized on the basis of this condenser entering air temperature. Remotely located air cooled condensers may be used when packaged chillers are not practical. Air-cooled condensers should not operate at less than 9.5^{o}C differential between refrigerant condensing temperature and entering air in order to avoid control problems at partial load. Factory mounted, air side type control shall be used to minimize the refrigerant charge and the risk of slugging the compressor or diluting the lubrication oil with liquid refrigerant. Compressors shall have time delays to start after the fan when condenser coils are placed to sunlit locations in order to avoid startup high pressure tripouts. Air-cooled condensers should be vertical or horizontal coil, propeller fan type. The fan motors shall be totally enclosed or as required to prevent the accumulation of sand in cooling passages, and shall be designed to operate at the local airstream temperature which may be higher than ambient if the motor is in the leaving airstream. Airtight, dustproof control cabinets shall be sunshaded and internally cooled without requiring the introduction of outside air. A compressed air hose or some other means of removing sand, lint, and other foreign materials which may have accumulated on the condenser should be provided.

(2) Water-cooled. When specifying a water-cooled condenser for chillers, a complete description of the cooling water treatment, automatic blowdown control, and cooling tower construction will be included. See paragraph: Water Treatment for water quality control limits. Water cooled condensers for small tonnage space cooling applications shall be close

connected, closed-shell, and straight cleanable fin tube type with water in the tubes and an extended surface on the shell side. Water tube velocities recommended to minimize fouling and erosion should be between .9 meters and 1.8 meters per second.

(3) Radiator cooled. In extreme conditions, where water is either unusable or totally unavailable, the use of radiator-cooled water chillers shall be considered. In such systems a standard water-cooled chiller with "high lift" capability would be used. The condenser water would be pumped via a closed circuit system through a large industrial type radiator.

(4) Due to environmental concerns regarding ozone depletion, all mechanical refrigeration equipment shall use refrigerants with an Ozone Deflection Potential less than or equal to 0.05. Note that R-407c, R-410, R-123 and R-134a all meet this requirement.

b. Cooling towers.

(1) General. When field-erected towers are required on projects for evaporative cooling purposes, the towers shall be of masonry shell construction utilizing ceramic tile fill. Cold water basins should be deep to enable maintenance personnel to move about under the fill to wash down accumulated dirt, sand, and debris. Cleanout sumps shall be provided for this purpose. When non-field erected towers (packaged or factory fabricated) are to be used, the materials of construction shall be those required by the project. Cooling towers shall be sized based on the 1 percent wet bulb temperature. The specifications shall require that all towers be tested by Cooling Tower Institute (CTI) procedures, but CTI certification shall not be required. The specifications shall also require that the manufacturer guarantee 100 percent thermal performance of the tower.

(2) Sand control. Means shall be provided to limit the amount of sand blown into the tower. The most straight forward means of accomplishing sand control is through the use of sand louvers or maze intake structures. The location and size of the intake structure can be adjusted to fit

architectural considerations so long as basic air flow patterns are unaltered and sufficient air flow area is provided.

(3) Side Stream Filtration. Means should be provided to maintain concentration of total dissolved solids in the circulating water to an acceptable level by use of side stream filtration and appropriate retention time in the cooling tower sump.

c. Air handling units (AHU's).

(1) Modular packaged units shall be used rather than "built-up" systems to the greatest extent possible. Compartmentalization of the air handling equipment shall be considered in order to limit the amount of space affected by failure of a unit. Stacking of fan rooms shall be utilized when possible in multistory buildings.

(2) Cooling coils. The recommended cooling coil face velocity is 152 meters per minute (mpm). Maximum allowable face velocity is 167.6 mpm. In general, wide fin spacing shall be used when possible, even if coil depth needs to be increased to maintain the required capacity. The maximum fin spacing shall be 8 fins per 25 mm. Cooling coils, greater than 5 ton refrigeration capacity, shall have copper tubes and copper fins for facilities located within 32 kilometers (km) of the Sea coast. For air-conditioners (single packaged units, split systems, etc.) the total capacity must be derated such that the minimum sensible coil capacity of the equipment will meet the sensible load requirements.

(3) Electric heating coils. In single zone or zoned reheat installations, the heating in ducts and AHU's shall be electric. When multi-zone installations are required, electric hot deck coils are not recommended because the varying air flows across the different parts of the coil will cause thermal overload tripout. In these instances, consideration shall be given to using additional single zone or zoned reheat units rather than a lesser number of multi-zone units. Where it is possible to use a manufacturer's standard electric heating coil modules in modular AHU's, their standard product shall be used. Where the heating requirement is

too small for the electric coil to be installed in the AHU, it shall be installed in the ductwork. The following requirements shall be met for electric coils.

A. The heater shall be completely prepackaged, including all conductors, safety controls, etc.

B. The only external controls required shall be the temperature sensor and controller (step switch or current valve).

C. Heating elements shall be finned tubular (enclosed element) type, for facilities within 32 km of the sea coast.

D. Generally, heaters shall be sized to fit the duct exactly. Where it is necessary to have duct transitions, they shall be in accordance with the requirements of SMACNA.

d. Pumps for chilled water and condenser water shall, in general, be end suction type for capacities up to 284 lpm and of the split case type for capacities over 284 lpm. Vertical turbine type pumps may be used for condenser water. Pumps such as vertical in-line pumps shall be allowed where their use will significantly simplify pump room piping. Primary pumping shall be accomplished by using several constant speed pumps in parallel. Motors shall be of sufficient size without operating in the service factor for the duty to be performed and will not exceed their full rated load when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. See paragraph: ELECTRIC MOTORS.

10.7.3.2 Piping, Valves and Fittings.

a. Refrigerant piping shall be designed in accordance with the ASHRAE Handbooks. Where an optional refrigeration piping system is allowed, design of piping for all options shall be provided. Hot gas discharge and suction lines shall be designed to ensure oil return. Oil separators shall be provided as required. Hot gas by-pass connections may be permitted to allow unit operation below minimum capacity control step.

b. Water distribution piping.

(1) System layout. Interior piping shall be self-balancing, to the greatest extent possible, by using reverse return systems. Reverse return systems shall be looped to minimize the amount of pipe required.

(2) Balancing. At every point where balancing is required, a flow sensor plus a balancing valve (or a combination unit) shall be specified and shown on the plans. The required length of straight pipe before and after the flow sensor shall be clearly shown on the plans. In buildings with multiple water coils, approximately eighteen (18) or more, automatic pressure-compensating constant flow control valves shall be employed and shown.

(3) System flow. Chilled water system designs shall use the variable flow concept to the minimum extent possible. Constant flow concept may be used for systems less than 350 kilowatt (kw) capacity.

(4) Piping systems. Pre-insulated piping systems shall be used to the greatest extent possible. All fittings shall be prefabricated and pre-insulated. All valves and field joints shall be field insulated with preformed insulation.

(5) CHW Piping. Adequate quantity of isolation valves, balancing valves and instrumentation shall be provided. All devices shall be located in accessible valve vaults, boxes or manholes. Structure shall be located to prevent flooding from ground water and may require venting. See paragraph: SITE UTILITIES. (10.7.4)

(6) Water velocity in medium and small diameter water piping generally shall not exceed 2.4 meters per second.

(7) An air separator and an expansion tank shall be installed in the main line of all systems.

(8) Isolation valves shall always be used for isolating equipment from the system for maintenance purposes. In addition isolation valves shall be provided to systematically flush and clean the system during construction or after repair of a leak.

(9) Sea Water Systems. Piping systems and its components used to convey or in contact with sea water shall be investigated for proper material selections. A-E shall investigate acceptable materials and submit recommendations to MED for review and approval. Approved materials shall be used as a basis for the specifications.

c. Pipe Routing: Except for building entrances, piping shall not be routed beneath the floor slab of slab-on-grade buildings. A request of waiver to this requirement must be submitted to MED for approval.

d. Identification of Piping. Piping systems in process systems, buildings, mechanical equipment rooms and utility tunnels will be identified in accordance with the applicable portion of the American National Standard Institute (ANSI) A13.1.

e. Corrosion Protection for Piping Materials at Building Service Entrances:

(1) Below Ground Cast Iron and Ductile Iron Pipe. All pipe joints, fittings, valves, etc., should be electrically bonded. This bonding is to provide electrical continuity to disconnect differential corrosion from electrically isolated piping elements; to provide the ability to test the buried pipe and to facilitate installation of sacrificial anodes if testing shows the necessity of cathodic protection. After installation and before insulating and backfilling, all pipe, fittings, valve bodies, etc., shall be coal-tar epoxy coated and checked with a holiday tester. Insulation and insulation protection shall be applied as required. Prior to backfill, the exposed piping shall be encased in polyethylene.

(2) Below Grade Steel Pipe. In addition to the above corrosion treatment, the steel pipe is also to be bonded to the grounding network inside the building.

10.7.3.3 Air Distribution System.

a. Ductwork.

(1) Low velocity ductwork shall be designed, to the greatest extent practicable, to be self-balancing, i.e., pressure drop from the main supply to each outlet should be as nearly equal as possible. Unless otherwise indicated, glass fiber duct material may not be used. All branch ducts in low velocity ductwork shall have an adjustable volume control device in combination with an extractor at the take-off connection.

(2) High velocity and medium velocity. Variable volume duct systems should be designed in accordance with the "Static Regain" method of calculation. Constant volume systems may be sized by the simpler methods outlined in the ASHRAE Handbooks. The Static Regain design shall be such that the static pressure gain is as nearly equal to the friction static pressure losses as is practical. Duct runs and run-outs to attenuators shall be sized so that the resulting static pressure available to the unit is only slightly larger than the static pressure loss through the attenuator and discharge grills or diffusers. Supply fans for these systems may be of the backward or forward inclined airfoil blade type depending upon the application. External static pressures shall not exceed 10 cm of water at the fan. Provide sound attenuators at the fan discharge to eliminate fan noise from the system. Provide attenuators downstream from manual dampers and controlled mixing boxes if required to attenuate air noise.

(3) Special process exhaust ducts shall be designed in accordance with the " Industrial Ventilation Manual" and ASHRAE Handbooks.

(4) Pressure Classification: The A/E shall note pressure classification of all ductwork on contract drawings in accordance with SMACNA, except for small duct systems.

b. Air terminals and accessories.

(1) Diffusers shall be selected and spaced such that the air motion shall not exceed more than 25.2 mpm at the occupied level and area covered by the diffuser. In general, supply outlets shall be selected with throw equal to three-fourths of the total distance required at a terminal velocity

of 30.5 mpm.

(2) Exhaust or return air outlets shall be provided to permit the free flow of air from the conditioned area. Power exhaust or return air fans shall be used whenever necessitated by system design. The exhaust shall be drawn from hot or contaminated locations (kitchens, battery storage areas, toilets, etc.) whenever feasible. If the quality and temperature are acceptable, ventilated air may be used for condensers or engine radiator cooling.

(3) Supply and exhaust air quantities shall be balanced to maintain a slight positive pressure in the building. Wherever convenient, corridors and stairwells shall be pressurized in order to minimize the entry of smoke due to fire. Where variable air volume (VAV) systems are used or where pressure is critical, volumetric type pressure controls shall be used to set and control the pressure.

(4) Volume control dampers (where the size and shape of the duct permits) shall be of the multi-louver opposed blade type and shall be the standard product of a recognized air distribution equipment manufacturer.

(5) Sound attenuators and/or acoustical duct lining shall be provided as required to maintain room noise criteria (NC) as recommended in the ASHRAE Handbooks.

(6) Turning vanes shall be double blade and the standard product of a recognized air distribution equipment manufacturer.

(7) Control dampers shall not be sized according to the duct size. They shall be sized to provide the pressure drop which will result in the most linear performance curve. Damper sizing, including a copy of the manufacturer's sizing tables, shall be included in the design analysis.

10.7.3.4 Air Filtration.

a. Design Considerations.

(1) Degree of collection required. Clean country air contains less than 2.0 x 10^{-7} kg of largely harmless organic dust per cubic meter of air. Such air requires no filtration system beyond an insect screen. The permissible concentration of dust in the discharge air of the HVAC supply air should not exceed 0.187 x 10^{-7} pcf, 0.3 mg/m^3. The outside air quality and intake location determines the type of air filtration system required.

(2) Outside air intakes should be located as high as practical (preferably over 8 meters) but within reasonable architectural constraints. Where outside air intakes must be located below 3 meters, a consideration will be given to providing inertial separators as a first stage filter. In special use building areas or facilities, activated carbon filters or other types of special filters shall be employed for removal of odor, tobacco smoke, and bacteria during the 100% recirculation operation of the HVAC system.

(3) Economizer cycles are not recommended for use in the Middle East because of high air filter maintenance requirements and limited benefits of reducing refrigeration equipment operation. Use of economizer cycles may be granted by MED if feasible and requested by the A/E.

b. Filtration Equipment: Air intake systems shall be designed with air filtration equipment as follows unless specific design conditions warrant that a waiver be requested of MED. If such a waiver cannot be obtained from MED, air filtration systems for all projects shall consist of three stages as described below.

(1) First Stage Filtration: At locations where sandstorm and dust storm frequency is low and there is no need for an efficient pre-cleaner, weather louvers without inertial separators will be used for outside air intakes and shall serve as a first stage of filtration. Where sandstorm and dust storm frequency is high, weather louvers with inertial separators are required as the first stage filter for outside air. Therefore, weather louvers and inertial separators are required in areas of high sandstorm and dust-storm frequency and are also required for all locations if the outside air intakes are at elevations below 4.5 meters. The requirement of inertial separators may be waived in cases where the outside air requirements are extremely

small and inertial separators are not available.

(2) Second Stage Filtration: Medium efficiency type filters shall be the second stage of filtration for HVAC systems. Disposable media roll or traveling screen wetted filters are the recommended method of cleaning outside air for the second stage of filtration.

(3) Third Stage Filtration: High efficiency filters (80 - 85% dust spot efficiency with atmospheric dust in accordance with ASHRAE Standard 52) shall serve as the third stage of filtration in HVAC systems. The third stage of filtration is typically located within the HVAC distribution system so as to filter both the recirculating and outside air quantities. For high efficiency, third stage air filters, an agglomerator-roll filter, a throwaway cartridge, or a deep cell type filter should be utilized.

(4) Where inertial separators are used in the design, two basic filter layouts shall be used depending upon the quantity of outside air required.

A. Building or system outside air quantities less than 4250 cmh. The pre-cleaner(s) shall be located in the outside air duct; medium and high efficiency final filters shall be located in the air handling unit. The pre-cleaner(s) will handle only outside air and the second and third stages will handle the total air flow. Since pre-cleaners usually have pressure drops of 13 mm or greater and normal mixed air plenums usually have only about one tenth of 25 mm of suction, great care must be taken to assure that the required amount of fresh air will actually be drawn through the pre-cleaner.

B. Building or system outside air quantities greater than 4250 cmh. The pre-cleaner(s) and the medium efficiency filter shall be in a separate makeup air handling unit which handles outside air only. Pre-filtered outside air is then ducted to air handling unit(s) requiring outside air. The high efficiency final filter shall be in the main air handling unit handling the total air flow. Medium efficiency filters are not required upstream of the third stage filters in the air handling unit in this case.

c. Panel filters for HVAC systems shall be of the throw-away or disposable type. Panel filters may be used as second stage filters.

10.7.3.5 Cleaning, Flushing, Testing and Water Treatment. The chilled water system shall be designed to facilitate system flushing, testing, and balancing. Provisions must be made to add corrosion and scale inhibitors in closed loop chilled water systems. The water that would be used for system flush, test, final fill, and make up shall be of quality no less then that required by International Standard for drinking water. See table below:

INTERNATIONAL STANDARD FOR DRINKING WATER

(I) Constituent	International Standard Limit	
Calcium (Ca+)	75-200	mg/1
Magnesium (Mg++)	30-150(2)	mg/1
Sodium (Na+) & Potassium (K+) (expressed as Na+)	--	--
Biacarbonate (HCO3)	--	--
Arsenic (As)	0.05	mg/1
Carbonate (CO3)	--	--
Cadmium (Cd)	0.01	mg/1
Hydroxide (OH-)	--	--
Cyanide (CN)	0.05	mg/1
Sulfate (SO4=)	200-400	mg/1
Lead (Pb)	0.1	mg/1

Chlorides (C1)	200-600	mg/1
Mercury (Mg)	0.001	mg/1
Nitrate (NO3-)	--	--
Selenium (Se)	0.01	mg/1
Iron (Fe) total	0.1-1.0	mg/1
Manganese (Mn++)	0.05-0.50	mg/1
Anionic Detergents	0.2-1.0	mg/1
Silica (SiO2)	--	--
Mineral Oil	0.01-0.30	mg/1
Fluoride (F)	0.6-0.8(3)	mg/1
Phenolic Compounds	0.001-0.002	mg/1
Total Dissolved Solids	500-1500(4)	mg/1
Copper (Cu)	0.05-1.5	mg/1
Total Hardness	100-500(3)(5)	as CaCO3
Zinc (Zn)	5-15	mg/1
Hydrogen Sulfide (H2S)	--	--
Carbon Dioxide (CO2)	--	--
Dissolved Oxygen	--	--
pH	7.0-8.5(3)	--
Turbidity	5.0-25.0	JTU
Color	Clear, (6)	--

Notes:

(I) Constituent International Standard Limit

(1) Lower figure is desirable maximum, higher figure is maximum permissible.

(2) If there are at least 250 mg/l of sulfates, the maximum limit of magnesium is 30 mg/l, otherwise the limit is 125 mg/l.

(3) Lower figure is recommended minimum, higher is recommended maximum.

(4) Calculated by summation of ions plus uncharged substances.

(5) Calculated from Ca^{++} and Mg^{++} concentrations.

(6) After 8 to 10 hours water exhibits yellowish color due to iron oxidation.

(7) All values are as ion unless otherwise noted.

10.7.3.6 Control Systems.

a. HVAC controls based on standard control strategies and standard system control panels using single loop digital controllers or DDC controls shall be provided for all projects as is appropriate for the project location. Technical Manual (TM 5-815-3) providing criteria for HVAC single loop digital control systems shall be used for guidance.

b. A complete sequence of operation shall be included on the drawings along with a schematic control diagram for each typical system. The sequence of operation and schematic control diagrams shall specifically cover the following items and others as the project requires.

(1) Refrigeration compressor control.

(2) Refrigeration system protective devices.

(3) Chilled water and DX system controls.

(4) Water coil or evaporator coil control;

temperature and/or humidity as required.

(5) Air-cooled condenser control.

(6) Air handling unit control with protective

devices.

(7) Individual unit control.

(8) Motor interlocks for each system component

along with starting and stopping instructions.

(9) All thermostat, humidistat, and protective

device control settings.

(10) Chilled water pump and flow controls for

each building.

c. Central plant control will generally be manual through a hard wired control panel. Chillers, pumps, and other equipment in general will be started and stopped manually.

d. Air cooled chillers shall be specified to include a high ambient temperature control of some type. This control shall be inoperative up to 50°C. When the ambient air temperature rises above 50°C, this control will activate to sense head pressure and unload the compressors if required to maintain head pressures below the settings of the high pressure cut-out control. This control shall be furnished by the chiller manufacturer and shall be built into the chiller control panel.

e. Condenser water temperature. In general, the temperature of the cooling tower water entering the condenser shall not be controlled, i.e., the temperature shall not be maintained at the design figure but shall be allowed to drop as the system load and the ambient wet bulb temperatures drop. Cooling tower fans shall be cycled from the temperature of the water in the cooling tower sump. The minimum allowable condenser entering water temperature shall be determined by the chiller manufacturer. When the minimum temperature is approached, a control valve shall be used to bypass some condenser leaving water back to the condenser pump inlet to maintain the condenser inlet water temperature safely above the minimum allowable.

f. Variable air volume systems generally use inlet vane control. However, if the system selected is by a manufacturer who uses "run around" rather than inlet vane control, it is acceptable provided that the entire air distribution system is specified to be procured from this manufacturer.

10.7.3.7 Electric Motors. All motors exposed to 40.5°C temperature or greater shall be of the totally enclosed fan cooled (TEFC) type continuous duty classifications based upon 50°C ambient temperature of reference. Cooling tower applications, where vertical turbine pumps are used, electrical motor enclosures shall be equipped with strip heaters in order to avoid condensation due to dirernal temperature difference.

10.7.4 <u>Site Utilities</u>.

10.7.4.1 Thermal Expansion must be considered and accounted for in straight runs of piping. Allowable stress ranges are given in ANSI B31.1.

10.7.4.2 Anchors. Anchors shall be required where there is a change in direction, diameter, or wall thickness of a pipeline that may cause undesired movement, loads, or stress and whenever buckling of the pipe may occur. For buried piping, no credit may be taken for resisting friction between the pipe and the soil since the full development of this force does not occur when line movement is prevented. Anchors may be concrete or piling type.

10.7.4.3 The Minimum Depth of buried piping shall be 622 mm. Roads and changes in slope shall be considered where applicable.

10.7.4.4 Routing of pipes shall be in groups wherever possible.

10.7.5 <u>Equipment and Design Data Schedules</u>. The following equipment and general design parameters and information shall be provided on the mechanical equipment schedule drawings. Each schedule shall neatly provide sufficient space to include all applicable information required. The applicable mechanical equipment schedules shall be submitted, as hereinbefore described, on the preliminary and final submittal drawings.

AIR-CONDITIONING DESIGN SCHEDULE

Outside Design Conditions (Summer): ______oC d.b. and ___oC w.b.

Outside Design Conditions (Winter): _____oC d.b.

Inside Design Conditions (Summer): _____oC d.b. and _____%r.h.

Inside Design Conditions (Winter): _____oC d.b. and _____%r.h.

Abbreviations:

d.b.	dry bulb
w.b.	wet bulb
kw	Kilowatt
^{o}C	Degrees Centigrade
cm	Centimeters
cmh	Cubic meters per hour
cfm	Cubic feet per minute
m	meters
w.g.	water gauge
mpm	meters per minute
gpm	gallons per minute
lpm	liters per minute
r.h.	relative humidity

AIR HANDLING UNIT SCHEDULE

Equipment No:

Location:

Building. _________

Room. ___________

Unit Type: (Single Zone, Multi-Zone, Dual Duct, Draw Through, Blow Through, etc.)

Fan Data:

Air Volume - Outside cmh.

Air Volume - Total cmh.

Static Pressure - External cm W.G.

Static Pressure - Total, approximate cm W.G.

Fan Outlet Velocity, mpm (maximum)

Fan Speed, rpm

Fan Brake Horsepower; Bhp-approximate

Fan Motor Data; Horsepower, rpm maximum, volts, phase, hertz

Cooling Coil Data:

Heating Coil Data:

Filter Data:

Vibration Isolation:

Deflection; minimum, centimeters

Type of Base; (spring, etc.)

Remarks:

(examples of data required are shown hereinafter)

COOLING COIL SCHEDULE

Cooling Coil (chilled water):

Air Quantity, cmh.

Face Velocity (max.) mpm.

Capacity - Sensible, kw.

- Total, kw.

Air Temperatures -

Entering: dry bulb oC.

wet bulb oC.

Leaving: dry bulb oC.

wet bulb oC.

Chilled Water -

Flow, lpm.

Entering Tempt., oC.

Leaving Tempt., oC.

Water Pressure Drop, meter.

Air Pressure Drop, cm W.G.

Cooling Coil (direct expansion):

Air Quantity, cmh.

Face Velocity (max.), mpm.

Capacity - Sensible, kw.

- Total, kw.

Air Temperatures:

Entering:` Dry bulb oC.

wet bulb oC.

Leaving: dry bulb oC.

wet bulb oC.

Evaporating Temperature design oC.

Air Pressure Drop, cm W.G.

(this information may be combined within AHU schedule when drawing space permits).

HEATING COIL SCHEDULE

Heating Coil (Electric):

Air Quality, cmh.

Capacity; kw.

Air Temperatures,

Entering: ^{o}C.

Leaving: ^{o}C.

Number of Stages,

Capacity Per Stage, kw

Electrical Characteristics; volts, phase, hertz

Air Pressure Drop

(this information may be combined within AHU schedule when drawing space permits).

INERTIAL SEPARATOR SCHEDULE

Unit Reference No.:

System: (identify HVAC System unit is associated)

Number of Units:

Air Volume:

Total, cmh (Into inertial separator. Equals primary + 10% $\pm$ secondary air)

Primary Air Flow, cmh (Supply air to system, leaving separator).

Secondary Air Flow, cmh (10% $\pm$ of Total Air)

Air Pressure Drop: cm W.G.

Remarks: Include air pressure drops thru separator for both primary air flow and secondary air flow.

FAN SCHEDULE

Equipment No.:

Location:

Building ______________________

Room ______________________

Unit Type: (centrifugal, propeller, axial, etc.)

Fan Data:

Air Volume - cmh.

Static Pressure - total, cm W.G.

Outlet Velocity (max.) - mpm.

Fan Speed, rpm

Fan Brake Horsepower, Bhp, approximate

Fan Wheel; diameter, cm type (BI, AF, FC, Radial, etc)

Fan Motor Data; horsepower, rpm max., volts, phase, hertz.

Vibration Isolation:

Deflection, minimum: cm.

Type of Base: (spring, neoprene, etc).

A Hood Value of _____ cm W.G. is included as part of fan static pressure.

REMARKS:

EXHAUST HOOD SCHEDULE

(Kitchen, Fume, Machine, etc)

Unit Reference No:

Location:

Building: ____________________

Room: ____________________

Fan: ____________________

Filters: See info - "Filter Schedule" and include (as applicable)

Air Volume: cmh

Hood Static Pressure Loss: cm W.G.

(a) Exhaust Side

(b) Supply Side

PUMP SCHEDULE

Equipment No.:

Location:

Building ____________________

Room ____________________

Service: (chilled water, hot water, etc.)

(Operating, standby, etc.)

Unit Type: (Centrifugal, etc.)

Pump Data:

Flow Rate, lpm.

Head, meters.

Efficiency Pump Motor Data; horsepower, rpm, volts, phase, hertz

Remarks:

WATER CHILLER SCHEDULE

Equipment No.:

Location:

Building ________________

Room ________________

Operating Function: (operating or standby)

Unit Type: (air cooled centrifugal, etc.)

Tonnage, Nominal:

Input, KW:

Chiller Cooler (evaporator) Data:

Flow Rate, lpm.

Water Temperatures, entering _____ oC, leaving _____ oC.

Number of Passes.

Pressure Drop, meters.

Fouling Factor.

Chiller Condenser Data (Air Cooled):

Number of condenser fans.

Air Temperatures, entering _____ oC, leaving _____ oC.

Fan Drive, (direct, belt).

Fan Motor Data, horsepower, rpm, volts, phase, hertz.

Chilled Condenser Data (Water Cooled).

Water flow rate.

Water temperature

entering _____ oC, leaving _____ oC.

Pressure drop, meters.

Fouling factor.

Remarks:

VARIABLE (CONSTANT) VOLUME (REHEAT) BOX SCHEDULE

Unit No.:

System: (identify HVAC system unit is associated).

Air Flow Range: minimum-maximum, cmh.

Nominal Size: length, width, height; cm.

Duct Size: outlet and inlet; cm.

Acoustical Rating: Noise criteria, maximum.

Remarks:

ACOUSTICAL SOUND TRAP SCHEDULE

Equipment No.

Location:

Building.

Room.

System: (identify HVAC system unit is associated).

Air Flow: cmh.

Size: approximate; length, width, height, cm.

Air Pressure Minimum Dynamic Insertion Loss Ratings Self-Noise

Power Levels Drop: cm W.G. max.

Remarks:

FILTER SCHEDULE

Unit Reference No.:

System: (identify HVAC System unit is associated).

Filter Type: (throw-away, oil bath, high efficiency, etc).

Air Volume: cmh.

Filter Face Velocity (maximum), mpm.

Air Pressure Drop (maximum initial): cm W.G.

Remarks:

(this information may be combined with AHU schedule when drawing space permits).

FLOW CONTROL VALVE SCHEDULE

Unit No.:

System: (identify HVAC system or equipment unit is associated).

Flow Rate: lpm.

Line Size: cm.

Valve Size: cm.

Pressure Drop: (control range) psi

Shut off head:

Remarks:

TEMPERATURE CONTROL VALVE SCHEDULE

Unit No.:

System Served: (identify equipment that valve serves).

Valve Size cm.

Valve Type - (Two way, Modulating etc).

Design Flow: lpm.

Pressure Drop: m. WG.

Normal Valve Position: (NC-NO etc).

Shut-Off Head: m. WG.

COOLING TOWER SCHEDULE

Equipment No.:

Location:

Building. ________________

Service: (cooling water, condenser water, chiller no. 1, etc.).

Total Capacity: tons of refrigeration.

Total Heat Load: Btu/hr per tower.

Water Flow Rate: lpm.

Water Temperatures: entering, _____ ^{o}C.

leaving, _____ ^{o}C.

Water Pressure Drop: meters.

Ambient Air Temperature: dry bulb, _____ ^{o}C.

wet bulb, _____ ^{o}C.

Motor Data: horsepower, rpm, volts, hertz:

CHAPTER 11
PLUMBING

CHAPTER 11

PLUMBING

11.1 GENERAL.

11.1.1 Scope. The term "plumbing installation" as used herein includes water service pipe; building drain, waste, and vents; roof and storm drains; domestic hot and cold water systems; hospital gases; and vacuum and compressed air systems, including all pipe, fixtures, vents and branches. A system includes all connections in the building to a point 1.5 meters outside the building.

11.1.2 Document Requirements. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including drawings and design analysis, shall be in accordance with Chapter 2: PRESENTATION OF DATA.

11.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below form a part of this Manual:

COE Publication:

Architectural and Engineering Design Criteria Instructions (AEI)

Department of the Army Technical Manuals:

TM 5-842-2	Laundries and Dry Cleaning Plants

Department of the Navy (NAVFAC):

DM-3.5	Design Manual for Compressed Air and Vacuum Systems

Department of Defense (DOD)

UFC 3-230-03,	Water Treatment
UFC 3-310-04,	Seismic Design for Buildings
UFC 3-420-02FA,	Compressed Air
UFC 3-420-01,	Plumbing Systems
UFC 3-450-01,	Noise and Vibration Control
UFC 3-460-01,	Design: Petroleum Fuel Facilities
UFC 4-510-01,	Design: Military Medical Facilities

<u>International Cooling Council (ICC)</u>:

International Plumbing Code

<u>American National Standards Institute, (ANSI) Standard</u>:

A 13.1	Scheme for the Identification of Piping Systems

<u>National Fire Protection Association (NFPA) Standards</u>:

No. 54	National Fuel Gas Code

11.3 CONCEPT SUBMITTAL REQUIREMENTS.

11.3.1 <u>General Considerations</u>.

a. At the Concept design stage of project development it is recognized that all calculations are tentative for analysis purposes and only indicate approximate capacities of equipment. Any dimensions and sizes required are order-of-magnitude figures, conservatively stated, to assure adequate space for installation and maintenance of equipment and utility elements such as piping, pumps, etc.

b. Equipment shown in plans and sections is not shown in great detail but is merely presented as simple geometric forms with approximately correct dimensions.

c. Piping layouts shown are simple main pipe runs showing general location, routing and, when applicable, approximate order-of-magnitude sizes.

d. Drawings and sketches. Scale of concept drawings will generally be smaller than the working drawings. Plans and sections need be only large enough to properly show pertinent information. Sketches, neatly drawn, will be acceptable when sufficient to show pertinent information or convey basic system concepts. Quantity of concept drawings are to be kept to the minimum number required to convey basic systems information. Some mechanical information required in the Concept submission may logically be included on other discipline drawings or in sketch form in the design analyses and need not be duplicated on formal drawings.

e. When the plumbing design involves systems or components which are of an ordinary nature, e.g., simple residential, administrative, etc. the concept submittal can be simplified when approved by the Middle East District (MED)

11.3.2 <u>Concept Design Analysis</u>. The following specific items shall be included, as applicable.

a. A list of criteria furnished by MED, codes, documents, and design conditions used; references to any authorized waiver of criteria and codes.

b. Tentative calculations and sizing of domestic hot and cold water, sanitary, roof drainage, compressed air, vacuum, fuel gas, water treatment, and special gas systems.

c. Description, approximate capacity, and location of all miscellaneous equipment such as air compressors, vacuum pumps, water treatment softeners, water heaters, fuel gas storage tanks, etc., to be installed in the project.

d. Hot water and fuel gas demand analysis, including hourly heating capacity, hourly requirements, and storage capacity.

11.3.3 Concept Design Drawings. The plans shall be sufficiently complete to show locations and the general arrangement of plumbing fixtures and major plumbing system equipment.

11.4 PRELIMINARY REVIEW SUBMITTAL REQUIREMENTS.

11.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any necessary revisions. In addition, the following specific items shall be included when applicable.

a. Detailed calculations for sizing equipment, piping, water treatment systems, etc. for each plumbing system involved in the design.

b. Data showing the capacity of hot and domestic potable water circulating or booster pumps (where required).

c. Any other information or computations required to permit verification that the design complies with the design criteria, codes, and standards and is satisfactory for the intended purpose.

d. Catalog Cuts. As a minimum catalog cuts for all major items of equipment shall be submitted. Catalog cuts shall be a part of the design analysis.

11.4.2 Preliminary Design Drawings. The plans shall include, but not be limited to the following:

a. Enlarged partial plans and riser diagrams of typical toilet rooms including hot water, cold water, waste, and vent piping.

b. Locations and arrangement of all plumbing fixtures and equipment.

c. Layout of domestic water, sewer, roof drainage, and all other piping systems used in the building, including sections and details, especially of congested areas, etc.

d. Flow diagrams of compressed air systems including all equipment such as air compressors, accessories, pipe, tubing, and control valve actuators or any other equipment to which air is supplied.

e. Since equipment rooms represent the most congested areas for both equipment and piping. The drawings shall represent by enlarged partial plans, sections, and details that sufficient removal, maintenance, replacement, and installation space has been provided.

f. Vertical control for horizontal runs of piping, etc. shall be clearly delineated on the drawings. The drawings, by sections, elevations, or notes, shall show vertical control of piping. The design shall ensure sufficient vertical clear height has been provided.

11.4.3 Equipment Schedules. The final form of all equipment schedules which will be included in the project shall be shown with Preliminary equipment data filled in (capacity, size, flowrates, pressures, etc.).

11.5 FINAL REVIEW SUBMITTAL REQUIREMENTS.

11.5.1 Final Design Analysis. The design analysis shall include all of the information required in the Preliminary submittal but in its final form, any additional information required, and also the information listed below when applicable.

a. All textbooks, handbooks, and other references used in the design analysis shall be cited, giving page and paragraph numbers from which data is obtained.

b. The basis of sizing water treatment system shall be presented.

c. Pump lpm, TDH, and horsepower calculations shall be shown for potable drinking water, and hot water recirculating pumps. The friction losses in the water circuits and pipe sizing shall be tabulated for proper review.

d. The method of sizing hot water heaters, etc. shall be shown.

e. Equipment sizing calculations to support the selection of all equipment shall be shown in the design analysis.

f. Explanatory notes shall be included in the design analysis covering all rationale for design which would not be obvious to an engineer reviewing the analysis. The A-E shall review the prepared plans and specifications and determine that they are in accordance with this manual and all other criteria and instructions furnished by MED. It will be the responsibility of the designer to coordinate the plumbing systems with the other trades involved in the building design and to eliminate interference between plumbing equipment and other components of the building.

11.5.2 Final Design Drawings. Flow diagrams, riser diagrams, and plans containing all the necessary details to attract accurate and competitive bids and to afford a clear understanding throughout construction shall be included in the drawings. Plans shall be complete in all respects, showing location of all equipment, piping, and accessories. Sections and details shall be provided as required to clearly show all aspects of the system design. The following specific items shall be included when applicable:

a. Schematic flow and/or riser diagrams of all systems.

b. Equipment room layouts and appropriate sections and details.

c. Pipe sizes.

d. Vertical control for horizontal runs of piping, etc. shall be clearly delineated on the drawings. The drawings, sections, elevations, or notes, shall show vertical control of piping and ductwork. The design shall ensure sufficient clear vertical height has been provided.

e. Equipment to be furnished and installed by others.

f. Equipment schedules giving capacities, working temperatures and pressures, and other pertinent data necessary to give a clear and concise description of all equipment.

11.5.3 Catalog Cuts. Complete catalog cuts and data sheets shall be submitted for all major items of equipment. Catalog cuts shall be a part of the design analysis.

11.6 READY TO ADVERTISE (RTA).

The comments generated during the Final design review shall be incorporated in the documents before they are submitted as RTA.

11.7 TECHNICAL REQUIREMENTS.

11.7.1 Packaged Equipment. Packaged equipment shall be used to the greatest extent possible to simplify specifying, purchasing, installation, and maintenance of equipment.

11.7.2 Existing Services. The location, elevation, etc., of all existing sewers, water mains, and other necessary services will be verified to ascertain that such services are adequate and that connection thereto is permissible. If the water supply pressure obtained from the water main is inadequate, a house tank or hydropneumatic system shall be provided. In the event that sanitary sewer or water services are not available or connections thereto are prohibited, an individual sewage disposal or water system shall be installed to adequately serve the building. Water flow tests on public hydrants shall be made to ascertain the adequacy of the fire protection water supply based on the water supply requirements in Chapter 18: WATER, WASTEWATER, AND SOLID WASTE SYSTEMS.

11.7.3 Soil Surveys, to determine the electrical resistivity and percolation characteristics of the soil and ground water information along the alinements of all proposed buried piping systems, shall be conducted. These surveys shall be conducted by MED when requested by the Architect Engineer (A-E).

11.7.4 Sanitary and Roof Drainage Systems.

11.7.4.1 Storm and Sanitary Sewers. Requirements for storm drainage outside buildings are included in Chapter 6: SITE PLANNING AND LAYOUT. Roof and area drains shall be piped to storm drains wherever available. In no case shall drainage be directed to adjacent property without approval of MED. Interior downspouts from roof drains shall be entirely separated from the sanitary system inside of the building, even though they may connect to a combined city sewer.

11.7.4.2 Lift Stations and Backwater Valves. Special consideration should be given to insure against the possibility of sewage and water backup. See UFC 3-420-01 for guidance.

11.7.4.3 Roof Drains. Design of roof drains shall be on the basis of one-hour rainfall and 25-year records (if available). It shall also be in accordance with the recommendations of the National Standard Plumbing Code. The extent of any water retention on the roof shall be coordinated with the structural engineer.

11.7.4.4 Compactor Area Drains. An area drain shall be provided in trash compactor areas.

11.7.4.5 Floor Drains. Floor drains shall be provided in all boiler and mechanical equipment rooms and adjacent to each emergency deluge shower in addition to all areas listed as requiring floor drains in UFC 3-420-01. Provide at least one floor drain with trap in each room with a water source, e.g., in kitchens, toilets, and tea rooms. Where fire pumps are installed having conventional packing glands, floor drains with dedicated gland leak-off piping shall also be provided.

11.7.4.6 Grease Interceptors shall be installed outside of buildings in accordance with UFC 3-420-01.

11.7.4.7 Garbage Can Washing Facilities, including hot water booster heater shall be provided on the kitchen loading platform or in other suitable space adjacent to the kitchen service doors.

11.7.5 Water Supply System. For guidance additional to the paragraphs below, refer to Chapter 18: WATER, WASTEWATER, AND SOLID WASTE SYSTEMS.

11.7.5.1 Water Treatment. The A-E shall provide recommendations as to the chemical treatment system required for the following special facilities. The systems recommended shall be based upon an evaluation of the existing site water quality analysis.

a. Laundry softening is required where the water supply has a total hardness of 86 ppm or more, in accordance with UFC 3-230-03.

b. Dishwashing for Mess Halls. Softening is required where the water supply has a total hardness of 86 ppm or more, in accordance with UFC 3-230-03.

c. Hospitals. Softening is required where the water supply has a total hardness of 10 grains per gallon (171 ppm) or more, in accordance with UFC 4-510-01.

d. Aircraft/Vehicle Wash Facilities.

e. Humidifiers.

11.7.5.2 Water Usage. In all locations, the minimum acceptable level of water usage shall be maintained. Consideration should be given to methods that will preserve fresh water supplies, and minimum water treatment.

11.7.5.3 Dual Distribution Network. Where dual site water distribution networks exist and are approved for use within buildings, i.e., one raw or hard water main and one treated or soft water main, two separate cold water piping systems shall be installed as follows.

a. All facilities. Hard water shall be supplied to water closets and urinals.

b. Public facilities. Hard potable water shall be supplied to sinks and lavatories; soft water shall be supplied to drinking fountains and hot water heaters.

c. Living quarters (private or hotels). Soft water shall be supplied to both cold water faucets and hot water heaters.

11.7.5.4 Metering. In general, provide separate metering for each building on site, including single family housing units, except for small structures such as guard houses, sheds, etc.

11.7.5.5 Backflow Prevention. The water distribution system shall be protected against the flow of water or other liquids into the distributing pipes from any source or sources other than their intended flow. Backflow preventers shall be provided on all water mains supplying a facility at the water service entrance. Refer to the International Plumbing Code for requirements on all systems.

11.7.5.6 Pressure Reducing Valves. Where excessive water pressures (above 448 KPa) are encountered, pressure reducing valves shall be installed to protect plumbing units or equipment which are inadequate to withstand such pressures. The valves shall be installed either on the building service line or on individual lines to the various units, whichever is more economically feasible.

11.7.5.7 Potable Water Outlets.

a. Water coolers (Drinking Water Dispensers) in work areas should be located out of the way of possible traffic aisles whenever possible. However, if located in the flow of traffic, they shall be provided with safety guard rails to protect user and fountain where shop type vehicles are used. Provide cold drinking water stations in the following locations:

(1) Near toilet rooms.

(2) In lunchrooms.

(3) In accordance with UFC 3-420-01.

b. Water shall be chilled by standard packaged, self-contained water coolers (electric water coolers) with hot water heating capability as authorized. See UFC 3-420-01 for drinking water consumption requirements.

c. Vending machine areas. Valved and capped potable cold water outlets shall be provided for vending machines at convenient locations in vending areas. Hot water for hot drinks may be incorporated with water coolers as authorized by MED.

11.7.5.8 Domestic Hot Water.

a. Shower system capacity. (See UFC 3-420-01.) In the design of any buildings in which water closets and showers are installed, the designer shall exercise the necessary precautions to prevent personnel from being scalded while taking showers due to simultaneous operations of water closets equipped with flush valves. The final temperature for hot water supplied for showers shall not exceed 43°C. It is suggested that consideration be given to the correction of this condition by the methods listed hereinafter:

(1) Water supply line design. The water supply lines shall be designed to provide an adequate flow of water without excessive pressure drops.

(2) Separate water lines. Separate water supply lines shall be provided for the showers, so that a sudden demand on the water supply such as would be caused by the simultaneous flushing of flush valve equipped closets, will not affect the flow to the showers.

(3) Valves for showers. The showers shall be equipped with pressure-balancing mixing valves.

(4) "Mixed Water Temperature Control", in accordance with National Standard Plumbing Code.

b. Water heaters.

(1) Wherever commercial or industrial size domestic hot water heaters (as opposed to residential size) are supplied from a hard water line, a water softener shall be installed in the cold water line to the heater. All water softeners in individual buildings shall be of the automatic duplex

type, so that there is no interruption of the soft water supply during backwash.

(2) The energy source for water heaters shall be electric. Other sources may be as indicated in UFC 3-420-01 and as determined by availability and economic considerations. Electric water heaters serving individual toilet rooms may be economically justified when toilet rooms are spaced far apart requiring long runs of piping or where venting is a problem. Where more than a 2,000-watt capacity is required, dual heater elements shall be specified to reduce instantaneous power demands.

(3) Check valves will not be placed on cold water inlet of water heaters.

c. Selection of piping materials and storage tanks. The selection of pipe, valves, fittings, materials and tanks will be in accordance with the quality of the water as classified in UFC 3-420-01. Material selection must be coordinated with the project specifications.

d. Domestic hot water temperatures shall be in accordance with UFC 3-420-01.

11.7.5.9 Hose Faucets (bibbs) and Lawn Faucets. All hose bibbs and lawn faucets shall be furnished with 15 mm water supply and standard hose type connections.

a. Exterior. Where buildings are located in grassed areas, lawn faucets shall be located so that watering may be accomplished using not more than 30 meters of hose and so that sprinkling can be accomplished without extending the hose over main walks and driving areas. A hose bibb with vacuum breaker shall be mounted adjacent to the cooling tower sump. A shutoff valve and drain shall be included in all areas if subject to freezing conditions.

b. Interior. Hose bibbs shall be provided at interior locations as follows and in other locations where required.

(1) At least one cold water hose bibb in mechanical equipment rooms housing central heating and refrigeration equipment.

(2) At least one cold water hose bibb at trash compactor areas.

(3) At least one hot water hose bibb at garbage storage locations.

(4) A cold water hose bibb in battery room for washdown of spills and leaks.

c. Vehicle maintenance facilities. Hose bibbs shall be provided in the following areas:

(1) At least one hose bibb for cold water service in the repair and lube area.

(2) At least one hose bibb at each gasoline servicing island. Provide a frostproof type hydrant where the winter design temperature is -1°C. or below.

(3) One hose bibb in each wash bay.

(4) An unthreaded hot water faucet three (3) feet above floor in the wash bay.

11.7.5.10 Emergency Deluge Showers and Eyewash Fountains. A deluge shower and combination eye-face wash fountain shall be provided in the following areas:

a. Any area where acid is handled, such as battery rooms.

b. The general vicinity of chemical water treatment feeders in the mechanical equipment rooms, or as required by the nature of the chemicals being handled, the form of the chemical (powder, liquid, etc.), and the type of feed equipment.

11.7.5.11 Swimming Pool Criteria.

a. Pipeless perimeter recirculation systems shall be used for all pools with surface areas of 325 square meters and less. Pipeless perimeter recirculation systems or systems using continuous overflow gutters and bottom inlets shall be used for all pools with surface areas greater than 325 square meters.

(1) Pipeless perimeter recirculation system: Pipeless perimeter recirculation systems shall be designed to store surge within the pool thus eliminating the need for a surge tank. Surge weirs shall operate without the use of electric or electronic probes or sensors. At least one skimming weir shall be provided for every 46 m^2 of water surface area or fraction thereof, and each weir shall be designed for a flow rate of at least 114 lpm at full flow.

(2) Continuous overflow gutter systems: Pool surge from continuous overflow gutters shall be stored in an external surge tank. Recirculation supply shall be from bottom inlets or from extruded Polyvinyl Chloride (PVC) conduit system imbedded in the racing lanes in the pool. (Bottom inlets shall be shown on the drawings as the base design). The continuous gutter drain shall be separated from the deck drainage system. Buried piping shall be minimized to the greatest extent possible. All piping under the pool bottom slab shall be encased in concrete.

b. Inlets from the recirculation system shall be flush with the pool walls or bottom and submerged at least 200 mm below the water level. An adequate number of inlets shall be provided to accomplish complete and uniform recirculation of the pool water. Gutter drain system shall be designed for 100% of recirculation flow to break up thermal stratification.

c. Main Drains shall be at least four times the area of the discharge pipe. Multiple outlets shall be provided where the width of the pool is more than 9 meters. Multiple outlets shall be spaced not more than 9 meters apart and not more than 5 meters from the side walls of the pool.

d. Hydrostatic relief valves shall be provided in areas where high water tables are anticipated. Pool drain lines shall discharge into the sanitary sewer or storm sewer through a suitable air gap. Pools shall drain at a rate not to exceed 100 mm per hour to allow the hydrostatic relief valves to relieve the pressure on the pool structure. Main drain lines shall be designed to carry 100% of the recirculation flow.

e. Pools shall be designed with a six hour turnover rate. Where wading facilities for children are provided, these areas shall be physically separated from the swimming pool and shall be designed with a two hour turnover rate.

f. The recirculation system shall be provided with a strainer to prevent hair, lint, etc., from reaching the pump and filters. Duplex pumps shall be provided with each pump sized for full flow. Whenever possible, pumps shall be located such that they shall have a flooded suction. Where this is not possible, pumps shall be self-priming.

g. Filter types in order of preference are as follows:

(1) Vacuum DE filters

(2) Rapid Sand filters

(3) High rate sand filters

A. High rate or rapid sand filters shall be used for all pools with surface areas of 325 square meters and less. Rapid sand or Vacuum diatomaceous Earth filters shall be used for all pools with surface areas greater than 325 square meters. Maximum flow rates for filters shall be as follows:

Rapid Sand 120	lpm/m^2
High Rate 600	lpm/m^2
Vacuum DE with continuous body feed	80 lpm/m^2
Vacuum DE without continuous body feed	60 lpm/m^2

B. When vacuum DE filters are used, three filters shall be provided. Each filter shall be sized for half the recirculation flow. When high rate sand filters are used, a dual tank system shall be used. When rapid rate sand filters are used, one spare filter shall be provided.

h. Pool water heaters shall be provided for all pools where the water temperature would fall below 24°C at any time when the pool is in use. Design water temperature for heated pools shall be adjustable from 24°C to 30°C db. Cooling of pool water may generally not be required. A/E shall determine if water softeners are required to minimize scaling of pool heater elements.

(1) The heating load for sizing pool heaters shall be calculated in accordance with the recommendations of the ASHRAE Handbook, HVAC Applications. Sizing should be based primarily upon evaporation loss from the pool surface, and to maintain the pool at a given temperature without regard to the required initial warm-up time.

i. Water used in the initial swimming pool fill and subsequent makeup shall be potable water quality. Additional treatment of swimming pool water to preclude corrosion and scaling of the pool, piping, and associated components shall be as determined by the designer. Chemically treated pool water shall have no adverse or toxic affects on humans exposed to or ingesting it.

j. Calcium Hypochlorite is the preferred method of disinfection and shall be used for all pools with volumes of 1325 m^{3} or less. Gas chlorination will be considered for larger pools on a case by case basis. Powdered calcium hypochlorite will be the type of hypochlorite used due to the stability problems associated with liquid bleach. Chlorinators shall be designed to pump 0.50 kilograms of free chlorine per eight hours per 40,000 liters of pool volume. Equipment shall be provided to maintain the ph of the pool water between seven and eight with preference to the lower range. Acid treatment may be required periodically to eliminate calcium deposits within the pool, and from treatment equipment.

k. When gas chlorination is provided, the following precautions must be taken:

(1) Chlorine cylinders and chlorination equipment shall be located in a separate above ground room that opens to the outside.

(2) Air inlets for chlorine rooms shall be near the floor. Chlorine rooms shall be ventilated at a rate of at least one air change every 15 minutes for normal ventilation and at least one air change every four minutes in case of a severe chlorine leak. Fan switch shall be located outside of the chlorine room.

(3) A gas mask designed for use in a chlorine atmosphere and of a type approved by the U.S. Bureau of Mines shall be provided. This gas mask shall be located in an unlocked closed cabinet outside of the chlorine storage room.

(4) Chlorine cylinders shall be anchored to prevent mechanical damage.

l. Pools shall be provided with an automatic chlorination and ph control system. Controller shall be capable of controlling free chlorine residual within 0.1 ppm of the setting.

m. Bathing load design shall be based on the following requirements:

(1) One square meter for each swimmer in the shallow area.

(2) Two square meters for each swimmer in the deep area.

(3) Twenty-eight square meters for each diving board.

n. Piping material shall be as follows:

Main Drain Lines	Cast Iron, Ductile iron or RTRP
Gutter Drains	RTRP, cast iron or ductile iron
Recirculation Supply	RTRP, cast iron, or ductile iron
Surge Chamber	Cast Iron or ductile iron.
Filter Piping	Cast Iron, ductile iron or RTRP
Filter House Piping	RTRP, Cast Iron or ductile iron

o. Portable vacuum cleaning devices shall be provided for all pools. Built-in type systems shall not be used.

p. The design of the heating, air conditioning or ventilation systems for the swimming pool shall be in accordance with ASHRAE Applications Handbook.

11.7.5.12 Decorative Water Fountain Criteria. The following criteria shall be applied to fountain design:

a. Water used in the initial fill of the decorative water fountain and subsequent makeup shall be of potable water quality. Additional water treatment shall be provided as follows:

(1) Disinfection shall be accomplished by the addition of hypochlorite to the fountain water or by an equivalent approved method. Chlorine gas will not be permitted. If calcium hypochlorite is used, additional treatment may be required to eliminate calcium deposits within the fountain. The designer shall determine the concentration of disinfectant required and the method of application.

(2) Algicide shall be used as necessary. The designer shall determine the concentration of algicide required and the method of application.

(3) Additional treatment of fountain water to preclude corrosion and scaling of the fountain, piping, and associated components shall be as determined by the designer.

b. Location of decorative water fountains shall be indoors, or they shall otherwise be protected against the environment to prevent large evaporative losses due to the sun and wind and to prevent mechanical and maintenance problems due to blowing silt, sand and salt residue.

c. Cascading or waterfall type fountains shall be preferred over bubbler, aerated and spray types. Minimum orifice size shall be 15 mm diameter.

d. The recirculation system shall be provided with a strainer to prevent debris from reaching the filter, pump, and valves. Pumps shall have a flooded suction.

11.7.6 Piping System.

11.7.6.1 General. Piping materials and sizes shall comply with the recommendations in the International Plumbing Code and the applicable Guide Specifications. Flow velocities in water pipe shall not exceed 2.4 meters per second. All piping shall be sloped to permit complete drainage and must be properly supported with allowances for expansion and contraction. Piping systems shall contain sufficient isolation valves to allow segregation of the system for maintenance, draining, and/or testing. Piping systems, which may be extended by another contractor or at some future date, shall be terminated with blind-flanged valved connections. Expansion loops or expansion joints and anchor points shall be shown on plumbing drawings. Water supply piping shall not be buried under concrete floors except in special instances where other methods of installation are impracticable. See UFC 3-420-01 for further guidance.

11.7.6.2 Concealment of Piping. All piping with the exception of individual fixture runouts shall be completely concealed in finish spaces such as offices, toilet rooms, housing units, etc. In other spaces, overhead lines shall be concealed whenever dropped ceilings are provided unless construction interferences prevail. Vertical stacks and risers in workshop spaces shall be concealed or properly protected from damage by trucks.

11.7.6.3 Pipe Supports. Exposed interior pipe supports shall be coordinated with pipe supports used for process piping, heating systems, and cooling system piping, and will be identical throughout each individual facility.

11.7.6.4 Interferences. All work shall be installed so as not to interfere with lighting and other equipment and to provide necessary clearances where truck lifts operate.

11.7.6.5 Color Coding. Plumbing and piping in building will be identified in accordance with the applicable portion of the American National Standard Institute (ANSI) A13.1. Compressed gas cylinders and piping will be coded in accordance with applicable commercial standards.

11.7.7 Plumbing Fixtures. The number of plumbing fixtures allowed for various types of facilities and hospitals shall be as listed in UFC 3-420-01, Plumbing Systems.

11.7.7.1 Faucets and Shower Heads in all facilities shall be provided with flow limiting devices for water conservation. Maximum allowable flow shall be 7.5 to 9.5 lpm for faucets and 11 to 13 lpm for shower heads. In addition, lavatories for the following areas shall be provided with self-closing type faucets with adjustable closing time (generally from 2 to 15 seconds): public buildings, barracks, gymnasiums, offices, motels, auditoriums, mess halls (except kitchens), clubs, schools, and swimming pools.

11.7.7.2 Floor Receptors and Service Sinks. Provide a floor-mounted receptor with 80 mm drain and removable strainer plate in each janitor's closet and battery room. A service sink shall be installed in areas where there is insufficient space for a floor receptor. Receptors shall be cast or molded stone, or enameled cast iron, with rim guard, approximately 700 mm by 700mm with wall-mounted service sink faucet.

11.7.7.3 Utility or Engineers' Sinks. Utility or engineers' sinks shall be provided in main mechanical equipment rooms, general repair shop, paint shops, and elsewhere as required.

11.7.7.4 Fixture Materials. Fixtures shall be of the materials listed hereinafter:

a. Bathtubs. Porcelain enameled cast iron or steel, acid resisting.

b. Floor drains. Cast iron.

c. Grease traps. Usually reinforced concrete or cast iron; vitrified clay in laboratories.

d. Laundry trays. Reinforced fiberglass or porcelain enameled cast iron.

e. Lavatories. Porcelain enameled cast iron, acid resisting. Lavatories in dormitories shall be provided with carriers, except for those lavatories which are installed on masonry chase type or solid masonry walls.

f. Medical plumbing equipment. See UFC 4-510-01.

g. Sinks. Kitchen, stainless steel; scullery, stainless steel; and service, porcelain enameled cast iron, acid resisting.

h. Urinals. Vitreous china. Modesty shields shall be provided to isolate urinals except when they are provided with integral extended shields.

i. Water closets. Vitreous china. Both Eastern and Western style closets may be required. Eastern Water closet shall be specified optional vitreous china or enameled cast iron.

j. Ablution Faucets: Each water closet shall be provided with ablution faucet (wash hose) unless otherwise directed. Ablution faucet shall be installed on the right side of the water closet. The nozzle for the faucets shall be suitable for the type of water closet used (Eastern or Western type).

11.7.8 Pipe Protection.

11.7.8.1 Pipe Sleeves. Pipes passing under or through wall shall be protected from breakage. Any plumbing pipe passing under a footing or through a foundation wall shall be provided with a relieving arch; or there shall be built into the masonry wall an iron pipe sleeve two pipe sizes greater than the pipe passing through; or equivalent protection shall be provided as may be approved by TAC.

11.7.8.2 Corrosion. Pipe subject to corrosion passing through or under corrosive fill such as cinders, concrete, or other corrosive material, shall be protected against external corrosion by protective coating, wrapping, or other means which will resist such corrosion. Piping made of inherently noncorrosive material will be used to the greatest extent possible. Dielectric unions shall be used where dissimilar metals are used in the same piping system.

a. Corrosion Protection for Piping Materials at Building Service Entrances.

(1) Below ground Cast Iron and Ductile Iron Pipe. All pipe joints, fittings, valves, etc., are to be electrically bonded. This bonding is to provide electrical continuity to disconnect differential corrosion from electrically isolated piping elements; to provide the ability to test the buried pipe and to facilitate installation of sacrificial anodes if needed. After installation and before insulating and backfilling, all pipe, fittings, valve bodies, etc., are to be coal-tar epoxy coated and checked with a holiday tester. Insulation and insulation protection shall be applied as required. Prior to backfill, all piping shall be encased in polyethylene.

(2) Below grade Steel Pipe. In addition to the above corrosion treatment, the steel pipe shall be cathodically protected and also bonded to the grounding network inside the building.

11.7.9 Seismic Design. Design for the plumbing systems shall conform to the requirements of UFC 3-310-04. Seismic zone determinations shall be in accordance with Chapter 21: GEOTECHNICAL, of this manual.

11.7.10 Noise Control. All noise control design work shall be in accordance with TM 5-805-4.

11.7.11 Testing and Inspection. A/E shall specify that all new, altered, extended, or replaced plumbing shall be left uncovered and unconcealed until it has been tested and approved. Testing of each piping system shall be performed. All equipment, materials, and labor required for testing a plumbing system shall be furnished by the installing contractor. Potable water systems shall be disinfected.

11.7.12 Compressed Air and Vacuum Systems. Design for Compressed Air and Vacuum systems shall be in accordance with UFC 3-420-02FA. NAVFAC DM-3.5 shall be used for design for Compressed Air Pressure above 1034 KPag.

11.7.13 Fuel Gas Piping: Design for fuel gas piping systems shall be in accordance with the recommendations of UFC 3-460-01.

11.7.13.1 Fuel gas heating valves shall be as indicated in UFC 3-460-01unless otherwise approved.

11.7.14 Equipment and Fixture Schedules. The following equipment and fixture schedules shall be provided on the mechanical plumbing schedule drawings. Each schedule shall neatly provide sufficient space to include all applicable information required. The applicable equipment and fixture schedules shall be submitted, as hereinbefore described, on the preliminary and final drawings.

PLUMBING FIXTURE SCHEDULE

Plan	PIPE CONNECTION SIZE, millimeters.				
Code	Description	CW	HW	WASTE	VENT
P-1	Water Closet (Western)	25	--	100	50
P-2	Urinal	20	--	50	40
P-3	Lavatory	15	15	40	40
P-4	Service Sink	15	15	80	40
P-5	Bathtub	15	15	40	40
(x)P-6	Drinking Fountain	15	--	32	40
N/A	Shower	15	15	50	40

NOTE:

The above schedule is intended as a guide only. Additions or deletions will be made to suit specific requirements. Each schedule will show designations or P numbers in **consecutive** numerical order, using the same designations on the plans as appear in the schedule and in the specifications. If more than one type of each fixture is required, such types shall be designated by alpha-numeric designations as shown. Where more than one type of building is to be covered in a specification, each building shall carry the same designation or P number for identical fixtures.

(x) Do not confuse this fixture with mechanically refrigerated water cooler.

WATER HEATER SCHEDULE

Equipment No.:

Location:

Building

Room

Unit Type:

Heating Capacity:

Total, kw

Recovery:

Rate, lph at _____ °C temperature rise

Storage Capacity - minimum, liters

Electrical Requirements:

Number of Elements, each

Capacity per Element, kw

Electrical Characteristics; volts, phase, hertz

Remarks:

HOT WATER STORAGE TANK SCHEDULE

Equipment No.:

Location:

Building

Room

Storage Capacity: minimum, liters

Dimensions:

Length, cm

Diameter, cm

Remarks:

WATER COOLER SCHEDULE

Equipment No.:

Location:

Building

Room

Recovery

lph @ 10°C Supply

lph @ 82°C Supply

Ambient Air Temperature

Degrees C.

Inlet Water Temperature

Degrees C.

Remarks:

PUMP SCHEDULE

Equipment No.:

Location:

Building

Room

Service: (Chilled potable water, hot water, etc.)

(operating, standby, etc.)

Unit Type: (Centrifugal, etc.)

Pump Data: Flow Rate, lpm

Head, meter

Efficiency (Percent)

Pump Motor Data; horsepower, rpm volts, phase, hertz

Remarks:

AIR COMPRESSOR SCHEDULE

Equipment No.:

Location:

Building

Room

Capacity:

volume, scmh (acmh)

Pressure, KPa

Type: (reciprocating, oil free, liquid ring, etc.)

Motor Data:

Speed, rpm

Electrical characteristics in horsepower volts, phase, hertz Refrigerated Air Dryer:

Capacity, scmh (acmh)

Receiver Capacity: liters

Operating Pressure: KPag

Cooling Media: (air, water)

Ambient Condition: Degrees Centigrade

Remarks:

MISCELLANEOUS EQUIPMENT CONNECTION SCHEDULE

Equipment No.:

Location:

Building

Room

Description: (garbage grinder, ice maker, sterilizer, tumbler, ironer, etc.)

Pipe Connection Size:

cold water,	mm
hot water,	mm
waste,	mm
vent,	mm
compressed air,	mm
vacuum,	mm

Ductwork Connection Requirements:

vent,	mm
flow,	cmh

Remarks:

NOTE:

The above schedule shall be used for facilities, such as: mess halls, laundries, hospitals, laboratories which have various items of equipment falling into the F&E category and require various utility connections. If a composite equipment schedule is provided by the architects it need not be duplicated.

11.8 ABBREVIATIONS:

cw	cold water
hw	hot water
^{o}C	Degrees Centigrade
rpm	revolutions per minute
ppm	parts per million
lpm	liters per minute
lph	liters per hour
kw	kilowatt
mm	millimeters
cm	centimeters
m	meters
cmh	cubic meters per hour
scmh	Standard cubic meters per hour
acmh	Actual cubic meters per hour
sq	square
TDH	Total dynamic head
KPa	KiloPascals

CHAPTER 12
SPECIAL MECHANICAL SYSTEMS AND EQUIPMENT

CHAPTER 12

SPECIAL MECHANICAL SYSTEMS AND EQUIPMENT

12.1 GENERAL.

Systems covered in this chapter include special purpose, POL and process piping, and miscellaneous building equipment not covered under Chapter 11: PLUMBING and Chapter 10: HEATING, VENTILATING, AND AIR-CONDITIONING. Specific submittal requirements in this chapter, supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including drawings and design analysis, shall be in accordance with Chapter 2: PRESENTATION OF DATA.

12.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below form part of this Manual.

American National Standards Institute (ANSI) Standards.

ANSI A13.1-1981 - Scheme for the Identification of Piping Systems.

American Petroleum Institute (API) Standards.

American Welding Society (AWS) Standards.

American Society of Mechanical Engineers (ASME)

Publications, Boiler and Pressure Vessel Code, and

Interpretations: Pressure Vessels, Welding Qualifications.

AFM 32-1084. Facility Requirements.

UFC 3-460-01 Design: Petroleum Fuel Facilities

UFC 3-450-01 Noise and Vibration Control

12.3 CONCEPT SUBMITTAL REQUIREMENTS.

12.3.1 Concept Design Analysis. The following specific items shall be included where applicable.

a. A list of criteria furnished by the consulting engineer, and the codes, documents, and design conditions used. Reference to any authorized waiver of these criteria or codes.

b. Tentative sizes of equipment, piping and space required for the equipment and distribution method selected.

c. A description of the proposed control system.

d. Description, approximate capacity, and location of any miscellaneous equipment such as elevators, cranes, lifts, etc.

e. Description of the various types and quantities (supported by calculations as applicable) of POL products and their associated unloading, storage, and dispensing systems.

12.3.2 Concept Design Drawings. The following specific items shall be shown where applicable.

a. Flow diagrams of all systems proposed. These diagrams shall be an accurate schematic representation of the system, showing all proposed equipment, piping, control valves and primary control loops. In addition, the drawings shall indicate approximate capacities of equipment; flow rates in mains, branches, and outlets; and shall identify the location of equipment by building and room.

b. Plans which are sufficiently complete to show the location and general arrangement of mechanical equipment and major piping. Piping may be shown with single lines.

12.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

12.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any necessary revisions. In addition, the following specific items shall be included when applicable.

a. Detailed calculations for sizing equipment, storage tanks, filter pumps, piping, control valves, liquid surge analysis, etc.

b. Detailed logic diagrams for the control schemes used.

c. Any other information or computation required to verify that the design complies with the design criteria, codes, and standards, and is satisfactory for the intended purpose.

d. Catalog Cuts. Minimum catalog cuts shall be submitted for all major items of equipment. Catalog cuts shall be a part of the design analysis.

12.4.2 Preliminary Design Drawings. The following specific items shall be shown when applicable.

12.4.2.1 Flow Diagrams of All Systems. These diagrams shall show all of the information given on the Concept drawings, but in greater detail. The diagrams shall include equipment capacities and power requirements, all piping sizes with flow rates indicated, all valves, piping specialties, instrumentation, and control devices.

12.4.2.2 Plans showing layout and details of the final version of the proposed system, showing location, arrangement, capacity, and space requirements of all equipment.

12.4.2.3 Equipment. The drawings shall include space for rating data in tabular form for all items of equipment, with space reserved for designating the manufacturer and the model number in anticipation of as-built drawings. Preliminary rating data shall be submitted for all items of equipment, even though it is not mandatory that it be inserted in the equipment schedule at this stage. Equipment schedules shall be completed when final rating data are established, but not later than the Final submission. Since equipment rooms represent the most congested areas for both equipment and piping, the following guidelines should be followed when drawings are being prepared.

a. Single-line piping or ducting layouts are not sufficient to adequately plan major installations and check interference.

b. All pipe shall be shown by single-line layouts and symbols except in equipment rooms or other congested areas to assure that the allocated space is adequate for installation, maintenance or repair work. Pipes 3 inches and larger shall be shown to scale by double-line layout.

c. All ducts and fittings in equipment rooms and other related congested areas shall be drawn to scale by double-line layouts.

d. All equipment shall be outlined to scale, and maintenance or removal space shall be indicated.

e. Removal, replacement, or moving space must be considered for the largest and heaviest equipment when a drawing is made.

f. In plans, sections, and details these same rules shall apply.

12.5 FINAL SUBMITTAL REQUIREMENTS.

The design analysis and the drawings submitted for the Final review shall be complete, as described in Chapter 1: GENERAL INSTRUCTIONS.

12.5.1 <u>Catalog Cuts</u>. Complete catalog cuts and data sheets shall be submitted for all major items of equipment. Catalog cuts shall be a part of the design analysis.

12.5.2 <u>Complete sequences of operations and controls</u>.

12.5.3 <u>Storage Tank Construction, Cleaning, and Coating</u>.

A complete analysis shall be submitted indicating the type and degree of cleaning required, and tank coatings to be utilized.

12.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the Final design review shall be incorporated in the documents before they are submitted as Ready To Advertise (RTA).

12.7 TECHNICAL REQUIREMENTS.

12.7.1 Expansion.

12.7.1.1 Temperature Ranges. When designing the flexibility of the system, full consideration shall be given to the maximum and minimum temperature to which the line will be exposed. This shall include not only environmental temperatures but also temperatures of cleaning processes such as steam or vapor. Ample provision shall be made for temperature ranges and shall be completely covered by the design analysis. Generally, where expansion of piping will be absorbed by utilizing the inherent flexibility of the piping or by providing expansion loops and bends, the pipe expansion stresses shall be calculated by a standard method used in industry such as the Tube Turn, Blaw-Knox, Grinnell, or M. W. Kellogg methods.

12.7.1.2 Piping Alignment. The horizontal and vertical alignment of the piping shall be carefully planned to utilize the inherent flexibility of the pipe to absorb expansion. Obstructions such as road crossings which may occur in the route of the piping shall be given due consideration.

12.7.2 Supports. Supports for aboveground piping shall be designed with full allowances for the movement and forces developed by the piping, either during operation, testing, cleaning, or shock loading, whichever is the most severe condition, and shall be of ample strength to withstand the forces developed by the piping.

12.7.3 Anchors. All pipe anchors shall be designed to completely withstand the maximum forces developed by the pipe system during the most severe condition of operation, either during regular operation, testing, shock loading, or cleaning. Design calculations for anchors shall be a part of the design analysis and should show all forces, assumptions, soil bearing values, etc.

12.7.4 Piping Components. Components such as valves, strainers, gages, surge suppressors, and other devices shall be specified in detail with pressure or temperature rating, size, capacity, pressure and temperature ranges, test pressures, and materials called out. Valves and miscellaneous components shall be as directed by Middle East District (MED) or applicable publications.

12.7.5 Piping Materials. The options on materials for the piping systems shall be furnished as part of the design criteria. Pipe and tank coatings shall be as directed by Middle East District or the applicable publications.

12.7.6 Welding Qualifications. Welding shall be specified in accordance with the ASME Boiler and Pressure Vessel Code, ANSI Piping Code, or the American Welding Society Standards. Requirements for welding procedure, welding operator, and welder qualification and identification shall be specified. Detailed requirements for welding shall be specified.

12.7.7 Surge Analysis. A complete fuel surge analysis shall be performed upon the final design of the fuel systems. All corrective action to the design shall be performed as required. The surge shall be less than the pressure ratings of all system components.

12.7.8 Protective Coatings and Insulation. Protective coating for both aboveground and underground piping shall be specified with appropriate test procedures.

12.7.9 Seismic Design. Design shall conform to the requirements of the Seismic Zone.

12.7.10 Noise Control. All design work shall be in accordance with UFC 3-450-01.

12.7.11 Drainage and Sectionalizing. All conditions of operation of the system shall be taken into consideration when designing the drainage points and sectionalizing. If a system is to be cleaned in place, the line shall be capable of being divided into short sections for ease of cleaning without having to cut the piping. Drains shall be located at all low points, and if they are to be used for cleaning or flushing, they will be of a size large enough to assure adequate flow of cleaning agents and rinses. Piping systems shall contain sufficient isolation valves to allow segregation of the system for maintenance and/or testing. Piping distribution systems, which may be extended by another contractor or at some future date, shall be terminated with blind-flanged valved connections.

12.7.12 Cleaning. The details of the cleaning processes and the number and location of cleanings shall be specified. The specification shall call out the degree of inspection and shall require the use of approved cleaning facilities. Detailed cleaning procedures shall be required of the Contractor prior to cleaning any piping. Shop cleaned pipe or components cleaned off the job will be required to be sealed against contamination with a substantial sealing method which will endure, without failure, the rigors of shipment, handling, and storage.

12.7.13 Testing and Inspection.

12.7.13.1 General Requirements. Methods and degree of cleanliness and welding inspection shall be specified. Generally, welding inspections shall consist of visual and radiographic or other non-destructive inspection. The method of testing and the standards by which they will be judged shall be indicated.

12.7.13.2 Detailed Requirements shall be specified for pressure, leak, and operational testing. All test requirements for components such as leak testing and proof testing shall be specified in detail. Operational tests shall also be carefully indicated. Records of all tests shall be made and reproducible copies shall be turned over to the Contracting Officer. Performance and other tests of valves, strainers, etc., shall require certification, with copies furnished to the Contracting Officer.

12.7.14 Piping Identification. Piping systems in boiler plants, heating plants, buildings, mechanical equipment rooms, and tunnels will be identified in accordance with the applicable portion of the American National Standard Institute (ANSI) A13.1. Bulk petroleum product systems and Compressed gas cylinders and piping shall be coded in accordance with accepted Commercial and Industry Standards. Special markings or identification may be required, and will be as directed by MED.

12.7.15 Corrosion. For corrosion protection, see paragraph: Corrosion in Chapter 11. Special corrosion protection will be required for underground piping based on project location, as directed by Transatlantic Division.

12.7.16 POL Facilities. POL facilities shall be in accordance with UFC 3-460-01.

CHAPTER 13
SAFETY

CHAPTER 13

SAFETY

13.1 GENERAL.

13.1.1 Policy. The design of facilities, equipment, and systems shall provide a safe and healthful work environment such that occupants, and operations and maintenance personnel suffer no avoidable risk in the performance of their respective work, thereby preserving the safety of personnel and property.

13.1.2 Criteria. The nature and mission of these facilities, as well as the impacted time and cost factors, require the following.

a. Safety considerations shall be completely integrated during project development and not imposed upon the final design.

b. Variances with explosive safety requirements shall be avoided.

c. Building codes, safety codes, standards, and requirements shall be uniformly interpreted and applied.

13.1.3 Scope. Explosives, systems, and industrial safety; fire protection; industrial hygiene; and human engineering shall be fully considered in the development and design of projects.

13.1.4 Reviews. All designs shall be reviewed prior to their approval for conformance with established safety codes, standards, and principles and with regard to accident prevention principles. Planning and design personnel shall apply the same analytical approach to identifying potential hazards and incorporating appropriate safeguards that they apply to other design problems.

13.1.5 Built-in Safety. Equipment, systems, and facilities shall be designed so that hazards are eliminated. Where the lack of technology or the constraints of operational effectiveness preclude this, appropriate measures shall be built-in to identify and control hazardous conditions or otherwise safeguard personnel and property. Intrinsic safety and fail-safe devices shall be used to the maximum rather than depending on less reliable means.

13.1.6 Interpretations. Architect-Engineer (A-E) firms and each design element of the Corps of Engineers (CE) shall monitor and control the application of building codes, safety codes, standards, policies, and procedures to assure that they are consistently, uniformly, and effectively applied on all project.

13.1.7 Document Requirements. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including Drawings and Design Analysis, shall be in accordance with Chapter 2: PRESENTATION OF DATA.

13.2 APPLICABLE PUBLICATIONS.

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this manual to the extent indicated by the references thereto:

MIL-STD-882D	Military Standard Practice for System Safety
AR 385-16	System Safety Management Guide
DoD 6055.09	DoD Ammunition and Explosives Safety Standards
AR 385-64	Army Ammunition and Explosive Safety Standards.
AR 385-63.	Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat.
UFC 3-340-01	Design and Analysis of Hardened Structures to Conventional Weapons Effects.
UFC 3-340-02	Structures to Resist the Effects of Accidental Explosions.
UFC 4-010-01	Minimum Antiterrorism Standards for Buildings
TB MED 501	Noise and Conservation of Hearing, Aug 88
EM 385-1-1	Safety and Health Requirements Manual
ATP 5-19	Risk Management

13.3 CONCEPT SUBMITTAL REQUIREMENTS.

13.3.1 Concept Design Analysis. The following specific items shall be included when applicable.

13.3.1.1 Siting. Special considerations shall be given to the design and location of facilities that involve the handling, manufacture, storage, and transportation of hazardous materials, such as ammunition, explosives, chemicals, and liquid propellants. Site planning for such facilities should be done as soon as the requirement is known. All facilities shall be sited in accordance with the requirements of AR 385-63, and AR 385-64.

13.3.1.2 Safety. Analyze the project in terms of the required criteria and determine the following.

a. The types of hazardous materials to be used or stored in the facility or to be used in its construction and the general methods to be incorporated in order to maintain the required standards of safety.

b. The type of electrical equipment and light fixtures, ventilation requirements, and other related safety features required for any buildings or areas involved with the use or storage of hazardous materials.

c. The guidelines to be used to control noise levels throughout the project.

13.3.1.3 Security.

a. List all facilities and/or rooms that are to be secure against theft, or sabotage and the recommended means by which the security is to be achieved. Rooms or areas wherein arms, ammunition, high value items, narcotics, classified documents, are stored as well as mission critical rooms or areas such as power plants, communication centers, command posts will require varying degrees of security. Fully describe rationale used in recommending each security measure. All design discipline applicable to the security measures shall provide a narrative description of the means and degree by which the security measure accomplishes its task.

b. The duration of the "button-up" period and the necessity for standby electrical and mechanical systems.

13.3.1.4 Risk Management. In all cases of analysis, a composite risk management plan shall be developed to mitigate all potential threats of moderate severity. Moderate severity will be defined by ATP 5-19.

13.3.2 Concept Design Drawings. The following specific items shall be shown when applicable.

13.3.2.1 Site Safety Plan. Prepare a site plan to present a compendium of the total explosives safety features being incorporated into the site layout. As a minimum, such plans shall contain the following data.

a. The location and distances between the facility to be constructed or modified and other installation facilities, the installation boundary, public railways and public highways, including power transmission and utility lines.

b. The identification and brief description of the mission of all other facilities which will be constructed or modified within the inhabited building distance of the facility.

c. A general description of items, components, or other hazardous materials to be handled or stored in the new or modified facility; i.e., rockets, artillery ammunition, fuses, etc.

d. The explosive limits and class(es) of ammunition, explosives, or other hazardous materials proposed for the facility, including a breakdown by room or bay when appropriate.

e. The explosive limits and class(es) of ammunition, explosives, or other hazardous materials in facilities located within the inhabited building distance of the facility.

f. A topographic map with appropriate contours when terrain features are considered to constitute natural barricading or when topography otherwise influences layout.

13.3.2.2 Other Drawings. In general, very little detail beyond the Fire Protection Plan is required for the Concept design submittal. However, if any unusual pieces of equipment or methods of protection are proposed, details shall be shown on the appropriate drawings.

13.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

13.4.1 Preliminary Design Analysis. The preliminary design analysis shall include all items in the concept design analysis and any necessary revisions. In addition, the following specific items shall be included when applicable.

13.4.1.1 Safety. The following items shall be included in the Preliminary design analysis.

a. A comprehensive analysis of all safety requirements of a facility with an indication of the treatment for each potential hazard, the alternatives considered, and the justification for the alternatives selected.

b. Calculations for the following items.

1. Noise control.

2. Ventilation requirements.

3. Explosion protection.

c. A complete list of materials used in construction that may be of a hazardous nature and the precautions, protection equipment, or treatment required due to the use of these materials.

13.4.1.2 Facility Security. Include in the Preliminary design analysis a comprehensive analysis of all security measures taken for a facility with an indication of the security measures employed, the alternatives considered, and the justification for the alternatives selected.

13.4.1.3 Protective Construction. Include a comprehensive analysis of the protective construction measures for a facility with an indication of the protective measures taken, the alternatives considered, and the justification for the alternatives selected. Calculations for any structural protective construction measures shall appear with the other structural calculations.

13.4.2 Preliminary Design Drawings. Many of the features for safety, physical security, and protective construction shall appear on the drawings of the various disciplines. In addition, the following specific item shall be shown on a separate drawing.

13.4.2.1 Site Safety Plan. Submit the revised compendium of the total explosive safety features previously submitted with the Concept design drawings.

13.5 FINAL SUBMITTAL REQUIREMENTS.

The design analysis shall include all the items in the Preliminary design analysis and any necessary revisions. For mechanical items such as pumps and blowers, provide a list of at least three manufacturers whose equipment will perform the desired function. The design analysis and the drawings submitted for Final review shall be complete, as described in Chapter 1: GENERAL INSTRUCTIONS.

13.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the Final design review shall be incorporated into the documents before they are submitted as READY TO ADVERTISE (RTA).

13.7 TECHNICAL REQUIREMENTS.

13.7.1 Human Engineering. To be safe as well as usable, facilities, equipment, and operations must be adapted to the limitations of the people who use them. In keeping with this, designs and specifications shall consider the following items.

a. When equipment is inappropriate or inadequate, people will improvise and modify, thereby taking unnecessary risks and exposure to hazards and accidents.

b. Reliance shall not be placed on the safety consciousness of personnel where it is feasible to provide protection against human error.

c. Anticipate that equipment may be used improperly and procedures improvised, and then design the operation to minimize the consequences.

d. Make sure that equipment use and limits are readily identifiable to help assure that it will be operated and maintained properly.

e. A warning note in technical and operating manuals will not overcome a safety problem. People may not read, remember, or even know where to find the warning notes. Bilingual warning signs shall be placed near hazardous operations areas.

f. Do not assume that effective standard operating procedures will be developed or that personnel will receive appropriate safety indoctrination, training, and supervision. Instead, build safety into the design.

13.7.1.1 Accessibility Check. Designers shall check each system and its equipment to assure ready accessibility and operability of all maintenance points, gages, valves, controls, and signals. Devices whose operations are critical during emergency conditions shall be prominently located and singularly identified.

13.7.1.2 Coordination Check. A cross-check shall be made by designers of the structural, process piping, heating and ventilation, plumbing, conveyors, and packaged equipment and systems in order to detect and correct interferences with illumination levels, fire detection, alarm and suppression systems, toxic or explosive detection systems, personnel, fire doors and shutters and material and equipment traffic or other degradations of the safety of personnel or property.

13.7.2 Explosive Safety. DoD 6055.09 is the standard for explosive safety. Its provisions shall be fully incorporated in the design of explosives related facilities. TM 5-1300 shall be used to locate and design barricades, blast walls, and other blast-resistive structures.

13.7.3 Hazardous Materials. Chemicals are used throughout industry as preservatives for equipment in storage, as equipment lubricants and cleaners, as electrical conducting or insulating mediums, and as sealants or protective coatings for working surfaces. However, many of these compounds are also flammable, toxic, or allergenic in nature. The danger to personnel and property rise steadily in light of the annual introduction of new chemicals and the use of trade names which do not identify the product's chemical constituents. In selecting generic or trade name chemicals to be called for in the specifications, A-E's must investigate the flammability, toxicity, and allergenic hazards associated with those chemicals. To the maximum extent possible, those chemicals which are considered nonhazardous shall be specified. Where chemicals of a hazardous nature are employed for lack of a safe substitute, the construction specification paragraph shall identify the hazards, the precautions, personal protective equipment or apparel, first-aid treatment, antidote, and firefighting equipment to be employed. Technical sections of specifications containing epoxy coatings and/or mortar shall include a paragraph on safety precautions. Film projection rooms shall be designed for the hazards associated with the use of cellulose base film.

13.7.4 Noise. Technical specifications for mechanical and electrical equipment shall be developed to call for noise levels in inhibited equipment spaces that are consistent with the levels set forth in TB Med 501, entitled "Noise and Conservation of Hearing". Consistent with these requirements, designers shall provide an engineering estimate of sound pressure levels for mechanical-electrical equipment for use in the design of the structure.

13.7.5 Facility Security. There are no additional requirements for facility security systems. Refer to the criteria previously listed and to Chapter 17: COMMUNICATIONS and Chapter 14: ELECTRICAL.

13.7.6 Protective Construction. There are no additional requirements for protective construction designs. Refer to the criteria previously listed and to Chapter 8: STRUCTURAL.

CHAPTER 14

ELECTRICAL

CHAPTER 14

ELECTRICAL

14.1 GENERAL

14.1.1 Application. This chapter gives requirements for the preparation of drawings, specifications, and design analysis of electrical systems. Electrical systems include distribution systems, lighting systems, and security alarm systems.

Specific requirements for related electrical design are found in Chapter 15: POWER GENERATION, Chapter 16: POWER TRANSMISSION AND DISTRIBUTION, and Chapter 17: COMMUNICATIONS.

The requirements of this chapter supplement the requirements in Chapter 1: GENERAL INSTRUCTIONS, Chapter 2: PRESENTATION OF DATA, Chapter 3: SPECIFICATIONS, and Chapter 4: COST ESTIMATING. In addition, the electrical design requirements must be coordinated with the requirements of Chapter 9: FIRE PROTECTION AND LIFE SAFETY, and Chapter 10: HEATING, VENTILATING, AND AIR CONDITIONING, and Chapter 12: SPECIAL MECHANICAL SYSTEMS AND EQUIPMENT, and Chapter 13: SAFETY.

14.2 APPLICABLE PUBLICATIONS.

The current editions of the publications listed below form a part of this manual and define the standard to which the electrical design shall conform. Designers shall generally follow the criteria as listed on the website: http://www.wbdg.org. Some of the common UFC criteria are listed below:

Corps of Engineers Computer-Aided Design and Drafting (CADD) Details:

Standard Details	Internet Hyperlink: CAD BIM Center

United Facilities Criteria (UFC):

UFC 3-501-01	Electrical Engineering
TP-12	UFC 3-500-10N Appendices, Tri-Service Electrical Working Group Technical Papers
	Internet Hyperlink: WBDG Technical Criteria
UFC 3-510-01	Foreign Voltages and Frequencies Guide
UFC 3-520-01	Interior Electrical Systems
UFC 3-530-01	Design: Interior and Exterior Lighting and Controls
UFC 3-535-01	Visual Air Navigation Facilities

UFC 3-535-02	Design Drawings for Visual Air Navigation Facilities
UFC 3-540-04N	Diesel Electric Generating Plants
UFC 3-550-01	Exterior Electrical Systems
UFC 3-555-01N	400 Hertz Medium Voltage Conversion/Distribution and Low Voltage Utilization Systems
UFC 3-570-02A	Cathodic Protection
UFC 4-020-04A	Electronic Security Systems: Security Engineering
UFC 4-510-01	Design: Medical Military Facilities

United Facilities Guide Specs (UFGS):

Standard Details	Internet Hyperlink: UFGS Forms, Graphics and Tables Index

Illuminating Engineering Society (IES):

IES Lighting Handbook - Application Volume

IES Lighting Handbook - Reference Volume

Institute of Electrical and Electronic Engineers (IEEE):

IEEE Std. 141	IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants. (Red Book)
IEEE Std. 142	IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems. (Green Book)
IEEE Std. 241	IEEE Recommended Practice for Electrical Power Systems in Commercial Buildings. (Gray Book)
IEEE Std. 242	IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems. (Buff Book)
IEEE Std. 399	IEEE Recommended Practice for Power Systems Analysis. (Brown Book).
IEEE Std. 446	IEEE Recommended Practice for Emergency and Standby Power Systems.(Orange Book)

IEEE Std. 493	IEEE Recommended Practice for Design of Reliable Industrial and Commercial Power Systems. (Gold Book)
IEEE Std. 602	Recommended Practice for Electric Systems in Health Care Facilities (White Book)
IEEE Std. 739	Recommended Practice for Energy Conservation and Cost-Effective Planning in Industrial Facilities (Bronze Book)
IEEE Std. 1100	Powering and grounding Sensitive Electronic Equipment (Emerald Book)
C2	National Electrical Safety Code

National Fire Protection Association (NFPA):

NFPA 70	National Electrical Code (NEC).
NFPA 101	Life Safety Code.

14.2.1 Additional Standards. In addition to the above standards, there may be design standards which are enforced by the government of the country in which the project is located. These standards, if any, are identified in the Scope of Work. Conflicts between standards shall be brought to the Government's attention for resolution.

14.3 CONCEPT SUBMITTAL REQUIREMENTS.

The concept submittal shall provide sufficient information to show how the functional requirements of the electrical design will be met. The specific information required to achieve this is provided in the following sections.

14.3.1 Concept Design Analysis. The concept design analysis shall provide narrative descriptions, initial calculations, analysis of alternative design approaches, and recommendations which explain and justify the concept design presented. The design analysis shall also document how the basis of design criteria has been met. The following items shall be included in the concept design analysis. (Note: Items that are not applicable to the project shall be noted as such in the design analysis.) The design analysis shall consist of two parts, part A: Narrative, and part B: Calculations. The calculations may be provided as an appendix to the narrative.

NARRATIVE:

14.3.1.1 Site Electrical Supply and Distribution

a. Service Availability: Discuss the availability of electrical service from the local utility, on-site electrical distribution system, or local generator.

1. Summarize calculations (provided as an appendix to the design analysis) of the estimated project load, including any assumptions and approximations made (follow applicable procedures of UFC 3-501-01)

2. Identify the recommended source of power and discuss its capacity to meet the estimated demand of the new load.

3. Define the characteristics of the power source at the point of service to the new facility, i.e. voltage, frequency, number of phases, KVA capacity, and available fault current. Discuss all assumptions made.

b. Distribution Scheme: Describe the proposed distribution scheme. Provide reasoning for selection of simple radial, loop radial, primary selective, etc. system. The description shall also include an explanation of the protection scheme proposed for the distribution scheme (with appropriate references to the site one-line diagram). The recommended distribution system shall be responsive to the operational needs of the facility as well as economic factors. The description should include a discussion of the recommended distribution voltage levels and location of transformers. Computer or manual calculations of approximate short circuit current and voltage drop associated with the proposed scheme (for major components only, to demonstrate the range of expected results) shall be provided (in the appendix) and the results discussed in the narrative.

c. Grounding: Describe the proposed grounding scheme (i.e., resistance or solidly grounded distribution systems, lightning protection grounds, special equipment grounds, etc). Indicate how the grounds will be interconnected within the site, including the use of counterpoise conductors, building ground rings, ground rods, etc.

d. Construction Methods: Describe the proposed construction method (direct burial, duct bank, aerial) and provide supporting documentation for the recommended approach. Both operational requirements (reliability, site congestion, etc.) and cost shall be addressed in the analysis. Design criteria, such as separation of medium voltage (15KV), high voltage (33KV etc), low voltage (380V), and control conductors shall be discussed.

14.3.1.2 Other Electrical Site Utilities.

a. Security: Describe the requirements for any site security systems (i.e. CCTV, intrusion detection, etc.) identified in the Scope of Work. Discuss requirements with the Center of Expertise in Huntsville to see if scope is only to supply infrastructure or a full system as they should be reviewing all of the more complicated electronic security system designs. For each required system, describe the proposed technology (i.e., infrared, capacitance field, tensioned wire, etc.) construction methods (coax, fiber optic, radio, etc.), and routing. This description shall discuss the relative advantages of alternative solutions and provide supporting information for the selected system. Describe proposed interfaces of responsibility between contractor and site security authority.

b. Other: Provide similar analysis for any other site utility identified by the Scope of Work, such as cable TV, data communication, etc.

c. Exterior Lighting: Describe the site lighting requirements, including security lighting. State the proposed lighting intensities for each system. Describe the type of lamps and luminaries for each system, addressing such issues as restoration of lighting after a power outage and color rendition. Describe the proposed spacing and location of such fixtures and their relation to security and maintained uniformity in lighting intensities. Describe the proposed construction method for the wiring and the source of power (including control philosophy).

d. Cathodic Protection: Discuss the requirement (or lack of) for cathodic protection of underground materials. The discussion should address the corrosiveness of the soils, the materials to be used on the project (for all disciplines, not just electrical), and the need for active or passive protection. If protection is required, provide supporting documentation for the recommended system. Be sure to coordinate any special requirements with other design disciplines.

e. Lightning Protection: Identify requirements for lightning protection of any facility included in the project. The discussion should include descriptions of surge arresters for distribution equipment and feeders as well as lightning rods for facilities, down conductors, and connection to the ground system.

14.3.1.3 Building Electrical Systems

a. Power Distribution: State the proposed system voltage for each level of distribution. Describe how the power will be derived and distributed, including the point of service from the site distribution system. Identify any special utilization requirements (such as 400 HZ power, 120 v power on a 380/220V system, UPS, Frequency Converter requirements, etc.) and describe how the requirement will be met.

b. Lighting Systems: Describe the proposed lighting systems. Identify and discuss all tasks that require special lighting treatment. Provide (in an appendix) a table listing each room or area, the lighting level required (including reference to criteria), and the proposed fixture type. Describe the emergency lighting and exit lighting requirements for the facility and indicate the proposed means of meeting the requirements.

c. Wiring Methods: Describe the proposed wiring methods. Identify the proposed applications for of rigid metal conduit, EMT, cable trays etc. Define which type of circuits will be in or beneath floor slabs, run overhead, exposed, etc. Identify the type of conductors proposed, including any special requirements for high ambient temperature, etc. Identify any proposed use of busway, including justification. Identify the type of outlets to be used for various system voltages, phases, and frequencies.

Indicate how special circuits (such as 400 hz) circuits will be segregated from other circuits.

d. Emergency Power: Identify requirements for emergency power (based upon the Scope of Work or other safety criteria). For all such requirements, identify the proposed method of providing emergency power, and provide supporting reasons for its selection. Include a description of the proposed source of power, define the distribution system for the emergency power, and discuss the proposed use of transfer switches or other means of interconnection of emergency and normal power sources. Define the period of time the emergency power will be sustained and the criteria used to select it.

e. Hazardous Locations: Define all hazardous locations within the limits of the project. Discuss the type of hazard and the resulting electrical design criteria that will be followed during the design of the project. Identify any special circuiting requirements that this may impose on the design.

f. Special Grounding or Shielding: Identify any special grounding requirements (such as isolated electronic ground for computer systems), special power conditioning (filtered power supplies, etc.), and shielding (EMI/RFI) required for the facility. For all such requirements provide a description of the design features that will meet these requirements.

g. Special Equipment: Identify any special mechanical equipment (elevators, cranes, foundry ovens, etc.) that require special electrical design attention. For all such equipment describe the design features that will meet these requirements. This description shall be coordinated with the requirements of Chapter 12: SPECIAL MECHANICAL SYSTEMS AND EQUIPMENT.

CALCULATIONS:

The following calculations shall be provided in support of the concept design submittal:

a. Load Calculations. The estimated electrical load of the facility shall be calculated. The estimated load shall include estimates of large mechanical or other loads in addition to estimated lighting and general power loads. Use of demand and diversity factors shall be fully explained.

b. Cable size. Based upon the load calculations, initial cable sizing calculations shall be provided for main feeders. Calculations shall include all derating factors (such as ambient temperature, conductors in conduit, etc.). Manual calculations are acceptable. Alternative choices (such as three conductor versus single conductor, direct buried versus duct or conduit installation) shall be discussed, with resulting recommendations.

c. Transformers. Calculations for main service transformer capacity shall be presented based upon the load calculations described above. Although not final, these calculation should indicate the approximate size of transformers needed and their configuration.

d. Short Circuit. Initial short circuit calculations shall be provided. These shall be based upon the available utility short circuit, transformer impedances proposed for the project, and main feeder configuration. Manual calculations are acceptable. An impedance diagram corresponding to the calculations shall be furnished if necessary. The calculations shall be of sufficient detail to identify the approximate magnitude of short circuit available with the proposed design. The purpose of this study is to identify potential problems with equipment ratings. A detailed bus by bus analysis is not required so long as the overall range of ratings has been identified.

e. Voltage Drop. An initial voltage drop study shall be provided. The study shall be based upon the load analysis, transformer impedances, feeder sizes, and physical configuration for major elements of the proposed system. Manual calculations are acceptable. An impedance diagram corresponding to the calculations shall be furnished for larger systems. The calculations shall be of sufficient detail to identify any voltage drop problems associated with the proposed design. Excessive drops will be corrected and calculations done again to demonstrate that the proposed design satisfies all criteria.

14.3.2 <u>Concept Design Drawings</u>.

14.3.2.1 Site Drawings.

a. Plan. Develop site drawings showing all facilities included in the project, the proposed power and signal cable routings, location of transformers, and location of electrical interfaces (service connection point, substation, etc.). Show existing utility lines (if pertinent to the design or the construction of the new work). Identify all proposed removals. Significant features of construction (i.e. roads, paved areas, etc.) shall also be shown. The drawings shall be sufficiently complete to define the overall electrical site distribution systems, although details need not be provided.

b. One-line diagram. Provide a site one-line diagram showing the power source for the project, the proposed distribution scheme, all transformers, and major protective devices. For simple building designs with only one service entrance panel, all information can be included in the panel schedule in lieu of an one-line diagram. Only approximate equipment ratings and configurations are necessary at the concept stage. The design should be sufficiently complete to determine the effectiveness of the protection scheme and evaluate the efficiency of the operating configuration. Any special requirements shown on the one-line diagram (remote metering, etc.) shall be discussed in the design analysis.

14.3.2.2 Building Drawings

a. Floor Plans - power.

1. Equipment location. Provide floor plans showing the proposed location of all major electrical equipment including electrical switchgear rooms, vaults, transformers, switchboards, motor control centers, distribution panels, power and lighting panels, main telephone terminal cabinets, and fire alarm panels. Space allocations and equipment layouts shall provide for maintenance and egress as required by the NEC or the appropriate ruling standard.

2. Show sample branch circuit designs for several circuits. Drawing presentation for branch circuits shall include location of outlets, lines connecting outlets representing wiring and home run arrow to panel (with panel designation and circuit number shown). Connecting lines shall differentiate between concealed wiring, wiring in or under floor, and exposed wiring. Connecting lines do not need to show the actual physical routing of the circuit, only its schematic configuration.

b. Floor Plans - lighting. Show sample lighting layout designs for several typical rooms. The layout shall show how fixtures will be identified as per type of fixture, how circuits and switching legs are to be identified, and provide a representation of required wiring methods. In general, circuit conductors shall be shown in a similar fashion to that described above for branch circuits. The method of wiring to lay-in type fixtures shall be via a flexible conduit from a junction box (which can serve up to four fixtures) mounted above the suspended ceiling. All fixture layouts shall be coordinated with the reflected ceiling plan and HVAC requirements.

c. Single-line Diagrams. If required to show design components, provide a one-line diagram for the building electrical distribution system. The diagram shall include incoming power feeders, transformers, main distribution panels, sub-panel feeders, major sub-panels and motor control centers, transfer switches, emergency generators, and any major load centers. Tentative sizing of major components and feeders shall be indicated (based upon the information contained in the design analysis). Conceptual design of protective relay schemes (where required) will also be presented.

14.3.2.3 Detail Drawings. Detail drawing sheet anticipated for the design shall be included in the drawing index to demonstrate the estimated requirement for detailed drawings. Concept level detail drawings may be submitted if some details have been initiated at this phase of the design.

14.3.2.4 Panel Schedules. Panel schedule sheets anticipated for the design shall be included in the drawing index to demonstrate the estimated requirement for panel schedules. Blank, or partially filled out panel schedules may be submitted if they have been developed at the concept level design.

14.3.3 Concept Design Specifications. Outline Specifications, per the requirements of Chapter 3: SPECIFICATIONS shall be submitted. All major items of the electrical design (i.e. items shown on the one-line diagram) shall be addressed in the outline specifications. All special requirements (i.e. grounding, communication wiring, etc.) shall also be contained in the outline specifications. The outline specification serve to identify the materials and equipment required by the design without imposing the requirement to edit the Guide Specifications to provide the information.

14.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

14.4.1 Preliminary Design Analysis.

NARRATIVE:

The design analysis narrative shall include all items addressed in the concept submittal, revised as necessary, to accurately document the basis of the preliminary design. All accepted Government review comments made on the concept submission will be addressed in the preliminary submission. New information required as a result of the preliminary design development shall also be included.

CALCULATIONS:

The following calculations shall be provided in support of the preliminary design submittal.

a. Load Calculations: Provide the estimated project electrical load based upon the design loads known at the preliminary design. Provide individual circuit loads, tabulated in volt-ampere or KVA for each panelboard, motor control center, and switchboard. Provide known loads where available, otherwise use estimated loads per circuit. The tabulations shall correspond to the panel schedules shown on the drawings. Loads shown shall be based upon the ratings of equipment shown on the drawings. Use of demand factors, load factors, growth factors, etc. shall be clearly documented in their application. Computer "spreadsheets" showing this data shall be acceptable only if the calculation contained within is documented. The load summaries shall be auditable from the panel schedules through to system to establish the overall project load. A load diagram (similar to a one-line diagram, but showing load distribution) is an acceptable method to show this where numerous panels exist in the project. The preliminary analysis shall highlight any significant changes in the project load that may have occurred since the concept submittal.

b. Cable Size. Provide updated cable sizing calculations based upon the preliminary load calculations. Cable sizing calculation shall clearly indicate all load factors, ambient temperature derating factors, installation (ductbank, thermal) factors required for proper cable sizing. Recommended cable sizes shall be clearly identified. Manual calculations are preferred, although computerized calculations are acceptable if documentation is provided to show that appropriate factors required by the project have been properly considered. (Caution: some computerized calculations rely upon assumed conditions that may not be appropriate to the project.)

c. Transformers. Provide updated transformer calculations based upon the preliminary load calculations.

d. Short Circuit. Provide an updated short circuit calculation based upon the preliminary design configuration. An updated impedance diagram shall also be provided. The study shall address all busses to the panelboard level unless it is obvious that the short circuit current does not warrant that level of study. Calculations using reactance only are acceptable unless results are very close to standard equipment ratings, in which case resistance and reactance calculations are required. The calculations shall include all sources of short circuit current, such as large rotating machinery, to the extent such contributions are significant to the results. Manual calculations are preferred for small projects. Computerized calculations are acceptable if documentation is provided to show that appropriate factors required by the project have been properly considered. (Caution: some computerized calculations rely upon assumed conditions that may not be appropriate to the project.)

e. Voltage Drop. Provide an updated voltage drop calculation based upon the preliminary design configuration and loads identified in the load study. An updated impedance diagram shall also be provided. The study shall address all feeders to the panelboard level. Calculations shall also be provided for worst case branch circuits. Revised calculations shall be provided when initial calculations indicate potential voltage drops in excess of criteria. Manual calculations are preferred for small projects. Computerized calculations are acceptable if documentation is provided to show that appropriate factors required by the project have been properly considered. (Caution: some computerized calculations rely upon assumed conditions that may not be appropriate to the project.)

f. Lighting. Provide lighting calculations for all spaces. Computerized calculations are acceptable so long as sufficient information is shown to validate the computations.

g. Other calculations. Other calculations may be required at this submittal depending upon the requirements of the project. Examples of these include generator sizing calculations, reduced voltage motor starting requirements, overhead distribution lines (pole sizing, conductor tensioning and sagging, guy wire sizing, etc.), cathodic protection, ground resistance, telephone equipment, etc. All such calculations required for the proper design of the project shall be provided in preliminary form as part of this submission.

CATALOG CUTS:

The preliminary design analysis shall include, in the appendix, catalog cuts representing the type of equipment called out on the drawings and specifications for major components of the electrical system. Catalog cuts shall be provided for all major pieces of equipment, such as transformers, switchgear, switchboards, power circuit breakers, transfer switches, busway, load break switches, generators, etc. Where feasible, more than one source for major equipment shall be represented in the catalog cuts. The catalog cuts shall demonstrate that the selected equipment fits within the dimensions allowed in the design, and is available in the ratings required.

14.4.2 Preliminary Design Drawings.

14.4.2.1 Site Drawings.

a. Plan. The concept site plan drawings shall be updated to reflect preliminary design development. Additional information shall be shown to describe such features as duct bank configurations, manhole locations, splice boxes, etc. as necessary for the project. Exterior electrical features of the project, such as exterior lighting, security systems, etc. shall also be shown. Detail sheets shall be referenced on the plan drawings, and all such referenced sheets (developed to the 60% stage) shall be added to the package.

b. One-line diagrams (if applicable). The one-line diagram shall be updated to reflect preliminary design development. Device ratings shall be based upon the design as documented in the design analysis. Protection scheme relaying shall be shown, including CT ratios, fuse ratings, device numbers, control lines, etc. The site one-line diagram shall be fully coordinated with building one-line diagrams.

14.4.2.2 Building Drawings.

a. Floor Plans - power.

1. The equipment location plans shall be updated to reflect preliminary design development.

2. Branch circuit designs shall reflect approximately 60 percent completion. All equipment served by dedicated circuits shall be shown. Circuits shall be coordinated with design analysis data and panel schedules.

b. Floor Plans - lighting. Lighting layouts shall reflect approximately 60 percent design completion. Lighting design shall be shown for each type of fixture used in the design. A fixture schedule shall be added to the drawing set showing mounting heights, lamp data, and reference to Standard Detail descriptions. Exterior light fixtures may also be included in the fixture schedule with additional information on pole heights and types.

c. Single - line Diagrams. If applicable, one-line diagrams for building electrical distribution systems shall be updated to reflect the preliminary design development. Sizing of major components and feeders shall be based upon the information in the design analysis and be coordinated with information shown on the plan drawings. Preliminary design of protective relay schemes (where required) will also be presented, including device ratings and control schemes.

14.4.2.3 Detail Drawings. Detail drawings shall be submitted showing approximately 60 percent design development. These drawings shall show the design for such things as motor control center elevations (generic in nature) showing approximate maximum dimensions permitted, general layout of compartments, and conduit interfaces (These details should be coordinated with the catalog cuts specifying exact model numbers, ratings, etc., mentioned above). Similar details shall be shown for metal enclosed switchgear, load break switches, low voltage switchgear, busway, etc. Detail layout drawings shall be provided for electrical equipment rooms and other congested areas. Conduit routings in congested areas shall also be detailed. Details shall be provided for conduit penetrations of exterior walls and floor slabs. Special mounting requirements or unusual equipment connection requirements shall also be detailed.

14.4.2.4 Panel Schedules. Panel schedule drawings shall be provided for the panel included in the design. The format of the schedule shall show, as a minimum, the phase connection of each circuit, the number of poles required, a circuit number, ampere rating of the protective device, conductor sizes and number of conductors, conduit size, load description, and volt-ampere load per phase of each circuit. The panel schedule shall show the total connected load per phase, the estimated demand load (per NEC requirements if applicable, or the Engineer's estimate) per phase, and the estimated currents. The panel ratings shall also be provided, including the bus ratings, the short circuit ratings, the main breaker (if required) ratings (both frame size and trip rating), the size of the feeder to the panel, and its source of power.

14.4.3 Preliminary Design Specifications. Specifications shall be submitted in accordance with the requirements of Chapter 3: SPECIFICATIONS.

14.5 FINAL SUBMITTAL REQUIREMENTS.

14.5.1 Final Design Analysis
NARRATIVE:

The design analysis narrative shall include all items addressed in the preliminary submittal, revised as necessary, to accurately document the basis of the completed design. All Government review comments made on the preliminary submission will be addressed in the Final submission. New information required as a result of the completed design development shall also be included. The narrative shall include a detailed description of the protective scheme for the system, including a detailed description of the sequence of operations. Appropriate references shall be made to the design calculations, one-line diagrams, and tentative coordination study.

CALCULATIONS:

The following calculations shall be provided in support of the Final design submittal.

a. Load Calculations: Provide the estimated project electrical load based upon the design loads known at the completion of the design. Provide individual circuit loads, tabulated in volt-ampere or KVA for each panelboard, motor control center, and switchboard. Provide known loads where available, otherwise use estimated loads per circuit. The tabulations shall correspond to the panel schedules shown on the drawings. Loads shown shall be based upon the ratings of equipment shown on the drawings. Use of demand factors, load factors, growth factors, etc. shall be clearly documented in their application. Computer "spreadsheets" showing this data shall be acceptable only if their operation is documented. The load summaries shall be auditable from the panel schedules through to system to establish the overall project load. A load diagram (similar to a one-line diagram, but showing load distribution) is the preferred method to show this where numerous panels exist in the project.

b. Cable Size. Provide updated cable sizing calculations based upon the completed design load calculations. Cable sizing calculation shall clearly indicate all load factors, ambient temperature derating factors, installation (ductbank thermal) factors required for proper cable sizing. Recommended cable sizes shall be clearly identified. Manual calculations are preferred, although computerized calculations are acceptable if documentation is provided to show that appropriate factors required by the project have been properly considered. (Caution: some computerized calculations rely upon assumed conditions that may not be appropriate to the project.)

c. Transformers. Provide updated transformer calculations based upon the completed design load calculations.

d. Short Circuit. Provide an updated short circuit calculation based upon the completed design configuration. An updated impedance diagram shall also be provided. The study shall address all busses to the panelboard level unless it is obvious that the short circuit current does not warrant that level of study. Calculations using reactance only are acceptable unless results are very close to standard equipment ratings, in which case resistance and reactance calculations are required. The calculations shall include all sources of short circuit current, such as large rotating machinery, to the extent such contributions are significant to the results. Manual calculations are preferred for small projects. Computerized calculations are acceptable if documentation is provided to show that appropriate factors required by the project have been properly considered. (Caution: some computerized calculations rely upon assumed conditions that may not be appropriate to the project.)

e. Voltage Drop. Provide an updated voltage drop calculation based upon the completed design configuration and loads identified in the load study. An updated impedance diagram shall also be provided if the Engineer deems it is necessary. The study shall address all feeders to the panelboard level. Calculations shall also be provided for worst case branch circuits. Revised calculations shall be provided when initial calculations indicate potential voltage drops in excess of criteria. Manual calculations are preferred for small projects. Computerized calculations are acceptable if documentation is provided to show that appropriate factors required by the project have been properly considered. (Caution: some computerized calculations rely upon assumed conditions that may not be appropriate to the project.)

f. Lighting. Provide lighting calculations for all spaces. Computerized calculations are acceptable so long as sufficient information is shown to validate the computations.

g. Other calculations. Other calculations may be required depending upon the requirements of the project. Examples of these include generator sizing calculations, reduced voltage motor starting requirements, overhead distribution lines (pole sizing, conductor tensioning and sagging, guy wire sizing, etc.), cathodic protection, ground resistance, telephone equipment, etc. All such calculations required for the proper design of the project shall be provided in final form as part of this submission.

h. Coordination Study. If requested by the reviewing engineer, a coordination study will be provided to assure that the system as designed can provide a coordinated protective response. This study shall show the damage curves for the specified equipment (transformers, conductors, major loads), curves for typical protective devices (fuses, circuit breakers) as called out on the drawings at each level of protection, and the minimal time-current curve required from the utility serving the project. While the final specifications shall impose upon the construction contractor the requirement for a detailed coordination study based upon the equipment installed on the project, the purpose of this study is to demonstrate that a coordinated system can be achieved within the parameters of the design.

CATALOG CUTS:

The design analysis shall include, in the appendix, catalog cuts representing the exact type manufacturer and model of equipment for called out on the drawings and specifications for major components of the electrical system. Catalog cuts shall be provided for all major pieces of equipment, such as transformers, switchgear, switchboards, panelboards, power circuit breakers, transfer switches, busway, load break switches, generators, or whatever equipment the Engineer deems necessary. Where feasible, more than one source for major equipment shall be represented in the catalog cuts. The catalog cuts shall demonstrate that the selected equipment fits within the dimensions allowed in the design, and is available in the ratings required.

14.5.2 Final Design Drawings.

14.5.2.1 Site Drawings.

a. Plan. The preliminary site plan drawings shall be updated to reflect the completed design. Thorough information shall be shown to describe such features as duct bank configurations, manhole locations, splice boxes, etc. as necessary for the project. Exterior electrical features of the project, such as exterior lighting, security systems, etc. shall also be shown. Detail sheets shall be referenced on the plan drawings, and all such referenced sheets shall be added to the package.

b. One-line diagram. The one-line diagram shall be updated to reflect completed design. Device ratings shall be based upon the design as documented in the design analysis. Protection scheme relaying shall be shown, including CT ratios, fuse ratings, device numbers, control lines, etc. The site one-line diagram shall be fully coordinated with building one-line diagrams. The diagram shall include complete descriptions of all components, including size and rating of devices, conductors, conduits, trip settings, frame size, bus bracing ratings, short circuit ratings, surge suppressors, terminations, etc. Ensure that information shown on the one-line diagram is not duplicated elsewhere in the construction package, as this will likely cause conflicts if changes are necessary. Indicate on the electrical legend the exact nomenclature used to indicate conductor and conduit sizing. Provide a schedule for feeder runs. Provide medium voltage one-line diagrams for stations and distribution systems that have a geographic affiliation to the actual constructed distribution system. Typical illustrations showing proper methods for displaying one-line and power riser diagrams on the contract drawings are provided in a PDF format within the electrical technical paper TSEWG TP-12: UFC 3-501-01 Appendices. https://www.wbdg.org/ffc/dod/supplemental-technical-criteria

c. 14.5.2.2 Building Drawings.

a. Floor Plans - power.

1. The equipment location plans shall be updated to reflect the completed design.

2. Branch circuit designs shall be complete. Circuits shall be coordinated with design analysis data and panel schedules. All unusual grounding requirements shall be shown by reference to detail sheets.

b. Floor Plans - lighting. Lighting layouts shall be complete. Exterior light fixtures may also be included in the fixture schedule with additional information on pole heights and types.

c. One-line Diagrams. If deemed necessary by the Engineer, the one-line diagrams, if required for building electrical distribution systems, shall be complete. Sizing of major components and feeders shall be based upon the information in the design analysis and be coordinated with information shown on the plan drawings. Design of protective relay schemes (where required) will also be presented, including device ratings and control schemes. The one-line diagram shall depict all major loads within the facility, and include such details as disconnect switches for motor loads and control devices (thermostats, level switches, etc.) required for control of devices (with appropriate reference to mechanical equipment specifications.).

14.5.2.3 Detail Drawings. Detail drawings shall be submitted based upon the completed design. These drawings shall show motor control center elevations (generic in nature) showing approximate maximum dimensions permitted, general layout of compartments, and conduit connections. Similar details shall be shown for metal enclosed switchgear, load break switches, low voltage switchgear, busway, etc. Detail layout drawings shall be provided for electrical equipment rooms and other congested areas. Conduit routings in congested areas shall also be detailed. Details shall be provided for conduit penetrations of exterior walls and floor slabs. Special mounting requirements or unusual equipment connection requirements shall also be detailed. Details shall be provided for special grounding requirements, cathodic protection requirements, security device mounting requirements, and all other special construction requirements.

14.5.2.4 Panel Schedules. Completed panel schedules shall be submitted based upon the completed design.

14.5.3 Final Design Specifications. Specifications shall be submitted per the requirements of Chapter 3: SPECIFICATIONS.

14.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

14.6.1 RTA Design Analysis. The RTA design analysis shall consist of the Final design analysis updated to reflect incorporation of review comments.

14.6.2 RTA Design Drawings. The RTA design drawings shall consist of the Final design drawings updated to reflect incorporation of review comments.

14.6.3 RTA Design Specifications. Provide RTA specifications in compliance with the requirements of Chapter 3: SPECIFICATIONS.

14.7 TECHNICAL REQUIREMENTS.

14.7.1 General Requirements. The design shall comply with the requirements of the National Electrical Code, the Life Safety Code, and the National Electrical Safety Code. The design shall be developed in accordance with the Department of the Army Technical Manuals, Naval Facility Engineering Command Design Manuals, and IEEE recommended practices. The design shall be based upon the use of U.S. equipment and standards, including appropriate ANSI and UL standards. The specifications shall be based upon Government furnished guide specifications when available and A/E developed specifications (CSI three part format) when guide specifications are not available.

14.7.2 Equipment. All electrical equipment, including switchboards, panelboards, controllers, metering cabinets, transformers and special equipment shall be housed within NEMA or equivalent enclosures, shall be in accordance with appropriate ANSI standards for design and manufacture, and shall be located and mounted in compliance with the NEC.

14.7.3 Services. Complete electrical service will consist of the incoming power lines, transformers, meters, disconnect switches, and main over-current devices. Electrical equipment shall meet or exceed UL requirements. Service configurations will comply with NEC or BS7671 requirements, dependent on local codes. The demand load used in determining conductor size shall include the spare capacity requirements defined for lighting and power panelboards.

14.7.4 Metering. In general, metering requirements shall be in accordance with standard practice for electrical equipment such as switchgear. Special metering requirements, such as for individual housing units, shall be determined during the concept stage of design.

14.7.5 Power Utilization Voltage Levels.

a. 60 Hertz Systems. For projects complying with U.S. practices, in general; if a building has a total demand load of less than 150 amperes, power distribution in the building shall be 240/120 volts, single phase, three wire unless otherwise required by equipment or as directed by the Government. All other utilization shall be at 208Y/120 volts, three phase four wire. Where economically justified, 480Y/277 volts may be used for lighting and distribution within the building with step down transformers for 120 volt loads. All single phase receptacle loads shall be at 120 volts. Convenience outlets shall be NEMA standard. Interior lighting may be at 120 volts or 277 volts as determined by economic analysis. Projects required to meet Saudi Arabian Standards shall be designed at 127/220V, 3 phase, 4 wire and 220/380V, 3 phase, 4 wire. Where exterior underground branch circuits exceed 150 feet in length, a higher supply voltage shall be considered to reduce voltage drop.

b. 50 Hertz Systems. The utilization voltage for outlets and lighting shall be in accordance with the prevailing standard in the area of the project. In general, this means either 380Y/220 volts three phase four wire, or 415Y/240 volts three phase four wire designed for a nominal voltage of 400V. Convenience outlets shall be specified to correspond with prevailing use in the area of the project. In general this means either DIN standard "Schuko" outlets, BS.1363:1984 outlets, or French Standard (19mm) outlets. Transition from these non-NEMA devices to U.S. standard equipment (conduit, panelboards, etc.) shall be done in an orderly and defined manner. Particular attention is required in the editing of the project specifications for outlets and outlet boxes. Boxes must be called out to properly accommodate the specified outlets. Standard U.S. boxes do not work with European outlets.

14.7.6 Transformers.

a. Interior. Transformers installed in buildings, unless installed in fireproof vaults, shall be dry type. Ventilation supplied for transformer rooms shall not be less than specified in Article 450 of the NEC.

b. Distribution. Distribution transformers shall be Type I, mineral oil insulated, cast resin, or dry type two winding. Transformers shall be provided with no-load tap changes having two 2-1/2 percent taps each, above and below, rated primary voltage unless otherwise directed or required by the system design. Transformer impedances and BIL ratings shall be for standard applications within the industry.

c. Traffic barriers. Heavy duty traffic barriers shall be installed around exterior pad-mounted transformers where transformers are located in the vicinity of any vehicle traffic.

d. Demand and diversity factors. Appropriate demand and diversity factors shall be applied when selecting transformer ratings.

e. Derating factors. Where applicable, apply appropriate derating factors to transformers for ambient temperature conditions, giving special attention to transformers in poorly ventilated enclosed spaces. Derating factors shall be used as described in NEMA TR-1, ANSI C57.92 and ANSI C57.96.

f. Grounding. All grounding shall be done in accordance with Article 250 of the NEC for US facilities or generally BS 7671 for Middle Eastern countries. However, each Host Nation (HN) may have special requirements. Provide details on the drawings indicating all the service entrance neutral ground connections required by the NEC or HN for each building or facility. An equipment grounding conductor shall be run in all conduits with ungrounded conductors.

14.7.7 Branch Circuits. Branch circuits shall be designed in accordance with Article 210 of the NEC.

a. Branch circuit loading. For the purpose of branch circuit loading, lighting panelboard branch circuits shall be loaded to a maximum of 80 percent of the circuit capacity. In general, 20-ampere circuit breakers shall be used as branch circuit protective devices for convenience outlets. Convenience outlet branch circuiting shall be limited to 16 amperes per circuit using 180 volt-amperes per outlet. Additional restrictions or design criteria may apply dependent on local codes.

b. Load identification. Extreme care shall be taken to assure that proper service is provided for all electrical loads, and that all electrical loads are properly identified on the drawings.

c. Number of conductors. The number of conductors shall be shown in all conduit runs where more than two circuit and equipment grounding conductors are required. As an alternative, the panel schedule may be used to show number of conductors in branch circuits. An equipment grounding conductor shall be run with circuit conductors.

14.7.8 Feeders and Sub-Feeders. Feeders and sub-feeders shall be designed in accordance with the NEC, UFC and HN requirements. Feeder circuits shall be run in rigid conduit, intermediate metal conduit, or electrical metallic tubing except where large loads justify the use of enclosed bus bars. Feeder circuit conductors shall have heat resistant thermoplastic insulation. For large buildings, feeder lengths and sizes should be reduced by use of several transformer banks supplied at primary voltages. The combined voltage drop of the feeder and branch circuit shall be proportioned not to exceed a total voltage drop of 5 percent from the transformer to the furthest load. In general, the voltage drop for the feeder circuit conductors shall not exceed 2 percent and the branch circuit conductors shall not exceed 3 percent. Feeders shall be derated for high ambient temperature where required by project conditions. General routing of main feeders shall be shown on the drawings where required for purposes of constructability.

14.7.9 Wiring Methods and Materials. Wiring methods and materials shall be those recognized by the National Electrical Code, except as modified below. All interior power, lighting, and line voltage control conductors shall be run in raceways, except where cable tray systems are employed. Low voltage and temperature control wiring shall be encased in conduit where the run is exposed.

14.7.9.1 Conduit. Electrical metallic tubing shall not be installed below grade, where subject to severe corrosive conditions, or where embedded in concrete. Only rigid steel conduit may be used where exposed to damage, 7 feet or less above the floors. Where rigid steel conduit is required to run below slab-on-grade, the conduit will be appropriately coated to prevent corrosion. Use of intermediate metal conduit shall be permitted and shall comply with Article 345 of the NEC. Use of plastic conduit shall be permitted as outlined in the Guide Specifications.

14.7.9.2 Wiring for Power and Lighting. The minimum size wiring for power and lighting shall be No. 12 AWG. The design shall be based upon the use of copper conductors unless otherwise instructed by the Government.

14.7.9.3 Under-floor Duct. Under-floor duct systems shall be installed in administrative or other areas where extensive power or signal systems are required, or where wall outlets (in combination with occasional floor outlets) cannot serve an area adequately. Separate duct sections shall be provided for power and telephone systems. Power ducts shall have a minimal nominal cross sectional area of 3 square inches. Junction or pull boxes shall be provided to facilitate wiring and spaced at not more than 50 foot intervals. Specifications shall call for complete system installation, including boxes, covers, pans, rings, and outlets suitable for the finished floor.

14.7.9.4 Grounding. When extensive metal is in or on a building, a ground grid shall be installed around the building, and the building steel and equipment shall be connected to the grounding grid system. Special grounding requirements shall be fully detailed, such as electronic signal ground connections or shielded enclosure grounds. Where complex grounding systems exist within a facility, a detail showing the NEC requirements and their relation to the special requirements shall be shown. Equipment grounding conductors shall be installed in all raceways containing power conductors.

14.7.9.5 Switchboxes. Not more than one switch or duplex receptacle shall be placed in a single gang position of a switchbox.

14.7.10 Panelboards.

14.7.10.1 Types and Ratings. Branch circuit panelboards shall be of the circuit breaker type. Feeder, distribution, and sub-distribution panelboards shall be either circuit breaker, current limiting circuit breaker, or circuit breaker and current limiting fuse type. A main circuit breaker or disconnect shall be provided on all panelboards when two or more panelboards are supplied from the same feeder. All panelboards shall be provided with insulated neutral terminals and equipment grounding terminals.

14.7.10.2 Loads. Supplying small single-phase loads from power and distribution panels shall be avoided. Large three phase loads shall not be fed from lighting panels. Lighting and power panelboards may be combined for small facilities, but shall generally be segregated for larger facilities.

14.7.10.3 Location of Panelboards. The location of panelboards shall be coordinated with architectural drawings to assure cabinet mounting is correct for the location and wall type. Panel location shall provide for economical distribution of branch circuit conductors and minimal voltage drop.

14.7.10.4 Spare circuits. One spare circuit shall be provided for each five active single phase circuits in lighting panelboards. Spare circuit breakers and spaces in power and distribution panelboards shall be provided in the range of 10 to 20 percent of the active circuits. The spare circuits shall be included when applying demand loads for feeder, panel, and transformer sizing. For panelboards recessed in finished wall spaces, spare conduits shall be called out to be provided from the panelboard to overhead accessible areas for the spare circuits.

14.7.11 Lighting.

14.7.11.1 Lighting Fixtures.

a. Selection. Lighting fixtures shall be of the most efficient type to meet lighting requirements. A description and pictorial view for each such lighting fixture shall be prepared on an 8-1/2" x 11" drawing and included in the specifications. As an option, CADD details of the fixtures may be grouped on detail drawing sheets.

b. Application. Color corrected lighting shall be used where beneficial for operations in the lighted area. Fixtures mounted 25 feet or more above the floor shall be provided with facilities for relamping. Ceiling mounted fixtures shall be controlled by wall mounted switches. (Where economically justified, wall switches may control circuit breaker contactors to control large areas of ceiling lighting.) Street and road lighting shall be white light typically using LED or metal halide to achieve the necessary lighting levels most economically. Overhead lighting is required in every room of family housing, BOQ, and similar facilities to provide illumination of these rooms without the need for portable table or similar lamps.

Care shall be taken to reduce the stroboscopic effect of fluorescent in areas where revolving machinery is used. Stroboscopic effect can be reduced by using a lead-lag ballast per pair of fluorescent lamps or simply use LED if possible

14.7.11.2 Lighting intensities. Lighting intensities shall be based upon the requirements of UFC 3-530-01 and the I.E.S. Lighting Handbook.

14.7.11.3 Design analysis. The design analysis for lighting systems shall include the following:

14.7.11.3.1 Interior systems.

a. Room designation number

b. Required foot-candles

c. Room dimensions (length, width, height)

d. Fixture mounting height

e. Room Cavity Ratio

f. Maintenance factor

g. Coefficient of Utilization (Note: unless otherwise noted in the design, ceiling reflectance of .80, wall reflectance of .50, and floor reflectance of .20 shall be used.)

h. Number of fixtures

i. Fixture type, # of lamps, volt-amperes

j. Actual foot candles provided (must not deviate more than 20 % above or 10 % below required level)

14.7.11.3.2 Roadway lighting.

a. Roadway classification of traffic

b. Illumination level for each class.

c. Classification of roadway.

d. Type of luminaire and distribution (provide catalog cut of typical fixture)

e. Mounting height, spacing, overhang, arrangement, width of roadway.

f. Average foot-candles required.

g. Minimum foot-candles provided in covered area.

14.7.11.3.3 Area Lighting Systems.

a. Illumination level required

b. Type and location of fixtures

c. Coefficient of beam utilization

d. Maintenance factor

e. Number of fixtures per pole

f. Mounting height

g. Area to be lighted

h. Intensity of illumination for typical areas (showing maximum and minimum values)

14.7.11.4 Fixture Properties. Use the following output lumen values and input volt-ampere values for calculations:

a. Incandescent lamps:

Rating (W)	Lumens	volt-amperes
50	660	50
60	835	60
75	1150	75
100	1620	100
150	2600	150
200	4000	200
300	6000	300
500	10500	500
750	16700	750

b. Fluorescent lamps (Depending on local availability):

Rating (W) Lumens volt-amperes
40w T-12 3100 50 (va per lamp)
36w European 32w
T-8 2800 40 (va per lamp)

e. Metal Halide

Rating (W)	Lumens	volt-amperes
400	26500	455
1000	79000	1070

f. LED-see specific manufacturer values and types

14.7.11.5 Exit lighting systems.

Exit lights shall be provided to meet all applicable codes. All wiring of emergency lighting systems shall conform to the applicable sections of the NEC. The entire exit lighting system shall be considered as an emergency system, and shall be installed in conduit. Illuminated exit signs, in the appropriate language for the project, shall be provided at all emergency exits and passageways required by the NFPA Life Safety Code. In general, exit signs are required in:

a. Theaters, auditoriums, assembly halls, and places of public assembly.

b. Clubs, gymnasiums, and similar places of public and private gatherings.

c. Schools, lecture halls, and similar educational facilities, including technical training buildings.

d. Hospitals, dispensaries, and similar facilities for housing and sheltering of patients.

e. Exchanges, commissaries, and similar sales occupancies in excess of 5,000 sf.

f. Dormitories, officer's quarters, and similar quarters for occupancy by ten or more persons.

g. Administrative offices, shops, laboratories, and similar technical facilities having in excess of four rooms designed for an aggregate capacity in excess of 50 persons.

14.7.11.6 Power source. The electrical power source for an exit light system shall be taken from the service entrance circuit. In facilities equipped with emergency standby electrical power systems, the exit lighting shall be connected to the emergency power source. When battery powered individual emergency lighting units are used, they may be considered separate standby systems, but will be served from the same normal supply serving the exit lighting in the immediate area of application. Only one switch and over-current device shall be installed in the supply circuit for the exit lighting. The unit shall be tamper-proof. Where more than 10 lights are required or where the load exceeds 1,000 watts, two or more exit lighting circuits with over-current protection may be provided after the main exit lighting switch.

14.7.12 <u>Control Circuits</u>.

14.7.12.1 Special Control Circuits. Special control circuits shall be explained with schematic diagrams, logic diagrams, and narrative descriptions as appropriate. Schematic diagrams of control circuits shall be shown on the drawings for such items as remotely controlled lights, mechanical equipment, access control, etc. Care shall be taken in the design to assure voltage drop and conductor sizes are matched to the specified components and their physical location on the project site.

14.7.12.2 Motor Control Circuits. Motor control circuits shall be coordinated with the mechanical design. Where the control circuits are part of an integral mechanical system, they shall be clearly specified as such. Where control circuits are not integral to the mechanical system, a detailed control diagram shall be developed and included in the design documents. A basic schematic diagram (ladder type) shall be provided with references to devices, junction boxes, power sources, etc. shown on the building power drawings. Motor control stations for major equipment loads shall also be shown on the building one-line power diagram.

14.7.13 Fire Alarm System. Refer to chapter 9, Fire Protection and Life Safety for fire alarm system requirements.

14.7.14 Hazardous Locations. The drawings and specifications shall indicate the extent and classification of the hazardous areas. Electrical equipment, lighting fixtures, and devices in hazardous locations shall be noted on the drawings to as having to meet the classification requirements of the NEC and be UL approved.

14.7.15 Grounding. Existing soil conditions and project criteria shall be considered. Drawings and specifications shall clearly indicate all requirements for special grounding. Grounds for equipment, transformers, AC and DC generators, rectifiers, enclosures, shields, and lightning protection shall be clearly shown on the drawings and described in the specifications. Note that often the project will be installed in a remote location by laborers unfamiliar with NEC grounding requirements. For this purpose it is important to provide a detail showing the relationship between the equipment grounding conductors, the main bonding jumper, neutral bus, grounding electrode conductor, and the grounded service conductor. Additional details are required to show grounding requirements for computer and other electronic signal grounds, especially how they relate and are connected to the grounded service conductor.

14.7.15.1 Grounding system. Ground rods, where jointed, shall be exothermically welded. All metal supports or exposed metals in electrical cable trenches or tunnels shall be grounded. Convenience outlets for appliances or portable equipment use, or for extension of service through flexible cable shall be provided with a grounding pole electrically connected to a suitable grounding conductor. Ground conductors are required to be run with all branch and feeder circuits. The system neutral shall not be used for a grounding conductor.

14.7.16 Substations. Local building substation ratings should not normally exceed 500 KVA for 120/208 or 1500 KVA for 380/220V (480/277V or 415/240V) volt secondaries. Double ended substations shall be provided with a normally open, manually switched secondary bus tie, interlocks, and isolating switches to permit load transfer operation of building loads at reduced capacity in an emergency. Normally, primary disconnect switches shall be metal-enclosed, air-insulated, with current limiting fuses when required (although newer technology switches may be used if economically justified). Safety interlocks shall be provided. Switch ratings (BIL, interrupting capacity) shall be industry standard ratings for the application.

14.7.17 Switchboards. Switchboards, including those integral with unit substations, shall be of the dead-front, free-standing type. Protective elements shall be coordinated to provide a fully selective system. At least one space for future feeder positions shall be provided in each switchboard. All switchboards shall be provided with a main protective device and an equipment ground bus. In lieu of a full size neutral bus, a reduced size neutral bus shall be provided when the maximum unbalanced load between the neutral and any one ungrounded conductor can adequately carry the resultant neutral current. NOTE: There shall be no reduction of the neutral capacity for that portion of the load which consists of electric discharge lighting and other third harmonic producing equipment.

14.7.18 Motors and Controllers. Motors rated 1/2 horsepower or less shall be single phase. Motors rated more than 1/2 horsepower shall be three-phase, except where it is impractical to provide three phase power. This restriction does not apply to appliances and devices that are receptacle loads. Building equipment shall be controlled and protected by motor starters installed either individually or in motor control centers. Three phase running over-current protection shall be provided. Where equipment requires periodic maintenance, each starter shall be supplied with a H-O-A switch. Provide dust-tight enclosures for electrical equipment in areas susceptible to dust infiltration.

14.7.19 Security Control Systems. Security requirements will be identified by the project Scope of Work. When required, security control equipment shall be provided for monitoring and control of designated entrances, visual scanning of designated areas, intrusion detection systems, and fence detection systems. Control for all security systems shall be provided in one console. A block diagram shall be provided on the drawings showing all system components and interconnection. References to building and site drawings shall be included on the block drawing. All wiring for security devices shall be suitable protected.

14.7.20 Units of Measure. Follow the requirements for a given project in either metric or English units.

EXAMPLE 1 - PANELBOARD SCHEDULE

EXAMPLE 1

PANELBOARD ______________ __________ MOUNTED ____________________________ ASYM. A.I.C. MIN.
________ AMP. MAIN LUGS (OR) ____________ AMP. MAIN BREAKER W/ ________________ AMP. TRIP
CIRCUIT BREAKER TYPE _______ VOLTS _____ PHASE _____ WIRE _______________ AMP. BUS

CKT. NO.	TRIP AMPS	NO. POLES	WIRE MM²	GND MM²	CONDUIT MM	LOAD SERVED	LOAD-V.A.			LOAD-V.A.			LOAD SERVED	CONDUIT MM	GND MM²	WIRE MM²	NO. POLES	TRIP AMPS	CKT. NO.
							AØ	BØ	CØ	AØ	BØ	CØ							

TOTAL CONN. LOAD
PER PHASE (KVA): AØ ____ BØ ____ CØ ____

TOTAL CONN. LOAD _________ KVA. _________ % DEMAND = ESTIMATED DEMAND LOAD _________ SUPPLIED FROM PANEL _________

EXAMPLE 2 - LIGHTING FIXTURE SCHEDULE

EXAMPLE 2

LIGHTING FIXTURE SCHEDULE

FIXTURE TYPE	LINE VOLT.	DWG. 40-06-04		LAMPS		MOUNTING	REMARKS
		TYPE	SHEET NO.	NO.	WATTAGE		

CHAPTER 15
POWER GENERATION

CHAPTER 15

POWER GENERATION

15.1 GENERAL.

This chapter gives general guidelines for the preparation of drawings, specifications, and design analysis for power plants and supplements the requirements of Chapter 1 with specific criteria and additional specific design requirements. All required documents including drawings and design analysis shall be in accordance with Chapter 2: PRESENTATION OF DATA.

15.2 APPLICABLE PUBLICATIONS.

The current editions of the publications listed below form a part of this Manual.

Department of the Army Technical Manuals (TM):

TM 5-810-6. Non-Industrial Gas Piping Systems.

United Facilities Criteria (UFC):

UFC 3-230-03 Water Treatment

UFC 3-420-02FA Compressed Air

UFC 3-420-01 Plumbing Systems

UFC 3-400-02. Design: Engineering Weather Data.

UFC 3-450-01. Noise and Vibration Control.

UFC 3-450-02 Design: Petroleum Fuel Facilities

UFC 3-310-04. Seismic Design for Buildings.

UFC 3-410-01. Heating, Ventilating and Air Conditioning Systems.

UFC 3-501-01 Electrical Engineering

UFC 3-510-01 Foreign Voltages and Frequencies Guide

UFC 3-520-01 Interior Electrical Systems

UFC 3-540-04N Diesel Electric Generating Plants

UFC 3-550-01 Exterior Electrical Systems

American Society of Heating, Refrigeration, and Air- Conditioning Engineers (ASHRAE) Inc. Standards:

ASHRAE Handbooks, latest editions.

ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality

International Code Council:

IPC International Plumbing Code.

IMC International Mechanical Code

National Fire Protection Association (NFPA):

No. 30. Flammable and Combustible Liquid Code.

No. 54. National Fuel Gas Code.

No. 70. National Electrical Code.

NO. 90A. Installation of Air Conditioning and Ventilating Systems.

No. 91. Blower and Exhaust Systems for Air Conveying of Materials.

Illuminating Engineering Society (I.E.S.) Lighting Handbook:

Institute of Electrical and Electronic Engineers (IEEE):

IEEE Std. 242	IEEE Recommended Practice for Protection and Coordination on Industrial land Commercial Power Systems (Buff Book).
IEEE Std. 493	IEEE Recommended Practice for Design of Reliable Industrial and commercial Power Systems (Gold Book).
C2	National Electrical Safety Code

Sheet Metal and Air-Conditioning Contractors National Association, Inc. (SMACNA):

Low and High Pressure Duct Construction Standards.

American Conference of Government Industrial Hygienists:

Industrial Ventilation, A Manual of Recommended Practice.

15.3 CONCEPT SUBMITTAL REQUIREMENTS.

15.3.1 Concept Design Analysis. The advantages and disadvantages of various schemes shall be discussed and cost comparisons shall be submitted. Alternative fuel sources shall be discussed. Differing configurations of unit sizes and number of units shall be investigated, and the relative merits (cost, efficiency, maintenance) of each analyzed. Recommendations shall be presented as to how to best serve the load. Climatic and other physical conditions which may affect the reliability of service shall be discussed. The following specific items shall be included when applicable.

15.3.1.1 Power Plant Operation and Control Philosophy shall be discussed and the use of an Emergency Management Control (EMC) system of the power generation system shall be considered.

15.3.1.2 Protective Device Coordination Study. A conceptual protective device coordination study and short circuit analysis of the current and voltages under fault conditions shall be made. The study shall cover all operating arrangements of the system, symmetrical 3-phase faults, line-to-line faults, single phase line-to-ground faults, and double line-to-ground faults. This study shall demonstrate that the proposed configuration can be constructed using equipment with standard ratings and that proper coordination can be achieved using standard devices.

15.3.1.3 Relaying Systems that will be used to protect faulty conditions of circuits of apparatuses shall be discussed.

15.3.1.4 Grounding and Bonding. Discuss the general requirements for grounding and bonding of electrical installations; specific requirements for system grounding such as solid system grounding, resistance system grounding, or reactance system grounding; and the type of grounding for substations or switching stations (for example, upper steel rods, station ground mat, or counterpoise).

15.3.1.5 Prime Movers. A study shall be made to determine the number and type of prime movers to be furnished based on suitability for the particular condition. See paragraph: 15.7.1 Generating Units. Show the selection of these units based on a load study.

15.3.1.6 Load Analysis. Provide a load analysis in the development of the design showing estimated connected load, demand factors which are applied to various loads or areas, and total demand load.

15.3.1.7 Additional Generating Units. Consider the location and space requirements for additional generating units to handle future load growth and expansion.

15.3.1.8 Life-Cycle Cost Comparison. Provide a life-cycle cost comparison of different types and sizes of prime mover generating units.

15.3.1.9 Diversity. Discuss completely the effect that diversity will have in sizing the generating units.

15.3.1.10 Available mVA. State the maximum available short circuit mVA (3-phase symmetrical).

15.3.1.11 Auxiliary Power Requirements for control and black startup (such as standby electrical power and station batteries as applicable) shall be discussed.

15.3.1.12 Cathodic Protection of underground metallic pipes, structures, buried tanks, lead-covered cables, and equipment in manholes shall be considered.

15.3.1.13 Power Plant Communication System. If a power plant communication system is required, it shall be discussed. Indicate the method of operation of plant intercommunication systems for use between various handset locations and for paging personnel throughout the power plant, administration building, or warehouse. See Chapter 17: COMMUNICATIONS.

15.3.1.14 Building Lightning Protection to be provided for generating plants shall be discussed.

15.3.1.15 Fire Alarm System. Discuss required fire alarm systems and the type of fire and smoke detectors to be used. See Chapter 9: FIRE PROTECTION AND LIFE SAFETY.

15.3.1.16 Power Plant Security System. If a power plant security system is required, it shall be discussed. See Chapter 9: FIRE PROTECTION AND LIFE SAFETY.

15.3.1.17 Power Plant Mechanical Systems. Discuss required HVAC and plumbing systems and the method of operation. See Chapter 10: HEATING VENTILATING AND AIR CONDITIONING, and Chapter 11: PLUMBING.

15.3.2 <u>Concept Design Drawings</u>. The following specific items shall be shown when applicable.

15.3.2.1 Plant Drawings shall show the proposed location of generating units, engine auxiliaries room, machine shop and spare parts storage, transformers, switchgear, switchyards, and control room. The plans shall indicate fuel supply storage and handling.

15.3.2.2 Flow diagrams of all HVAC, Plumbing and Generator Auxiliary systems, including Fuel Storage and Supply System, Cooling System, and Compressed Air System. These diagrams shall be an accurate schematic representation of each system showing proposed equipment, primary control accessories, and piping as applicable.

15.3.2.3 Single-Line Diagrams. Provide complete ac and dc system single-line diagrams for buildings, including package system auxiliaries such as diesel or gas turbine generators.

15.3.3 <u>Concept Design Specifications</u>. Concept design specifications shall be submitted in accordance with Chapter 3: SPECIFICATIONS.

15.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

15.4.1 Preliminary Design Analysis. A design analysis shall be required as part of the Preliminary design submittal in support of information depicted on the plans. The analysis shall include all items in the concept design analysis and any necessary revisions. It shall indicate computations, references, any assumptions made in the design, and shall indicate criteria on which the design is based. Complete calculations shall be submitted for the following items.

15.4.1.1 Maintained Foot-Candle Intensities in all areas shall be provided.

15.4.1.2 Demand Load Summary. Provide a summary of feeder demand, connected loads, overall demand load at generating plant and overall demand load for area to be served; give quantity and type of conductors, type of conduit, minimum rating of feeder bus duct, voltage drop calculations, and actual size and type of overcurrent devices including interrupting capacity and transformer capacity.

15.4.1.3 Protective Device Selectivity. In addition to the short circuit analysis required in paragraph: Protective Device Coordination Study of the Concept design analysis, protective device selectivity assuring that a faulted circuit is cleared and that no other parts of the system are affected shall be considered.

15.4.1.4 Relay and Circuit Breaker Settings. Provide calculations for recommended relay and circuit breaker settings.

15.4.1.5 Selection Factors. Provide all demand, diversity, ambient temperature, or derating factors considered in the selection of equipment and conductors.

15.4.1.6 Design Data and Loads. Provide structural and mechanical design data and design loads. Mechanical design to include equipment heat rejection, cooling system, room ambient temperature and equipment temperature deration.

15.4.1.7 Computer Printouts submitted as part of computer fault studies shall have the inputs and outline of the computer program. A one-line diagram with lines and feeder references shall be provided. An impedance diagram shall be provided.

15.4.1.8 Electrical Characteristics. Discuss the electrical characteristics of the supply to the facility or portion thereof involved. Include in this discussion the interrupting capacity of devices intended to break current and the bus bracing requirements of electrical equipment housing these devices. Electrical characteristics shall be in accordance with TM 5-811-1 unless otherwise stated in this Manual.

15.4.2 Preliminary Design Drawings. Preliminary design drawings shall incorporate the following requirements.

15.4.2.1 Plan Drawings shall show the location of all major items or equipment, including the following.

a. High voltage switchgear.

b. Low voltage distribution equipment.

c. Control panels.

d. Instrumentation panels.

e. Lighting panelboards.

f. Power panelboards.

g. Motor control centers.

h. Prime mover details.

i. Lightning protection.

j. Telephone cabinets.

k. Automatic transfer switches.

l. Emergency generators.

m. Magnetic motor starters.

n. Lighting.

o. Site plan details.

p. All HVAC, plumbing and other building equipment including air conditioning, exhaust fans, and overhead door operators.

q. Special operating equipment such as compressors, radiators, pumps, and bridge cranes.

r. Fuel bulk storage and day tanks.

15.4.2.2 Power Distribution Features. All major items of equipment shall be sized and properly identified to agree with electrical plans. All motor control circuits shall be explained with basic schematic diagrams (ladder type) on the plan drawings. Power distribution features shall include the following detailed single-line diagrams of the electrical system.

a. Primary power.

b. Central power plant building.

c. Motor control center.

d. Direct current for battery systems.

e. Generator auxiliaries.

15.4.2.3 Power and Control Wiring. Plan drawings shall show location and routing circulation of all power and control wiring.

15.4.2.4 Grounding. Show the grounding necessary for power plant building, outdoor substations, outdoor switching stations, transmission lines, chimneys, flagpoles, and ordinary buildings. Show details for all unusual grounding requirements including those for transformer pads, all ac generating equipment, dc generators and rectifiers, static grounds, lightning protection, and primary equipment.

15.4.3 Preliminary Design Specifications. Preliminary design specifications shall be submitted in accordance with Chapter 3: SPECIFICATIONS.

15.5 FINAL SUBMITTAL REQUIREMENTS.

The design analysis and the drawings submitted for Final review shall be complete, as described in Chapter 1: GENERAL INSTRUCTIONS.

15.5.1 Final Design Specifications. Final design specifications shall be submitted in accordance with Chapter 3: SPECIFICATIONS.

15.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the Final design review shall be incorporated in the documents before they are submitted as Ready to Advertise (RTA).

15.7 TECHNICAL REQUIREMENTS.

15.7.1 Generating Units. Life-cycle cost analyses will be made, and site elevations, ambient conditions, etc. must be considered for proper selection of the type and size of generating units. In addition, factors peculiar to each generating station must be considered. Examples of these factors include the following: availability and cost of water, logistics of fuel supply, types of fuel available to the site, future expansion considerations, future ties to commercial power, use of heat recovery, standardization of module size, market availability of competitively sized units, and system availability analyses. Analysis described in UFC 3-540-04N shall be followed.

15.7.2 Noise Control. Noise control design shall be in accordance with TM 5-805-9.

15.7.3 Intake Air System. The air intake system consists of an air inlet filter system, air inlet silencer, and connecting ducts capable of providing clean air. Total pressure drop across the inlet system shall be kept to a minimum (not to exceed 3 inches of H_20). Location of the inlet shall be such that contaminants from exhaust, tank vent vapor, etc., are kept to a minimum. The inlet air filter system shall include an inertial type filter to remove the larger particles, followed by intermediate and high efficiency stages of filtration. Installations also require filtration to remove salt from the inlet air.

15.7.4 Exhaust System. The exhaust system ductwork must be terminated in a manner that precludes recirculation of exhaust products through the air intake or cooling radiator. The height of exhaust duct above air inlet, the building roof design, the direction of prevailing wind, and the proximity of adjacent structures must be considered. Where two or more units exhaust into a common header such as that used for heat recovery equipment, provisions must be made to prevent hot gas from flowing into the non-operative units.

15.7.4.1 Heat Reclamation. At any installation which produces prime power from diesel engines or gas turbines consider the use of waste heat boilers to reclaim all possible heat economically consistent with the total heating and/or air-conditioning requirement of the installation. An economic study shall be made to determine the feasibility of using heat from waste heat boilers and engine jacket water heat recovery equipment.

15.7.4.2 Exhaust Silencing. When exhaust silencing is required, provisions shall be made to mount and support the equipment adequately and to limit the silencer pressure.

15.7.5 Ambient Air. The combination of arid desert climate, generally poor water supply, and high temperatures requires special consideration with respect to power generation facilities design. When the water supply is generally inadequate, dry air cooling shall be provided. The use of dry air cooling results in larger heat exchanger surfaces and greater fan horsepower than would be required for evaporative cooling. High ambient temperatures in comparison to typical U. S. and European temperatures, reduces the theoretical and actual thermodynamic conversion efficiencies of generating units. Ambient air temperatures within generation facility buildings can exceed 65^{o} C (150^{o} F) near generating units, imposing a requirement for special concern about the cooling of generators and other items which may be affected by high local air temperatures.

15.7.6 Sandstorms. Sandstorms are a climatic threat to power plants. Obviously, the entrance of dust and/or sand into an engine or turbine would have serious deleterious effects on the internal working parts. Although highly effective inlet air infiltration may be required for routine operation, it is unlikely that such filtration would be adequate during sandstorm conditions. During such periods it would be necessary either to use additional high efficiency filters in the inlet air stream, to reduce power output to supply essential needs only, or to do both.

15.7.7 Fuel Systems.

15.7.7.1 Fuel Oil and Crude Oil. Base load generating stations will be provided with facilities to handle Grades 1 and 2 fuel oil and light crude oil. Systems will be designed for primary use of Grade 1 and 2 fuel oil with crude oil as standby. Space will be provided for future installation of a natural gas line. Alternate fuel sources shall be considered as required by the Scope of Work.

15.7.7.2 Natural Gas. The natural gas fuel system includes all components necessary to control fuel at the proper schedule during starting and operating, from no load to full load. The gas supply should be at a regulated pressure of 165 to 200 psig.

15.7.7.3 Liquid Fuel. Fuel systems consist of the following major parts.

a. Booster pump and strainer.

b. 10-micron, low pressure, duplex filter replaceable element).

c. Main turbine or engine driven fuel pump.

d. High pressure filter (10-micron).

e. Main fuel control (combines the functions of the acceleration control and the fuel metering valve) controlled by governor actuator.

f. Valve block (provides manifolding and mounting for shutoff valve, bypass valve, purge valve, and igniter valve).

g. Fuel manifold block for distributing fuel to the fuel injectors.

h. Fuel washing system for crude oil only.

i. Oil heating system for crude oil only, when required.

15.7.7.4 Dual Fuel System. The dual fuel system combines all the features of the natural gas fuel system and the liquid fuel system, and includes the controls for fuel changeover during operation. Two basic types of systems are discussed below.

a. The engine-driven main liquid fuel pump system includes an offset fuel cooler for eliminating the heat dissipated into the fuel by the engine driven fuel pump while the unit is running on gas fuel. The boost pump for this system shall be the jet type system.

b. With an ac motor-driven pump system, the motor driven pump is shut down when the unit is running on gas fuel, thus deactivating the liquid fuel system. A return-to-tank liquid line is not required.

15.7.7.5 Fuel Storage. In addition to the day tank, underground storage shall be provided for all generating plants covered by this Manual. The storage tank shall be of sufficient capacity to operate the plant for two weeks using No. 2 fuel oil during the months of largest average demand. Actual fuel consumption of the engines and estimated number of hours of operation shall be used in determining the capacity of the storage tank. A maximum of one-half of the total storage tanks will be piped to dispense both No. 2 fuel oil and light crude oil with proper valving to guard against pumping into the wrong system.

15.7.8 Relaying. Protective relaying will cause the prompt removal of any element of a power system when it suffers a short circuit or when it starts to operate in any abnormal manner. The protective relaying system shall detect a failure or abnormal condition quickly and commensurate with system requirements. Relays will open a minimum of overcurrent protective devices to isolate the defective element. Quick isolation will minimize or prevent damage to the defective element and will minimize the seriousness and duration of the defective element's interference with normal operation of the rest of the power system. Relays shall be suitable for use with the frequency.

15.7.8.1 The Relaying Scheme shall be selective and shall meet the following conditions.

a. Minimum disturbance of the system by isolating the fault from the remainder of the system.

b. Discrimination between genuine faults and abnormal conditions that do not require tripping of circuit breakers (for example, locked rotor in-rush currents of motors).

15.7.8.2 Backup Relaying shall be provided only when the original relaying scheme can be designed to incorporate backup as an inherent feature of the relaying scheme.

15.7.8.3 Current Transformers for Differential Relaying shall not be used for any purpose than differential relaying.

15.7.9 Emergency Power. Provide an uninterruptable power supply (UPS) for reliable power to critical control and/or protection systems for black start, proper operation, or safe shutdown of the generator upon complete loss of the ac auxiliary power system.

15.7.9.1 Transfer Switch. Provide an automatic solid state transfer switch for the UPS. During normal operation, the UPS will be powered by the ac system, with automatic transfer to the dc system upon loss of ac power.

15.7.9.2 Stored Energy Starting. Stored energy starting may be used where only short interruptions of power is permissible. Energy is stored in batteries, capacitors, flywheels, pneumatic pressure vessels, and similar units. The energy shall be utilized in a particular fashion to provide service during interruption of prime mover service until emergency generation is available.

15.7.10 Wiring Methods. See paragraph: Wiring Methods in Chapter 14 of this Manual.

15.7.11 Synchronization. Generator units will be paralleled via synchronizing bus when operating in parallel. Operation of the system shall have provisions for manual and automatic start. A synchronizing relay, which will bring selected units on line, will sense voltage on the bus and either close the breaker when the incoming unit is in phase with the voltage or close immediately if there is no voltage on the bus. With the synchronizing switch turned on the operator shall have the option to manually put a unit(s) on the line by watching a synchroscope and closing the circuit breaker switch at the proper synchronous point.

15.7.12 Grounding. For power generating plants, a grid type ground system shall be installed around the building. Each ground grid shall consist of buried loop copper wire, not smaller than number 4/0, which encircles the area. Ground rods shall be driven along this loop. A number of cross-connections shall be installed to connect building steel and equipment to the ground grid in such a way that each major piece of equipment or structure has common ground paths. The individual ground grids shall be ties together with an interconnecting ground wire. Building steel and conductive enclosures of electrical equipment shall be connected to the ground system. The ground system shall be in accordance with the National Electrical Code and National Electrical Safety Code, taking into account conditions encountered at the particular location.

15.7.13 Communication System. A telephone system shall be provided for power plants. This system shall be in accordance with Chapter 17: COMMUNICATION. When required by the contract, a complete plant intercommunication system shall be provided for use between various handset locations and for paging of personnel throughout the power plant and auxiliary Buildings.

15.7.14 Energy Management Control (EMC). The use of EMC for power plant operation and control shall be considered. An Energy Management System eliminates the requirements for many operators, reducing the overall manpower requirements, and decreasing the margin of human errors. An EMC system has the following capabilities.

a. An EMC system enables the operator to monitor the operating status of (on-off) functions from a central control station.

b. The system can measure variables such as temperature, flow, and pressure.

c. EMC has alarm capabilities for out-of-tolerance conditions.

d. Control interfaces with central HVAC systems and/or central control monitoring systems are possible.

e. The EMC system can also be used to shed noncritical loads if and when the demands of the plant exceed its generating capacity.

15.7.15 Layout Criteria. Layout will provide easy access to all equipment and will minimize daily maintenance time. (For example, all motor starters shall be grounded together in motor control centers, and a central instrumentation and control panel shall be provided.)

CHAPTER 16
POWER TRANSMISSION AND DISTRIBUTION

CHAPTER 16

POWER TRANSMISSION AND DISTRIBUTION

16.1 GENERAL.

This chapter gives guidelines for the preparation of drawings, specifications, and design analysis for power transmission and distribution. It supplements the general requirements of Chapter 1: GENERAL INSTRUCTIONS and Chapter 14: ELECTRICAL with specific criteria and additional specific design requirements. All required documents, including Drawings and Design Analysis, shall be in accordance with Chapter 2: PRESENTATION OF DATA.

16.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below, form a part of this manual.

Unified Facilities Criteria:

UFC 3-501-01	Electrical Engineering
UFC 3-550-01	Exterior Electrical Power Distribution
UFC 3-555-01N	400 Hertz Medium Voltage Conversion/Distribution and Low Voltage Utilization Systems
UFC 3-575-01	Lightning and Static Electricity Protection Systems

Institute of Electrical and Electronic Engineers (IEEE):

IEEE Transactions.	Standard Basic Impulse Insulation Levels.
IEEE Std. 141	IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants. (Red Book)
IEEE Std. 142	IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems. (Green Book)
IEEE Std. 241	IEEE Recommended Practice for Electrical Power Systems in Commercial Buildings. (Gray Book)
IEEE Std. 242	IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems. (Buff Book)
IEEE Std. 399	IEEE Recommended Practice for Power Systems Analysis. (Brown Book).

IEEE Std. 446	IEEE Recommended Practice for Emergency and Standby Power Systems.(Orange Book)
IEEE Std. 493	IEEE Recommended Practice for Design of Reliable Industrial and Commercial Power Systems. (Gold Book)
IEEE Std. 602	Recommended Practice for Electric Systems in Health Care Facilities (White Book)
IEEE Std. 739	Recommended Practice for Energy Conservation and Cost-Effective Planning in Industrial Facilities (Bronze Book)
IEEE Std. 1100	Powering and grounding Sensitive Electronic Equipment (Emerald Book)
C2	National Electrical Safety Code

National Electrical Manufacturers Association (NEMA) Standards:

Insulation Power Cable Engineers Association (IPCEA):

National Fire Protection Association (NFPA):

NFPA 70.	National Electrical Code (NEC).
NFPA 101.	Life Safety Code.

Institute of Electrical and Electronics Engineers, Inc. (IEEE):

IEEE Std. 141.	Recommended Practice for Electric Power Distribution for Industrial Plants. (Red Book)
IEEE Std. 142.	Recommended Practice for Grounding of Industrial and Commercial Power Systems (Green Book).
IEEE Std. 242.	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).

16.3 CONCEPT SUBMITTAL REQUIREMENTS.

Specific requirements for concept documents are given below. These requirements are in addition to the general requirements of Chapters 1 and 2.

16.3.1 Concept Design Analysis. The Concept design analysis shall include a narrative, identifying systems, and a description of the method of distribution with supporting rationale. The following specific items shall be included when applicable.

16.3.1.1 Fault Calculations and Protective Coordination Study. Provide fault calculations and a protective coordination study for the system. The design analysis shall include a simplified single-line diagram in support of fault calculations. Show all equivalent resistances, reactances, and interrupting capacities on the single-line diagram. Short circuit calculations shall be coordinated with the requirements of Chapter 15: POWER GENERATION if required.

16.3.1.2 System Design Calculations shall include an estimate of the total connected and demand loads as well as individual feeder loads.

16.3.1.3 Primary Voltage Selection. Provide the rationale and economic justification for selection of the primary voltage.

16.3.1.4 Selection of Equipment and Material. Include any assumptions or conditions peculiar to the project which will effect selection of equipment and material. For example, if derating factors are used in determining cable ampacities, transformer capacities, etc., these factors must be clearly stated in the design analysis and supporting data given to show how factors were determined.

16.3.2 Concept Design Drawings. The following specific items shall be shown when applicable.

16.3.2.1 Proposed Distribution. Show proposed routing of electrical distribution and street lighting systems.

16.3.2.2 Electrical Distribution System Diagram. Provide a single-line diagram of the electrical distribution system showing a tie-in with the local or municipal plant.

16.3.3 Concept Design Specifications. Provide concept design outline specifications as described in Chapter 3: SPECIFICATIONS.

16.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

16.4.1 Preliminary Design Analysis. A design analysis shall be required as part of the Preliminary design submittal in support of information depicted on plans. The analysis shall include computations and shall indicate criteria on which the design is based, references approximately indexed, and any assumptions made in the design.

16.4.1.1 Complete Manual and/or Computer calculations shall be submitted for the following.

a. Short circuit performance of bare overhead conductors and underground cables including thermal stresses on conductors, worst-case fault conditions, and single-phase short circuit currents which are the most frequent type to occur shall be indicated.

b. Calculations to support the strength requirements used to select the proper size poles, insulators, guying, anchors, and foundation details.

c. Calculations to select the proper rating of electrical components such as lightning arresters, disconnect switches, fused cutouts, and insulators.

e. Structural calculations as required to support the electrical design.

f. Feeder calculations including all derating factors.

16.4.1.2 Distribution at 50 Hertz. When the project requires distribution at a 50 Hz frequency, use tables, charts, and graphs suitable for 50 Hz or add appropriate correction factors.

16.4.1.3 Worst-Case Voltage Drops. Include computations in the design analysis for worst-case voltage drops.

16.4.1.4 Roadway or Area Lighting. When roadway lighting or area lighting is required, provide lighting calculations in accordance with Chapter 14: ELECTRICAL.

16.4.1.5 Soil Boring Data. Provide all pertinent soil boring data when special pole bracing or footings are required for subnormal soil bearing conditions.

16.4.2 Preliminary Design Drawings. Preliminary design drawings shall incorporate the following requirements.

16.4.2.1 Plan Drawings. Provide plans showing the underground distribution, telephone and fire alarm systems. Consideration shall be given to establishing right-of-way clearances, manhole and ductline spacing, and any special space or physical protection requirements. Aerial distribution will only be considered for temporary installations, unless specifically directed otherwise in the Scope of Work.

16.4.2.2 Details. Details for plan drawings shall include but not be limited to the following items when applicable.

a. Overhead line construction details and transpositions.

b. Underground line construction details and sections.

c. Guying of poles.

d. Manhole details (check proper sizing).

e. Special pole setting foundation details.

f. Distribution transformer details.

g. Transformation connections (Ex: A-Y).

h. Grounding details.

i. Exterior substation and switching stations.

j. Overcurrent protection and control equipment.

k. Tower line construction.

l. Schematic Diagrams.

m. Where ductbanks are used, profiles of ductbank and manhole elevations, coordinated with civil topographical drawings and other underground utilities and manhole elevations, coordinated with civil topographical drawings and other underground utilities.

16.4.3 Preliminary Design Specifications. Provide preliminary design specifications in accordance with Chapter 3: SPECIFICATIONS.

16.5 FINAL SUBMITTAL REQUIREMENTS.

The Design Analysis and drawings submitted for Final Review shall be complete, as described in Chapter 1: GENERAL INSTRUCTIONS. Specifications shall be prepared per Chapter 3: SPECIFICATIONS.

16.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the Final Design Review shall be incorporated in the documents before they are submitted as Ready To Advertise.

16.7 TECHNICAL DESIGN REQUIREMENTS.

16.7.1 Selection of Distribution Systems. In choosing the distribution system, the designer must consider load requirements, permissible voltage regulation, reliability, flexibility, and initial cost. The following systems as listed in MIL-HDBK -1004/2 are available.

16.7.1.1 Conventional Simple-Radial Distribution System.

16.7.1.2 Modern Simple-Radial Distribution System. The modern simple-radial distribution system can be used for capacities in excess of 1,000 kVA. The length of low-voltage feeders shall be kept to a minimum, reducing cable cost and energy losses. Size each transformer to handle the peak load of the area served.

16.7.1.3 Modified Modern Simple-Radial Distribution System.

16.7.1.4 Loop Primary-Radial Distribution Type.

16.7.1.5 Banked Secondary-Radial Distribution System.

16.7.1.6 Primary Selective-Radial Distribution System.

16.7.1.7 Secondary Selective-Radial Distribution System.

16.7.1.8 Simple Network Distribution System.

16.7.1.9 Simple Spot-Network Distribution System. The simple spot-network distribution system shall be used for installation that have heavy loads concentrated in small areas with a considerable distance between each other.

16.7.1.10 Primary Selective Network Distribution System. The primary selective network distribution system shall be used for industrial applications in which heavy loads are evenly distributed.

16.7.1.11 Primary Selective Spot-Network Distribution System.

16.7.2 Conductor Selection. Primary cable systems shall be selected in accordance with the following Unified Facility Guide Specifications (UFGS).

a. UFGS 33 71 02 Underground Electrical Distribution

b. UFGS 33 71 01 Overhead Transmission and Distribution

16.7.3 Transformers. Transformers shall be of the self-cooled type, with rating selected from Standard NEMA tables where the required size is not listed in the table, the next larger size should be installed unless the next smaller size will provide at least 90 percent of the required rating. Wye-wye connected transformers should not be utilized. All transformers installed outdoors or in fire proof transformer vaults should be of the oil-insulated, self-cooled type. Transformers installed within buildings in which fireproof vaults have not been provided shall be of the dry type (ventilated or sealed as appropriate).

16.7.3.1 Transformer capacities shall be selected so that all transformers will be operating as nearly as practicable to the allowable temperature limits during periods of maximum demand. Transformer derating shall be applied as required by NEMA Standards TR 27 "Commercial, institutional and industrial dry-type transformer" and TR 98 "Guide for loading oil-immersed power transformers with 65, C average winding rise". Special derating should be addressed for loads having high harmonic neutral currents.

16.7.3.2 Distribution transformers, pad-mounted compartmental type, single-phase, three-phase oil-filled and dry type shall be utilized where it is not advantageous to use secondary or primary unit substations. The transformer and associated terminal compartments shall be tamper proof, protected from the unusual site service conditions and derated for altitude and ambient temperatures as appropriate. Compartmental pad mounted transformers shall be comprised of air filled incoming and outgoing terminal compartments. The high voltage bushings in the incoming compartment shall consist of appropriate high voltage fuses. The outgoing compartment shall consist of low voltage bushings as required for system distribution.

16.7.3.3 Secondary unit substation shall be utilized where the low voltage section is rated 1000 volts or less and shall consist of the following.

a. Incoming section providing connection of one or more incoming H.V. circuits, each of which may or may not require a switching device or a switch and interrupting device.

b. Transformer section including one or more transformers.

c. Outgoing section for connection of one or more outgoing feeders, each of which is provided with a switching and interrupting device. These sections shall be either preassembled at the factory or sub-assembled in field as appropriate.

16.7.3.4 Primary unit substations shall be utilized where the low voltage section is rated above 1000 volts and with incoming transformers and secondary sections indicated above for the secondary unit substations.

16.7.3.5 Transformers should be located as close to the center of the secondary load as practicable and should preferably be located in buildings. Where the installation of transformers in buildings is not practicable, such as in housing areas, compartmental type transformers should be installed on outdoor concrete foundations.

16.7.3.6 When exterior pad-mounted transformers are located in the vicinity of any vehicular traffic, install heavy-duty traffic barriers around the transformer. Locate outdoor installation so that the equipment and enclosure will be as inconspicuous as possible and, with the addition of shrubbery, will fit properly into the landscaping layout.

16.7.3.7 Oil Filled Transformers 2,000 kVA through 10,000 kVA. In general, oil-filled transformers 2,000 kVA and larger operating at voltages not exceeding 15 kV and electrically remote from generating stations (low X/R ratio) shall have the following protective measures.

a. Circulating current differential protection, utilizing percentage differential relays of the induction type.

b. Rate of pressure rise relay (for hermetically sealed transformers).

c. Overcurrent and ground fault relays, directional or non-directional, as required to ensure selectivity.

d. Over pressure detector wired to give alarm in attended substations and to disconnect the transformer in unattended substations.

e. Winding and oil over temperature detection wired to give alarm in attended substations and to disconnect the transformer in unattended substations.

f. Interlocks and alarms to ensure that all auxiliaries (fans, pumps, and similar items) are in working order.

16.7.3.8 Oil Filled Transformers Below 2,000 kVA and All Dry Transformers. Fuses shall normally be used for primary protection of transformers. However, should primary circuit breakers (medium voltage) be provided, overcurrent and ground fault relays shall be used.

16.7.3.9 Protection of Switchgear. Substations of primary importance shall have some form of bus bar differential relaying. Substations of secondary importance will not normally warrant bus bar protection. In any case, switchgear must be capable of withstanding, both mechanically and thermally, the largest available fault currents. All current transformers for bus bar differential relaying shall be the same ratio and type. Bus differential relaying shall be installed on the line side of circuit breakers to minimize outages due to malfunction of the main differential system. The tripping of all circuit breakers connected to bus bars should not occur unless both relays have operated. Special arrangement shall be made to facilitate frequent maintenance and testing of the installation with the bus in service. The risk of accidental tripping shall be reduced to a minimum.

16.7.3.10 Outdoor vs Indoor Substations. If a substation shall have an attendant constantly on the premises, then shelter and a room in which to work, i.e., a building, shall be required. As a minimum, the building would house the control board, telephone, control battery and charger, and any other devices that are normally built only for indoor service. Otherwise, it is more practical to build new unattended substations outdoors.

16.7.3.11 Bus Arrangement: The selection of the substation bus arrangement shall depend upon the cost, the application, and the required degree of service continuity and reliability.

16.7.3.12 Lightning Arresters shall be included in substations connected to overhead lines. Where possible, on high voltage systems the neutral shall be permanently connected to ground for a more effective arrester. The resultant lower impulse voltage obtained by grounding the neutral will allow for a more economical installation since lower impulse installation ratings may be used in selecting other equipment and components.

16.7.3.13 Connections to Existing Distribution Systems. When the project requires extension of or tapping into an existing medium voltage distribution system, the connection must be done in a way approved by the local organization responsible for the existing distribution system. Generally this requires the use of a ring main unit (RMU), loop switch, or sectionalizing switch. "T" splices are generally not acceptable. The designer shall provide sufficient documentation to the local authority to obtain approval for the connection and provide a record of the approval in the design analysis. The design analysis shall also contain all information about the existing distribution obtained by the designer during the course of the design. On site involvement by the designer, either to obtain design data or to coordinate with the local authority for approval of the design, shall be as defined in the general scope of work.

16.7.4 Circuit Design. The proper procedure for the design of circuits may be ascertained from the list of detailed data in Table A.

TABLE A Information Required for Circuit Design

Item	Specific information required
Voltage, phase	13.8 kV, 3-phase, 480/277V, 3-phase, 208/120V, 3-phase.
Load	Location, magnitude, load factor, peak load, and coincidence factor.
Peak load	For each circuit, point where power feeds into circuit.
Voltage drop	For peak load. For each phase, if circuit is multi-phase with unbalanced load.
Motor load	Add to normal load currents on circuit.

16.7.4.1 Criteria. Use the following criteria for design.

a. Provide for spare capacity in each circuit where required by design.

b. Select the wire size in accordance with the current carrying capacity required.

c. Size regulating devices in accordance with the amount of regulation required.

d. Choose the type of regulators from fixed capacitors, switched capacitors, single-step boosters, multi-step regulators, and induction regulators as required.

e. Provide line drop compensation for automatic operation when these regulators are used on more than one source or when more than one regulator is used on a single circuit.

f. Select physical design features in accordance with type of circuit involved and the type of distribution, that is, primary or secondary. Select from the following types.

1. Direct burial single or multi-conductor.

2. Duct encased single or multi-conductor.

3. High and low voltage in cable tray.

16.7.4.2 Grounding. Provide grounding for all equipment and structures associated with electrical systems to prevent shock from static or dynamic voltages. For information on grounding of overhead distribution systems, see the National Electrical Safety Code, Part 2.

16.7.4.2.1 Ground resistance. Provide a low impedance path at the source of fault currents if a circuit contains a deliberate ground connection.

16.7.4.2.2 Maximum ground resistance. Consult the National Electrical Safety Code, Part 2. Consider the source or power, capacity, magnitude of fault current, and method of system grounding, as they affect this resistance.

16.7.4.2.3 Grounding methods.

a. Water pipe connection. The electrical system may be grounded to a water supply system except where nonmetallic pipes or insulating couplings are incorporated in the water pipe systems.

b. Ground rods. Ground rods may be used either singly or in clusters. Drive the ground rods to ground level for effective and permanent installation. Provide for corrosion prevention by a proper choice of metals or by cathodic protection. Where ground water cannot be reached, chemicals such as salt or calcium chloride should be used to improve soil conductivity. Provide for easy maintenance and periodic testing. Protection against lightning shall comply with NFPA-78.

c. Grounding network. In poor soil, effective safety grounds shall be obtained by the use of a buried network of ground conductors. If meshes are made small enough, the control of surface voltage gradients can be obtained even though the ground resistance may be relatively high.

d. Combination of grounding methods. Where the ground resistance in an existing system is high, any of the aforementioned methods, either singly or in combination, may be used to effect improvement.

e. Underground Distribution Systems. All manholes and handholes in an underground distribution system shall be provided with an integral ground rod. A copper ground counterpoise conductor shall be run above all power ductbanks.

16.7.5 Underground Construction. Underground construction shall be in accordance with UFC 3-550-01. Underground system is to be a long-life installation that will be adequate for any foreseeable degree of expansion during the life of the facility.

16.7.5.1 Route. The first problem in preparing an underground line system is selection of the route. This is important whether or not the cables are laid in ducts or buried directly in the earth. An accurate map should be made showing the location of fire hydrants, street-light standards, curb lines, buildings to be served, and points of entrance for service to buildings. The map should also show the subsurface obstructions. A route should be selected which will require as few curves and bends as possible and which will not have to be placed at too great a depth. The route should avoid the following obstructions.

a. Gas mains and gas service laterals.

b. Telephone and other communication duct lines and laterals.

c. Sewer mains, manholes, and service connections.

d. Water mains and service laterals.

e. Storm sewers and catch basins.

f. Steam pipes.

g. Chilled water pipes.

16.7.5.2 Direct Burial. In general, direct burial cable installations shall be limited to secondary voltage and street lighting systems in uncongested areas.

16.7.5.3 Duct System. The duct system shall be used for all primary voltage, telephone and fire alarm systems or when direct burial cables are subject to mechanical damage. The nominal diameter of ducts for primary cables shall not be less than 4 inches. Where power and communication cables are routed in the same duct bank the nominal diameter of ducts shall also not be less than 4 inches. A sufficient number of spare ducts shall be provided for future installation of a minimum 25 percent increase in the initial number of cables. Distances between manholes, service boxes, and ducts shall be as required by UFC 3-550-01. Do not use a duct bank containing more than 16 ducts because of cable arrangement in manholes and best heat dissipation. Usually if more than 12 ducts are needed, a separate bank is installed with minimum separation of 2 feet of earth.

16.7.5.4 Ducts. Service ducts shall be limited to a length of about 125 feet. The main conduit shall not be over 500 feet between manholes, and should have as few bends as possible. Mechanical damage is caused by pulling stresses imposed on cables during installation, and ducts that are too long or have frequent and sharp bends cause considerable damage.

16.7.6 Voltage Drop. As required by UFC 3-550-01, voltage drop shall not exceed 2 percent on the primary and 3 percent on secondary circuits, respectively (total 5 percent).

16.7.7 Circuit Protection. Circuit protection shall comply UFC 3-501-01.

16.7.7.1 Circuit Interrupting Devices.

16.7.7.1.1 Fuses. Based on the required current carrying capacity, the interrupting duty, and the time-current blowing characteristics, selection of the fuse should be made from the three principal types available.

a. Expulsion type.

b. Boric acid type.

c. Current limiting type.

16.7.7.1.2 Circuit breakers. Coordinate the circuit breaker rating with the load interrupting duty, and coordinate the circuit breaker with the fuses ahead of and after it.

16.7.7.1.3 Switches. Use switches to allow localizing of a defective portion, and to permit dead-circuit work to be accomplished. Select from one of the following principal types.

a. Nonload-break switches. Use nonload-break switches only for the interruption of circuits that carry no appreciable load. Select the type applicable, depending on circuit importance, load, voltage, and fault circuit duty. The types available are porcelain disconnect fuse cutouts, plain or fused disconnect switches, and disconnect fuse cutouts of various types. See manufacturers' catalogs and NEMA Standard publication No. SG-6.

b. Load-break switches. Load-break switches are provided with an interrupting device capable of disconnecting circuits under load, and should be used for that purpose. Vacuum switches are in this class.

16.7.7.2 Lightning Arresters. In determining the requirements for lightning protection, consider the overhead ground wire, open or expulsion gaps, self-protected transformers, distribution valve type and station-type lightning arresters. Select the proper arrester in accordance with the chosen basic impulse insulation level (BIL) for which the circuit must be built. Follow the criteria in "Standard Basic Impulse Insulation Levels", adopted by a Joint Committee of IEEE, Edison Electric Institute, and NEMA (published in IEEE Transactions 1941), also IEEE Standards for Lightning Arresters.

16.7.8 Reliability. Refer to UFC 3-550-01 for reliability criteria. The supply should have a degree of reliability which the project warrants. Except for small posts and camps having a population of less than one thousand, duplicate supply lines should be installed wherever this type of service will be made available without excessive cost to the Government. To be of any value in insuring an uninterrupted supply of electricity to the project, the two supply lines should be fed from different sources, over different routes.

CHAPTER 17
COMMUNICATIONS

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COMMUNICATIONS

17.1 GENERAL. Communication systems include video, radio, intercoms, paging, music, hospital-patient monitoring systems, servants' call, telephone-telex, data transmission systems, security alarm systems, access control systems, and monitoring systems, to the extent required by project criteria. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including Drawings and Design Analysis, shall be in accordance with Chapter 2: PRESENTATION OF DATA.

17.2 APPLICABLE PUBLICATIONS.
The current edition of the publications listed below, form a part of this manual.

Department of the Army United States Army Information Systems Engineering Command (ISEC)

USAISEC OSPDPR — available upon request/or during contract bidding

Secret Internet Protocol Router Network (SIPRNET) Technical Implementation Criteria

US Department of Agriculture Rural Development (RUS)
https://www.rd.usda.gov/publications/regulations-guidelines/regulations/telecommunications

7 CFR 1751 Telecommunications System Construction Policies and Procedures

7 CFR 1753 Telecommunications System Construction Policies and Procedures

7 CFR 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction

United Facilities Criteria (UFC):

UFC 3-501-01 Electrical Engineering

UFC 3-520-01 Interior Electrical Systems

UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design

Institute of Electrical and Electronic Engineers (IEEE):

C2 National Electrical Safety Code

National Electrical Manufacturer's Association

NEMA VE 1 Metal Cable Tray Systems

NEMA VE 2 Cable Tray Installations Guidelines

Committee on National Security Systems (CNSS) TEMPEST

CNSSAM TEMPEST/1-13	Red/Black Installation Guidance
NSTISSI-7003	Protective Distribution Systems (PDS)

National Fire Protection Association (NFPA):

NFPA 75	Standard for the Fire Protection of IT Equipment
NFPA 76	Standard for the Fire Protection of Telecom Facilities
NFPA 70	National Electrical Code (NEC)

17.3 CONCEPT SUBMITTAL REQUIREMENTS.

17.3.1 Concept Design Analysis. The following specific items shall be included where applicable. Describe the site telephone/data system requirements. Identify project requirements (such as number of trunk lines) and requirements for connection with supplying telephone service (such as transmission protocol, 2 or 4 wire circuit, twisted pair, single-mode, multi-mode fiber, etc.). Identify source of telephone service. Describe proposed construction method for installation of interconnecting cables. Define proposed responsibilities (i.e. does the contractor or the user provide the cable, who makes what connections, etc.). Requirements of UFC 3-580-01 shall be followed. Describe all proposed signal and communications systems within the facility. These include telephone, intercom, data networks, public address, security, paging, tea call, etc. For each system describe the proposed wiring method, distribution scheme within the facility, construction methods (conduits, open-wire, etc.), equipment and devices provided as part of this contract, and any other pertinent features of the proposed design. Identify points of interface between the building system and connections to the related site distribution system. Identify interface responsibilities between the construction contractor and others (i.e., who installs the wiring, who installs telephone instruments, who installs electronic equipment.)

17.3.1.1 Design Criteria. List design criteria furnished by the Corps of Engineers (CE) and by the Basis of Design Documents, codes and other documents, such as industry standards used in the preparation of the designs. Explain all unauthorized deviations from these criteria.

17.3.1.2 An Individual System Description explaining the logic behind the need for the system, the life-cycle costs of the various alternates considered, and the justification for the system ultimately selected shall be included.

17.3.1.3 Equipment Characteristics. Equipment sizes, power needs, special voltage and current characteristics, and special cable characteristics shall be included. Major components and distribution lines shall be located. Ambient needs shall be delineated.

17.3.1.4 Special Requirements. Denote any special shielding, bonding, or grounding requirements peculiar to the system selected.

17.3.2 Plan Drawings. Show conduit or duct routing on site plans. Show equipment rooms, including space required for maintenance work and for future expansion. Show emergency power source(s) if applicable. Provide sample communication floor plans if necessary. These plans are not required if the communication requirements for the project are minimal and the power plans will not be congested in their final development. In this case, the communication requirements may be included on the power plans. If, however, the power plans will be congested, or substantial communication requirements exist for the project, separate communication plans shall be provided. These plans shall show the location for such items as telephones, data network terminals, fire alarms and detectors, public address systems, intercom stations, security devices, cable TV, etc. The proposed method of wiring shall also be indicated on the drawing. Depending upon the nature of the systems, the description of wiring methods may be accomplished via the use of notes.

17.3.3 Concept Design Specifications. Provide concept design specifications in accordance with Chapter 3: SPECIFICATIONS.

17.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

17.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any revisions necessary. In addition, the following specific items shall be included when applicable.

a. Calculations. Provide detailed calculations for equipment sizing.

b. Verification of Best Practices. Provide all information and computations to permit verification that precepts of the design criteria, codes, standards, and engineering design best practices have been met, and that the design is satisfactory for its intended purpose. Provide published data from manufacturers to demonstrate equipment specified is available and appropriate for project.

17.4.2 Preliminary Design Drawings. The following specific items shall be shown when applicable.

a. Riser Diagrams of all systems shall be supplied which provide detail beyond the Concept stage and which show capacities of equipment, and terminal cabinet locations. Schematics shall show both normal and emergency power supplies. Modified "riser" diagrams shall be provided to show the interconnection of devices such as telephones to telephone cabinets, intercom stations to controllers, security devices to alarm panels, fire detectors to fire alarm panels, etc. These riser diagrams shall depict routing methods, i.e. above the ceiling or beneath the floor slab), conduit sizes, conductor collection schemes, etc.

b. Plans shall show building and room layouts. Master Conduit and duct bank routings, terminal cabinets, and the final location of all equipment items shall appear on the plan drawings. All emergency power supplies shall be located. Communication plans shall be updated to reflect preliminary design development. The combination of the plan locations and the riser diagrams shall enable each communication circuit to be traced.

c. Details. Special mounting details shall be indicated when necessary. Interface connections with other communication systems shall be shown.

17.4.3 Preliminary Design Specifications. Provide preliminary design specifications in accordance with Chapter 3: SPECIFICATIONS.

17.5 FINAL SUBMITTAL REQUIREMENTS.

The Design Analysis and the Drawings submitted for Final Review shall be complete, as described in Chapter 1: GENERAL INSTRUCTIONS.

17.5.1 Final Design Drawings. Communication plans shall be complete. Modified "riser" diagrams shall be provided to show the interconnection of devices such as telephones to telephone cabinets, intercom stations to controllers, security devices to alarm panels, fire detectors to fire alarm panels, etc. These riser diagrams shall depict routing methods (i.e. above the ceiling or beneath the floor slab), conduit sizes, conductor collection schemes, etc. The combination of the plan locations and the riser diagrams shall enable each communication circuit to be traced. The drawings shall include location of all fire alarm equipment and associated wiring, including alarm bells, manual stations, control panels, power supply, and connections to the site system. Similar information shall be presented for security alarm systems if required.

17.5.2 Final Design Specifications. Provide Final design specifications in accordance with Chapter 3: SPECIFICATIONS.

17.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the Final Design Review shall be incorporated in the documents before they are submitted as Ready to Advertise (RTA). A/E contractor generated final drawings and specifications for design-bid-build and design-build projects must be stamped by a BICSI Registered Communications Distribution Designer (RCDD).

17.7 TECHNICAL REQUIREMENTS.

17.7.1 Design Objectives. The technical design objectives which must be met for telecommunication/data systems work are as follows:

a. The telecommunications/data systems shall comply with the requirements of UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design and as augmented by ISEC Technical Criteria for the Installation Information Infrastructure Architecture (I3A)
A new UFC for OSP is currently being published; until such time, refer to ISEC's Outside Plant Design and Performance Requirements (OSPDPR)
a. System adequacy to meet the design requirements
b. Installation details consistent with codes, manufacturers' requirements, and current industry practice
c. Maintainability of both the manufacturers' equipment and the installation as an entire unit

d. Ease of systems operation

e. Durability

17.7.2 Cable Television. Cable Television, often referred to as CATV (Community Antenna (or Cable) TV), shall be required for all new facilities. This may include, but not be limited to, inside and outside Cable Television Premises Distribution System, Television Signal Reception System, or a combination of each. Designer may need to conduct a systems analysis and requirements analysis to determine specific requirements.

17.7.3 Electronic Security Systems. Electronic Security Systems include one, some or all of the following:

a. Closed Circuit Television (CCTV)
b. Physical Access Controls System (PACS)
c. Intrusion Detection System (IDS)

MILCON-funded projects require provisions for these systems to include, but not limited to, spaces and pathways, conduits, pull boxes and junction boxes, outlet boxes, pull strings, and power where required. If optioned or required under different funding, a complete and usable system may be required. In some cases, design of a complete system will be required, but may not be installed under a design contract. See Chapter 14 ELECTRICAL for further clarification.

17.7.4 Intercom System. The intercom feature shall be incorporated into the telephone system as much as possible. It is more economical to provide intercom capabilities within a telephone system than it is to provide individual intercom systems. However, there are certain areas where only an individual intercom system will suffice, e.g. in surgery suites, certain lab areas, and utility areas. Caveat: with the advent of digital switching systems and VoIP that allow 4 –digit dialing, the requirement for telephone-integrated intercom has greatly diminished. However, in some areas there may still be a requirement for a segregated system.

Other Intercommunication Systems include, but are not limited to:

a. Direct connected, keyed system
b. Single conversation path, central control system
c. Multiple conversation paths
d. Paging (including radio paging)
e. Public address and monitoring system
f. Interior and exterior, wired and wireless

The designer should make every attempt to determine existing systems, if existing, and verify the maintenance capabilities of the receiving unit.

17.7.5 Telecommunications Cabling System. This system comprises the bulk of Inside Plant (ISP) telecom cabling requirements for holistic construction of all new facilities. It covers, but is not limited to, spaces and pathways, cable type and performance requirements (permanent link and channel), termination requirements, connectors and outlets, patch panels, supporting equipment racks and cabinets, and telecommunications bonding and backbone system.

17.7.6 Telecommunications Outside Plant (OSP). The OSP consists of all exterior communications distribution systems. These systems, for the sake of this manual and applications, are predominantly underground, and traverse through either a conduit/duct bank and manhole system, or are direct buried. This includes the cabling (fiber optic, twisted-pair copper, and coaxial), bonding infrastructure, terminations and splices, inner duct, and protective housings and enclosures. While the supporting infrastructure is not considered OSP, it forms an integral part of the system as OSP requirements are unique. This infrastructure includes, but is not limited to, cable racking and support, manholes and hand holes, conduits, trenches, and bonding and grounding infrastructure of supporting equipment

17.7.7 Medical Facilities, Communications Systems. Communications systems for health care facilities shall meet the requirements indicated in UFC 4-510-01 Design: Medical Military Facilities. Unique and common requirements for these facilities include, but are not limited to, nurse call systems (visual nurse call system, audio-visual nurse call system, centralized nurse call system, central processor controlled subsystem, and/or nurse call tone-visual (NCTV) system).

17.7.8 Cable Trays for Communication Systems. Cable trays systems, as part of spaces and pathways, are very unique for inside plant cabling and require unique and application-specific criteria. A complete design for these systems shall be in strict accordance with the UFC, UFGS specifications, and the most recent NEMA and TIA-607 standards.

17.7.9 Protected Distribution Systems (PDS) for SIPRNET Communication Systems. Design for these pathways require very strict conformance with applicable criteria and undergo evaluation for accreditation/certification and require time-sensitive inspections throughout its lifecycle. Depending on certain physical protection and access control situations, these systems may be hardened, simple, or comprised of emerging alarmed carrier solutions (for interlocking armored fiber cable), or a combination of these. The alarmed carrier is currently being evaluated for eliminating the need for costly and unsightly epoxied, steel solutions.

17.7.10 Services of the Communication Engineering Specialists

a. Unless the project scope of work specifically states to the contrary, all projects shall require the services of a specialist qualified and experienced in designing and specifying installed communications systems. In addition, the specialist shall perform an in-depth analysis of the overall facility, outside plant and operational configuration to verify that:

- The facility designs comply with all applicable provisions of UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design (2016)
- Outside Plant (OSP) is designed in accordance with the pertinent RUS (RDUP) codes and U.S. Army ISEC (Information Systems Engineering Command) Outside Plant Design and Performance Requirements (OSPDPR).
- The final Design Analysis shall include certification signed by the specialist stating that the design complies with all applicable codes.

b. Qualifications of the Communication Engineering Specialist shall be as follows:

17.7.11 Qualifications. Communications designs and specifications shall be prepared by qualified communications engineers with at least 5 years' experience in the systems being designed. Construction specifications shall include minimum qualifications required for the installation contractor.

17.7.12 Submittals. The specifications shall clearly call out the submittals required of the contractor to demonstrate compliance with the design. As a minimum, this shall include a block diagram, equipment list, and published vendor date showing compliance with requirements. A/E contractor generated final drawings and specifications for design-bid-build and design-build projects must be stamped by a BICSI Registered Communications Distribution Designer (RCDD).

17.7.13 Testing Plan and Acceptance Criteria. The specifications shall call out testing plan requirements and establish acceptance criteria.

CHAPTER 18
WATER, WASTEWATER, AND SOLID WASTE SYSTEMS

CHAPTER 18

WATER, WASTEWATER, AND SOLID WASTES SYSTEMS

18.1 GENERAL.

This chapter presents general requirements for the preparation of drawings and design analyses for water supply systems; water and wastewater treatment facilities; water distribution, wastewater collection, and irrigation systems; and solid waste systems. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including drawings and design analysis, shall be in accordance with Chapter 2: PRESENTATION OF DATA.

18.2 APPLICABLE PUBLICATIONS.

The current edition of the publications listed below form a part of this Manual.

Department of Defense (DOD)

DoD 4715.05-G	OVERSEAS ENVIRONMENTAL BASELINE GUIDANCE DOCUMENT

United Facilities Criteria (UFC):

UFC 3-230-01	Water Supply sources and General Considerations
UFC 3-230-03	Water Supply, Water Treatment, Water Desalination
UFC 3-230-01	Water Supply, Water Storage, Water Distribution, Pumping Stations
UFC 3-230-01	Water Supply for Special Projects
UFC 3-240-01	Sanitary and Industrial Wastewater Collection; Gravity Sewers and Appurtenances
UFC 3-240-01	Sanitary and Industrial Wastewater Collection; Pumping stations and Force Mains
UFC 3-240-02	Domestic Wastewater treatment
UFC 3-240-10A	Sanitary Landfill
UFC 3-280-02A	Hazardous Waste Land Disposal/Land Treatment Facilities
UFC 4-214-03	Central Vehicle Wash Facilities
UFC 3-240-14N	Solid Waste Management

UFC 3-600-01. Fire Protection for Facilities Engineering, Design and Construction.

18.3 CONCEPT SUBMITTAL REQUIREMENTS.

18.3.1 Concept Design Analysis. The following specific items shall be included where applicable.

18.3.1.1 Domestic and Industrial Water Supply Sources. Discussion of water supply shall include but not be limited to the following items:

a. Alternate sources and justification for sources selected.
b. Sufficient water quality data to establish general treatment criteria.
c. Adequacy of the existing supply system to meet additional requirements.
d. Special corrosion prevention requirements.

18.3.1.2 Domestic and Industrial Water and Wastewater Treatment Facilities. Discussion of treatment facilities shall include but not be limited to the following items:

a. Influent quantity and quality, including temperature.
b. Required product water quality.
c. Treatment alternatives and justification for system selected.
d. General treatment description and a process flow diagram.
e. Chemical types, including sources, dosages, and storage requirements.
f. Alternative disposal methods for water treatment and industrial reject water; backwash water; chemical and biological sludge; screenings, grit, and wastewater treatment plant effluent; and justification for selection of the methods used.
g. Documentation of unusual waste, (e.g. photographic wastes), proposed treatment, and disposal.
h. Adverse environmental impact
i. Provision for future expansion
j. Adequacy of the existing treatment system to meet increased loads
k. Alternative treatment plant sites and justification for selection of a particular location

18.3.1.3 Water Distribution, Wastewater Collection, and Irrigations Systems. Discussion of water distribution, wastewater collection, and irrigation systems shall include but not be limited to the following factors:

a. Proposed pipe materials, minimum pipe sizes, lengths between manholes, etc.
b. Pumping facilities.
c. Provision for future expansion.
d. Adverse environmental impact.
e. Corrosion prevention requirements.

18.3.1.3.1 Discussion of water distribution shall include but not be limited to the following:

a. Population served, fire protection requirements, domestic and industrial demands, as well as average and peak demands.
b. Required residual pressures.
c. Storage requirements.
d. The adequacy of the existing system to meet the added requirements.

e. The adequacy of the proposed system to meet peak demand and pressure requirements.

18.3.1.3.2 Discussion of wastewater collection shall include but not be limited to the following:

a. Contributing sources
b. Average peak flow rates
c. Velocity analysis in pipes at average and peak flow rates

18.3.1.3.3 Discussion of irrigation water shall include but not be limited to the following:

a. Required irrigation water quality.
b. Required quantity of irrigation water.
c. Alternative sources and justification for the one selected.
d. Alternative systems of irrigation and justification for the one selected.

18.3.1.4 Solid Waste Systems. Discussion of solid waste systems shall include but not be limited to the following:

a. Solid waste contributors, respective quantities, composition, alternative collection and disposal methods and site locations, and justification for selected method and site.
b. Provision for future expansion.
    a. Adverse environmental impacts.

18.3.2 <u>Concept Design Drawings</u>. The following specific items shall be submitted when applicable.

18.3.2.1 Domestic and Industrial Water Supply Sources.

a. A site plan showing the water supply source, location and piping.
    a. A floor plan with equipment layout and single-line piping for pumping stations.

18.3.2.2 Water and Wastewater Treatment Facilities.

a. A site plan showing major structures and/or treatment units, including new and existing yard piping with directional arrows indicating flows.
b. A floor plan showing equipment layout and single-line piping for each building, major structure, and pump station.

18.3.2.3 Water Distribution, Wastewater Collection, and Irrigation Systems.

a. The site plan with layout of water distribution, wastewater collection, and irrigation systems shall include proposed routing of lines and tentative location of valves, hydrants, manholes, pumping stations, etc. Site plans shall include existing utilities and any other features which could affect construction.

b. Wastewater pump stations shall utilize submersible pumping systems, unless otherwise approved by the client or directed by Middle East District (CETAM).

18.3.2.4 Solid Waste Systems.

a. A site plan showing location of collection, storage, and disposal sites.
b. A floor plan of major structures showing equipment layout.
c. A schematic flow diagram.

18.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

18.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any necessary revisions. In addition, the following specific items shall be included when applicable.

18.4.1.1 Domestic and Industrial Water Supply Sources.

a. Detailed water quality analysis of all sources.
b. Calculations to support selection of all equipment and pipe sizes.

18.4.1.2 Domestic and Industrial Water and Wastewater Treatment.

a. Average and peak loadings for individual unit processes including hydraulic, organic, solids, etc.
b. Detailed descriptions of proposed unit process including type, size, capacity, supporting data, and calculations showing the degree of treatment expected in each unit process, as well as the overall treatment efficiency.
c. Discussion of controls, instrumentation, and proposed operating sequences or methods.
d. Discussion of features for operator safety and comfort.
e. Discussion of facility layout from the standpoint of easy operation and maintenance.
f. Calculations to support selection of all equipment and pipe sizes.

18.4.1.3 Water Distribution, Wastewater Collection, and Irrigation Systems.

a. Detailed hydraulic calculations for each system, including the worst fire situation for the water distribution system.
b. Discussion of pipe materials and justification for the materials selected.
c. Discussion of the irrigation system including justification for the system selected.

18.4.1.4 Solid Waste System. Discussion of the solid waste system shall include a detailed description of solid waste storage, collection, transportation, and disposal methods including collection schedules and disposal design calculations.

18.4.2 Preliminary Design Drawings. The following specific items shall be submitted when applicable.

18.4.2.1 Domestic and Industrial Water Supply.

a. Detailed floor plans and sections of pumping stations with equipment layout, piping, and sufficient dimensions and elevations to physically locate all items of equipment, piping, etc.
b. Hydraulic profiles.
c. Pipe sizes and details of piping.

18.4.2.2 Domestic and Industrial Water and Wastewater Treatment.

a. Hydraulic profiles.
b. Detailed floor plans and sections of structures with equipment layout, piping, and sufficient dimensions and elevations to physically locate all items of equipment, piping, etc.
c. Instrumentation and control schematics.

18.4.2.3 Water Distribution, Wastewater Collection, and Irrigation Systems.

a. Location of lines by grid coordinates or other suitable means. Items to be located include bends, tees, valves, fire hydrants, manholes, pumping stations, laterals, etc.
b. Sizes for new and existing pipelines and manholes.
c. Partially completed profiles of gravity sewers. Double lines are required for profile piping.
d. Invert and rim elevations for all manholes.
e. Details for connecting new lines to existing systems.
f. Irrigation systems shall include control valves pressure reducing and regulating valves, flow control valves, emitters, and typical sections for various types of irrigation systems if applicable.

18.4.2.4 Solid Waste System.

a. A site plan showing collection routes. Relatively simple systems may be described by notes on site plans.
b. Detailed floor plans and sections of structures and/or disposal facilities with equipment layout, including sufficient dimensions and elevations to locate all items of equipment and appurtenances.
c. Instrumentation and control schematics.

18.5 FINAL SUBMITTAL REQUIREMENTS.

In addition to the corrected Preliminary design, the following information shall be provided at the Final stage:

18.5.1 Design Analysis. The design analysis shall be complete, and include a list of at least three suitable manufacturers for all major mechanical items of equipment, e.g. pumps, blowers, aerators, etc. Catalog cuts and manufacturer's data for all equipment items shall be included. The sections of the annotated Design Checklist pertaining to water, wastewater and solid waste systems will be included.

18.5.2 Design Drawings. Working drawings for all systems shall be complete, including all revisions resulting from review comments.

18.5.2.1 Domestic and Industrial Water and Wastewater Treatment Facilities.

a. Schematic diagrams for complex piping installations such as reverse osmosis units, pressure filters, digesters, etc.
b. Separate equipment schedules for such items as valves and gates, pumps, blowers, yard piping, and interior piping. The schedule should include an item designation number or letter (e.g. pump No. 3 or valve B, etc.), item description, function, size or capacity, material of construction, and any special remarks or information.

18.5.2.2 Domestic and Industrial Water Supply and Distribution, Wastewater Collection, and Irrigation Systems.

a. Details for standard appurtenances such as manholes, valve settings, hydrant settings, etc.
b. Special construction details
c. Details for runways, railroad, and highway crossings
d. Pipe bedding details

18.6 READY TO ADVERTISE (RTA) SUBMITTAL REQUIREMENTS.

The comments generated during the Final design review shall be incorporated in the documents before they are submitted as RTA.

18.7 TECHNICAL REQUIREMENTS.

The following technical requirements will be adhered to when applicable, unless specifically instructed otherwise by the Scope of Work:

18.7.1 Water Supply, Treatment, and Distribution. Water supply, treatment, and distribution shall be designed in accordance with UFC 3-230-01 and UFC 3-230-03.

18.7.2 Outside Fire Protection. Outside fire protection shall be designed in accordance with the applicable sections of UFC 3-230-07A through UFC 230-11A, the National Fire Protection codes, and UFC 3-600-01.

18.7.3 Sanitary and Industrial Wastewater Systems. Sanitary and industrial wastewater systems shall be designed in accordance with UFC 3-240-01, and UFC 3-240-02. Sanitary and industrial wastewater systems shall also comply with DoD 4715.05-G Overseas Environmental Baseline Guidance Document.

18.7.4 Solid Wastes Systems. Solid wastes systems shall be designed in accordance with TM 5-634, UFC 3-240-10A and UFC 3-280-02A. Solid wastes systems shall also comply with DoD 4715.05-G Overseas Environmental Baseline Guidance Document

18.7.5 Reference Discrepancies. When a discrepancy exists between the Technical Manuals and other references, the designing Architect/Engineer (A-E) shall immediately notify CETAM for clarification of the governing document.

18.7.6 Potable Water Quality. Potable water quality shall comply with World Health Organization (WHO) Standards latest edition unless otherwise advised by CETAM. The WHO standard is only good for non-US costomers. Wastewater treatment plant effluent shall be reused to the maximum extent possible for irrigation, industrial cooling, etc. Also, provision shall be made to reuse industrial blowdown water to the maximum extent possible.

18.7.7 System Reliability. Only those systems or processes having proven reliability, ease of operation, and minimal maintenance requirements shall be considered.

18.7.8 Safety and Comfort Items. If a facility is to be manned by an operator, provide adequate safety and comfort items including emergency showers, eye washers, toilets, drinking fountains, etc.

18.7.9 Storage Space and Handling Facilities. Adequate storage space and handling facilities shall be provided for supplies and chemicals.

18.7.10 Corrosion. Pipe corrosion is often a problem when metallic pipe is used in an underground application. Good designs will minimize corrosion by selecting proper materials; protecting metals by protective coatings and linings; or installing cathodic protection. The use of cathodic protection systems should be limited, since proper operation and maintenance services are often not locally available.

CHAPTER 19
RENOVATION DESIGN

CHAPTER 19
RENOVATION DESIGN

19.1 GENERAL.

19.1.1 Scope. This chapter provides the required guidance for presenting renovation designs and submittal requirements to be observed in the development of design which involves renovation. Renovation design shall include rehabilitation, upgrading, or demolition as part of, or to an entire existing facility, or the systems contained therein. Renovation to an existing facility or its systems can also include additions or extensions thereto.

19.1.2 Document Requirements. Specific submittal requirements in this chapter supplement the general requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents; including drawings, and design analysis shall be in accordance with Chapter 2: PRESENTATION OF DATA. Specifications shall be in accordance with Chapter 3: SPECIFICATIONS.

19.1.3 Early Planning. The decisions required to determine how to approach and present a renovation design must be made before the start of the project since they will impact manhour budgets, schedules, and final packaging. The decisions will also impact the number of site surveys, the degree of information to be collected or obtained during the surveys, and the required length of surveys.

19.1.4 Clearances/Approvals. Some foreign agencies hesitate to allow or release photographs or video tapes. Therefore, clearances or approvals must be obtained prior to site surveys. Approvals to use (or not) pictures will greatly affect the detail of field notes, sketches, etc. required and the overall presentation of the renovation design.

19.2 SUBMITTALS.

19.2.1 General. The documents which are submitted for review shall be as generally described below. For additional specific submittal requirements, refer to Chapters 3 through 19.

19.2.2 Concept Submittals. The concept submittal shall show sufficient detail, plans, elevations, etc. to convey:

a. Existing construction and systems together with an indication of the extent of removal, repair, and replacement.
b. The method of presenting the renovation design. It shall be evident whether separate or consolidated discipline removal drawings are to be used. Design Analysis shall narratively identify existing construction, materials, and systems involved in the

renovation; describe the proposed rehabilitation, and support the decision to remove, repair, or replace as appropriate.

19.2.3 Additional Submittals. Removal drawings and design analysis provided for each additional submittal, preliminary, prefinal and final. Each submittal shall be an extension of the previous one including any refinements, additions, or revisions required as the result of design development. The preliminary submittal shall begin to show the designers method of representing removal and identification of exact quantities to be removed.

19.3 TECHNICAL REQUIREMENTS.

19.3.1 General. The objective of the renovation design is to clearly show the existing conditions, components of construction, and systems of the facility and clearly define the scope of work involved. The extent of work must: (a) provide each bidder a clear, concise, and accurate baseline upon which to base his bids, and (b) provide the Contracting Officer a basis from which to administer the contract and monitor the Contractor's progress. The renovation design must not leave it to the Bidders, the Contractor, or the Contracting Officer to determine the extent of work. In general each renovation design shall include:

a. Renovation/removal drawings.
b. Removal, repair, and disposal specifications
c. Appropriate special contract requirement clauses
d. Appropriate removal bid items

19.3.2.1 General. Each renovation design shall include the necessary drawings which show the existing conditions, components, systems, etc. of the facility. The extent of these drawings will vary based upon the extent of the renovation required within or to a facility. In most cases, the standard shall be to provide renovation/removal drawings for each discipline involved. If the extent of design warrants, and if approved, combined demolition drawings may be used to show multiple discipline work. Such drawings shall be organized to be the first drawings behind the site drawings, or the first drawings within each discipline.

19.3.2 Renovation Drawings.

19.3.2.2 Drawings. Each drawing shall clearly show the extent and location of demolition or removal, and provide sufficient descriptive data, sizes, etc. as may be required to clearly convey the scope of work. Provide floor plans, roof plans, elevations, and sections as necessary to show exact locations, areas, or quantities involved.

a. Drawings shall clearly show which existing components of the facility are to be retained, to be removed or to be abandoned in place. The exact extent of removal shall be clearly shown. The location and type of patching shall be indicated especially when mechanical and electrical systems or equipment are removed and/or replaced.
b. Where shading is approved to be used on the drawings, it shall be such that the shaded area is readable at full size and at half size.

c. By varying drawing line weights existing verses new work can be easily distinguishable on drawings. Existing conditions are typically shown in light line while new work is shown in bold darker lines.
d. Appropriate legends of symbols, line weights, etc. shall be provided on the renovation/demolition drawings.
e. Notes used on the drawings shall be as descriptive as possible without becoming wordy in order to fully define the work required. Words such as approximate, assumed, or to be determined shall not be acceptable.

19.3.2.3 Photographs shall be used to show existing conditions, but they shall not eliminate the need for demolition drawings. The use of photographs must be approved prior to beginning the design, since clearance must be granted by the foreign agency involved. Photographs shall be black and white and of sufficient size (5 x 7 or 8 x 10) to show conditions after reducing drawings to half size. Each photograph shall be "keyed" on a floor plan so as to indicate location and direction of items shown. Photographs shall be provided with titles and any other applicable notes which may describe the existing items shown.

19.3.2.4 Video tapes used in conjunction with renovation/demolition designs can be used to show existing conditions. The use of video tapes must be approved prior to the start of design. Video tapes shall be of the highest quality and clearly show existing conditions. The use of voice communication shall be clearly heard and understood and shall describe what is being shown as well as the location from where the video is being taken. Video tapes shall not eliminate completely the need for demolition drawings, but could reduce the number and complexity of the information placed upon the drawings. The final video tape shall be the edited version of the site survey tapes.

19.3.3 <u>Renovation Specifications</u>.

19.3.3.1 General. Each renovation design shall contain renovation specifications. A separate specification shall be used whenever the nature and scope of renovation, salvage, and demolition work is extensive. Each design discipline shall be responsible to provide the required input into this specification to cover its renovation involvement. For some renovation designs, it may be more appropriate to incorporate the scopes of work into the various technical provisions of the specifications.

19.3.3.2 Specifications and drawings shall be fully coordinated. If renovation work is specified in the various technical provisions, the cross references shall be placed upon the drawings referring to the applicable section.

19.3.3.3 As built conditions obtained during the site visit shall be the basis of the renovation design. There will be some facilities, however, which will have these conditions change between the time of the site visit and time of award. When this is likely, the specifications shall include a paragraph requiring the Contractor to perform a plan-in-hand survey in the presence of the Contracting Officer. The survey shall update the contract set of documents and provide a current as built condition before beginning construction.

CHAPTER 20
CORROSION PREVENTION AND CONTROL

CHAPTER 20
CORROSION PREVENTION AND CONTROL

20.1 GENERAL.

20.1.1 Scope. This chapter provides criteria, requirements and guidance for the design of corrosion prevention and control systems. The term corrosion is used here in a broad sense covering generally the degradation of construction materials caused by harsh arid desert environment, as well as conventional corrosive soil conditions. Corrosion of metallic materials is usually electrochemical in nature. Corrosion of nonmetallic materials depends on other types of reactions.

20.1.2 Document Requirements. Specific submittal requirements in this chapter supplement the general requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents; including drawings, and design analysis shall be in accordance with Chapter 2: PRESENTATION OF DATA. Specifications shall be in accordance with Chapter 3: SPECIFICATIONS.

20.1.3 Design Objective. The engineering objective is to obtain structures, equipment, systems, etc., of present and continuing utility and durability which will require minimal maintenance. Therefore, construction systems, materials and coatings shall be designed and selected not only on their ability to fulfill an intended purpose but also on their ability to resist the corrosive forces present in the environment to which they will be subjected.

20.2 APPLICABLE PUBLICATIONS.

The current editions of the publications listed below, form a part of this Manual.

National Association of Corrosion Engineers (NACE):

NACE RP0193	External Cathodic Protection of On-Grade Carbon Steel Storage Tank Bottoms
NACE RP0285	Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
NACE RP0286	Electrical Isolation of Cathodically Protected Pipelines
NACE SP0178	Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service

Department of the Defense United Facility Criteria (UFC):

UFC 3-570-01	Cathodic Protection

American Society for Testing and Materials (ASTM):

ASTM C 150	Specification for Portland Cement.

ASTM A 934	Specification for Epoxy-Coated Prefabricated Steel Wire and Welded Wire Fabric for Reinforcement.
ASTM A 775	Specification for Epoxy-Coated Steel Reinforcing Bars

20.3 CONCEPT SUBMITTAL REQUIREMENTS.

20.3.1 Concept Design Analysis. The following specific items shall be included.
20.3.1.1 Basis of Design Summary. Provide a summary of the Basis of Design, including, but not limited to, the following where applicable:

a. List weather data peculiar to the site.
b. List results of soil resistivity investigation.
c. List results of soil chemical analysis.
d. List data regarding air pollution.

20.3.1.2 Technical Criteria. List the technical criteria used as a guide in the design work.

20.3.1.3 Corrosion Prevention and Control Systems Analysis. Include any explanatory material necessary to support the selection of the cathodic protection systems, materials and coating systems chosen insofar as it relates to the problem of corrosion.

20.3.2 Concept Design Drawings. The Concept design drawings shall include a site plan drawing showing the construction intended to be protected.

20.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

20.4.1 Preliminary Design Analysis. The Preliminary design analysis shall include all items in the Concept design analysis and any necessary revisions thereto. Calculations generated in the design of a cathodic protection system shall also be included.

20.4.2 Preliminary Design Drawings. The Preliminary design drawings shall include, when applicable, anode, resistor and test station locations. For impressed current cathodic protection systems, electrical one-line diagrams shall be included.

20.5 FINAL SUBMITTAL REQUIREMENTS.

The design analysis and drawings submitted for final review shall be complete, as described in Chapter 1: GENERAL INSTRUCTIONS.

20.6 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the final review shall be incorporated before the documents are submitted as Ready to Advertise.

20.7 TECHNICAL REQUIREMENTS.

20.7.1 Meteorological Conditions. Since climate is an important factor influencing the corrosion rate of building elements exposed to the atmosphere, an understanding of the local climate is necessary for the design of proper corrosion prevention and control systems.

20.7.1.1 General Meteorological Conditions.

a. Temperature and Humidity. The climate for projects covered by these instructions is generally desert-like. Temperatures may range from winter lows of -7 degrees Centigrade to summer highs of 49 degrees Centigrade. At such high temperatures, corrosion occurs more rapidly than at more moderate temperatures. While relative humidities in interior areas are generally low (down to 3 percent in summer months), the relative humidity in coastal areas frequently could be in the 80 to 100 percent range. In such areas where high relative humidities exist, it is not unusual to have the dropping evening temperature fall below the dewpoint, resulting in moisture condensing on exposed metal surfaces. Such moisture, often salt laden due to the fact that the high humidities occur in the coastal area, is particularly corrosive. Upon evaporation, this moisture leaves behind a salt residue which accumulates as the condensation and evaporation cycle recurs.
b. Wind. Another meteorological factor which affects the corrosion of building surfaces is the wind. High velocity winds, accompanied by vertical mixing, will generally cause dust storms and sandstorms. It is the sandstorms, which occur when the wind velocity exceeds 27 knots, that are a corrosive factor in that they wear away nonresistant protective paint finishes allowing surface corrosion to occur. Chlorides and sulfates are also present in some airborne dusts which enhance corrosion in some of the materials they contact. The wind deposited dust also provides a binder for the accretion of salt and moisture.
c. Sun. A third element of the climate which is of a corrosive nature, and must be considered during material selection, is the sun. With many areas lying south of the Tropic of Cancer, the intensity of the sun is greater than that experienced farther north. This greater intensity combined with the lack of atmospheric moisture found in some areas results in fairly intense ultraviolet radiation levels which have a deleterious effect on certain protective coatings and plastics.

20.7.1.2 Specific Meteorological Conditions. Prior to the start of any design work, the Architect/Engineer (A-E) shall familiarize himself with the specific meteorological conditions of his particular construction site. This information will be provided to him by the Middle East District (MED) as required.

20.7.2 Other Environmental Conditions. Besides meteorological conditions, there are other environmental factors that play an important role in the corrosion of building elements. A knowledge of these other factors is necessary for the design of proper corrosion prevention and control systems.

20.7.2.1 Soil Resistivity. The resistivity of the soil is an important factor in the corrosion of underground structures. Soil test results including soil resistivity measurements will be provided as required (See Chapter 21: GEOTECHNICAL). The relationship between soil resistivity and corrosion rate of isolated buried structures is as follows:

Anticipated Resistivity Corrosion Classification	Resistivity Range (ohm-cm)	Activity
Low	0 - 2,000	Severe
Medium	2,000 - 10,000	Moderate
High	10,000 - 30,000	Mild
Very High	> 30,000	Unlikely

20.7.2.2 Soil Chemical Content. Soil tests are required to determine if applicable amounts of chlorides, organic matter, ammonia compounds, sulfates or sulfides are present. Soil test results will be provided as required, (See Chapter 21: GEOTECHNICAL). If analysis shows the soil to have a low ph, or to support anaerobic bacteria activity, corrosion will be accelerated, and any corrosion prevention and control design decisions shall be made accordingly.

20.7.2.3 Water Chemical Content. For identified specific projects where metallic surfaces will come into contact with ground water or other water, a chemical analysis of the water is required. Water analysis results will be provided as required (See Chapter 21: GEOTECHNICAL. The information obtained from such analyses shall be considered in the design and selection of corrosion prevention and control methods.

20.7.2.4 Air Pollution. If the A-E is contracted to design within an industrialized area, he shall investigate the presence of possible harmful airborne pollutants and shall consider their effect on his design.

20.7.3 Methods of Corrosion Prevention and Control. Once the various corrosive factors for a particular project site have been determined and measured, the A-E shall consider these factors in the design of his project. The selection and design of cathodic protection systems, the selection of materials and the selection of coating systems shall all be based on their ability to prevent and control corrosion of the building elements.

20.7.3.1 Cathodic Protection. Metallic surfaces which will be in contact with soil or water shall be considered as candidates for cathodic protection. Normally, the surfaces of different metals, or of the same metal in different environments, assume different electrical potentials when submerged in an electrolyte. Some metal surfaces become anodic, while others become cathodic. Corrosion occurs at the anodic areas on metal surfaces. Cathodic protection consists of making cathodic a surface upon which corrosion is to be controlled. Cathodic protection systems include components which are strongly anodic. Immersion of these components in the same electrolyte as the metal to be protected, provided an electrical connection completes the circuit, results in the creation of a cathodically biased protected metal surface, thus, minimizing metal loss. The degree of protection accomplished is contingent upon the potential difference between the protected metal surface and the electrolyte in which the surface is buried or submerged.

a. Methods of Achieving Cathodic Protection. There are two methods of achieving cathodic protection: the sacrificial anode method and the impressed current method. Both methods can provide the external direct-current source necessary to make a metallic structure cathodic. After it has been determined that a cathodic protection system is required, the proper system shall be selected depending on the circumstances encountered.
    1. Sacrificial Anode Method. Sacrificial anodes are generally used where small increments of current are required in areas where electrolyte resistivity is low. Such anodes when electrically connected to a metallic structure lower in the galvanic series when both are in a common electrolyte, discharge current in the process.
    2. Impressed Current Method. Impressed current systems are beneficial when there is a high probability of change in the parameters which affect system design. Protective current is introduced into the electrolyte through anodes and flows through the electrolyte to the structure to be protected. The current then flows along the protected structure and the circuit is completed by a metallic connection to the negative terminal of the rectifier. The rectifier is energized by an outside alternating current power source.
b. Basic Design Factors. To a large extent, cathodic protection system design is based on the conditions of the existing electrolyte and the effect those conditions have on the metal to be protected. Other factors also influence basic system design.
    1. Electrolyte Resistivity. Electrolytes with low resistivity are more conducive to electrochemical reactions.
    2. Electrolyte Composition. The chemical composition of the electrolyte is an important factor in cathodic protection system design.
    3. Liquid Electrolyte Velocity. Whenever a liquid electrolyte passes over or contacts a metallic surface to be cathodically protected, the velocity of the electrolyte shall be considered because as the velocity increases, the protective current requirement also increases.
    4. Type of Metal. Since corrosion occurs at different rates for different metals, cathodic protection system design shall take the type of metal to be protected into consideration.
    5. Design Life. A cathodic protection system shall be designed to provide protective current for the life of the structure to be protected. If the life

expectancy of the structure exceeds that of the cathodic protection system, provisions shall be made to replace portions of the system as necessary when the protection provided the structure is no longer adequate.

6. Power Source Availability. For cathodic protection systems of the impressed current type, the availability of an ac power source shall be considered. Locating the rectifier in the vicinity of the ac power source is the preferred procedure providing the effectiveness with regard to the range of protection is sufficient and the cost of the rectifier is not prohibitive. If an ac power source is not available, solar powered units shall be considered.

c. Supplemental Design Factors. After the basic design factors have been considered, certain other factors shall also be considered in the design of a cathodic protection system.

1. Electrical Continuity. Where it is desirable for a cathodically protected structure to be electrically continuous, bonding wires shall be installed, where required, by exothermally welding two cables to both sides of each non-electrically continuous connection, such as a joint in slip-jointed carbon steel, ductile iron or cast-iron pipe. Bolted, soldered or welded joints of carbon steel, copper and stainless steel will provide adequate electrical continuity without additional bonding.
2. Electrical Isolation. Cathodic protection systems shall be designed to provide protection to specific installations, the limits of which are well defined. To assure that protective current is not being diverted to surfaces that do not need protection, electrical isolation shall be provided. Insulated flanges shall be installed at the boundaries where cathodic protection is no longer required, such as where pipe emerges from below ground.
3. Encasement. Whenever an underground metallic pipe is partially concrete encased and partially buried in direct contact with an electrolyte, additional cathodic protection shall be provided as required to protect the pipe in contact with the electrolyte as accelerated corrosion is likely to occur as a result. In such cases, the entire pipe, both the part encased and the part buried, shall be provided with a high quality dielectric coating. If metal reinforcing is used in the concrete encasement of pipe, extreme care shall be taken to assure that metal-to-metal contact between the pipe and the reinforcement is avoided.
4. Presence of Other Structures. The presence of other structures in the same electrolyte as the structure to be protected shall be considered in cathodic protection system design. The proper location of system components will assure that shielding is minimized and that as much of the protective current as is practical will flow directly to the structure for which it is intended rather than be diverted to other structures.
5. Stray Current Control. Potential measurements made on surfaces to be protected often reveal the presence of stray currents. The control of such undesirable stray currents shall be accomplished as required by using

drainage bonds, coatings, insulated joints, reverse current switches, polyethylene encasement or by a combination of such techniques.

6. System Monitoring. A cathodic protection system shall be provided with a means of testing its effectiveness. The system shall provide leads directly to the structure and shall be terminated in a field test station. Monitoring of structure to electrolyte potentials, electrical isolation, electrical continuity and the level of protection shall be accomplished by means of these test leads.
7. Other Environmental Factors. The routing of an underground metal structure shall be considered in the design of a cathodic protection system for that structure. In some areas, cathodic protection facilities installed in the usual manner may be aesthetically unacceptable. Cathodic protection system facilities shall avoid excessive interference with the normal use of the land. When overhead power lines are present, cathodic protection equipment, such as insulated flanges or rectifiers, shall be selected which are capable of withstanding high voltage power surges.

20.7.3.2 Material Selection. One important method of preventing corrosion is to select materials which will not corrode in the environment to which they will be exposed. While this is not always possible, materials used in corrosive environments shall be selected based on their relative ability to withstand corrosion. Such a selection, however, shall be contingent on the materials' ability to fulfill its intended function and the materials cost as related to the anticipated life span of the structure. Materials shall also be selected based on their compatibility with adjacent materials to reduce the possibility of galvanic corrosion.

a. Concrete. To avoid the degradation of concrete in natural environment good engineering practices shall be used. Cement conforming to ASTM C 150, Type V is the standard for resistance to sulfate exposure at the concentrations found in the soils and waters of much of the countries that TAD has design responsibilities. Because of physical characteristics, however, cements other than Type V may be preferred for certain uses of concrete.
b. Reinforcing Steel. Epoxy-coated reinforcing bars are the most commonly used corrosion-resistant reinforcing bar used in reinforced concrete projects due to corrosion-resistance and cost. Specify reinforcing with ASTM A 934 and A 775
c. Plastics. Some plastics suffer from ultraviolet deterioration due to the strong solar radiation. Plastics which will be exposed to direct sunlight shall be specified as ultraviolet resistant.
d. Metals. Metals used for construction shall be carefully selected. In coastal areas even galvanized steel corrodes readily. Stainless steel suffers from concentration cell corrosion when it contacts sea water. Well water, even treated, is generally high in chlorides and is corrosive to steel and galvanized steel. Distilled water from desalinization plants, is also highly corrosive to steel. Where dissimilar metals are adjacent, adequate separation shall be provided to prevent galvanic corrosion.

20.7.3.3 Coating Selection. The proper selection of applied coating systems is an important element of corrosion control. Ordinarily, a material subject to corrosion is covered with an inert coating to protect it from attack by a corrosive environment. Other coatings, such as inorganic zinc coatings, consist of substances more anodic than the surface they are protecting. These coatings sacrificially corrode in preference to the surface they are protecting so as to protect that surface electrochemically. A third application of a coating is to cover the most noble of two dissimilar metals which are in electrical contact and immersed in a common electrolyte. This type of coating prevents the metal from acting as a cathode. The proper selection of applied coatings is just as important for shop-applied as for field-applied coatings. Those shop-finished items which will be exposed to corrosive forces, such as preformed metal siding, condensing units, transformers, etc., shall be specified to receive coating systems designed to resist the anticipated corrosion. The specification of a "manufacturer's standard" shop-applied finish shall be made only after the composition of the finish has been determined and found appropriate to the particular situation. For items specified to be shop-primed only, the prime coat specified shall be compatible with the anticipated finish coat.

a. Design of Facilities to be Coated. Whenever practical, anything to be coated shall be designed to minimize the corrosion problem and to effectively accept the protective coating. Crevice corrosion, concentration cell corrosion, and stress corrosion cracking can be avoided, or at least minimized by suitable design. As sharp edges of metals are very subject to corrosion and are not easily coated, they should be avoided. Guidance in the design of metal vessels is presented in NACE Standard RP-01-78. The components of concrete that will be coated shall be carefully selected to avoid soluble salts which can cause efflorescence on surfaces which interferes with the application of coatings. These salts can also cause osmotic pressure buildup under coatings exposed to moisture resulting in blistering and loss of coating.
b. Coating Application. The successful performance of coatings selected for corrosion resistance usually depends upon the careful application of the coatings to properly prepared surfaces and the proper curing and drying of the coatings. Adequate quality control standards are required with inspection procedures to determine whether the standards are met.
    1. Surface Preparation. Contract specifications shall specify that surface preparation shall be in accordance with the manufacturer's recommendations or with the standard methods of the Steel Structures Painting Council or the National Association of Corrosion Engineers. The surface preparation specified shall be appropriate for the type of material, type of coating, and corrosive conditions anticipated.
    2. Application and Curing. Contract specifications shall specify that coatings shall be applied and cured in accordance with the manufacturer's instructions. Before being specified, however, it shall be determined whether or not the proposed coating can be properly applied and cured under the anticipated temperature and humidity conditions at the site.

3. Quality Control and Inspection. Adequate quality control procedures shall be specified to assure that the coatings have been properly applied and are of the appropriate thicknesses.

c. Coating Material Selection. The materials to be coated are generally concrete, ferrous metals and nonferrous metals. The type of protective coating each requires depends upon the type of environmental exposure it has. For Middle East areas, the exposures of concern are, principally, desert air, marine air, sea water immersion or splash, distilled water immersion, saline soil surface contact, underground burial and fuel tank interior. Coatings shall be selected which will protect the particular surfaces from the specific environmental exposure encountered. Generally, only those coating systems shall be selected that have proved serviceable under the conditions of concern. The various materials will sometimes encounter the following exposures.

1. Concrete. Generally, high quality concrete designed to withstand sulfate exposure does not need a coating to protect it from the desert air or sea. Also, exposure to soil containing less than 2.4 percent sulfate does not require a protective coating. However, exposure to soil containing over 2.4 percent sulfate or to water containing over 0.6 percent sulfate does require a protective coating. Distilled water from desalinization is also very corrosive to concrete and concrete pipe. Concrete exposed to sewage or sewage fumes should also be considered for coating.
2. Ferrous Metals. Because of the degree of thermal expansion and contraction of metals due to the climate, thin flexible coatings are preferred over thick inflexible ones which may crack as a result of thermal cycling. Both steel and galvanized steel corrode readily when exposed to marine air. In desert air, curing of some coatings is a problem due to lack of humidity. Wind-blown sand and dust also create an abrasion problem. Both sea water exposure and distilled water exposure produce serious corrosion problems with steel requiring a good quality coating free of defects. As the soil may contain salts corrosive to steel, protective coatings are desirable for steel equipment located on the surface of the ground or underground. Exposure to moist soils is more corrosive than exposure to dry soil. Under the most favorable circumstances, coatings recommend for exposure to the air will be adequate. Under the worst circumstances, coatings recommended for sea water exposure shall be considered. Coatings for tanks and pipes shall be compatible with the tank or pipe contents. Fuel tank coatings shall be resistant to the liquid fuel and vapors.
3. Nonferrous Metals. While aluminum normally does not require an applied coating, in a corrosive environment, pitting of aluminum sometimes occurs. In the case of pipes carrying sea water at a desalinization plant, the interior of high alloy (e.g. stainless steel) pipes shall be painted for a distance of three times the pipe diameter from the point where they are connected to iron pipes. This prevents the high alloy from acting as a cathode to the corrosion of the iron.

CHAPTER 21
GEOTECHNICAL

CHAPTER 21
GEOTECHNICAL

21.1 GENERAL.

This chapter specifies design criteria, submittal requirements, and additional technical requirements to be adhered to in the geotechnical design. Specific submittal requirements in this Chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including drawings and design analysis, shall be in accordance with Chapter 2: PRESENTATION OF DATA. Specifications shall be in accordance with Chapter 3: SPECIFICATIONS.

21.2 APPLICABLE PUBLICATIONS.

The current edition of the publication listed below, forms a part of this manual.

American Concrete Institute (ACI)

ACI 301	Specifications for Structural Concrete

Engineering Manuals (EM)

EM 1110-1-1804	Geotechnical Investigations
EM 1110-1-1904	Settlement Analysis
EM 1110-1-1905	Bearing Capacity of Soils

Engineering Regulation (ER)

ER 1110-34-1	Transportation Systems Mandatory Center of Expertise

Unified Facilities Criteria (UFC) Technical Publications

UFC 3-220-01	Geotechnical Engineering
UFC 3-220-04FA	Backfill for Subsurface Structures
UFC 3-220-05	Dewatering and Groundwater Control
UFC 3-220-08FA	Engineering Use of Geotextile
UFC 3-220-10N	Soil Mechanics
UFC 3-250-01FA	Pavement Design for Roads, Streets, Walks, and Open Storage Areas
UFC 3-250-03	Standard Practice Manual for Flexible Pavements
UFC 3-250-04	Standard Practice for Concrete Pavements, with Change 2
UFC 3-250-06	Repair of Rigid Pavements Using Epoxy Resin Grouts, Mortars and Concretes
UFC 3-250-07	Standard Practice for Pavement Recycling
UFC 3-250-08FA	Standard Practice for Sealing Joints and Cracks in Rigid and Flexible Pavements
UFC 3-250-09FA	Aggregate Surfaced Roads and Airfields Areas

UFC 3-250-11	Soil Stabilization for Pavements
UFC 3-260-01	Airfield and Heliport Planning and Design
UFC 3-260-02	Pavement Design for Airfields
UFC 3-260-03	Airfield Pavement Evaluation
UFC 3-260-16FA	Airfield Pavement Condition Survey Procedures Pavements
UFC 3-260-17	Dust Control for Roads, Airfields, and Adjacent Areas
UFC 3-270-01	Asphalt Maintenance and Repair
UFC 3-270-02	Asphalt Crack Repair
UFC 3-270-03	Concrete Crack and Partial-Depth Spall Repair
UFC 3-270-04	Concrete Repair
UFC 3-270-05	Paver Concrete Surfaced Airfield Pavement Condition Index (PCI)
UFC 3-270-06	Paver Asphalt Surfaced Airfield Pavement Condition Index (PCI)
UFC 3-320-06A	Concrete Floor Slabs on Grade Subject to Heavy Loads

Pavement-Transportation Computer Assisted Structural Engineering (PCASE)

	Publication
PCASE	https://transportation.wes.army.mil/pcase/

21.3 RESOURCES.

21.3.1 Geotechnical References. The Architect Engineer (A-E) shall base design and construction documents upon applicable UFC technical publications above, recognized state of the art geotechnical references, resources, and texts. Current standards of the American Society for Testing Materials should be used to the maximum extent possible.

21.4 SPECIAL REQUIREMENTS.

21.4.1 When airfield pavements and railways are elements of the design, USACE-Transportation Systems Center of Expertise (TSC) review of all planning and design documents is mandatory in accordance with ER 1110-34-1 for each phase of design.

21.4.2 When roadway (vehicular) pavements are elements of the design and the roadway portion of the design exceeds the threshold for roadways as stated in ER 1110-34-1 paragraph 6.b, USACE-Transportation Systems Center of Expertise (TSC) review of all planning and design documents is mandatory for each phase of design.

21.4.3 Where the above elements are part of the design, the TSC will be contacted prior to or during the planning phase of the project. All program and planning documents should be provided. Procedures for contacting the TSC are provided in ER 1110-34-1 part 13.

21.4.4 In-house designs shall be sent to TSC for review at the address provided in ER 110-34-1 appendix A part A-4 for each phase of the design.

21.4.3 In coordination with MED, A-E or design-build (DB) design submittals shall be sent directly to the TSC address listed in the A-E's contract or contract specification 01 33 00.15 10 "Design Build Submittal Procedures" for each phase of the design. If a TSC address is not listed in the contract, the A-E or DB contractor must contact MED for further guidance.

21.5 CONCEPT SUBMITTAL REQUIREMENTS.

21.5.1 Design Analysis. The following specific items shall be included.

21.5.1.1 Site Conditions. State results of research and review of existing information on the site, such as general topography, soil types, geology conditions (geology setting, rock types, outcrops, etc.), ground water, surface water sources, climate, etc. This may be based upon information in published geotechnical reports or the results of literature search

21.5.1.2 Foundation System. State the proposed foundation system based upon preliminary design research developed from generalized site conditions. Include rationale, both economic and technical, for choosing the proposed foundation system. These preliminary assumptions are subject to change.

21.5.1.3 Pavement Type. State the proposed pavement types (flexible or rigid pavement) which will be used in the design. Provide aircraft traffic loads and passes information. These preliminary assumptions are subject to change. The pavement designs shall be conducted with the Pavement-Transportation Computer Assisted Structural Engineering (PCASE) program.

21.5.1.4 Earthwork. Discuss any proposed earthwork that will be required in the design. This should include slope stability analysis, excavation and bracing, grading and drainage, soil improvement techniques, collapsible soil mitigation, etc. as applicable to the project.

21.5.2 Design Drawings. Include sketches showing proposed buildings, pavements, and other facilities layouts, and results of preliminary research on site conditions. Indicate the foundation systems anticipated for the structure(s) involved. Specifically indicate whether a shallow (e.g., spread footing, mat) or deep (e.g., pile, drilled pier) foundation is anticipated. Indicate the pavement types (flexible or rigid pavement) anticipated for the project. Approval at this point does not mean that a change cannot be made at a more advanced stage of the design if another system is considered more feasible.

21.5.3 Concept Design Specifications. Provide concept design specifications in accordance with Chapter 3: SPECIFICATIONS.

21.6 PRELIMINARY SUBMITTAL REQUIREMENTS.

21.6.1 Design Analysis. The preliminary design analysis is essentially an update or refinement of those items treated in the concept phase as additional information becomes available. Any changes from concept should be identified, explained and supported by calculations of other data.

21.6.2 Geotechnical Report. When a geotechnical investigation is required, the preliminary design shall include the results of all geotechnical investigations, field and lab testing, and the geotechnical investigation report.

21.6.3 Design Drawings. Provide updated information such as facilities and or pavement relocations or changes in conceptual assumptions.

21.6.4 Foundation System. The choice of a specific deep foundation system should be justified at this time by an economic comparison between shallow foundation systems (mat foundation, spread and strip footings) various types of ground improvement, and the proposed deep foundation system. Also provide justifications for the type of proposed deep foundation systems selected.

21.6.5 Pavement Type. Provide justifications for the selected type of pavement (flexible or rigid pavement).

21.6.6 Preliminary Design Specifications. Provide preliminary design specifications in accordance with Chapter 3: SPECIFICATIONS.

21.7 FINAL SUBMITTAL REQUIREMENTS.

21.7.1 Final Design Submittal. The final design submittal shall include the completed design analyses, geotechnical report, drawings, and specifications incorporating those comments generated by the preliminary design review. The design analyses shall contain complete calculations of all foundations and pavements.

21.7.2 Foundation Analysis. Foundation analysis is required to show that the type of foundation selected is the most feasible and capable of supporting the structure. The analysis must include a narrative describing the design approach and all estimates and assumptions made, as well as soil bearing and settlement calculations in accordance with the guidelines and general requirements of 21.2 APPLICABLE PUBLICATIONS.

21.7.3 Final Design Specifications. Provide final design specifications in accordance with Chapter 3: SPECIFICATIONS.

21.8 READY TO ADVERTISE (RTA) DESIGN REQUIREMENTS.

The comments generated during the final design review shall be incorporated in the documents before they are submitted as ready to advertise.

21.9 TECHNICAL REQUIREMENTS.

21.9.1 Geotechnical Design Specialist. Services of a Geotechnical Design Specialist will be required unless specifically waived by MED. Prior to the commencement of design work the name of the designated specialist along with the individual's educational background, experience, licenses and registrations shall be submitted for approval. The Geotechnical Specialist shall be a practicing registered professional Geotechnical Engineer, Engineering Geologist, or qualified Civil Engineer who has been practicing in geotechnical engineering field for a minimum of 5 years, etc., appropriate to the project. He shall be experienced, competent and specialized in soil mechanics, rock mechanics, subsurface investigations, interpretations, evaluations, ground water geology, rock excavation, hydrology, etc. The Geotechnical Design Specialist will be responsible for interpreting foundation investigation reports and reports of special geotechnical studies as well as designing various types of foundations, excavations, backfills, fills, dewatering systems, and other geotechnically related items. The Geotechnical Specialist shall present subsurface information in Design Reports, Contract Plans and Specifications.

21.9.2 Site Work. Discuss cut and fill recommendations. Relate foundation and pavement designs and excavation to utility layouts. Avoid excessive earth movement, and preserve natural site features where indicated.

21.9.3 Specifications. The applicable Unified Facilities Guide Specifications (UFGS) shall be edited by the A-E's geotechnical engineer/personnel. The edited specifications shall consider all geotechnical elements of the site. The edited specifications shall be coordinated between the drawings and design analyses.

CHAPTER 22
ADVANCED MODELING

22.1 GENERAL

22.2 ADVANCED MODELING PxP REQUIREMENTS

22.3 ADVANCED MODELING PxP TEMPLATE

22.4 ADVANCED MODELING PxP STANDARD OPERATING PROCEDURES (SOP)

LIST OF FIGURES

LIST OF FIGURES – continued -

LIST OF FIGURES – continued -

CHAPTER 22
ADVANCED MODELING

22.1 GENERAL

The intent of this chapter is to provide policy and guidance to the design disciplines of the US Army Corps of Engineers (USACE) Transatlantic Middle East District (TAM) Project Delivery Team (PDT) and/or designated Architect-Engineer (A-E) design agent firms in the development of all TAM design-build (DB) and design-bid-build (DBB) projects in order to follow strict adherence of meeting the requirements for Advanced Modeling (AdM).

a. **Reference.**

1) Engineering and Construction Bulletin (ECB) 2018-7, Advanced Modeling Requirements on USACE Projects, 06 June 2022.

2) USACE Minimum Modeling Matrix (M3), Version 1.3, 19 September 2013.

3) USACE Building Information Modeling Template for Revit (Template based on the 2016 Autodesk Revit Software), Master Guide: Template v3.4 Metric, February 2019.

4) USACE Civil 3D (Template based on the 2016 Autodesk Civil 3D Software), Template v3.3 Metric, August 2018.

5) ERDC/USACE Vicksburg, ITL CAD/BIM Technology Center, USACE Advanced Modeling BIM/CIM Object Standard, Final 1.0, March 2019.

6) Engineering Research & Development Center (ERDC) – Information Technology Laboratory (ITL) – Technical Resource (TR) -19-6: Architecture-Engineering-Construction (A/E/C) Graphics Standard, Release 2.1 August 2019.

7) ERDC-ITL-TR-19-7: A/E/C Computer-Aided Design (CAD) Standard, Release 6.1, August 2019.

8) USACE Sacramento District, Engineering Division, Delivering AutoCAD Drawings [&] Revit Models, August 2016.

9) Engineering Regulation (ER) 1110-1-8156 Engineering and Design Policies, Guidance and Requirements for Geospatial Data and Systems, 2012.

10) USACE AdM Submittal Review Checklist (CHX) (2016).

b. **Definition.** “Advanced Modeling” (AdM) refers to the use of Building Information Modeling (BIM), Civil Information Modeling (CIM), Computer Aided Design (CAD), and Geospatial Information Systems (GIS) for the development of design and construction deliverables.

c. **Purpose.** The AdM process supports collaboration amongst all project delivery team (PDT) members, Architect-Engineer (A-E) design firms, stakeholders and mission partners. Proper utilization of Advanced Modeling improves design and construction processes, reduces errors and omissions, generates more complete information-loaded deliverables and ensures higher design and construction quality.

d. **Background.** The information contained in these models enables the sharing of data to make more informed decisions during the complete life-cycle of a project from inception through decommissioning. A design generated through the use of AdM tools virtually represents the physical and functional features of the project, while embedding important life-cycle information and data specific to the design.

e. **Applicability.** The AdM requirements apply to all TAM design projects.

f. **Policy and Implementation.**

1) All design and/or construction projects must use AdM to generate designs and solicitation documents. The final deliverable of AdM record drawing files will be coordinated with the stakeholder to include their end-use requirements.

2) Deliverables will meet the requirements of this chapter, ECB 2018-7, ERDC-ITL-TR-19-6, ERDC-ITL-TR-19-7, EM 1110-1-2909 and other applicable requirements of the TAM Design Instruction Manual.

3) Deliverables shall include a USACE TAM AdM Project Execution Plan (PxP), BIM/CIM design models, CAD sheet extractions and GIS databases in their native file format utilizing USACE/TAM template, structure, and PDF bookmarking format.

4) Questions, comments or feedback concerning this chapter shall be directed to Erick Stillman Erick.M.Stillman@usace.army.mil .

22.2 ADVANCED MODELING PxP REQUIREMENTS

All TAM projects shall utilize a TAM Project Execution Plan (PxP). The PxP shall incorporate the project development process from “Birth to Built” (B2B), ensuring all pertinent information is captured during the life of the project. Each PxP contains a cover sheet, table of contents and (14) distinctive sections. The PxP must be completed prior to the start of the project and approved by the Advanced Modeling Manager or approved delegate. Payment can be withheld for failure to perform.

a. **<u>Section A: Project Information</u>**. Contains (9) items to capture the information necessary to begin the project.

1) Items 1-4 capture Project Location, Client, Title and Code. These four items are listed in the same order as the PxP cover sheet and in the drawing titleblocks.

<u>Figure 22-1: TAM PxP Section A: Items 1-4</u>

1. **Project Location**: (Upper case each word) City, Country
2. **Project Client:** (Upper case each word)
3. **Project Title**: (Upper case each word)
4. **Project Code:** **CC-485034**

2) Items 5-8 captures the Contract Type, Brief Project Description, Facility Names and Designer of Record. These four items contain a generalization based on the project's Scope of Work (SOW).

<u>Figure 22-2: TAM PxP Section A: Items 5-8</u>

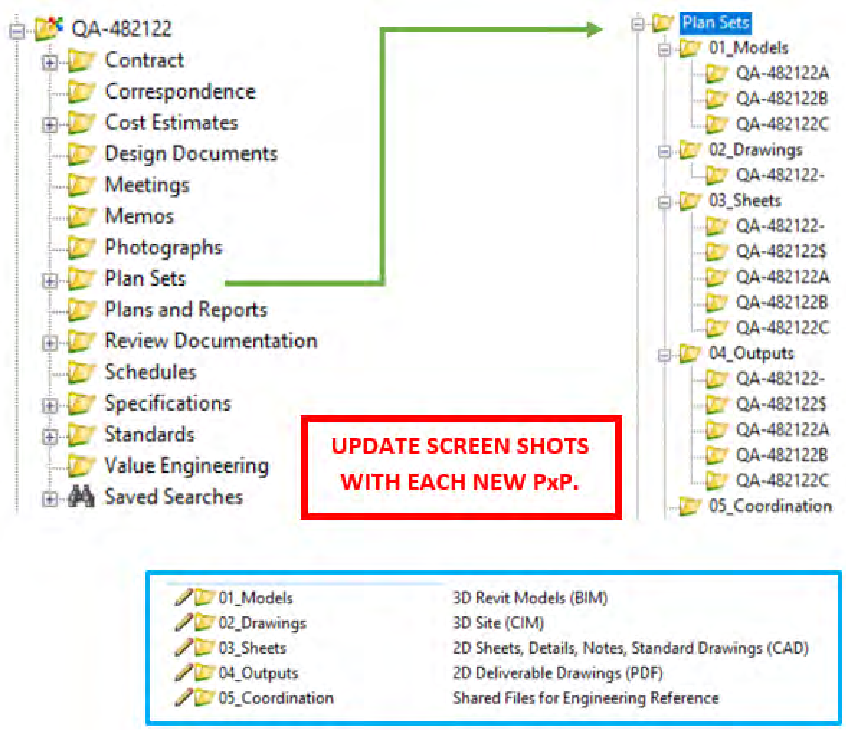
5. **Contract Type:** Design-Build (DB) or Design-Bid-Build (DBB)
6. **Brief Project Description:** *Who will do what? What will they do? Who will issue the contract award?* i.e.: "The AE will prepare the 65% Design Build Request for Proposal (RFP) packages for 10 facilities. TAM will issue the contract award."
7. **Facility Name(s):** (xx) Facilities - See Section K: Model Organization
8. **Designer of Record (DOR):** USACE TAM & (AE Firm or District Name)

3) Item 9 captures the TAM ProjectWise (PW) directory path to the project and specific folder structure. Advanced Modeling deliverables shall use the Plan Sets parent subfolder and corresponding child folders to house Models, Drawings and Sheets. AdM files will be grouped facilities, site design and standard details.

<u>Figure 22-3: TAM PxP Section A: Item 9 PW Directory Path</u>

9. **PW Directory:** Winchester\Documents\MED Projects\(Country)\(Project Code)\(Project Code)

Figure 22-4: TAM PxP Section A: Item 9 PW Folder Structure



b. **Section B: Project Delivery Team (PDT).** Contains (3) columns divided by Role, Organization and E-mail for each participant of the project. The first part contains constant participant information while the later includes variable information which changes per project. This supports collaboration amongst all PDT members.

Figure 22-5: TAM PxP Section B: Constant Participant Information.

ROLE	ORGANIZATION	EMAIL
Advanced Modeling (AdM) Manager	TAM	Erick.M.Stillman@usace.army.mil
AdM Engineering Systems Manager	TAM	N/A
AdM Service Unit Technician	TAM	Lacey.C.Sandate@usace.army.mil
Quality Manager	TAM	Douglas.S.Applegate@usace.army.mil
Value Engineer	TAM	Amanda.S.Bianchini@usace.army.mil
Scheduler	TAM	Erin.M.Specht@usace.army.mil

c. **<u>Section C: Project Goals & Advanced Modeling Objectives.</u>** Contains (2) items which are aligned "…improve design and construction processes, reduce errors and omissions, generate more complete information-loaded deliverables and ensure higher design and construction quality."

<u>Figure 22-6: TAM PxP Section C: Major AdM Goals/Objectives</u>

ADVANCED MODELING GOAL	DESCRIPTION
ENFORCE STANDARDS	MAXIMIZE CONSISTENCY AND MINIMIZE REDUNCANCY
3D COORDINATION	DESIGN OPTIMIZATION AND CLASH DETECTION
COST ESTIMATION	IMPROVING QUANITY TAKE-OFFS

USACE and TAM have specific requirements for the models. Items in Red are USACE minimum requirements, while items in Blue are TAM requirements. Depending on the need of the customer additional model uses may be required.

<u>Figure 22-7: TAM PxP Section C: Model Uses</u>

PLAN (NIC)		DESIGN		CONSTRUCT		OPERATE (NIC)	
	PROGRAMMING	X	DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING SYSTEM ANALYSIS
	SITE ANALYSIS	X	PROGRESS REVIEWS		CONSTRUCTION SYSTEM DESIGN		ASSET MANAGEMENT
		X	INTERFERENCE MANAGEMENT (3D COORDINATION)	X	INTERFERENCE MANAGEMENT (3D COORDINATION)		SPACE MANAGEMENT / TRACKING
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		DISASTER PLANNING
			LIGHTING ANALYSIS		3D CONTROL AND PLANNING		
			ENERGY ANALYSIS	X	RECORD MODELING		OPERATION & MAINTENANCE RECORD MODELING
			PROGRAM VALIDATION		FIELD / MATERIAL TRACKING		
			MECHANICAL ANALYSIS		DIGITAL LAYOUT		
			OTHER ENG. ANALYSIS				
			SUSTAINABILITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D)		PRELIMINARY CONSTRUCTION SCHEDULING (4D)		CONSTRUCTION SCHEDULING (4D)		BUILDING MAINTENANCE SCHEDULING (4D)
	COST ESTIMATION (5D)	X	COST ESTIMATION (5D)		COST ESTIMATION (5D)		COST ESTIMATION (5D)
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING
	CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)

d. **<u>Section D: Organization Roles</u>.** Contains (3) columns divided by Model Use, Organization and Lead Contact. Knowing who will do what at various stages helps coordinate overall responsibility for suspense dates.

Figure 22-8: TAM PxP Section D: Organization Roles

MODEL USE	ORGANIZATION	LEAD CONTACT
DESIGN AUTHORING	DOR	PROJECT MANAGER
PROGRESS REVIEWS	USACE	DESIGN MANAGER
2D / 3D COORDINATION	DOR / USACE	CAD-BIM MANAGER
COST ESTIMATION	DOR / USACE	COST ESTIMATOR
RECORD MODELING	AWC-CONSTRUCTION	CAD-BIM MANAGER

e. **Section E: Advanced Modeling Process Design.** *See PxP.*

f. **Section F: Advanced Modeling Information Exchange Worksheet.** *See PxP.*

g. **Section G: Minimum Modeling Matrix (M3) Requirements.** Contains (2) items for Reference and Enhancements. The Reference document is a spreadsheet which contains three worksheets: Instructions, Modeling Requirements and Scope-LOD-Grade. Refer to USACE Minimum Modeling Matrix (M3), V1.3, 19 September 2013.

These documents utilizes the AIA LOD definitions and classifies the built environment with a minimum level of required information categorizing reference to Omniclass, Uniformat and MasterFormat.

Figure 22-9: TAM PxP Section G: M3 Columns A thru E

Level	Element ID	OmniClass ID	UniFormat ID	MasterFormat ID
Level 3	Special Foundations	21-01 10 20	A1020	31 60 00
Level 4	Driven Piles	21-01 10 20 10	A1020.10	31 62 00
Level 4	Bored Piles	21-01 10 20 15	A1020.15	31 63 00
Level 4	Caissons	21-01 10 20 20	A1020.20	31 64 00
Level 4	Special Foundation Walls	21-01 10 20 30	A1020.30	31 66 16

Level 1-4 in column A refers to the Uniformat hierarchy level. For a simple definition see Figure 22-9 below and/or refer to https://en.wikipedia.org/wiki/Uniformat.

Figure 22-10: TAM PxP Section G: Column A - Uniformat Levels 1-4

Example:
Level 1 - A
Level 2 - A10
Level 3 - A1010
Level 4 - A1010.10

In column F the DOR will identify which items will be included for the Facility or Site Design. This information is based on input from the PDT and elements from SOW. Column G determines the Level of Develop (LOD) for each category.

Figure 22-11: TAM PxP Section G: Breaking Down the M3 LOD

Included in Facility or Site? (change to NO if NOT part of project scope)	LOD
Yes	•
Yes	300
Yes	300
Yes	300
Yes	300

Required Level of Development (LOD) =

LOD 100 = 62
LOD 200 = 195
LOD 300 = 245

Grand Total = 502 Element ID's

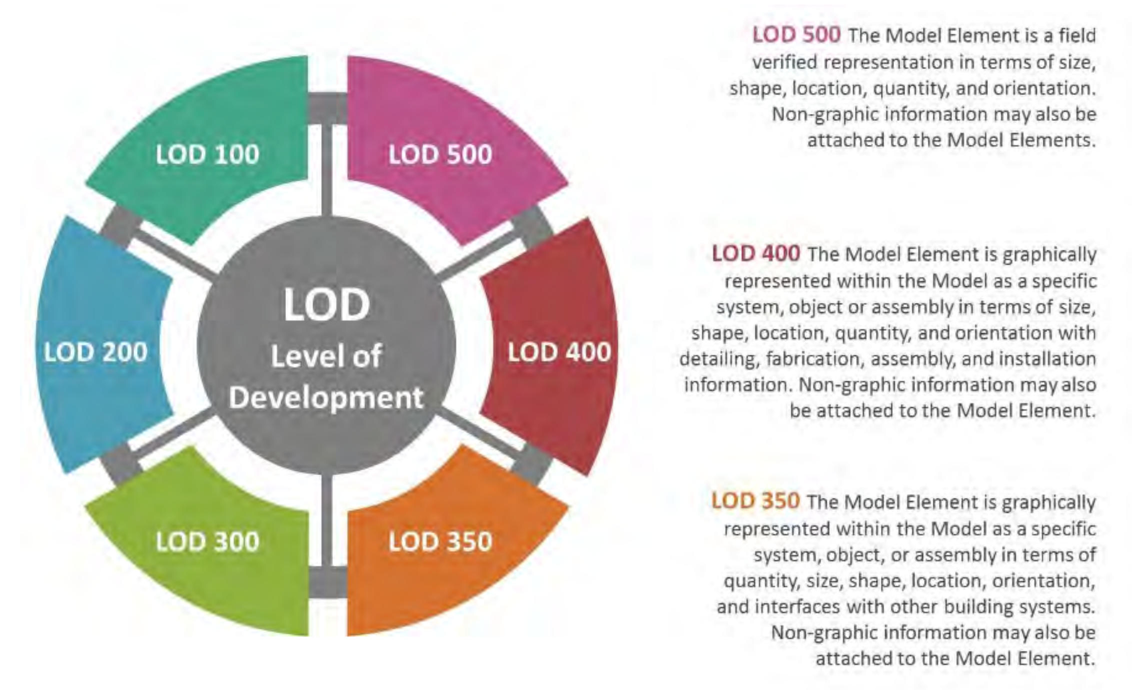
The LOD listed are the USACE minimum requirements and can only be enhanced. The LOD is unique to the degree of accuracy the information is being provided. Enhancement will be documented in the specific PxP.

Figure 22-12: TAM PxP Section G: LOD Definition (Accuracy)

LOD	Definition
•	Refer to the specific child element for appropriate LOD. (Used for categories that have multiple sub-elements for which varying LOD apply.)
100	Model Elements indicative of area, height, volume, location, and orientation may be modeled geometrically or represented by other data (i.e., a pump would be a cube.)
200	Model Elements are modeled as generalized systems or assemblies with approximate quantities, size, shape, location, and orientation. Non-geometric information may also be attached to Model Elements (i.e., a pump would be a generic pump of approximate size.)
300	Model Elements are modeled as specific assemblies accurate in terms of quantity, size, shape, location, and orientation. Non-geometric information may also be attached to Model Elements. Accurate to the degree dimensioned or indicated on contract documents (i.e., a pump would be a generic pump of accurate size complete with connections and clearances for a complete system.)

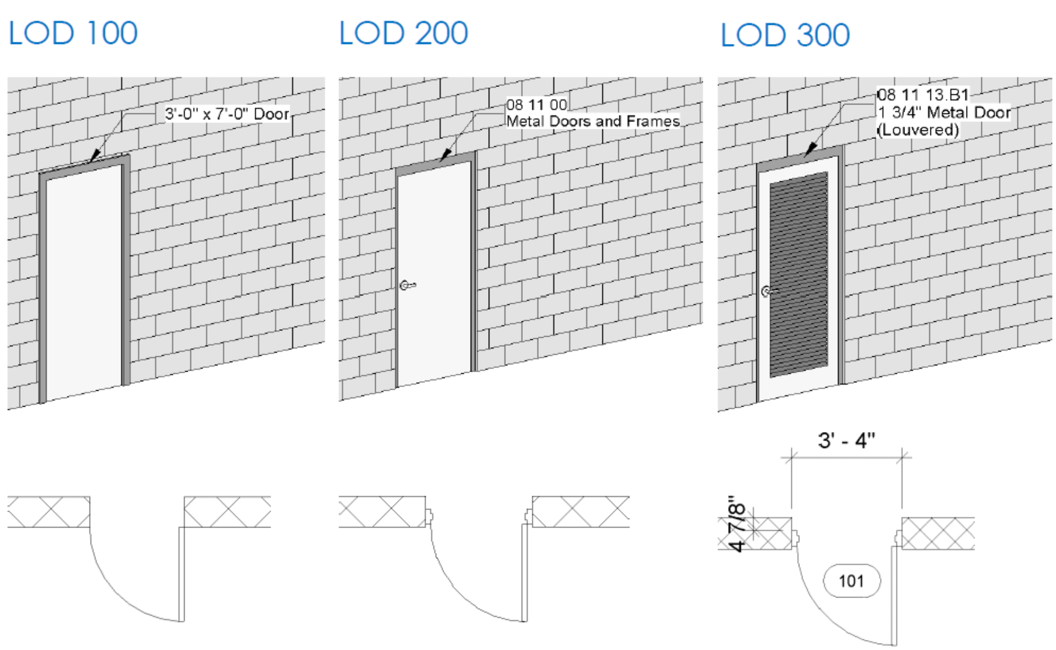
While USACE M3 design requirements achieve up to Level 300, the A/E/C industry further develops LOD model elements during the fabrication, construction, and facility management stages.

Figure 22-13: TAM PxP Section G: LOD 350 to 500



When the USACE M3 is used properly the model elements enhance the visual display of information. USACE has primarily utilized only LOD 200 and 300 LOD's, and has limited use for LOD 100.

Figure 22-14: TAM PxP Section G: LOD 100 to 300 Visual Example



Columns H and J (*column I is not used*) address the Element Grade Definitions in various formats to provide certain elements a greater benefit of 3-dimensional (3D) representation, while others drafting or representation in the form of narratives is sufficient for a particular deliverable.

Figure 22-15: TAM PxP Section G: Element Grade Definitions (Format)

Grade	Description
A	3D + Facility Data
B	2D + Facility Data
C	2D Only (Drafting, linework, text, and or part of an assembly)
+	Original Grade (A, B, or C) adjusted for contract changes and field conditions.
-	Not included in or tied to the model (however is still required in the deliverable)
•	Refer to the specific child element for appropriate Grade. (Used for categories that have multiple sub-elements for which varying Grades apply.)

The Record Model (As-Built) is included in the USACE minimum requirements. Shown with the plus (+) symbol it delineates how each model will be updated to record changes for contract changes and field condition during the construction process changes (usually via RFI or Change Order) updated with in in-field conditions.

Figure 22-16: TAM PxP Section G: Design/Record Model & Disciplines

DESIGN MODEL (CONSTRUCTION DOCUMENTS)	RECORD MODEL (AS-BUILTS)	FOR AGENCY OR CONTRACTOR INTERNAL USE. NOT A CONTRACTUAL REQUIREMENT.	
GRADE (CD)	GRADE (AB)	Primary Discipline (This will allow the team to identify discipline-specific areas of content)	Notes
•	•	Structural	
A	A+	Structural	
A	A+	Structural	
A	A+	Structural	
A	A+	Structural	

Columns K and L identify the primary discipline is assigned to the particular Element ID. This allow the PDT to identify discipline-specific areas of contents and an area to provide additional notes to identify supplementary disciplines. These columns are for Agency or Contractor use and not a contractual requirement.

In summary Revit & Civil 3D models and CAD files shall be incompliance with the USACE Minimum Modeling Matrix (M3) Scope, Level of Development and Grade. M3 will help ensure clarity in what is asked for and consistency in what is received. M3 resource information is available at the USACE CAD-BIM center (https://cadbimcenter.erdc.dren.mil/).

1) Questions concerning M3 please contact;
    1. Steve Hutsell (Steve.Hutsell@usace.army.mil) or
    2. Van Woods (Van.Woods@usace.army.mil).

2) Questions concerning specific object classifications contact;
    1. OmniClass (http://omniclass.org),
    2. UniFormat (http://www.csinet.org/uniformat), or
    3. MasterFormat (http://www.MasterFormat.com).

h. **Section H: Collaboration Procedures.** Contains (2) items which cover Collaboration Strategy and Activities. Both equally important, the strategies are simple reminders to keep the PDT involved, engaged and directed in the development of modeling for each project. While the activities stress the type, project stage, frequency, participants and location.

Figure 22-17: TAM PxP Section H: Collaboration Activities

ACTIVITY TYPE	PROJECT STAGE	FREQUENCY	PARTICIPANTS	LOCATION
ADVANCED MODELING PxP DEMONSTRATION	BEFORE DESIGN STARTS	ONCE	PDT	WEB MEETING
MODEL COORDINATION	DURING	WEEKLY	PDT	PROJECTWISE
PEER REVIEWS	BEFORE EVERY SUBMITTAL	MULTIPLE	PDT Leads	PDT WORKSTATION
ADVANCED MODELING TRAINING	ALL	AS-NEEDED	PDT	WEB MEETING
DESIGN SOFTWARE TRAINING	ALL	AS-NEEDED	PDT Design Team	WEB MEETING

Provided adequate software and bandwidth exists these locations may include web meetings, teleconference calls or in-person sessions. The goal is to accommodate as much participation as possible.

i. **Section I: Quality Control.** Quality Control measures are required to ensure what was agreed upon in the approved PxP is carried out. At each design submission stage a Contractor-certified written report will be provided, confirming that consistency checks as identified in this Section have been completed for the design submittal. This report shall be discussed as part of the design review conference and shall address cross-discipline interferences, if any.

1) Visual Check: Ensure there are no unintended model components and the design intent has been followed.

2) Interference Check: Locate conflicting spatial data in the Model where two elements are occupying the same physical space. Log hard interferences (e.g., mechanical vs. structural or mechanical vs. mechanical overlaps in the same location), and soft interferences (conflicts regarding service access, fireproofing, insulation), in a written report and document disposition.

3) Standards Check: Ensure that the BIM and A/E/C CADD Standard have been followed (fonts, dimensions, line styles, levels/layers, and other contract document formatting issues are followed per the A/E/C CADD Standard.)

4) Model Integrity Checks: Conduct QC validation processes to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements and the report on non-compliant elements and corrective action. Provide justification acceptable to the Government of non-compliant elements if allowed to remain within the Model.

5) Version Updating Check: Ensure that all users are using the agreed upon version of the software and the method by which changing software version is completed.

6) Revision Authority Check: Describe the method by which all users will be given access and extent of revision authority to versions of the model as updated.

7) Other QC Parameters: Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for concurrence.

8) Over-The-Shoulder Progress Reviews: Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.

Figure 22-18: TAM PxP Section I: QC Checks Responsible Parties

CHECKS	RESPONSIBLE PARTY
VISUAL CHECK	DOR Design Members
INTERFERNCE MANAGEMENT (3D COORDINATION)	DOR Design Members
STANDARDS CHECK	DOR Design Members
MODEL INTEGRITY CHECK	DOR Design Members
VERSION UPDATING CHECK	DOR Design Members
REVISION AUTHORITY CHECK	DOR CAD-BIM Manager
QC PARAMETERS CHECK	DOR CAD-BIM Manager
OVER-THE-SHOULDER PROGRESS REVIEWS	All DOR Members

USACE wants you to use the Model to produce your drawings. Get into the model, develop the families, meet the M3 requirements and review the design with the client.

j. **Section J: Technological Software & Standards.** Contains (2) items for AdM & CAD Standards and Exceptions. The AdM and CAD Standards lists the requirements that govern all USACE TAM projects. The standards are listed by and name and version number with corresponding month and year.

Figure 22-19: TAM PxP Section J: AdM & CAD Standards Versions

STANDARD	VERSION
CETAM DIM, Chapter 22 – Advanced Modeling	R 3.0 – JAN 2022
USACE Minimum Modeling Matrix (M3)	V 1.3 – SEP 2014
USACE BIM Template for Revit - Metric	V 3.4 – FEB 2019
USACE Civil Engineering Template for Civil 3D - Metric	V 3.3 – AUG 2018
USACE Advance Modeling BIM/CIM Object Standard	V 1.0 – MAR 2019
USACE ERDC/ITL TR 19-6 A/E/C Graphics Standard	R 2.1 – AUG 2019
USACE ERDC/ITL TR 19-7 A/E/C CAD Standard	R 6.1 – AUG 2019
USACE Standards A/E/C Symbols Guide	V 1.4 – AUG 2018

As with any project, USACE TAM prides itself on meeting the needs of our clients, whereby those needs may require exceptions as noted in this Chapter. When this occurs any deviation is captured in the specific PxP under the exemption table. This table will document the exception and identify the Chapter, Section and specific location in which it supersedes.

Figure 22-20: TAM PxP Section J: AdM & CAD Standard Exceptions

EXCEPTIONS	SUPERSEDES
Typical Examples;	
SHEET SEQUENCE NUMBERS CAN EXCEED (99) SHEETS.	TAM DIM JUN 2020 CHAPTER 22 SECTION 22-2.k.3.a
BIM WORKING UNITS WILL BE FEET AND INCHES.	TAM DIM JUN 2020 CHAPTER 22 SECTION 22-2.k.9 (a)
CIM WORKING UNITS WILL BE FEET AND INCHES.	TAM DIM JUN 2020 CHAPTER 22 SECTION 22-2.k.9 (b)

k. **Section K: Model Organization.** Contains (10) items which cover the TAM Project Code, Symbol Designators & Revit Abbreviations, CAD-BIM Sheet Files, Non-Revit Model Files, Revit Model Files, Minimum Modeling Requirements, Working Units & Coordinate Systems and Presentation of Graphics.

1) TAM Project Code: Drawing file naming conventions are a combination of the TAM Project Number with Symbol Designator, and combination of the A/E/C CAD & TAM AdM Standards. All shall meet the requirements of ERDC/ITL TR-19-7, with the following TAM exceptions as listed below.

(a) Where a P2 Number is provided at the start of the project, the TAM Project Code is comprised of the TAM Country Code abbreviation and specific P2 number (e.g. "KU-472118").

(b) Where multiple projects fall under the same P2 number, the TAM Project Code is comprised of a dash (-) immediately following the duplicate P2 Number and assigned a sequential number (e.g. "KU-472118-1").

(c) When no P2 number is provided at the start of the project, the TAM Project Code is comprised of the Country Code abbreviation, calendar year and project sequence number (e.g. KU-202001").

(i) **Note 1:** Changing the project code mid-project requires updates to the PxP's, Index of Drawings, Titleblocks, and renaming all of the sheets, indexes, filenames, CAD files & BIM models. Ripples of these changes include re-referencing and re-linking CAD file references and BIM models.

(ii) **Note 2:** Unless otherwise specifically requested by the client, Design Manager (DM), or senior management, the TAM Project Code will remain the same should a P2 number arrive after a project begins.

2) Symbol Designators & Revit Abbreviations: Each has a direct correlation when identifying the group's typical and variable symbols, names and abbreviations. These typical symbols will be found in BLDG ID field of the Sheet ID and include;

(a) **Facilities** will use a letter ("**A, B, etc.**").

(b) **Multiple facilities** will use letters if the count exceeds 26 ("**AA, AB**", **etc.**").

(c) **Standard Facility Details & Notes** will use a dollar sign ("**$**")

(d) **Site Design** will use a hyphen ("**-**").

(e) **Multiple Site Designs** will use a number ("**-1, -2, -3, etc.**").

As identified in PxP Section A.8 Facility Names will be provided in Section K.

Figure 22-21: TAM PxP Section K: Codes, Designators & Abbreviations

1. **TAM PROJECT CODE:** CC-123456

2. **SYMBOL DESIGNATORS & REVIT ABBREVIATION:**

TYPICAL

	GENERAL INFO	(**GEIN**)
-	SITE DESIGN	(**SIDE**)
$	STANDARD DETAILS FACILITY	(**SDFA**)

VARIABLE

A	FACILITY NAME	(**ABBR**)
B	FACILITY NAME	(**ABBR**)

From these facility names the Revit Abbreviations will be created to standardize and shorten the length of the BIM name. Each is developed using the following format;

(f) Single Name will use the 1st four letters of the name; i.e. the ABBR for WAREHOUSE is "**WARE**".

(g) Double Names will use the 1st and 2nd letter of each name; i.e. the ABBR for GENERAL INFO is "**GEIN**".

(h) Triple Names will use the 1st letter of the first two names and 1st & 2nd letters of the last name; i.e. the ABBR for FIRE PUMP HOUSE is "**FPHO**".

(i) Quadruple Names will use the 1st letter of each name; i.e. the ABBR for BATTALION ADMIN TRAINING FACILITY is "**BATF**".

3) CAD-BIM Sheet File Format: The Sheet File is a combination of the A/E/C CAD & TAM AdM Standards and has a direct correlation with the Sheet ID whereby it mimics the discipline designator with modifier, sheet type designator and sheet sequence number.

(a) TAM Sheet File Naming: A/E/C CAD Standards exemptions include;

(i) Sheet file names will use **BOTH** the Discipline Designator with Modifier.

Figure 22-22: TAM PxP Section K: TAM Sheet File naming

CC:	TAM Country Code;	**TAM Project Code**
(P2#):	P2 Number;	
S:	Symbol Designator;	
A:	Discipline Designator;	**AEC CAD Standard**
E:	Discipline Modifier;	
1:	Sheet Type Designator;	
99:	Sheet Sequence Number;	
-xx:	Amendments & Change Orders;	**TAM Advanced Modeling Standards**
.dwg/.dgn/.pdf:	File Extension;	

(ii) **Site Design** drawings that are site design specific will use both the discipline designator and modifier (e.g., HA = Hazardous Materials Asbestos, VA = Survey/Mapping Aerial, BB = Geotechnical Boring Logs, CS = Civil Site, LG = Landscaping Grading, etc.) showing "*HA101, VA101, BB101, CS101, LG101, respectively*".

(iii) **Non-Civil Site Design** drawings will use an "X" in front of non-specific site design disciplines (e.g., XE = Site Electrical, XT = Site Telecommunications, etc.) showing "*XE101, XT101, respectively*".

(iv) **Facility** drawings will use both the discipline designator and modifier (e.g., EL = Electrical Lighting, EP = Electrical Power, etc.) showing "*EL101, EP101, respectively*".

(v) **Facility Standard Details** will use an "S" in front of disciplines. (e.g., SE = Standard Electrical, ST = Standard Telecommunications) showing "*SE501, ST501, respectively*".

See Table 2-3 for Discipline Designators, ERDC/ITL TR-19-7, A/E/C CAD Standards, Release 6.1, AUG 2019. Table 2-4 shown below identifies the Sheet Type Designator which follow the Discipline Designator and Modifier.

Figure 22-23: TAM PxP Section K: A/E/C Sheet Type Designators

Sheet Type	Designator
General (symbols legend, notes, etc.)	0
Plans (horizontal views and combination plan and profile)	1
Elevations and profiles (vertical views)	2
Sections (sectional views, cross sections, etc.)	3
Large scale views (Scaled up reproductions of plans, elevations, or sections that are not details)	4
Details	5
Schedules and diagrams	6
User defined	7
User defined	8
3D Representations (isometrics, perspectives, photographs)	9

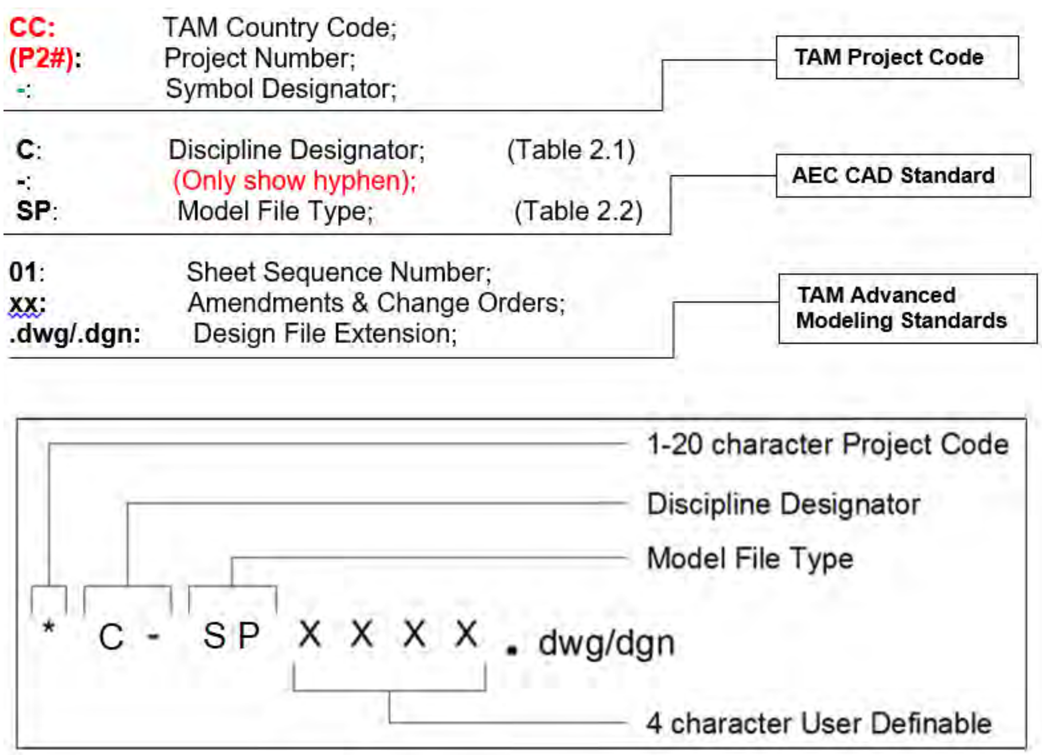
The Sheet Sequence Number shall immediately follow the Sheet Type Designator. The numbering range shall begin at **01** and end at **99**.

(vi) CIM sheet files format "CC-(P2)--CS199-xx.dwg/pdf".

(vii) BIM sheet files format "CC-(P2)**S**-AE199-xx.dwg/pdf".

4) CIM (Non-Revit) Model File Format: Similar to the section listed above this model file format is comprised of the TAM Project Code, Discipline Designator, Model File Type and other TAM AdM Standards.

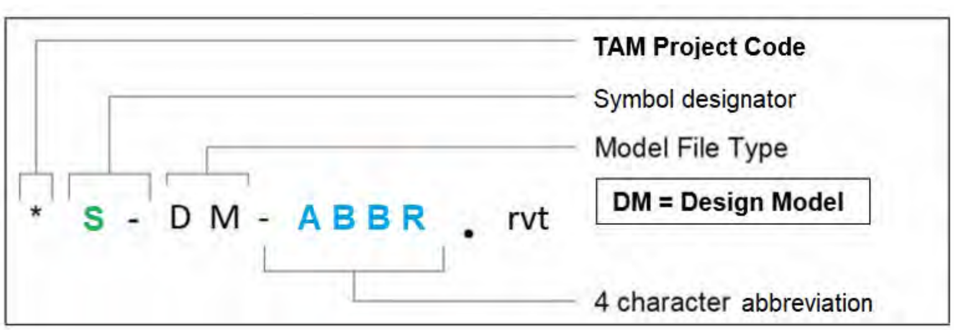
Figure 22-24: TAM PxP Section K: TAM (Non-Revit) Model File Format



See Tables 2-1 & 2-2 for Discipline Designators & Model File Types, ERDC/ITL TR-19-7, A/E/C CAD Standards, Release 6.1, AUG 2019

5) BIM (Revit) Model File Format: Similar to the section listed above this model file format is comprised of the TAM Project Code, Discipline Designator, Model File Type "**DM**" and the Revit Abbreviation (**ABBR**)**.**

Figure 22-25: TAM PxP Section K: TAM (Revit) Model File Format



TAM Revit models are grouped by facilities using the following options and the size of each Revit model shall **NOT** exceed 200 megabytes (MB).

(a) **<u>Option A</u>** <u>– Single Revit model containing ALL disciplines</u>. This reduces the need to manage multiple Revit models links.

<u>Figure 22-26: TAM PxP Section K: Single Model – ALL Disciplines</u>

Single Revit model with all disciplines "CC-(P2#)S-DM-ABBR-xx" where:

CC-	Country Code	**TAM Project Code**
(P2#):	Project Number	
S:	Symbol Designator	
-:	*(show hyphen)*	**TAM Advanced Modeling Standards**
DM:	Design Model	
-:	*(show hyphen)*	
ABBR:	Revit Abbreviation	
-xx:	Amendments & Change Orders	
.rvt:	File Extension	

(b) **<u>Option B</u>** <u>– Single Revit models with a grouping of disciplines</u>. This reduces the components in the models and allows for 2 or 3 similar disciplines to design in the same model. Groupings shall include;

(i) "SAI" - Structural (S), Architecture (A), & Interiors (I),
(ii) "FMP" - Fire Protection (F), Mechanical (M), & Plumbing (P), or
(iii) "ET" - Electrical (E) and Telecommunications (T).

Revit links from other facility discipline models will need to be attached.

<u>Figure 22-27: TAM PxP Section K: Single Model - Group Disciplines</u>

Single Revit model with grouping of disciplines "CC-(P2#)S-DM-SAI-ABBR-xx" where:

CC-	Country Code	**TAM Project Code**
(P2#):	Project Number	
S:	Symbol Designator	
-:	*(show hyphen)*	**TAM Advanced Modeling Standards**
DM:	Design Model	
-:	*(show hyphen)*	
SAI	Multiple Discipline Designators	
-:	*(show hyphen)*	
ABBR:	Revit Abbreviation	
-xx:	Amendments & Change Orders	
.rvt:	File Extension	

(c) **Option C** – Single Revit Model with each discipline. While this option reduces the size of the model and allows a single discipline to design in their own models, it also causes the constant monitoring of multiple Revit links from other facility discipline models to ensure proper coordination of accurate and current design information. Thus INCREASING man-hours during phases of Pre and Post-Award.

Figure 22-28: TAM PxP Section K: Single Model – Each Discipline

Single Revit model with each discipline "CC-(P2#)S-DM-E-ABBR-xx" where:

CC-	Country Code	
(P2#):	Project Number	**TAM Project Code**
S:	Symbol Designator	
-:	*(show hyphen)*	
DM:	Design Model	
-:	*(show hyphen)*	
E	Single Discipline Designator	**TAM Advanced Modeling Standards**
-:	*(show hyphen)*	
ABBR:	Revit Abbreviation	
-xx:	Amendments & Change Orders	
.rvt:	File Extension	

Currently (1) Hour is required for the TAM AdM Team to create, prepare, process, review, archive, recreate and link EACH Revit model for the purpose of model coordination at each activity type (i.e. New Project / 35% / 65% / 95% / 100% / CDC / Amendment / AWARD / Change Orders, etc.).

For instance;

A typical project contains General, Site Design, Facility and Standard Detail Information. (**2**) Revit models account for General Information and the Site Design Index of Drawings.

If a design package has (4) facilities, and each facility discipline has its own model (i.e.; *Structural, Architectural, Interiors, Fire Protection, Plumbing, Mechanical, Electrical and Telecommunications*) for a total of (8) disciplines for each facility, this equals (32) Revit models (4 facilities x 8 models).

Lastly, the Standard Details – Facility would account for (8) disciplines Revit Models. In total, a project with (4) Facilities using **Option C** would account for **(42) Revit models** at minimum.

This equates to a minimum of **(42) hours** per each AdM activity type and **(378 hours)** per project in **ONLY** AdM BIM support.

6) BIM Minimum Modeling Requirements: Shall meet the requirements as listed in USACE Building Information Modeling Template for Revit Master Guide: Template v3.4 Metric, February 2019.

(a) An Index of Drawings schedule shall be contained in every TAM Revit model populated with these column titles; SHT. REF. NO. (Sheet Reference Number), FILE NO. (same as filename found in management block), REVISIONS with sub-columns for REV. NO. (Revision Number or Letter), AM/COP NO. (Amendment or Change Order Number) and TITLE (same information as found in the Project Identification / Sheet Title Block).

Figure 22-29: TAM PxP Section K: Drawing Index Schedule Titles

SHT. REF. NO.	FILE NO	REVISIONS		TITLE
		REV. NO.	AM/COP NO.	
GENERAL				
GI001	(TAM Project Code)-GI001			COVER SHEET
GI011	(TAM Project Code)-GI011			INDEX OF DRAWINGS
GI021	(TAM Project Code)-GI021			GENERAL ABBREVATIONS, LEGENDS, SYMBOLOGY

(b) A Title Block Informattion schedule to caputure the Publish Order, SHEET_DISCIPLINE, Approved By, Checked By, Designed By, Drawn By columns.

Figure 22-30: TAM PxP Section K: Title Block Schedule Titles

Publish Order	SHEET_DISCIPLINE	Approved By	Checked By	Designed By	Drawn By
10	GENERAL	Approver	Checker	Designer	Author
10	GENERAL	Approver	Checker	Designer	Author
10	GENERAL	Approver	Checker	Designer	Author

(c) The Titleblock Information Schedule will be organized using the USACE Sheet Publish Order. This information is found on the USACE Revit Starting View window of each model.

Figure 22-31: TAM PxP Section K: USACE Sheet Publish Order

Discipline	Publish Order		
General	10	Fire Protection	120
Hazardous Materials	20	Plumbing	130
Survey/Mapping	30	Process	140
Geotechnical	40	Mechanical	150
Civil	50	Electrical	160
Landscape	60	Telecommunications	170
Structural	70	Resource	180
Architectural	80	Other Disciplines	190
Interiors	90	Contractor/Shop Drawings	200
Equipment	110	Operations	210

(d) Since USACE omitted the use of Publish Order 100, TAM shall use this number series to identify the non-site design disciplines to include;

(i) 61 for Site Structural
(ii) 62 for Site Architectural
(iii) 63 for Site Equipment
(iv) 64 for Site Fire Protection
(v) 65 for Site Plumbing
(vi) 66 for Site Mechanical
(vii) 67 for Site Electrical
(viii) 68 for Site Telecommunications

(e) The PDT is responsible for correctly populating the information listed in the fields as they are necessary to populate the sheet titleblock as well as the fields used in the creation of the project Index of Drawings.

(f) Each PDT member is responsible for their drawings. Any fields found to be left empty in either the models or drawing sheet PDF's will be REJECTED by the Technical Services AdM Team until the corrections are made.

(g) Depending on the time availability, disciplines run the risk of not having their work included in the final assembly. Questions concerning assemblies please contact Lacey Sandate Lacey.C.Sandate@usace.army.mil

7) CIM Minimum Modeling Requirements: Shall meet all requirements of the USACE Civil 3D, Template v3.3 Metric, August 2018 and all items as listed in this chapter. Questions concerning CIM specific requirements please contact Jeremy Coon Jeremy.L.Coon@usace.army.mil

8) GIS Minimum Modeling Requirements: Shall meet all requirements of the Engineering Regulation (ER) 1110-1-8156 Engineering and Design Policies, Guidance and Requirements for Geospatial Data and Systems, 2012 and Engineering Manual (EM) 1110-1-2909 Geospatial Data and Systems, 2012. Questions concerning GIS specific requirements please contact dll-cetam-dp-et-cadd@usace.army.mil

(a) Provide final geo-referenced GIS database of new building footprint, and site surface and subsurface features that exist outside the building footprint(s) out to the project extents compliant with current SDSFIE Adaptation provided by Installation Geospatial Support Office.

(b) Collect GIS georeferenced data pertaining to location and attribute data of subsurface utilities, facility footprint, roads, parking areas, etc. obtained at the time of project site excavation. Include the collection of elevation (Z) values in all data collection for underground utilities.

9) Working Units and Coordinate Systems: Shall meet all requirements of ERDC/ITL TR-19-7, with the following TAM exceptions as listed below;

(a) BIM Coordinate System shall use **UTM** and the Units of Measure shall equal to **millimeters**.

(b) CIM Coordinate System shall use **UTM** and the Units of Measure shall equal to **meters**.

(c) GIS Coordinate System shall use **UTM** and the Units of Measure shall equal to **meters**.

(d) CAD Coordinate System and Units of Measure shall mimic the BIM/CIM model. The Units command will use the **Decimal option** in the Drawing Units dialog box.

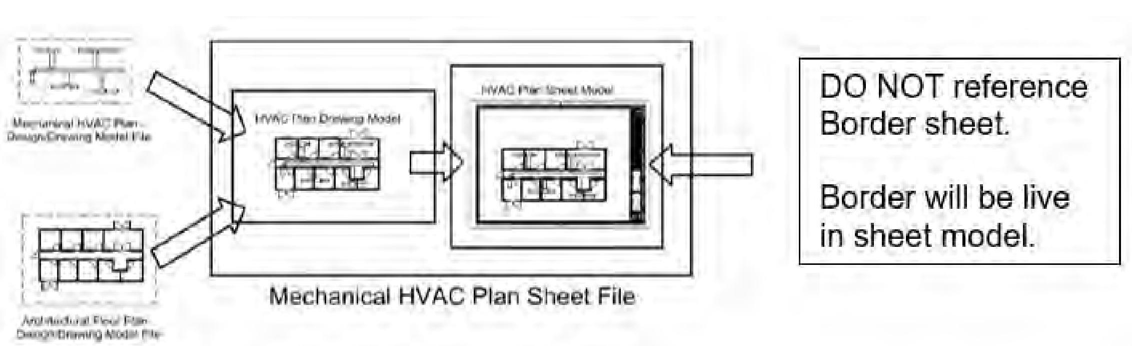
(e) Two dimensional **(2D) global origin** drawings will use ***x***=**0** and ***y***=**0**.

(f) Three dimensional **(3D)** the ***z*-origin** will be set to allow for elevations **below 0**.

(g) Reference files (external reference or XREF) will **NOT** bind references.

(h) Each drawing file shall contain **ONLY** one sheet model & design model view. The border sheet will be placed in the sheets live at a scale of 1:1 to create the final plotted sheets. Design models will be referenced into the sheets at a scale required to express an accurate visual to display the view with clarity.

Figure 22-32: TAM PxP Section K: CAD Sheet File Composition



10) <u>Presentation of Graphics (POG):</u> The POG serves to ensure that the USACE TAM AdM Presentation of Graphics CAD-BIM Standards and guidelines are met while enforcing elements of the "Essentials of Good Drafting" which is described in the ERDC/ITL TR-19-6 "A/E/C Graphics Standard : Release 2.1 as:

"A well prepared drawing, complete so that it conveys the intended meaning yet contains a minimum of unnecessary detail, is the type of drawing which is required. Such a drawing, when [correctly] prepared, reflects credit to the architect, engineer, technician or mission partners who was responsible for it.

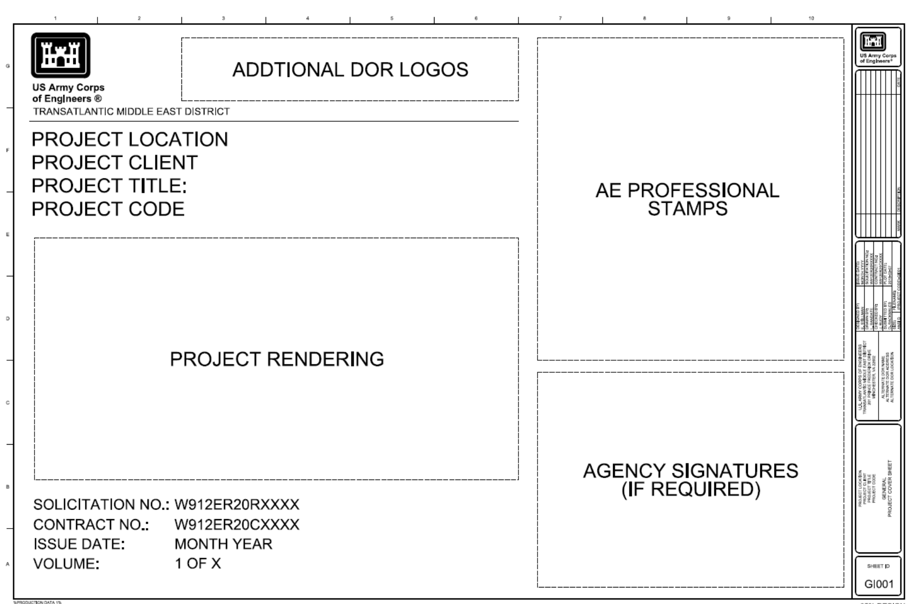
While the principal object in working up drawings is to produce a neat, accurate set of plans in the shortest possible time, it is not the intention to sacrifice neatness and accuracy for speed or vice versa. When making alterations or additions to existing drawings, special care shall be exercised to follow the same style and size of lettering and all other conventions on the drawings for uniformity."

Therefore TAM is striving for a consistent set of design deliverables (e.g. drawing submittals) which provide both a clear, concise, collaboration of information between the coordinating disciplines and meet the requirements as listed in the entirety of Chapter 22, Advanced Modeling.

(a) Cover Sheet: Shall meet the requirements of ERDC/ITL TR-19-6, with the following TAM exceptions as listed below.

(i) All cover sheets shall include titleblock border matching the drawings in the package. The sheet reference number shall be GI001 with a no symbol designator at Sheet ID.

<u>Figure 22-33: TAM PxP Section K: USACE TAM Project Cover Sheet</u>



(ii) Non-TAM designer and/or client's logos will be placed to the right of the USACE TAM logo. The TAM owner's logo shall always be the largest of the logos provided in this section of the cover sheet.

(iii) TAM in-house projects and USACE districts will **NOT** use the sign & seal area. All other DOR's for the Government will provide stamps & signatures at Contract Documents Complete (CDC) for Requests for Proposal (RFP) and at the Award stages.

(iv) A 3D color rendering for a project containing a single facility shall be included on the cover sheet. Projects with multiple facilities shall place a 3D bird's eye rendering of the Site Design showing the multiple facilities.

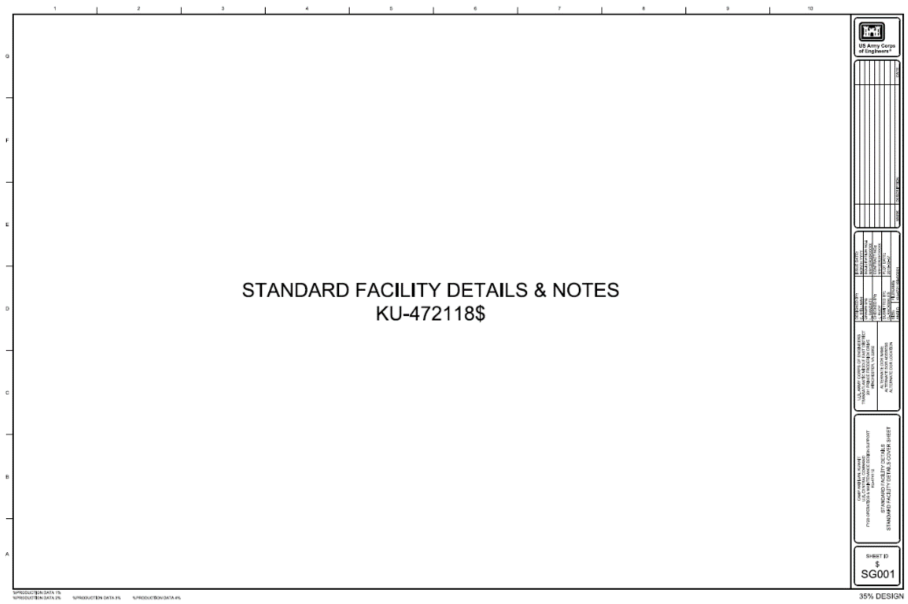
(v) A Site Design cover sheet shall be provided. The sheet shall include titleblock border matching the drawings in the package, name of the facility, and TAM Projects Code with specific symbol designator. An image of the overall project location shall be placed beneath this text. The sheet reference number shall be GI001 with a dash (**-**) at Sheet ID.

(vi) A Facility cover sheet shall be provided. The sheet shall include titleblock border matching the drawings in the package, name of the facility, and TAM Project Code with specific symbol designator. A 3D color rendering shall be placed beneath this text. The sheet reference number shall be GI001 with a letter (e.g. **A**) at Sheet ID.

<u>Figure 22-34: TAM PxP Section K: TAM Facility Cover Sheet</u>

(vii) A Standard Details cover sheet shall be provided. The sheet shall include titleblock border matching the drawings in the package, name of the facility, and TAM Projects Code with specific symbol designator of a dollar sign (**$**). The sheet reference number shall be SG001.

Figure 22-35: TAM PxP Section K: TAM Std Details Cover Sheet



(b) General Sheet: Every TAM design package will include an Index of Drawings and on occasion where the project consists of more than 250 drawing sheets, an Index of Volumes is required and General Abbreviations, Symbology and Legends sheet.

(i) The Index of Drawings (IOD) capture the project General, Site Design, Facilities and Standard Details Sheet ID, File No., and (sheet) Title information.

1. A facility shall be grouped so that a single building may be withdrawn without deleting or removing a consecutive block of sheets. Conversely, it shall be possible for USACE to easily add a facility to a bid package.

2. When multiple facilities are included in the design package, Standard Details & Notes are authorized and encouraged. These details must apply to all facilities.

3. However Standard Details & Notes particular to a specific Facility shall **NOT** be shown in the Standard Details, but instead be grouped with details of that specific facility.

4. The IOD is populated by each respective models. **When the models are not populated, the Index of Drawings cannot be created.** See Sections 22.k.6 (e-g) for more information. The sheet reference number shall be GI011.

Figure 22-36: TAM PxP Section K: IOD - Enlarged View in Sheet of General Information

KU-47211 GENERAL INFORMATION				
SHT. REF. NO.	FILE NO.	REVISIONS		TITLE
		REV. NO.	AM/COP NO.	
GENERAL				
GI001	KU-472118-GI001			COVER SHEET VOLUME 1 OF 3
GI010	KU-472118-GI010			INDEX OF VOLUMES
GI011	KU-472118-GI011			VOLUME 1 - INDEX OF DRAWINGS

Figure 22-37: TAM PxP Section K: IOD - Enlarged View in Sheet of Site Design

KU-472118- SITE DESIGN				
SHT. REF. NO.	FILE NO.	REVISIONS		TITLE
		REV. NO.	AM/COP NO.	
GENERAL				
GI001	KU-472118--GI001			COVER SHEET - SITE DESIGN
GC001	KU-472118--GC001			CONTRACTOR STAGING AREA & FENCING
GC002	KU-472118--GC002			CONTRACTOR HAUL ROUTES
CIVIL				
CS101	KU-472118--CS101			CIVIL SITE PLAN
CG101	KU-472118--CG101			CIVIL GRADING PLAN
CU101	KU-472118--CU101			CIVIL UTILITY PLAN
SITE ELECTRICAL				
XE101	KU-472118--XE101			ELECTRICAL SITE PLAN
XE501	KU-472118--XE501			ELECTRICAL SITE DETAILS

Figure 22-38: TAM PxP Section K: IOD - Enlarged View in Sheet of Facility "A"

KU-472118A - HEADQUARTER BLDG				
SHT. REF. NO.	FILE NO.	REVISIONS REV. NO.	 AM/COP NO.	TITLE
GENERAL				
GI001	KU-472118A-GI001			COVER SHEET - FACILITY "A"
STRUCTURAL				
SF001	KU-472118A-SF001			STRUCTURAL GENERAL NOTES, ABBREVATIONS & LEGENDS
SF101	KU-472118A-SF101			STRUCTURAL FRAMING PLAN - FIRST FLOOR
SR501	KU-472118A-SR501			STRUCTURAL DETAILS - CONCRETE REINFORCEMENT
ARCHITECTURAL				
AE001	KU-472118A-AE001			ARCHITECTURAL GENERAL NOTES, ABBREVATIONS & LEGENDS
AE101	KU-472118A-AE101			ARCHITECTURAL FLOOR PLAN - FIRST FLOOR
AE501	KU-472118A-AE501			ARCHITECTURAL DETAILS - DOORS AND WINDOWS
ELECTRICAL				
EL001	KU-472118A-EL001			ELECTRICAL GENERAL NOTES, ABBREVATIONS & LEGENDS
EL101	KU-472118A-AE101			ELECTRICAL LIGHTING FLOOR PLAN - FIRST FLOOR
EP101	KU-472118A-AE501			ELECTRICAL POWER FLOOR PLAN - FIRST FLOOR

Figure 22-39: TAM PxP Section K: IOD - Enlarged View in Sheet of Standard Facility Details & Notes

KU-472118$ - STANDARD FACILITY DETAILS & NOTES				
SHT. REF. NO.	FILE NO.	REVISIONS REV. NO.	 AM/COP NO.	TITLE
GENERAL				
SG001	KU-472118A-SG001			COVER SHEET - STANDARD DETAILS & NOTES
STRUCTURAL				
SS001	KU-472118A-SF001			STRUCTURAL GENERAL NOTES, ABBREVATIONS & LEGENDS
SS501	KU-472118A-SS501			STRUCTURAL STANDARD DETAILS - WALL ANCHORS
ARCHITECTURAL				
SA001	KU-472118A-SA001			ARCHITECTURAL STANDARD GENERAL NOTES, ABBREVATIONS & LEGENDS
SA501	KU-472118A-SA501			ARCHITECTURAL STANDARD DETAILS - CASEWORK
ELECTRICAL				
SE501	KU-472118A-SE001			ELECTRICAL GENERAL NOTES, ABBREVATIONS & LEGENDS
SE101	KU-472118A-SE501			ELECTRICAL STANDARD DETAILS - CABLE TRAYS

(ii) An Index of Volumes (IOV) is required when there are more than 250 drawing sheets. When this happens the drawing package shall be broken up into subsequent volumes having 200 or less sheets per volume. The Volumes will be identified as “Volume 1 of (X)”, where X = the number of volumes provided. The sheet reference number shall be GI010.

1. Drawings for a single facility shall **NOT** be divided between volumes.

2. Site development drawings shall not be broken within a discipline or divided between volumes.

3. An Index of Volumes sheet shall accompany each separate volume.

4. The Order of Sheets when an Index of Volumes is required will be assembled as follows; Project Cover sheet, Index of Volumes sheet, Index of Drawings sheet, General Abbreviations, Symbology and Legends sheet, Site Design Cover Sheet, followed by all other design package sheets.

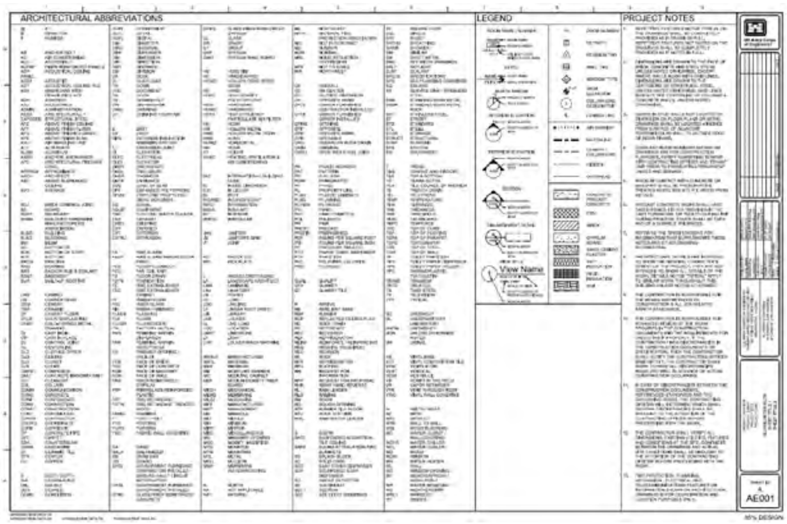
Figure 22-40: TAM PxP Section K: IOV - Enlarged View in Sheet

SHT. REF. NO.	FILE NO.	REVISIONS		TITLE
		REV. NO.	AM/COP NO.	
				VOLUME 1
GI001	KU-472118-GI001			COVER SHEET VOLUME 1 OF 3
GI010	KU-472118-GI010			INDEX OF VOLUMES
GI011	KU-472118-GI011			VOLUME 1 - INDEX OF DRAWINGS
				KU-474512- - SITE DESIGN
				VOLUME 2
GI002	KU-472118-GI002			COVER SHEET VOLUME 2 OF 3
GI010	KU-472118-GI010			INDEX OF VOLUMES
GI012	KU-472118-GI012			VOLUME 2 - INDEX OF DRAWINGS
				KU-474512A - HEADQUARTERS BLDG
				KU-474512B - OFFICER BARRACKS
				VOLUME 3
GI003	KU-472118-GI003			COVER SHEET VOLUME 3 OF 3
GI010	KU-472118-GI010			INDEX OF VOLUMES
GI013	KU-472118-GI013			VOLUME 3 - INDEX OF DRAWINGS
				KU-474512$ - STANDARD DETAILS & NOTES

(iii) The General Abbreviations, Symbology and Legends sheet shall use the information provided in the USACE template shall be provided by each specific discipline.

a. Projects containing only a single facility, the sheet shall be placed at the beginning of the discipline drawing sheets. The sheet reference number shall encompass the specific Discipline Designator with Modifier. For example the Architectural version of this sheet reference number would be AE001.

Figure 22-41: TAM PxP Section K: Discipline Specific General Sheet



b. Where multiple facilities exist the discipline specific General Abbreviations, Symbology and Legends sheet shall be placed within the Standard Details and Notes. Using the above example the Architectural version of the sheet would be SA001.

(c) Border Sheet: Shall meet all requirements of ERDC/ITL TR-19-6, with the following TAM exceptions as listed below.

(i) Border Sheet Size will use the **ANSI D** (**22 inches by 34 inches**) format.

(ii) Drawing area will use a grid with modules measuring **3 inches by 3 inches**.

(d) Title Block Area: Contains the (6) areas of Designer Identification Block, Revision Block, Management Block, Project Information / Sheet Title Block, Sheet ID Block and the Status Field.

(i) The Designer Identification Block contains a USACE logo and text. This signifies who shall issue the contract award. Clients who wish for their logos to be in the package shall be placed on the project Cover Sheet.

(ii) The Revision Issue Block shall contain only the mark, description and date of submittal for Amendments and Change Orders.

Figure 22-42: TAM PxP Section K: POG – Revision Block – Amendments

1	REVISED IAW AMENDMENT 0001	AUG 2020
MARK	DESCRIPTION	DATE

Figure 22-43: TAM PxP Section K: POG – Revision Block Change Orders

E	GENERAL REVISION COP 0005	JUN 2021
D	GENERAL REVISION COP 0004	MAR 2021
B	GENERAL REVISION COP 0002	FEB 2021
MARK	DESCRIPTION	DATE

(iii) The Management Block Designer Information area shall contain the information as populated from BIM Title Block Schedule or PW project properties fields.

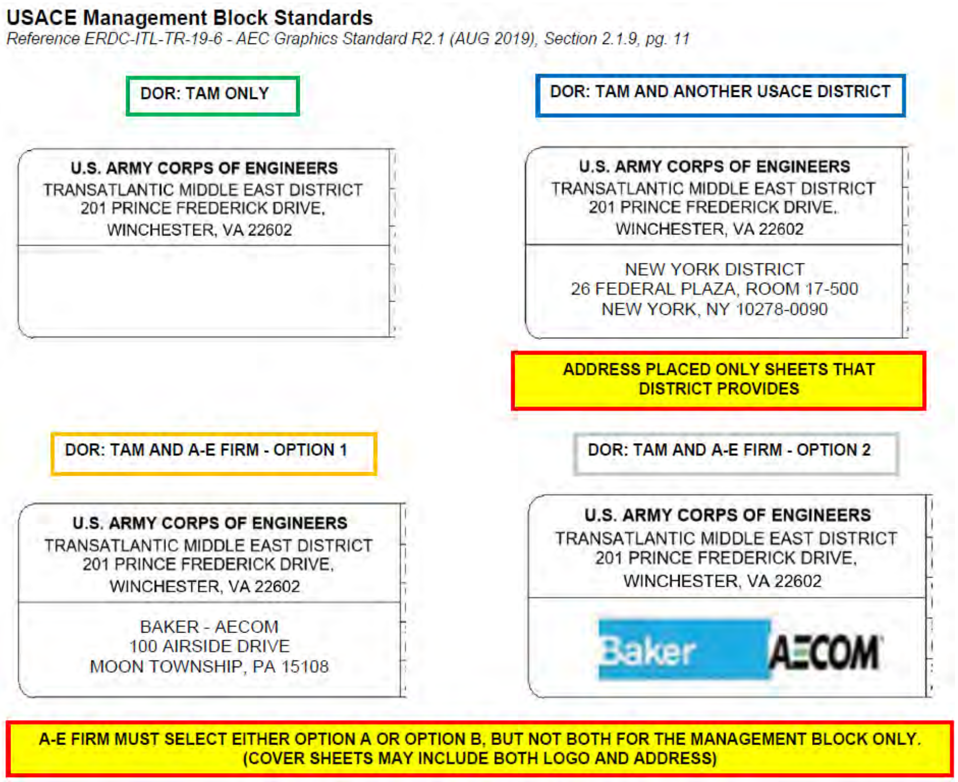
Figure 22-44: TAM PxP Section K: POG – Management Block – Designer Info

DESIGNED BY: E. STILLMAN	ISSUE DATE: MONTH YYYY
DRAWN BY: L. SANDATE	SOLICITATION NO.: W912ER20RXXXX
CHECKED BY: J. RUDY	CONTRACT NO.: W912ER20CXXXX
SUBMITTED BY: D. RACKMALES	PLOT DATE: 2018-02-07
SIZE: ANSI D	FILENAME: (PROJECT CODE)A-AE101

1. The CHECKED BY and SUBMITTED BY **cannot** be the same person.

(iv) The Management Block Designer Address area shall contain the information as populated by the TAM, other USACE districts and A-E firms.

Figure 22-45: TAM PxP Section K: POG – Management Block – Designer of Record Addresses



(v) The Project Information Block shall match Section A of the specific PxP.

Figure 22-46: TAM PxP Section K: POG – Project Information & PxP

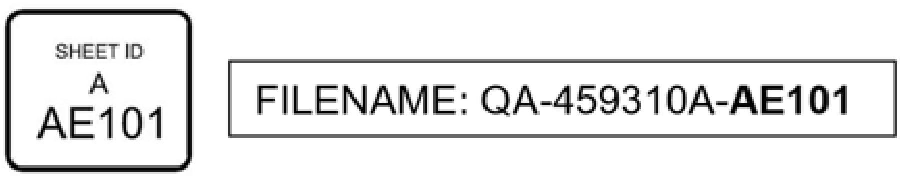
1. **Project Location:** (Upper case each word) City, Country
2. **Project Client:** (Upper case each word)
3. **Project Title:** (Upper case each word)
4. **Project Code:** CC-485034

1. The Group Name shall match the variable assigned for the symbol designator and the sheet title accurately match the information displayed in the drawing area.

Figure 22-47: TAM PxP Section K: POG – Group Names

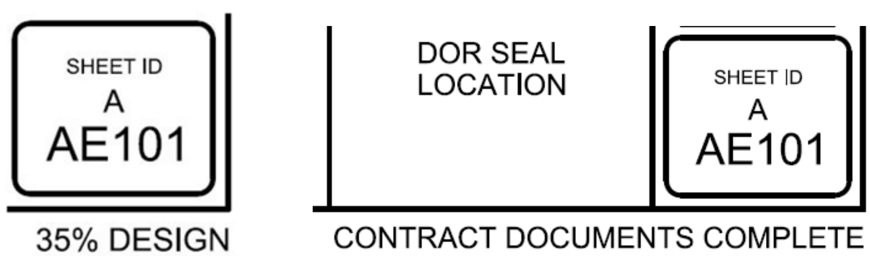
(vi) The Sheet ID Block shall contain the Symbol Designator and match the filename without project code and identifier.

Figure 22-48: TAM PxP Section K: POG – Sheet ID Block



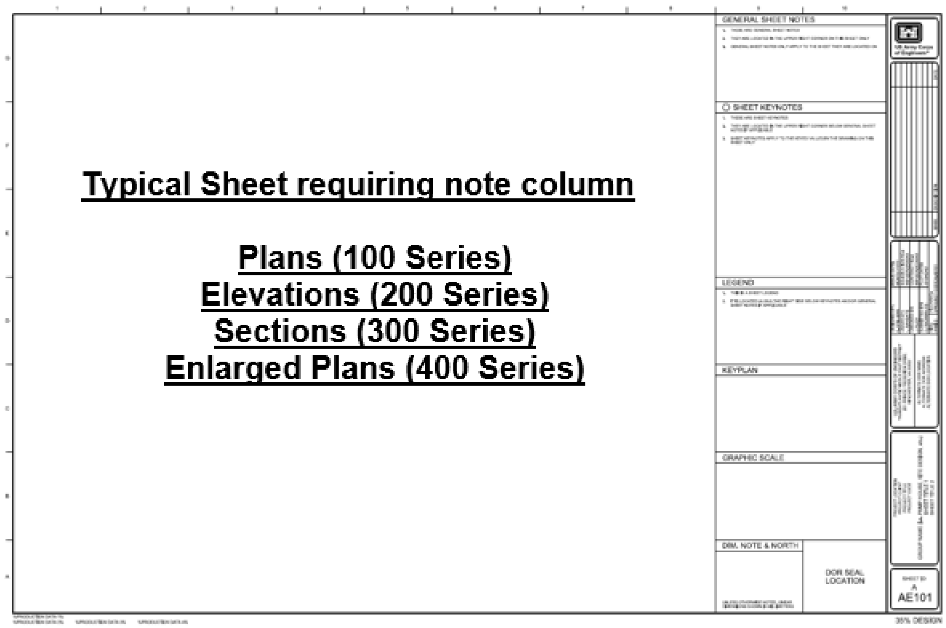
(vii) The Status Field shall match the submission type. Typical text examples shall include; "PXP DEMO, 35% DESIGN, CONTRACT DOCUMENTS COMPLETE, AMENDMENT 0002, AWARD, CHANGE ORDER 0004 AND AS-BUILTS".

Figure 22-49: TAM PxP Section K: POG – Status Field



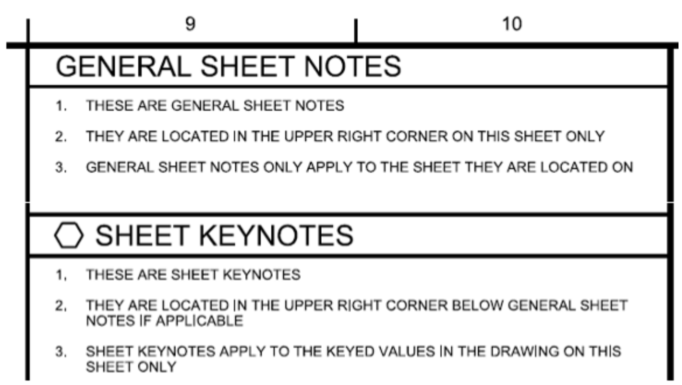
(e) General Notes Column: Contains (7) items of General Notes, Sheet Key Notes, Legends, Key Plan, Graphic Bar Scale, Dimension Note, North Arrow and DOR Seal Location areas. Sheet Type Designators series 100 thru 400 shall include a note column.

Figure 22-50: TAM PxP Section K: POG - Note Column



(i) The Notes shall apply only to the sheet for which they are located.

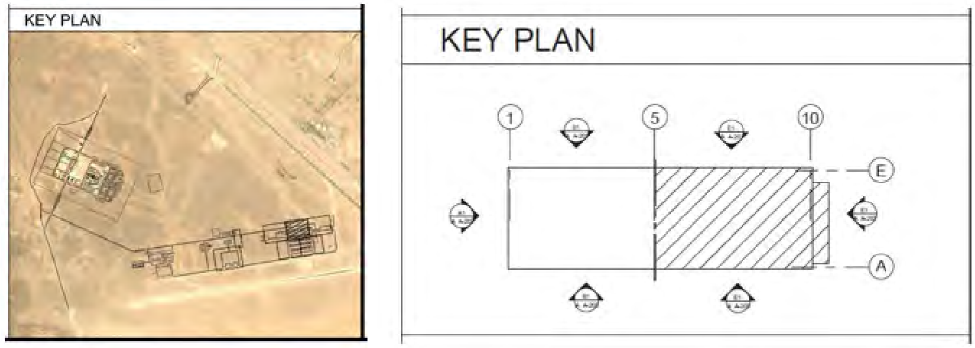
Figure 22-51: TAM PxP Section K: POG - General Notes & Sheet Keynotes



(ii) Typical Legends will **NOT** be duplicated on each sheet. General legends shall be placed on a discipline specific general note sheet and a note shall be provided for its location. Legends with specific symbolism and not found in these general sheets can be located only on the sheet in which they appear.

(iii) Key Plans will be provided to identify the relationship of facilities at an overall site or of enlarged floor plan with the overall floor plan.

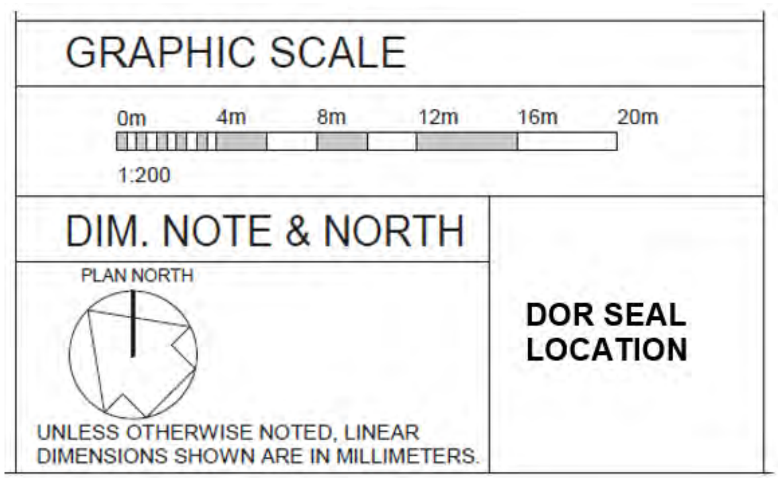
Figure 22-52: TAM PxP Section K: POG – Site & Floor Key Plans



1. Key Plans on elevations sheets shall contain elevation symbols indicating the location of each elevation

(iv) The lower portion of the note area contain graphic bar scales provided for each drawing title scale, the Meter or Millimeter Dimension note, North arrow & location for the DOR signature and seal.

Figure 22-53: TAM PxP Section K: POG – Graphic Scale, Dimension Note, North Arrow and DOR Seal Location

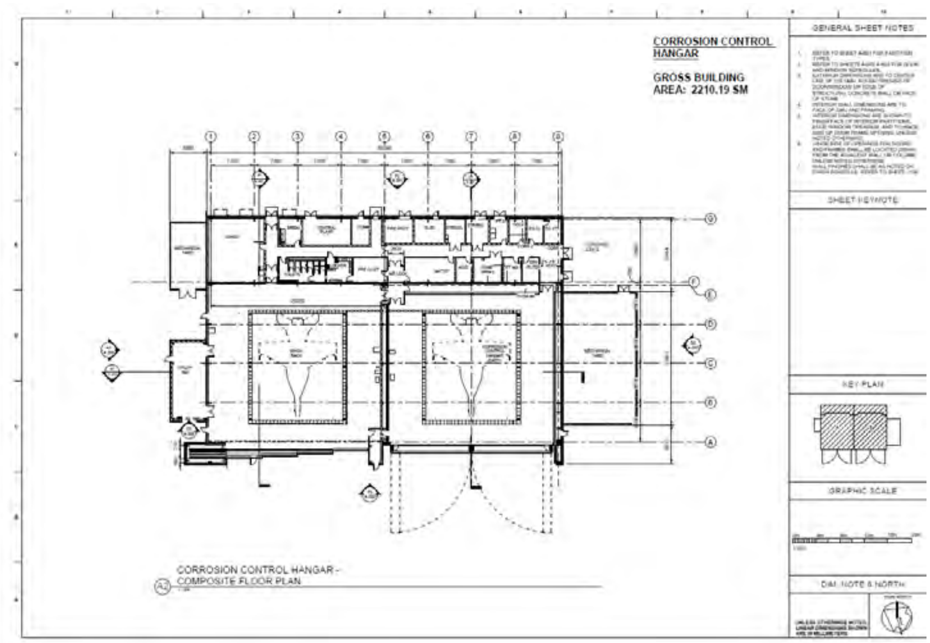


1. Floor plans shall be oriented so that the plan north arrow points to the top of the drawing block. The true north arrow (i.e., points to the North Pole) is adjusted so that the building grid and plan north arrow are parallel to the sheet orientation. Where possible, the orientation of true north shall be maintained throughout an entire drawing set.

(f) Drawing Organization: Shall meet the requirements of ERDC/ITL TR-19-6 & 19-7 expressly meeting the following item;

(i) Vertical construction floor plan will be comprised of one floor plan per level.

<u>Figure 22-54: TAM PxP Section K: POG – Drawing Organization – One Floor Plan per Level</u>



(ii) Non-architectural disciplines shall mimic the architectural floor plan scale, layout and alignment to provide a consistent display of information. For example;

1. If the Architectural discipline shows the Overall Floor Plan on sheet AE101, then subsequent disciplines shall use the same format, where the Overall Electrical Power Floor Plan would be sheet EP101.

2. The goal is to provide a clear, concise, collaboration of information between the coordinating disciplines.

(iii) The details, sections or elevations shall be placed starting with the lower right corner of the drawing area with the additional drawing types in order of priority will be placed from bottom to top and from right to left.

Figure 22-55: TAM PxP Section K: POG – Placement of Details, Sections or Elevations with Note Column

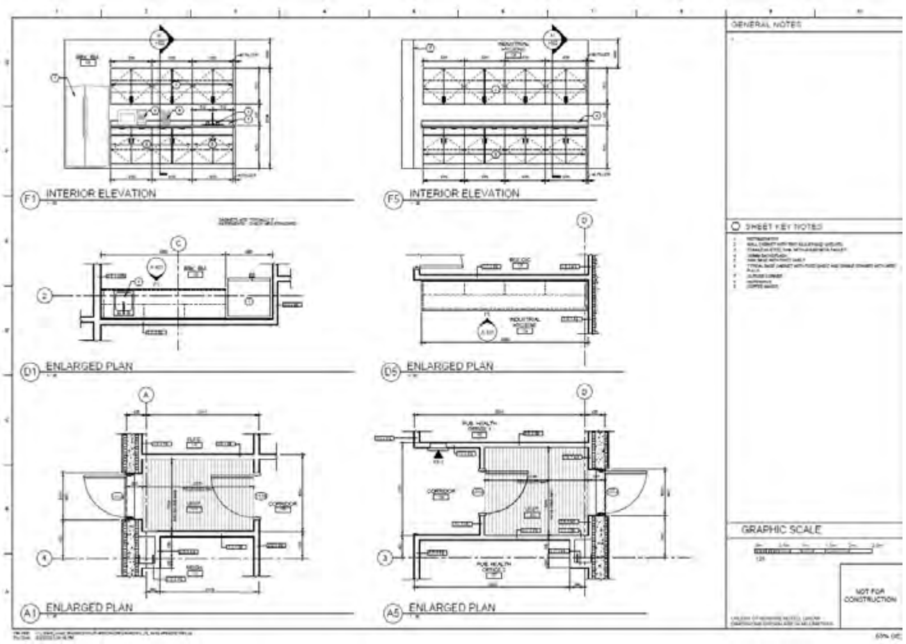
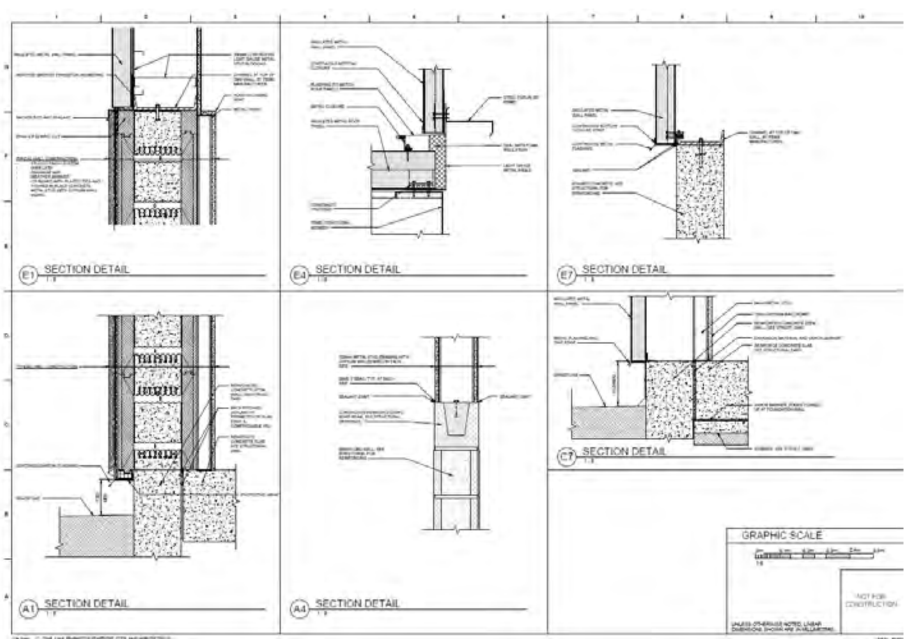
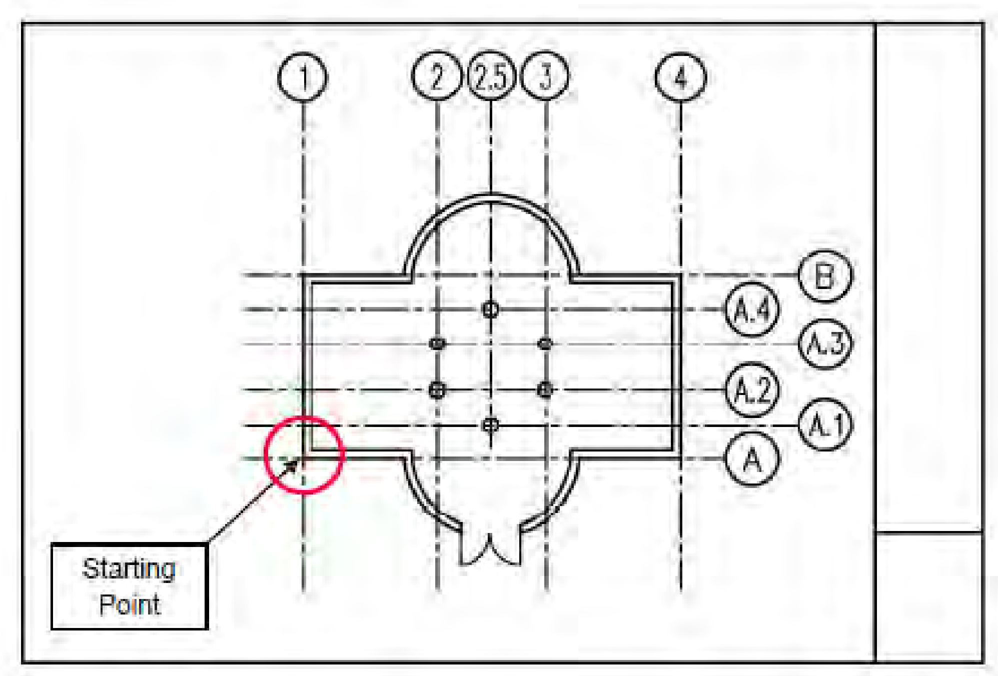


Figure 22-56: TAM PxP Section K: POG – Placement of Details, Sections or Elevations without Note Column



(iv) The Grid Line starting point shall be placed at the lower left corner of the floor plan. All discipline floor plans shall reference the same grid lines.

Figure 22-57: TAM PxP Section K: POG – Grid Lines Starting Point

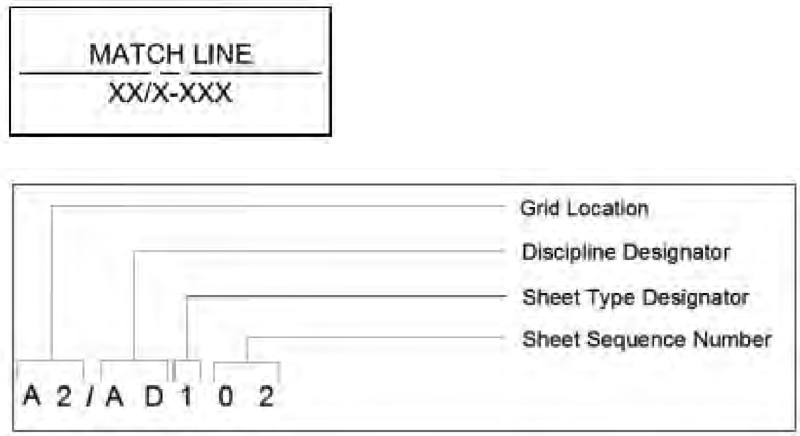


(v) View types will the use the following metric Drawing Scales;

1. 1:1000 – Overall Site Plans,
2. 1:500 – Civil, Electrical & Telecommunications Site Plans,
3. 1:200 – Roof Plans, Life Safety & Reflected Ceiling Floor Plans,
4. 1:100 – Typical Floor Plans, Exterior Elevations, Building Sections & Civil Horizontal Profiles,
5. 1:50 – Enlarged Floor Plans, Interior Elevations, Wall Sections & Civil Vertical Profiles,
6. 1:20 – Stair Details,
7. 1:10 – Details,
8. 1:5 – Details.

(vi) Match lines shall be used on sheets where site plans or floor plans could not be contained within the boundaries of a single drawing area.

Figure 22-58: TAM PxP Section K: POG – Match Lines



(g) Drawing Symbology: Shall meet the requirements of ERDC/ITL TR-19-6 & 19-7 expressly meeting the following items;

(i) The drawing title shall use a combination alphabetic/numeric identification to identify the placement of plans, elevations, sections, profiles, details, etc. for each drawing title. (i.e. A1, B2, C3, etc.)

Figure 22-59: TAM PxP Section K: POG – USACE Drawing Titles

1. The back referencing shall not be used with drawing area title.

(ii) The callouts shall use a two-part system whereby the top part is filled in with the identification and bottom filled in with the sheet number on which the callout is located.

Figure 22-60: TAM PxP Section K: POG – Detail Indicator Symbols

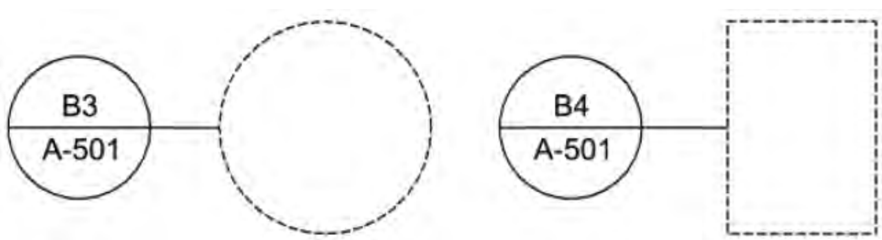


Figure 22-61: TAM PxP Section K: POG – Elevation Indicator Symbols

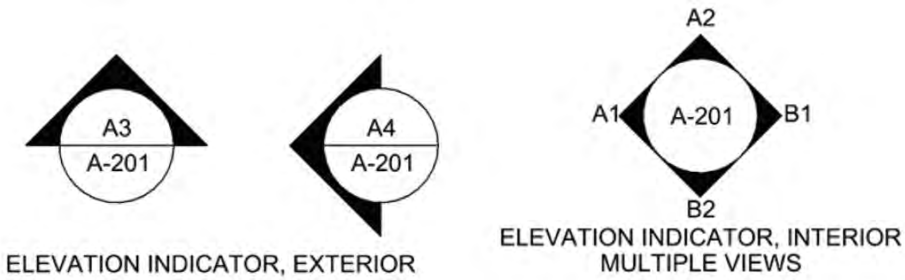
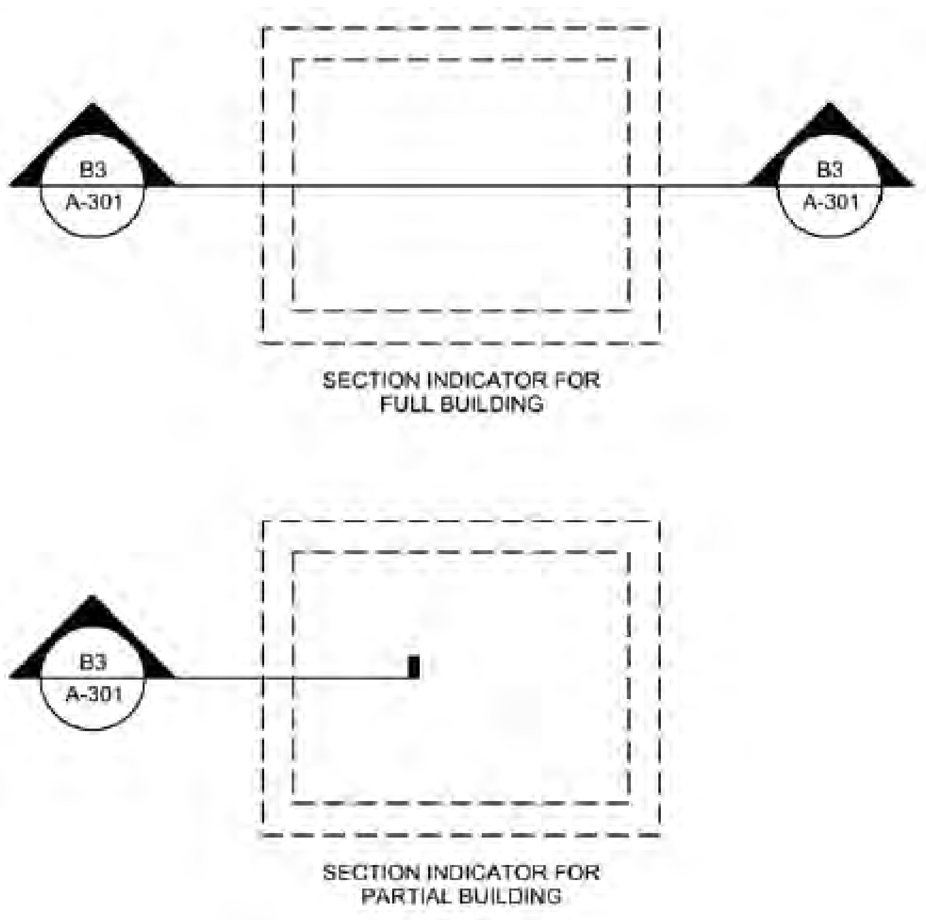


Figure 22-62: TAM PxP Section K: POG – Section Indicator Symbols



(h) Drawing Annotation: Shall meet all requirements of ERDC/ITL TR-19-6 & 19-7, especially the items listed below.

(i) Once an abbreviation has been used, the same abbreviation must be continued throughout the project document.

(ii) Capital letters shall be used in text, since capital letters retain readability when reproduced at one-half size.

(iii) All text in the design file, model, attached schedules and word documents will use the font **TrueType Arial.**

(iv) All normal text will not be smaller in size **than 2.4mm in both height and width.**

(v) An exploded dimension for the sole purpose of displaying a value different from the actual measured value is strictly prohibited.

(vi) Only filled arrowhead dimension terminators are allowed. Do not use slashes.

(vii) To avoid confusion, dual units (*both inch-pound and metric*) shall not be used.

(viii) Plan views of demolition work shall not be combined with those for new work.

(ix) New work shall be easily distinguishable from existing work.

l. **<u>Section L: Project Deliverables.</u>** Contains the (5) items in the areas of General Information, Ownership and Rights in Data, BIM Content, Design Software and Submittal Requirements.

1) <u>General Information</u>: The use of BIM does **NOT** negate the need for delivery of CAD files used for the creation of the Construction Documents Drawings.

(a) Specification of a CAD file format for the drawings submitted shall not be used to limit which BIM application(s) or software(s) may be used for project development and execution.

(b) Deliver the Model, CAD files, and Facility/Site Data, Workspace in the native file format, and PDF format to the AdM Manager or approved delegate for review using viewer software or Adobe Acrobat Reader.

(c) The BIM shall be in a native file format with linked performance based and in an interoperable file format like the Industry Foundation Class (IFC).

(d) Provide a list of all submitted files in Excel spreadsheet format. This file shall be used for creation of the TAM Indices. Population of spreadsheet shall be the responsibility of project DM, A-E or Contractor representative.

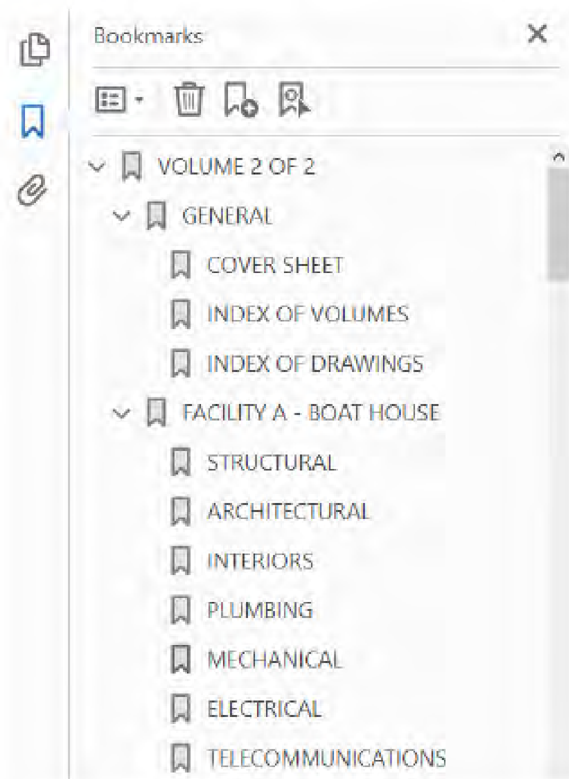
(e) Electronic submittals shall be on digital media acceptable to the Government. The electronic submittals shall be organized and structured supportive of archival and retrieval.

(i) File format in accordance with ISO 32000-1 and ISO 19005-3. Provide files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution whenever possible.

(ii) PDF will NOT contain any comments or embedded CAD levels.

(iii) The electronic submittals shall have a “dash-board” type feature to assist viewers navigate through the digital media and associated files.

Figure 22-63: TAM PxP Section L: TAM PDF “Dash-Board”



(f) Electronic drawing file names for in-house TAM projects shall contain the project code, symbol designator, publish order number, the text “Drawings” and the date in the DD MON YYYY format.

Figure 22-64: TAM PxP Section L: In-House PDF File Naming

Site Design Drawings

Site Electrical = QA-459310--67 _Drawings_22 JUN 2020

Facility “A” Drawings

Structural = QA-459310A-70_Drawings_22 JUN 2020

Standard Detail Drawings

Plumbing = QA-459310$-130_Drawings_22 JUN 2020

(g) Electronic drawing file names for AE DOR projects shall contain the project code, submission type (see below) volume number (if required) the word “Drawings” and the date in the DD MON YYYY format.

Figure 22-65: TAM PxP Section L: AE DOR PDF File Naming

KU-478117_DoC Drawings_26 SEP 19
KU-478117_35 PERCENT Drawings_26 SEP 19
KU-478117_CDC Volume 2 Drawings_26 SEP 19
KU-478117_Award Drawings_26 SEP 19
KU-478117_As-Built Drawings_26 SEP 19

(i) The electronic submittals shall have a “dash-board” type feature to assist viewers navigate through the digital media and associated files.

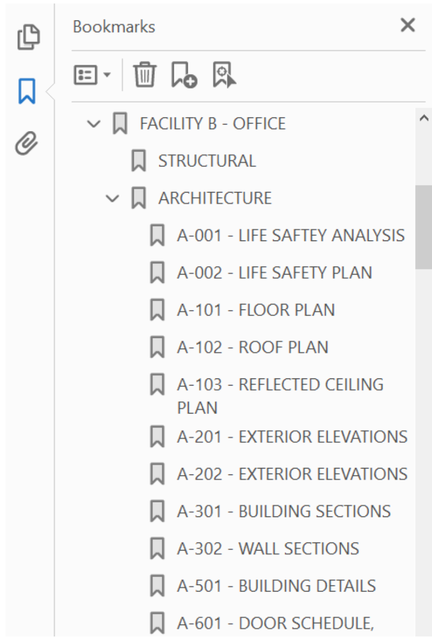
(h) AE DOR electronic submittals shall have a “dash-board” type feature to include the following:

(i) Format Parent Bookmark per Main Subject (e.g. GENERAL, SITE DESIGN, FACILITY A – (name), etc. and STANDARD DETAILS).

(ii) Format Child Bookmark per Discipline (STRUCTURAL).

(iii) Format Step-Child Bookmark per Sheet using Sheet ID and name (SF101 – FRAMING PLAN).

Figure 22-66: TAM PxP Section L: A-E PDF "Dash-Board"



(i) Hardcopy Plotted Deliverables will be provided only if specifically requested by the client. If approved, the plotted drawings for design submittals will be provided using half size sheets. These sheets will use the internationally recognized size of approximatively 11 inches by 17 inches.

For more information please contact Lacey.C.Sandate@usace.army.mil

2) Ownership and Rights in Data: The Government has ownership of and rights to all CAD files, BIM Model, and Facility/Site Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00) at the date of Design Completion or Closeout Submittal (as applicable).

The Government may make use of this data following any deliverable.

(a) This includes ALL content libraries and supporting files that define and embody a BIM standard.

(b) These libraries shall consist of a collection wall types, standard steel shapes, furniture, HVAC fittings, and sprinkler heads. It also contains sheet libraries such as print/plot configurations, font and text style libraries, and sheet borders and title blocks.

(c) These supporting files shall consist of "IFC": Industry Foundation Class, a standard and file format used for the exchange of BIM data; see www.iai-tech.org

(i) Note: In the context of this chapter, IFC does not mean "Issued for Construction."

3) BIM Content: Will include the Facility/Site Data to include material definitions and attributes that are necessary for the Project facility design and construction and meet the requirements of Section K: Model Organization.

(a) These submitted Drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) from the Model and Facility/Site Data.

(b) Drawings derived from the Model shall remain connected to the Model for the life of the Project and documented in the PxP.

(c) Drawings not derived from the Model shall also be documented in the PxP.

4) Design Software: All AdM files shall be in the native file format. Files shall be fully operable, compatible and editable within the native software tools. Formats which can be read using built-in or third party software are **NOT** considered standard format of the software. A-E's shall ensure translation is complete and accurate.

SUBMITTAL ITEMS	SUBMITTAL ACTIVITIES	SOFTWARE VERSIONS
BIM – Models	**ALL**	**REVIT 2020**
BIM – CAD File Extractions	**FINAL**	**AUTOCAD 2018**
3D Interference Checks	**ALL**	**NAVISWORK 2018 / REVIT 2020**
CIM – Models	**ALL**	**CIVIL 3D 2018**
CIM – CAD Files	**ALL**	**AUTOCAD 2018**
GIS – Map Files	**ALL**	**ArcGIS v10.6.1**
GIS – Geodatabase Files	**ALL**	**SDSFIE v.4**
PDF - Drawing Files	**ALL**	**ACROBAT PRO DC / BLUEBEAM**
XLS – List of Submitted Files	**ALL**	**MS 365 EXCEL**
WRD – PxP for each project	**BEFORE PROJECT STARTS**	**MS 365 WORD**

5) Submittal Requirements: Provide submittals in compliance with the PxP deliverables. For each Submittal as set forth in Section I: Quality Control, provide a Contractor-certified written report confirming that consistency checks above have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

   Only the TAM AdM Manager or approved delegate can confirm submissions meet the requirements of the USACE TAM AdM Presentation of Graphics CAD-BIM Standards. This is not the responsibility of the Contracting Officer (KO).

   (a) At each Submittal provide the Government with:

   (i) The Model, Facility/Site Data, Workspace and CAD Data files in the native BIM/CAD format.

   (ii) A copy of the Model in an interactive review format Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per PxP requirements. The format for reviews can change between submittals.

   (iii) Non-TAM in-house projects shall provide a list of all submitted electronic files including a description, directory, and file name for each file submitted. For all CAD printed sheets, include a list of the sheet titles and sheet numbers. Identify which files have been produced from the Model and Facility/Site Data.

   (iv) TAM in-house projects shall provide a list of all submitted electronic files including a Sheet Reference Numbers, File No. (aka filename, and (sheet) Title for drawings to be submitted.

   1. Technical Services (TS) shall use the tabs in the Indices spreadsheet to populate the General Information - Index of Drawings (IOD) Sheet.

   2. The IOD will be complied from the tabs provided in this Indices spreadsheet.

   3. The DM is holds ultimate responsibility ensuring the IOD information is populated prior to design submissions.

   4. The DM shall provide TS the project specific spreadsheet list of drawings submitted drawings and pdf's at each submittal.

   5. The DM is encouraged to have the PDT populated the Indices spreadsheet information.

Figure 22-67: TAM PxP Section L: TAM A, B C Submittal Process In-House Projects

A. PDT (Project Delivery Team)

A-1_PDT Site Design member provides TS with project location image.

A-2_PDT Architect provides TS a 3D rendering of facility or facilities exterior.

A-3_PDT Site Design & Architectural members create 3D rendering of overall site plan with facilities.

A-4_PDT Site Design & Architectural members provide TS a 3D rendering of overall site plan with facilities.

A-5_PDT conducts and resolves interdisciplinary (3D) model clashes.

A-6_PDT completes over-the shoulder reviews.

A-7_PDT prints PDF's and formats assembly accordingly.

A-8_PDT populates TAM Indices' spreadsheet.

A-9_PDT sends PDF's to DM before suspense date.

B. DM (Design Manager)

B-1_DM receives all PDT PDF's, or follows-up with missing disciplines.

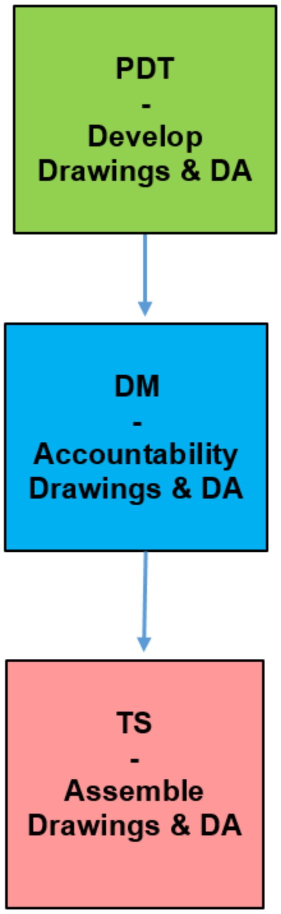
B-2_DM verifies TAM Indices' are filled out.

B-3_DM notifies TS all drawings and Indices' are complete.

Figure 22-68: TAM PxP Section L: Typical DM Submittal Checklist

Discipline	Div 1 Design-Build 01 80 00.12 10 Specification + Submittal Procedures	Drawings	DA	Notes
General			Yes	
Geotechnical			Yes	
Civil		No	Yes	Missed suspense date
Structural		No	No	
Architectural		Yes	No	Re-use 65% DA
Interior Design	No	Yes	Yes	

Figure 22-69: TAM PxP Section L: TAM A, B C Submittal Process - continued



C. TS (Technical Services)

C-1_TS receives notification from DM indicating all information ready for assembly.

C-2_TS creates Index of Drawings based on information populated in indices spreadsheet.

C-3_TS creates Cover Sheets for Project, Site Design, Facilities, and Standard Facility Details & Notes.

C-4_TS prints PDF's for all General Information Sheets.

C-5_TS assemblies all PDF's for submission.

C-6_TS bookmarks PDF accordingly.

C-7_TS uploads PDF in ProjectWise.

C-8_TS notifies DM of PW location for completed PDF's.

C-9_TS closes out suspense on CAD tracker.

(v) Drawing PDF’s shall be in ANSI D (22 inches x 34 inches).

(vi) Provide an IFC Coordination View in IFC Express format for all deliverables with exported property set data for all IFC supported named building elements.

(b) At the Initial Design Conference Submittal provide the Government with:

(i) Submit a digital copies of an editable PxP Word, M3 & Indices’ Excel of proposed list of drawings documents to the USACE TAM AdM Manager or approved delegate to confirm acceptability of the Plan or provide advice on additional processes or activities necessary to be incorporated into the PxP.

(ii) Within thirty (30) days after the acceptance of the PxP and M3, conduct a demonstration to review the Plan for clarification, and to verify the functionality of planned Model technology workflow and processes.

1. If modifications are required, the Contractor shall complete the modifications and resubmit the PxP performing a subsequent demonstration for Government acceptance.

2. There will be no payment for design or construction until the PxP is completed and accepted by the Government.

3. The Government may also withhold payment if there are design and construction items of unacceptable performance in executing the accepted PxP.

(c) At the Interim Design Submittals provide the Government with:

(i) Submit all items listed in Section 22.L.5.i along with the BIM and CAD Model with Facility/Site Data per the requirements per the requirements of Chapter 22 and project specific PxP.

(d) At the Final Design Submissions for the Request for Proposal (RFP) stage provide the Government with:

(i) Submit all items listed in Section 22.L.5.i along with the BIM and CAD Model with Facility/Site Data per the requirements per the requirements of Chapter 22 and project specific PxP.

(ii) Provide the USACE Advanced Modeling Submittal Review Checklist (CHX) form, June 2016.

(iii) The AE DOR's will sign and seal with the A-E professional stamp the Cover sheet and individual drawing sheets.

(iv) The solicitation number field on the Project Cover Sheet and Management Block shall be filled with the advertisement number.

(v) The issue block will in the titleblock shall show then full month and year going to advertisement.

(vi) The status field on the drawing sheets shall state "CONTRACT DOCUMENTS COMPLETE".

(e) If Amendment Submissions are required (Revisions that occur during the advertisement period requiring a change to the RFP set are called Amendments (AM)) provide the Government with:

(i) Provide the USACE Advanced Modeling Submittal Review Checklist (CHX) form, June 2016.

(ii) Provide a list of all submitted files in Excel spreadsheet format.

(iii) Provide the amended ANSI D drawing PDF's.

(iv) Submit BIM and CAD Data Model with Facility/Site Data per requirements of Chapter 22 and project specific PxP.

(v) The filename (a.k.a file number) shall use a dash and amendment "number" following existing filename. (e.g. EP101-01" reads "Electrical Power Plan, Sheet 01, AM #01")

(vi) The status field on the drawing sheets shall state "AM 0001".

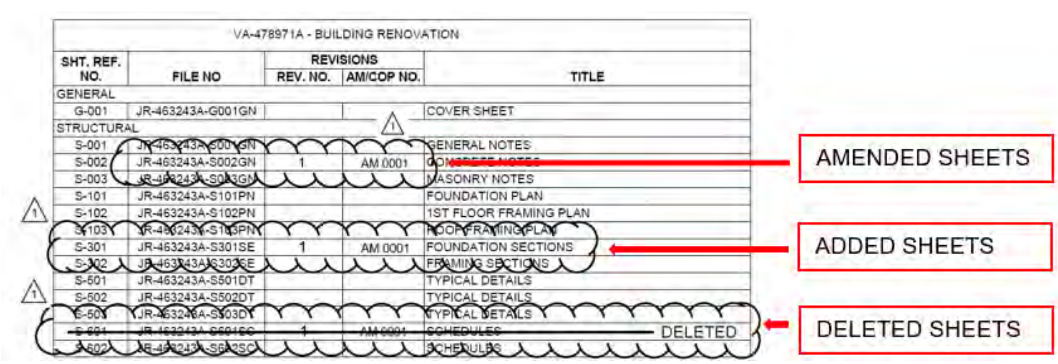
(vii) Provide an AM Index of Drawings sheet meeting the following requirements;

1. ***AMENDED*** sheets will cloud the File Number and Revisions column.

2. ***ADDED*** sheets will cloud the Sheet Reference Number, File Number, Revisions and Title columns. Revision Cloud will not exceed last letter of sheet title name.

3. ***DELETED*** sheets will cloud the full width of all columns.

Figure 22-70: TAM PxP Section L: Amendment Index of Drawings



(viii) The revision blocks shall show the AM number (mark), the text "REVISED IAW AM 00##" (description), and MON & YYYY (date) in the Revision (Issue) Block.

<u>Figure 22-71: TAM PxP Section L: Amendment Issue Block</u>

1	REVISED IAW AMENDMENT 0001	AUG 2020
MARK	DESCRIPTION	DATE

(f) At the Award Submission provide the Government with:

(i) Provide the USACE Advanced Modeling Submittal Review Checklist (CHX) form, June 2016.

(ii) Provide a list of all submitted files in Excel spreadsheet format.

(iii) Provide the award drawing PDF's.

(iv) Submit a "clean-set" of BIM and CAD Data Model with Facility/Site Data which have removed all inferences to Amendment revision clouds, delta triangles, and revision block text.

(v) Add the contract number to the Project Cover Sheet and titleblock Management Block. This shall be filled in with the actual construction contract award number. Keep the solicitation number.

(vi) The status field on the drawing sheets shall state "RELEASED FOR AWARD".

(g) Within (45) calendar days after the project is awarded the Government shall provide the Award Winning Contractor (AWC) the Government Furnished Materials (GFM) Submission.

(i) Upon award the AWC may request one set of "as-designed" electronic AdM files in the specified software and format revised to reflect all amendments. The burden of file conversion to any other software is the sole responsibility of the Contractor.

(ii) The AWC has the option of preparing their own Advanced Modeling files in the formats prescribed as a basis for design, design drawings, and interim design submittals. They shall maintain the same level of detail, properties, and functionality in the models that is prescribed in this Chapter.

(iii) The Government makes no guarantee that the GFM products of the BIM/CIM models, GIS data, and CAD files provide the level of completeness or quality required for a submittal. During the final stages of construction, develop or update files and data to completely and correctly represent the as-built conditions of the facility and the site.

(iv) Use of any GFM products of BIM, CIM, GIS and CAD for creation of contract submittals is at the Contractor's own risk. Any quality control issues discovered in the GFM does not absolve the Contractor from submitting contract compliant deliverables.

(v) The Government makes no representation regarding the accuracy or completeness of the GFM products of BIM, CIM, GIS and CAD, nor does it make representation to the compatibility of these files with the Contractor's hardware or software.

(vi) Use of GFM files is at the Contractor's risk. Verify data integrity upon receipt and request a replacement if necessary. Replacement must occur within (45) after receipt of the Advanced Modeling files.

(vii) Any adjustment of file structure, format, or software version required to make the GFM compatible with computer systems and/or software is the responsibility of the Contractor.

(h) If Change Order Submissions are required (Modifications that occur after the project is awarded are called Change Orders (COP)) provide the Government with:

(i) Provide the USACE Advanced Modeling Submittal Review Checklist (CHX) form, June 2016.

(ii) Provide a list of all submitted files in Excel spreadsheet format.

(iii) Provide the modified drawing PDF's.

(iv) Submit BIM and CAD Data Model with Facility/Site Data per requirements of Chapter 22 and project specific PxP.

(v) The filename (a.k.a file number) shall use a dash and change order "letter" following existing filename. (e.g. EP101-A" reads "Electrical Power Plan, Sheet 01, COP #01")

(vi) The status field on the drawing sheets shall state "COP 0001".

1. Note we do not say “COP A”, but instead refer the COP number to the corresponding letter of the alphabet.

2. When change order letters exceed the letter “Z”, use the format of “AA, AB, AC, etc.)

(vii) Sheets affected will show the COP letter (mark), the text “GENERAL REVISIONS COP 00##” (description), and MON & YYYY (date) in the Revision (Issue) Block.

Figure 22-72: TAM PxP Section L: Change Orders Issue Block

E	GENERAL REVISION COP 0005	JUN 2021
D	GENERAL REVISION COP 0004	MAR 2021
B	GENERAL REVISION COP 0002	FEB 2021
MARK	DESCRIPTION	DATE

(viii) Provide a COP Index of Drawings sheet meeting the same requirements as noted in Amendment Submission section.

Figure 22-73: TAM PxP Section L: Change Orders Index of Drawings

INDEX OF DRAWINGS				
SHT. REF. NO.	FILE NAME	REVISIONS		TITLE
		REV. NO.	AM/COP NO.	
GENERAL				
G-001	QA1401K-G-001			COVER SHEET
G-002	QA1401K-G-002-E	E	COP 0005	SHEET INDEX
G-011	QA1401K-G-011			STANDARD LEGENDS AND SYMBOLOGY
G-012	QA1401K-G-012-D	D	COP 0004	STANDARD ABBREVIATIONS
G-013	QA1401K-G-013-B	B	COP 0002	STANDARD ABBREVIATIONS
G-100	QA1401K-G-100			LIFE SAFETY - CODE ANALYSIS
G-110	QA1401K-G-110			LIFE SAFETY - GROUND FLOOR PLAN

(i) At the As-Built Submission provide the Government with:

(i) Provide the USACE Advanced Modeling Submittal Review Checklist (CHX) form, June 2016.

(ii) Provide a list of all submitted files in Excel spreadsheet format.

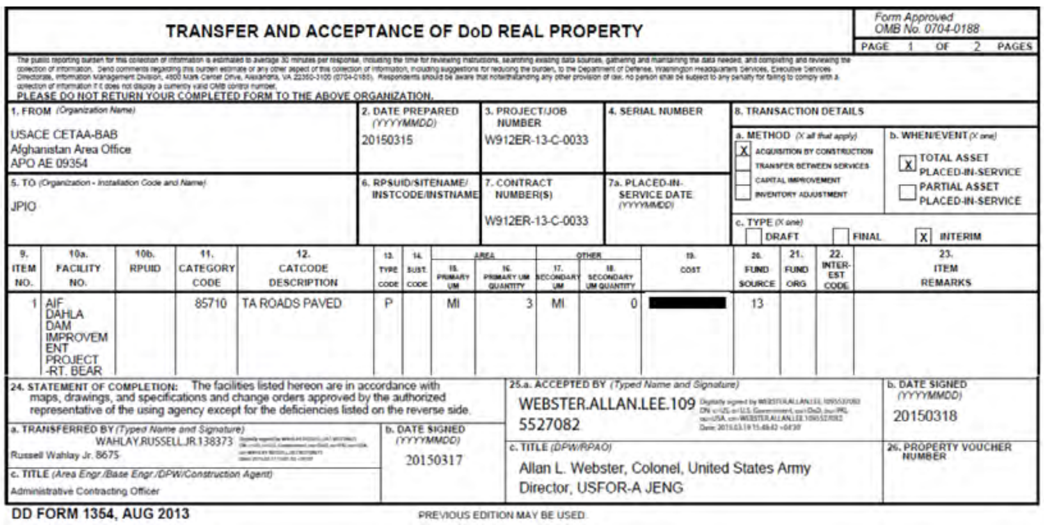
(iii) Provide the modified drawing ANSI D PDF’s.

(iv) Submit a "clean-set" of BIM and CAD Data Model with Facility/Site Data which have removed all inferences to Change Order revision clouds, delta triangles, and revision block text.

(v) The status field on the drawing sheets shall state "AS-BUILT".

(vi) Provide Transfer and Acceptance of DOD Real Property form.

<u>Figure 22-74: TAM PxP Section L: DD FORM 1354</u>



TRANSFER AND ACCEPTANCE OF DoD REAL PROPERTY

Form Approved
OMB No. 0704-0188

PAGE 1 OF 2 PAGES

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION.

1. FROM (Organization Name)	USACE CETAA-BAB Afghanistan Area Office APO AE 09354
2. DATE PREPARED (YYYYMMDD)	20150315
3. PROJECT/JOB NUMBER	W912ER-13-C-0033
4. SERIAL NUMBER	
5. TO (Organization - Installation Code and Name)	JPIO
6. RPSUID/SITENAME/ INSTCODE/INSTNAME	
7. CONTRACT NUMBER(S)	W912ER-13-C-0033
7a. PLACED-IN-SERVICE DATE (YYYYMMDD)	
8. TRANSACTION DETAILS a. METHOD (X all that apply)	[X] ACQUISITION BY CONSTRUCTION [ ] TRANSFER BETWEEN SERVICES [ ] CAPITAL IMPROVEMENT [ ] INVENTORY ADJUSTMENT
b. WHEN/EVENT (X one)	[X] TOTAL ASSET PLACED-IN-SERVICE [ ] PARTIAL ASSET PLACED-IN-SERVICE
c. TYPE (X one)	[ ] DRAFT [ ] FINAL [X] INTERIM

9. ITEM NO.	10a. FACILITY NO.	10b. RPUID	11. CATEGORY CODE	12. CATCODE DESCRIPTION	13. TYPE CODE	14. SUST. CODE	AREA 15. PRIMARY UM	AREA 16. PRIMARY UM QUANTITY	OTHER 17. SECONDARY UM	OTHER 18. SECONDARY UM QUANTITY	19. COST	20. FUND SOURCE	21. FUND ORG	22. INTER-EST CODE	23. ITEM REMARKS
1	AIF DAHLA DAM IMPROVEMENT PROJECT -RT. BEAR		85710	TA ROADS PAVED	P		MI	3	MI	0	[redacted]	13			

24. STATEMENT OF COMPLETION: The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

a. TRANSFERRED BY (Typed Name and Signature)
WAHLAY.RUSSELL.JR.138373
Russell Wahlay Jr. 8675

b. DATE SIGNED (YYYYMMDD)
20150317

c. TITLE (Area Engr./Base Engr./DPW/Construction Agent)
Administrative Contracting Officer

25.a. ACCEPTED BY (Typed Name and Signature)
WEBSTER.ALLAN.LEE.109
5527082

b. DATE SIGNED (YYYYMMDD)
20150318

c. TITLE (DPW/RPAO)
Allan L. Webster, Colonel, United States Army
Director, USFOR-A JENG

26. PROPERTY VOUCHER NUMBER

DD FORM 1354, AUG 2013 PREVIOUS EDITION MAY BE USED.

1. Acceptable as-built submittals will prompt the Advanced Modeling Manager to notify the KO that the as-built submission meets the requirements as listed in this Chapter and to proceed with Transfer and Acceptance of DOD Real Property.

2. Failure to meet these requirements does not constitute a delay in the period of performance nor does it not absolve the DOR or AWC from submitting contract compliant deliverables as described in the contract.

3. DD FORM 1354 will not be accepted until all AdM requirements are met.

4. Upon an acceptable successful resubmission the Advanced Modeling Manager, or approved delegate to notify the KO that the as-built submission meets the requirements as listed in this Chapter and to proceed with Transfer and Acceptance of DOD Real Property.

m. **Section M: Design Coordination Meetings.** Contains the (11) items in the areas of General Information, PxP Initial (PxP-IM), PxP Kick-off (PxP-KOM), Interim Design Submissions (IDS), Request for Proposal (RFP), Amendments (AM), Pre-AWARD Requirements, AWARD Release of AdM Information, Change Orders (COP), As-Built (ASB) and Building Lifecycle Management (BLM) (optional).

1) General Information: The information listed below contains the processes and references related to requesting Advance Modeling, ProjectWise or Service Unit Support. Please read the types of support offered and follow the directions provided. Allow one full business day for the request to be logged, evaluated and assigned.

(a) **Advanced Modeling.** Primary responsibilities include processing PxP requests & activities, reviewing & documenting CAD-BIM reviews, enforcing & explaining USACE TAM Advanced Modeling standards, developing SOP's & technical references, updating Chapter 22, TAM DIM and maintaining technical requirements for SOW, Specifications, & CAD-BIM templates.

- Primary Alternate for ProjectWise, *(except user accounts).

(b) **ProjectWise.** Primary responsibilities include creating project folders, providing user access permissions, creating user accounts, uploading, downloading & archiving files, providing reachback access, adding metadata, creating workspace and maintaining templates.

- Primary Alternate for Advanced Modeling.

(c) Service Unit. Primary responsibilities include assembling design packages, design analysis, creating CD's, plotting specifications, CWE's and drawings.

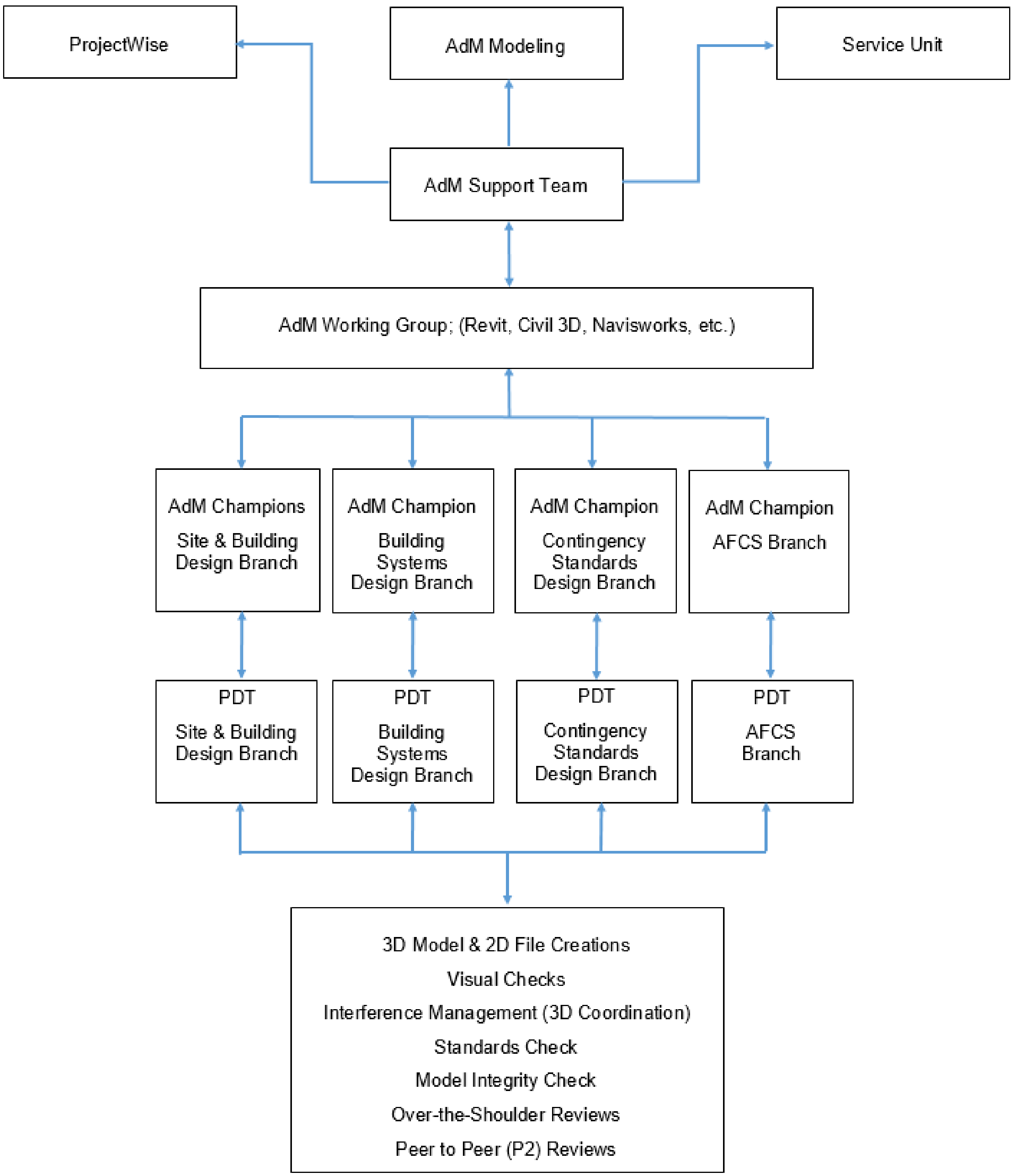
- Secondary Alternate for Advanced Modeling.

****

(i) Directions:

1. Create e-mail to DLL-CETAM-DP-ET-CADD@usace.army.mil
2. Copy & Paste BOLD Title into E-mail Subject Line.
3. Copy & Paste BULLET Questions into E-mail Body.
4. Answer BULLET Questions.
5. Send E-mail.

Figure 22-75: TAM PxP Section M: Hierarchy of AdM Support



2) PxP Initial (PxP-I) Meeting: This meeting shall occur after a new AdM design project is requested. Required attendance includes the project Design Manager (DM) and the Advanced Modeling Manager, or approved delegate. Topics of discussion shall include establishment of Labor Charge Codes (LCC), Scope of Work (SOW), and PxP Section(s) A: Project Information & B: Key Project Contacts. **Meeting held no later than (NLT) two business days prior to date of the PDT Kick-off Meeting.**

Subject Line: **PxP Initial Meeting Request**, provide;

- Active LCC for *CMA:
- Overtime Approved: Y or N
- Date of Request:
- Date of Kick-off Meeting:

Section A: Project Information

- Project Location: (Upper case each word) City, Country
- Project Client: (Upper case each word)
- Project Title: (Upper case each word)
- Project P2 Number:
- Contract Type: Design-Build (DB) or Design-Bid-Build (DBB)
- Brief Project Description: *Who will do what? What will they do? Who will issue the contract award?* i.e.: "The AE will prepare the 65% Design Build Request for Proposal (RFP) packages for 10 facilities. TAM will issue the contract award."
- Facility Name(s): (xx) Facilities & Facility Names
- Designer of Record (DOR): USACE TAM & (AE Firm or District Name)

Section B: DOR Project Delivery Team - provide Organization & E-mail

- Project Manager -
- Design Manager -
- Cost -
- Specifications -
- Environmental -
- Geotechnical -
- Civil -
- Structural -
- Architecture -
- Interior Design -
- Fire Protection -
- Plumbing -
- Mechanical -
- Electrical -
- Telecommunications -

3) PxP Kick-Off (PxP KO) Meeting: This meeting shall piggyback the PDT Kick-Off or be conducted separately, but must be conducted within **(45) calendar days** after PxP Initial Meeting and include discipline leads for the design. The intent of this meeting is to coordinate PDT expectations for the AdM PxP.

   Topics of discussion shall include;

   - Section A: Project Information
   - Section B: Project Delivery Team (PDT)
   - Section C: Project Goals / Advanced Modeling Objectives,
   - Section D: Organizational Roles,
   - Section E: Advanced Modeling Process Design,
   - Section F: Advanced Modeling Information Exchange Worksheet,
   - Section G: Minimum Modeling Matrix (M3) Requirements,
   - Section H: Collaboration Procedures,
   - Section I: Quality Control,
   - Section J: Technological Software & Standards,
   - Section K: Model Organization,
   - Section L: Project Deliverables,
   - Section M: AdM Support & Meeting Requests,
   - Section N: PxP Legacy Log.

4) PxP Demonstration (PxP-DEMO) Meeting: Within **(30) calendar days** after the acceptance of the PxP, a demonstration will be conducted by the each PDT member to the Advanced Modeling Manager to verify acceptance and understanding of the specific project PxP, remedy clarification, and verify the functionality of planned workflow, processes and deliverables.

   Required attendance are ALL of the PDT design members and Advance Modeling Manager, or approved delegate. Each PDT member shall provide a sample drawing from their respective discipline for review.

   PDT members shall be rated on the following items;

   - PxP References & General Knowledge,
   - PxP Section K: Model Organization – AdM Files
   - PxP Section K: Model Organization – AdM Presentation of Graphics (POG)

   PDT members will receive a **GO** or NO-GO rating. PDT members are encourage to work together as a team. If one fails, we all fail.

   Following a 100% "**GO**" rating, the PDT is approved to begin using the Revit models and CAD files for design development.

5) <u>3D Interference Management Meeting:</u> In accordance with Section I: Quality Control Check report will be provided to confirm the visual review process for the project 3D model files and to illustrate the clash detection process has been completed for the all Design Submittals from “35% to BLM handover using the USACE approved Navisworks platform.

   This software allows the PDT, stakeholders, and facility managers to find any errors, omissions, or deficiencies before they are built or renovated into the physical space by viewing the project from B2B and collaborating, developing, and modifying the AdM Files during an open flow of communications.

   These views are created from the multi-disciplinary models during the life of the project and enhanced with model hierarchy, object properties, and embedded review data, including viewpoints, animations, redlines, and comments for a published file.

   The USACE Interference Management Standard and Clash Tracker Tool is an excel file with macros for importing clash tests and reporting on New or Active Clashes with preset clash orders of precedence (e.g. Mechanical vs. Fire Protection). This report will include Visual Review and Clash Detection reports.

   (a) <u>Visual Review Report:</u> PDT shall model the facility in accordance with Section G: M3 requirements. The models shall contain the necessary Master-Systems, Systems, and Subsystems appropriate for the facility types and construction. The LOD shall be compliant with the levels mandated in the M3.

   Visual reviews of the (3D) models shall be done daily by the PDT as part of the TAM standard workflow for the design and documentation of a project, whereby the PDT will link in all disciplines during the execution of the work. Utilizing Working Views, the modelers can see what components exist in the model(s) and can adapt or adjust accordingly. This process reduces the volume of model component interferences.

   (b) <u>Clash Detection Report:</u> Clash detection interference check is run prior to each submittal using Autodesk Navisworks and/Revit. This program, in conjunction with Autodesk Revit, processes the (3D) model files to identify model component interferences.

   This means that any instance where a model component “touches” another Navisworks marks these as a “clash”. The resulting output catalogs the clashes for the designers to then review and resolve/accept.

   Not all “clashes” are unintentional, there are usually many instances where interferences are acceptable. In other words, the model components were intended to touch.

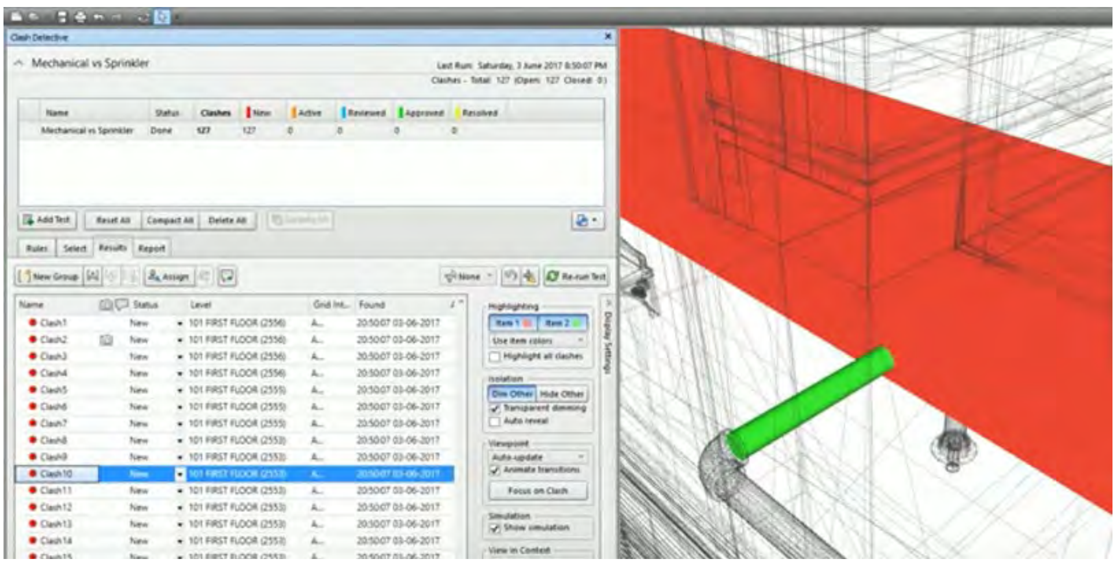
In preparation of the Submittal, the clash detection process will be run, and clashes will be reviewed and then resolved or accepted depending on the condition. **(Note: Clashes within the same discipline will be resolved prior to the 3D Interference Management Meeting.)**

The final report shall show the latest clash detection for the building model files, outstanding clashes and recommendations to be resolved.

Required attendance are all PDT design members, Advance Modeling Manager, or approved delegate, A-E manager and other DOR stakeholders.

This meeting shall be a minimum of 4hrs, allowing enough time to adequately process ALL discipline hard and soft clashes. Where conflicts cannot be resolved amongst PDT members the TAM DM will have the final call.

Figure 22-76: TAM PxP Section M: Navisworks Clash Detection Simulation



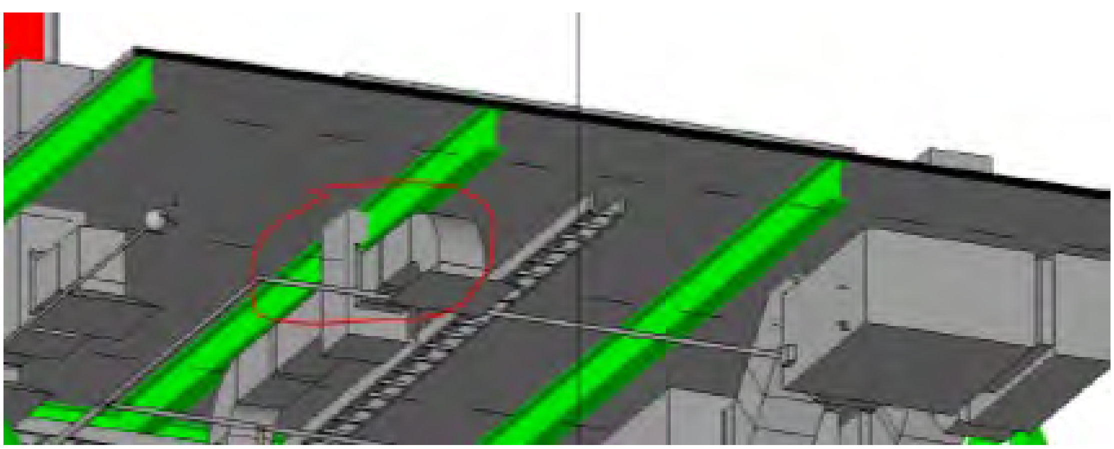


Figure 22-77: TAM PxP Section M: REVIT Clash Detection Report - Cover

Release: November 2020

CLASH DETECTION REPORT			
Version 1.00	**CoP**	**ARCHITECTURE**	
Date	**PREPARED BY:**	**Transatlantic Middle East District (TAM)**	
PROJECT INFORMATION			
PROJECT NAME	VIARNG- Vehicle Maintenance Shop		
PN NUMBER	VI-202001		
PROJECT LOCATION	St. Croix, USVI, United States		
SUBMITTAL	95%		
CONTENT			
	Mark with a "X" divisions included	*Discipline Color*	**INCLUDED**
CATEGORIES	ARCH W/ STRUCTURAL		X
	ARCH WITH ELECTRICAL		X
	ARCH WITH MECHANICAL		X
	ARCH WITH FIRE PROTECTION		
	ARCH WITH TELECOM		
	ARCH WITH INTERIOR DESIGN		X
	ARCH WITH CIVIL		
DISCIPLINE LEAD/ TEAM:	Steven Lee (Lee Sung Whan)		
	Lymarie Torres Rodriguez		
	Angelivette Nieves-Viruet		
NOTES:			

1. Use ID number to find to find element in REVIT.
(**MANAGE TAB>INQUIRY PANEL>SELECT BY ID**)

2. Perform Interference Check with each discipline link spearately.

3. Recommendation: To identify Interference quicker, create or duplicate a 3D view and overwrite Display Graphics to transparency 50%.

4. Assign color to link for easier visualization.
(**VISIBILITY GRAPHICS>REVIT LINKS>CHANGE "BY HOST VIEW" TO "CUSTOM">GO TO MODEL TAB>SELECT ALL>OVERWRITE ALL LINES AND CUT LINES TO DISCIPLINE COLOR**).

Figure 22-78: TAM PxP Section M: REVIT Clash Detection Report - By Discipline

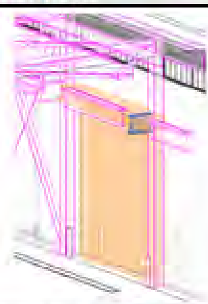
CATEGORY A_ARCHITECTURAL
CATEGORY B_STRUCTURAL

BUILDING ID: STT-A

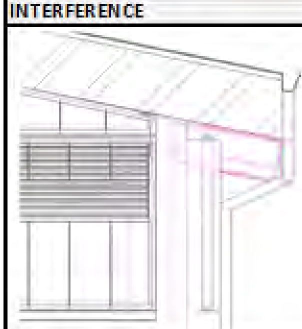
Link to Revit Interference Report

CLASH DETECTION REPORT

1 ARCH W/ STRUCTURAL

INTERFERENCE	CATEGORY A	STATUS
	868858	UNRESOLVED
	CATEGORY B	ASSIGNED TO
	861545	CENAP
	DESCRIPTION	COMMENTS
	BEAM INTERSECTING WITH ROLL-UP DOOR HOOD	ARCH TEAM HAVE TO UPDATE DIMENSIONS OF HOOD (29"Dx29"H)
	LOCATION ON 3D MODEL	
	DOOR 126E	

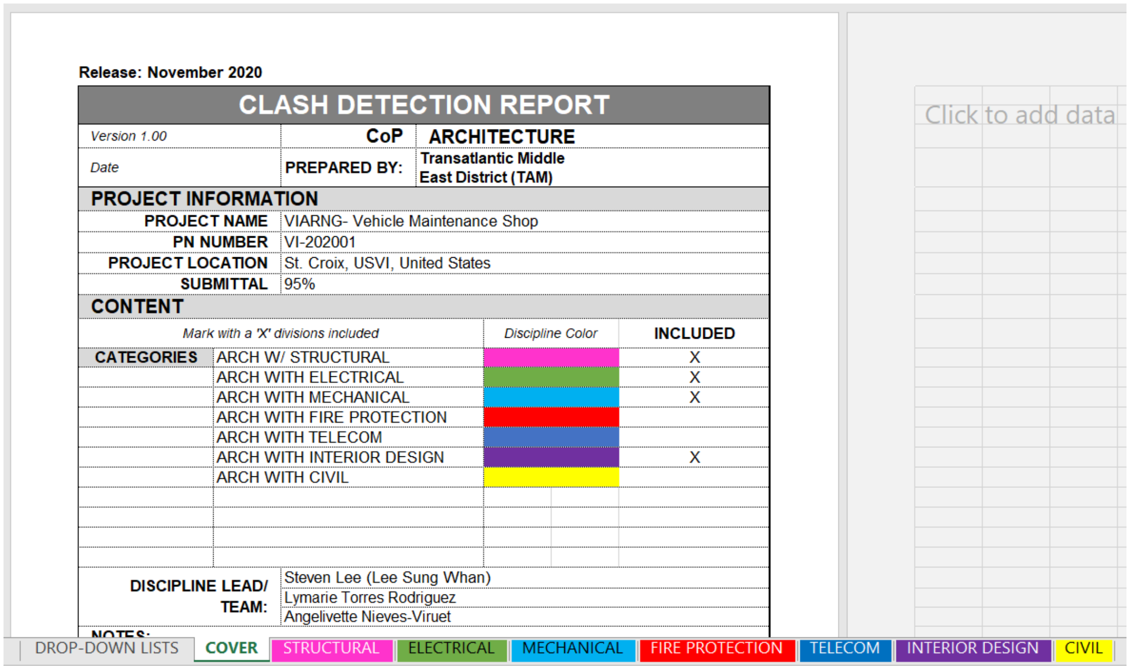
INTERFERENCE	CATEGORY A	STATUS
	1172750	UNRESOLVED
	CATEGORY B	ASSIGNED TO
	684862	CENAP
	DESCRIPTION	COMMENTS
	STRUCTURAL FRAMING INTERSECTING WITH LOUVER	
	LOCATION ON 3D MODEL	
	WASHBAY	

INTERFERENCE	CATEGORY A	STATUS
	1174048	UNRESOLVED
	CATEGORY B	ASSIGNED TO
	685079	CENAP
	DESCRIPTION	COMMENTS
	STRUCTURAL FRAMING INTERSECTING WITH LOUVER	
	LOCATION ON 3D MODEL	
	WASHBAY	

CLASH DETECTION TRACKER
C:\Users\n0enmems\Desktop\New folder\TAM_REVIT_Clash Detection Report+Interference Tracker_(Project Number)_(Project Name)_(Date YYYYMMDD)

Page 1 of 2

Figure 22-79: TAM PxP Section M: REVIT Clash Detection Report – Excel Tabs



Release: November 2020

CLASH DETECTION REPORT			
Version 1.00	CoP	ARCHITECTURE	
Date	PREPARED BY:	Transatlantic Middle East District (TAM)	
PROJECT INFORMATION			
PROJECT NAME	VIARNG- Vehicle Maintenance Shop		
PN NUMBER	VI-202001		
PROJECT LOCATION	St. Croix, USVI, United States		
SUBMITTAL	95%		
CONTENT			
	Mark with a 'X' divisions included	*Discipline Color*	INCLUDED
CATEGORIES	ARCH W/ STRUCTURAL		X
	ARCH WITH ELECTRICAL		X
	ARCH WITH MECHANICAL		X
	ARCH WITH FIRE PROTECTION		
	ARCH WITH TELECOM		
	ARCH WITH INTERIOR DESIGN		X
	ARCH WITH CIVIL		
DISCIPLINE LEAD/ TEAM:	Steven Lee (Lee Sung Whan)		
	Lymarie Torres Rodriguez		
	Angelivette Nieves-Viruet		
NOTES:			

6) Interim Design Submission Meeting: This meeting is designed to ensure proper submission requirements are met prior to the PDT plotting the PDF's. Topics shall include Revit and CAD titleblock information status fields, package assembly and PDF file naming, bookmarking and electronic delivery date.

   Required attendance is the DM, all PDT members and Advanced Modeling Manager, or approved delegate. **Meeting held NLT one week prior to date of each submission activity.**

   Subject Line: **Design Submission Meeting Request**, provide;

   - Active LCC for *CMA:
   - Overtime Approved: Y or N
   - Project Code:
   - Project Name:
   - Type of Submission:
   - Date of Submission:

7) Request for Proposal (RFP) Meeting: Prior to processing contract documents complete (CDC) submission, a meeting will be conducted to discuss solicitation number, date and delivery to contracting.

Required attendance includes the DM, Specifications Technician and Advanced Modeling Manager, or approved delegate. **Meeting held NLT one week prior to date of submission activity.**

Subject Line: **Request for Proposal (RFP) Meeting Request**, provide;

- Active LCC for *CMA:
- Overtime Approved: Y or N
- Project Code:
- Project Name:
- Issue Date:
- Solicitation Number:

8) Amendments (AM) Meeting: Pre-Award files may require modification. Should this occur a meeting will be conducted to discuss PxP Section K: Amendments. Topics shall include specific Revit models and CAD files to modify, schedules, LCC's and formatting.

Required attendance includes DM, discipline specific PDT members affected by the change and Advanced Modeling Manager, or approved delegate. **Meeting held NLT two business days prior to date PDT Amendment Kick-off Meeting.**

Subject Line: **Amendment (AM) Meeting Request**, provide;

- Active LCC for *CMA:
- Overtime Approved: Y or N
- Project Code:
- Project Name:
- Issue Date:
- Amendment Number:

9) <u>Pre-Award Requirements Meeting:</u> Prior to awarding a project the Contracting Officer (KO) will require a "clean-set" of drawing PDF's. When this occurs a meeting will be conducted to discuss PxP Section L: Project Pre-Award. Topics shall include Revit models and CAD files removal of prior amendments, and addition of designer of record (DOR) seals, contract award numbers.

Required attendance includes the KO, DM, PDT or DOR and Advanced Modeling Manager, or approved delegate. **<u>Meeting held NLT three weeks prior to anticipation of date of award.</u>**

Subject Line: **Pre-Award Meeting Request**, provide;

- Active LCC for *CMA:
- Overtime Approved: Y or N
- Project Code:
- Project Name:
- Issue Date:
- Contract Number:

10) <u>Award Release of GFM Information Meeting:</u> Within **(45) calendar days** after the award-winning contractor (AWC) is selected a meeting will be held to process PxP Section M: Project Award. Topics include the transferring the PxP, delivering the Government Furnished Materials (GFM) awarded AdM files and demonstration of TAM specific requirements and project deliverables.

Using BIM software the construction team has improved communication because team members can discuss changes, share their ideas and integrate existing site conditions with the construction model design.

Required attendance includes the DM, KO, AWC, Construction Control Representative (CCR) and Advanced Modeling Manager, or approved delegate.

Subject Line: **Award PxP Meeting Request**, provide;

- Active LCC for *CMA:
- Overtime Approved: Y or N
- Project Code:
- Project Name:
- Date of Contract Awarded:
- Contract Number:
- Contractor E-mail:
- Contractor Name:
- Contracting Officer:
- Construction Control Rep:

11) <u>Change Orders (COP) Meeting:</u> Post Award files may require modification. Topics shall include specific Revit models and CAD files to modify, schedules, LCC's and formatting.

Required attendance is DM, DOR discipline specific PDT members (e.g. specifications) affected by the change and Advanced Modeling Manager, or approved delegate. **<u>Meeting held NLT two business days prior to date PDT COP Kick-off Meeting</u>.**

Subject Line: **Change Order (COP) PxP Meeting Request**, provide;

- Active LCC for *CMA:
- Overtime Approved: Y or N
- Project Code:
- Project Name:
- Date of Submission to Contracting:
- Change Order Number:

12) <u>As-Built (ASB) Meeting:</u> Upon completion of project construction the AWC will provide a revised set of changes made in the drawings during the construction process. Topics shall include formatting, delivery and archiving of Advanced Modeling models, files, sheets & PDF drawings, in addition to receipt of DD FORM 1354 "Transfer of Acceptance of DoD Real Property".

Required attendance includes the KO, AWC, CCR and Advanced Modeling Manager, or approved delegate. <u>Meeting held NLT one month prior to the submission of submitting as-built files.</u>

Subject Line: **As-Built Submittal Meeting Request**, provide;

- ASB MEETING: DD MMM YY
- ASB MEETING LOCATION: WEB MEETING OR AGREED LOCATION
- ASB MEETING ATTENDEES: XXXXXXXXXXXXXXXXXXXXXX
- PROJECT COMPLETION DATE: DD MMM YY
- DD FORM 1354 PROVIDED: N or Y
- BIM FILES PROVIDED: N or Y FORMAT: XXXX VERSION: 20##
- CIM FILES PROVIDED: N or Y FORMAT: XXXX VERSION: 20##
- CAD FILES PROVIDED: N or Y FORMAT: XXXX VERSION: 20##
- GIS FILES PROVIDED: N or Y FORMAT: XXXX VERSION: 20##
- PDF FILES PROVIDED: N or Y FORMAT: XXXX VERSION: 20##

13) Building Lifecycle Management (BLM) Meeting (optional): Within **(120) days** after the project construction is complete an informational meeting should be held to discuss the benefits of integrating the as-built BIM model and facility management operations to maximize processes and workflows for the Total Lifecycle Cost of the facility.

It is estimated that 70% of the cost of a facility is incurred during its occupied lifecycle. Facilities that have a BLM based facility management system can expect improved coordination, efficient facility documentation, and accessible energy audit information.

Suggested attendance includes the Owner, Facility Manager's (FM) and Advanced Modeling Manager, or approved delegate.

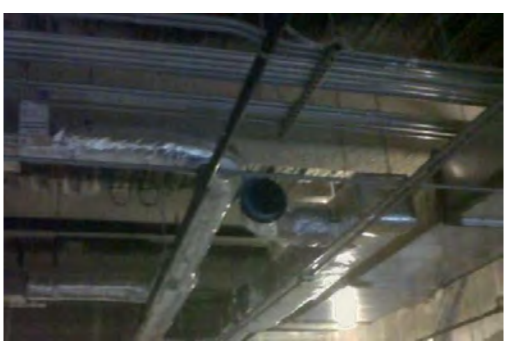
Subject Line: **Building Lifecycle Management (BLM) Meeting Request**, provide;

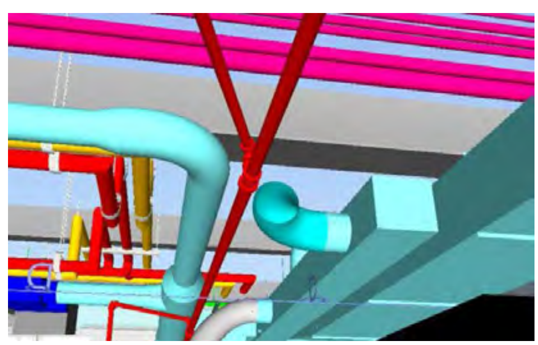
- Active LCC for *CMA:
- Overtime Approved: Y or N
- Travel Approved: Y or N
- Project Code:
- Project Name:
- Owner Name:
- Owner POC:
- Owner POC E-mail:
- Owner FM Name:
- Owner FM E-mail:

Reasons to want a **Building Lifecycle Management (BLM) Meeting;**

1. Improved project coordination: Teams made up of multiple disciplines and roles can collaborate in real time.
2. Improved planning and estimating: Minimize re-work in the field.
3. Efficient project documentation: Synchronization of information improves organization.
4. Readily accessible audit or assessment information: Put information in the facility manager's hands.

Figure 22-80: TAM PxP Section L: Built vs. BIM - What you see & what you don't





Topics may include;

1. Current State of BIM Use for Facility Management.
2. Manage Warranties – Timeframe, comprehensiveness.
3. Repurpose and Reuse model information in future projects.

Suggested attendance includes the Owner or Owner's representatives, Facility Manager's (FM) and Advanced Modeling Manager, or approved delegate.

Figure 22-81: Section M: Navisworks Clash Detection Simulation for Facility Management

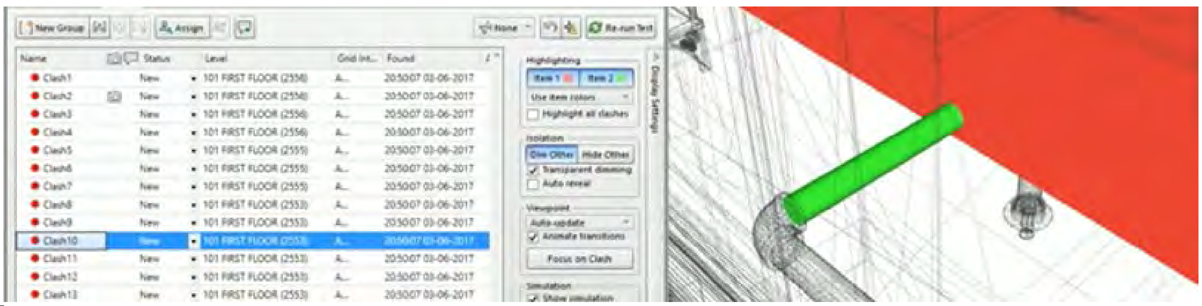
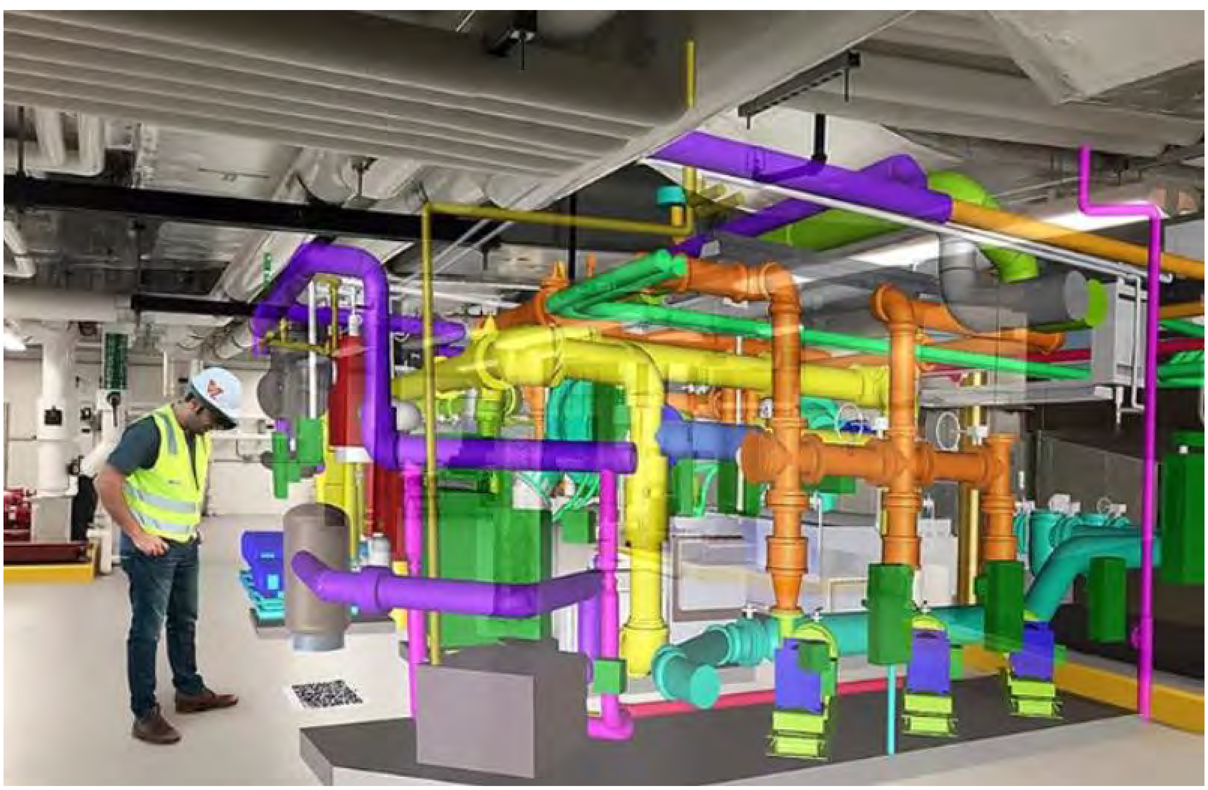


Figure 22-82: Section M: BIM Augmented Reality within Existing Facility Conditions



n. **<u>Section N: PxP Project Legacy Log.</u>** This table shall be to use to log all B2B milestones and changes to the approved PxP below providing a description and page number of the change. Consult with the Advanced Modeling Manager or Approved Delegate to determine if a resubmittal of the PxP is required.

<u>Figure 22-83: Section N: PxP Project Legacy Log</u>

DATE	DESCRIPTION	PxP REFERENCE	TAM DIM REFERENCE
YYYY-MM-DD	PxP General Request	Section: M.1	Chapter 22, Section 22.2.m.1
YYYY-MM-DD	PxP Initial Meeting	Section: M.2	Chapter 22, Section 22.2.m.2
YYYY-MM-DD	PxP Kick-Off Meeting (WITHIN (45) DAYS OF REQUEST)	Section: M.3	Chapter 22, Section 22.2.m.3
YYYY-MM-DD	PxP Approved	Section: ALL	Chapter 22, Sections ALL
YYYY-MM-DD	PxP Demonstration Meeting (WITHIN (30) DAYS OF APPROVAL)	Section: M.4	Chapter 22, Section 22.2.m.4
YYYY-MM-DD	35% 3D Interference Check & Design Submittal Meeting	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	65% 3D Interference Check & Design Submittal Meeting	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	95% 3D Interference Check & Design Submittal Meeting	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	100% 3D Interference Check & Design Submittal Meeting	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	RFP Design Meeting	Section: M.7	Chapter 22, Section 22.2.m.7
YYYY-MM-DD	AM Meeting	Section: M.8	Chapter 22, Section 22.2.m.8
YYYY-MM-DD	Pre-AWARD Meeting	Section: M.9	Chapter 22, Section 22.2.m.9
YYYY-MM-DD	AWARD Meeting	Section: M.10	Chapter 22, Section 22.2.m.10
YYYY-MM-DD	COP Design Submittal Due	Section: M.11	Chapter 22, Section 22.2.m.11
YYYY-MM-DD	AS-BUILT Submittal Due	Section: M.12	Chapter 22, Section 22.2.m.12
YYYY-MM-DD	BLM Handover	Section: M.13	Chapter 22 Section 22.m.13

22.3 ADVANCED MODELING PxP TEMPLATE

USACE TAM ADVANCED MODELING
PROJECT EXECUTION PLAN (PxP)
Created: DD MON 20YY

(PROJECT LOCATION)
(PROJECT CLIENT)
(PROJECT TITLE)
(PROJECT CODE)

US Army Corps of Engineers®
Middle East District

ERICK M. STILLMAN, ADVANCED MODELING MANAGER
UNITED STATES ARMY

CC-123456 PxP

January 2022 – R9

SECTION A: PROJECT INFORMATION

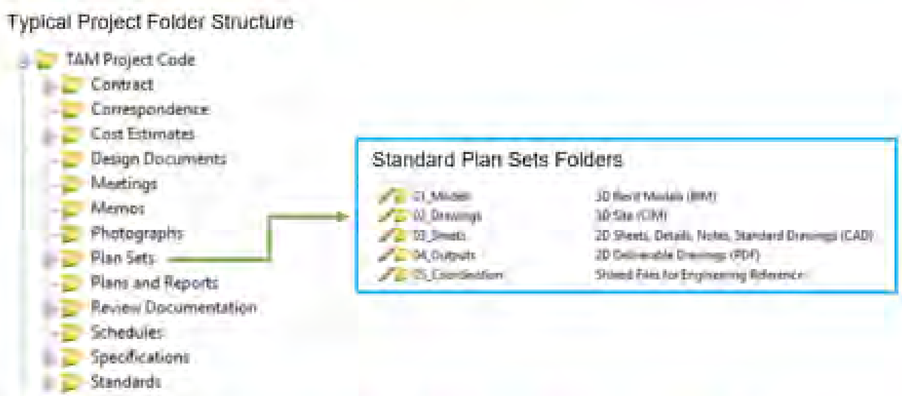
1. **Project Location**: (Upper case each word) City, Country
2. **Project Client:** (Upper case each word)
3. **Project Title**: (Upper case each word)
4. **Project Code:** CC-123456

---

5. **Contract Type:** Design-Build (DB) or Design-Bid-Build (DBB)
6. **Brief Project Description:** *Who will do what? What will they do? Who will issue the contract award? i.e.:* "The AE will prepare the 65% Design Build Request for Proposal (RFP) packages for 10 facilities. TAM will issue the contract award."
7. **Facility Name(s):** (xx) Facilities - See Section K: Model Organization
8. **Designer of Record (DOR):** USACE TAM or (AE Firm or District Name)

---

9. **PW Directory:** Winchester\Documents\MED Projects\(Country)\(Calendar Year)\(TAM Project Code)



10. **Revit Directory:** X:\ REVIT PROJECTS\(Country)\(Calendar Year) \(Project Code)
11. **Common Directory:** S:\XXXXXXXXXXXX

i

SECTION B: PROJECT DELIVERY TEAM (PDT)

ROLE	ORGANIZATION	EMAIL
Advanced Modeling (AdM) Manager	TAM	Erick.M.Stillman@usace.army.mil
AdM Engineering Systems Manager	TAM	N/A
AdM Service Unit Technician	TAM	Lacey.C.Sandate@usace.army.mil
Quality Manager	TAM	Joe.E.Godwin@usace.army.mil
Value Engineer	TAM	Amanda.S.Bianchini@usace.army.mil
Scheduler	TAM	Erin.M.Specht@usace.army.mil
AdM Technical Champions	**ORGANIZATION**	**EMAIL**
Site Design	TAM	Jeremy.L.Coon@usace.army.mil
Building Design	TAM	John.E.Hiergeist@usace.army.mil
Building Systems	TAM	George.W.Detraz@usace.army.mil
Building Systems	TAM	Scott.Doeden@usace.army.mil
Center of Standardization (COS)	TAM	Mark.L.Whitacre@usace.army.mil
GIS	TAM	N/A
PDT Design Team		
Project Manager	TAM	
Design Manager	TAM	
Regional Planner	TAM	
AE Manager	TAM	
Cost	TAM	
Specifications	TAM	
Environmental	TAM	
Geotechnical	TAM	
Civil	TAM	
Structural	TAM	

Architecture	TAM	
Interior Design	TAM	
Fire Protection	TAM	
Plumbing	TAM	
Mechanical	TAM	
Electrical	TAM	
Telecommunications	TAM	
BCOES Reviewer	TAM	TAM Engineering Branch Cheifs
AE PDT Design Team	**ORGANIZATION**	**EMAIL**

CC-123456 PxP

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SECTION C: PROJECT GOALS & ADVANCED MODELING OBJECTIVES

1. MAJOR ADVANCED MODELING GOALS / OBJECTIVES:

ADVANCED MODELING GOAL	DESCRIPTION
ENFORCE STANDARDS	MAXIMIZE CONSISTENCY AND MINIMIZE REDUNDANCY
3D COORDINATION	DESIGN OPTIMIZATION AND CLASH DETECTION
COST ESTIMATION	IMPROVING QUANITY TAKE-OFFS

2. MODEL USES: (RED = USACE & BLUE = TAM Mandatory. GREEN = Optional.)

PLAN (NIC)		DESIGN		CONSTRUCT		OPERATE (NIC)	
	PROGRAMMING	X	DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING SYSTEM ANALYSIS
	SITE ANALYSIS	X	PROGRESS REVIEWS		CONSTRUCTION SYSTEM DESIGN		ASSET MANAGEMENT
		X	INTERFERENCE MANAGEMENT (3D COORDINATION)	X	INTERFERENCE MANAGEMENT (3D COORDINATION)		SPACE MANAGEMENT / TRACKING
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		DISASTER PLANNING
			LIGHTING ANALYSIS		3D CONTROL AND PLANNING		
			ENERGY ANALYSIS	X	RECORD MODELING		OPERATION & MAINTENANCE RECORD MODELING
			PROGRAM VALIDATION		FIELD / MATERIAL TRACKING		
			MECHANICAL ANALYSIS		DIGITAL LAYOUT		
			OTHER ENG. ANALYSIS				
			SUSTAINABILITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D)		PRELIMINARY CONSTRUCTION SCHEDULING (4D)		CONSTRUCTION SCHEDULING (4D)		BUILDING MAINTENANCE SCHEDULING (4D)
	COST ESTIMATION (5D)	X	COST ESTIMATION (5D)		COST ESTIMATION (5D)		COST ESTIMATION (5D)
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING
	CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)		CONSTRUCTION OPERATIONS BUILDING INFORMATION EXCHANGE (COBie)

SECTION D: ORGANIZATION ROLES

MODEL USE	ORGANIZATION	LEAD CONTACT
DESIGN AUTHORING	DOR	PROJECT MANAGER
PROGRESS REVIEWS	USACE	DESIGN MANAGER
2D / 3D COORDINATION	DOR / USACE	CAD-BIM MANAGER
COST ESTIMATION	DOR / USACE	COST ESTIMATOR
RECORD MODELING	AWC-CONSTRUCTION	CAD-BIM MANAGER

4

CC-123456 PxP

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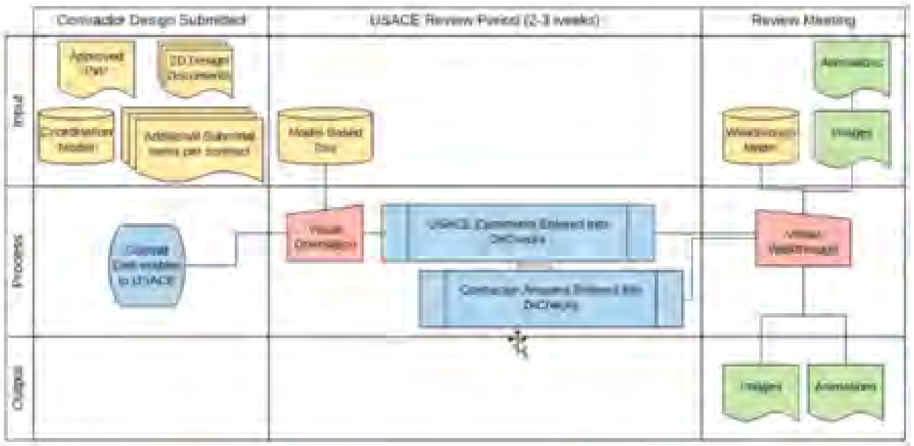
SECTION E: ADVANCED MODELING PROCESS DESIGN

1. SUBMITTALS:



2. REFERENCE: TAM PDF Submission Requirements, January 2021

3. REFERENCE: USACE Advanced Modeling Submittal Review Checklist, June 2016

SECTION F: ADVANCED MODELING INFORMATION EXCHANGE WORKSHEET

1. CONSTRUCTION DOCUMENTS SHEETS: **(Project Code)**_TAM Sheet Table.xlsx

2. INTERFERENCE MANAGEMENT: **(Project Code)**_TAM Clash Detection Report.

3. INDEX OF DRAWINGS: **(Project Code)**_TAM Index of Drawings.xlsx

SECTION G: MINIMUM MODELING MATRIX (M3) REQUIREMENTS

1. REFERENCE: USACE Minimum Modeling Matrix (M3), V1.3, September 2014.

2. ENHANCEMENTS: Minimum requirements priority before enhancements applies.

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SECTION H: COLLABORATION PROCEDURES

1. COLLABORATION ACTIVITIES:

ACTIVITY TYPE	PROJECT STAGE	FREQUENCY	PARTICIPANTS	LOCATION
ADVANCED MODELING PxP DEMONSTRATION	BEFORE DESIGN STARTS	ONCE	PDT	WEB MEETING
MODEL COORDINATION	DURING	WEEKLY	PDT	DOR PREFERENCE
PEER REVIEWS	BEFORE EVERY SUBMITTAL	MULTIPLE	PDT Leads	DOR PREFERENCE
ADVANCED MODELING TRAINING	ALL	AS NEEDED	PDT	WEB MEETING
DESIGN SOFTWARE TRAINING	ALL	AS NEEDED	PDT Design Team	WEB MEETING

SECTION I: QUALITY CONTROL

1. QUALITY CONTROL CHECKS:

CHECKS	RESPONSIBLE PARTY
VISUAL CHECK	DOR Design Members
INTERFERNCE MANAGEMENT (3D COORDINATION)	DOR Design Members
STANDARDS CHECK	DOR Design Members
MODEL INTEGRITY CHECK	DOR Design Members
VERSION UPDATING CHECK	DOR Design Members
REVISION AUTHORITY CHECK	DOR CAD-BIM Manager
QC PARAMETERS CHECK	DOR CAD-BIM Manager
OVER-THE-SHOULDER PROGRESS REVIEWS	All DOR Members

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SECTION J: TECHNOLOGICAL SOFTWARE & STANDARDS

1. ADVANCED MODELING AND CAD STANDARDS:

STANDARD	VERSION
CETAM DIM, Chapter 22 – Advanced Modeling	R 3.0 – JAN 2022
USACE Minimum Modeling Matrix (M3)	V 1.3 – SEP 2014
USACE BIM Template for Revit - Metric	V 3.4 – FEB 2019
USACE Civil Engineering Template for Civil 3D - Metric	V 3.3 – AUG 2018
USACE Advance Modeling BIM/CIM Object Standard	V 1.0 – MAR 2019
USACE ERDC/ITL TR 19-6 A/E/C Graphics Standard	R 2.1 – AUG 2019
USACE ERDC/ITL TR 19-7 A/E/C CAD Standard	R 6.1 – AUG 2019
USACE Standards A/E/C Symbols Guide	V 1.4 – AUG 2018

2. ADVANCED MODELING AND CAD STANDARDS EXCEPTIONS:

EXCEPTIONS	SUPERSEDES
AEC Level 1 Discipline or Level 2 Discipline Designators are allowed. If the sheet sequence number goes above 99 sheets for a particular discipline, the user might want to consider using the alphabetical Designators in the Discipline Designator to further divide the discipline. *(See Table 2-3 ERDC/ITL TR-19-7 A/E/C CAD Release 6.1)*	Section 22.k.3 (a) (i), TAM DIM Chapter 22
Drawing Titles & Elevation /Section Callouts The drawing title & callouts shall NOT use a combination alphabetic/numeric Drawing titles shall use the Revit automated parametric modeling tools when placing plans, elevations, sections, profiles, details, etc.	Section 22.K.10 (g) i & ii TAM DIM Chapter 22
Text Font Use of TT Arial Narrow font is ACCEPTABLE – Saves space on sheets	Section 22.k.10 (h) iii, TAM DIM Chapter 22

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SECTION K: MODEL ORGANIZATION

1. **TAM PROJECT CODE:** CC-123456

2. **SYMBOL DESIGNATORS & REVIT ABBREVIATION:**

TYPICAL

	GENERAL INFO	(GEIN)
-	SITE DESIGN	(SIDE)
$	STANDARD DETAILS	(STDE)

VARIABLE

A	FACILITY NAME	(ABBR)
B	FACILITY NAME	(ABBR)

3. **CAD-BIM SHEET FILE FORMAT:**

CIM - "CC-123456--CS199-xx.dgn/dwg/pdf"
BIM - "CC-123456S-AE199-xx.dgn/dwg/pdf"

4. **CIM (NON-REVIT) MODEL FILE FORMAT:**

CIM - "CC-123456--C-CS01BK-xx.dgn/dwg"

5. **BIM (REVIT) MODEL FILE FORMAT:**

Option A - BIM - "CC-123456S-DM-ABBR-xx.rvt" (all disciplines one model)
Option B - BIM - "CC-123456S-DM-SAI-ABBR-xx.rvt" (multi disciplines one model)
Option C - BIM - "CC-123456S-DM-E-ABBR-xx.rvt" (single discipline one model)

6. **BIM MINIMUM MODELING REQUIREMENTS:** Facility Data: (M3) V1.3 – SEP 2014

7. **CIM MINIMUM MODELING REQUIREMENTS:** Site Data: (M3) V1.3 – SEP 2014

8. **GIS MINIMUM MODELING REQUIREMENTS:** See (ER) 1110-1-8156

9. **WORKING UNITS & COORDINATE SYSTEM:** Meters / Millimeters & UTM

10. **PRESENTATION OF GRAPHICS (POG):** Entirety of Ch. 22, Advanced Modeling

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SECTION L: PROJECT DELIVERABLES

1. **GENERAL INFORMATION:** The use of BIM does NOT negate the need for delivery of CAD files used for the creation of the Construction Documents Drawings. See Section 22.I.1 for more information.

2. **OWNERSHIP AND RIGHTS IN DATA:** FAR Part 27, Section 00 72 00.

3. **BIM / CIM CONTENT:** Include the Facility/Site Data to include material definitions and attributes that are necessary for the Project facility design and construction and meet the requirements of Section K: Model Organization.

4. **DESIGN SOFTWARE:**

SUBMITTAL ITEMS	SUBMITTAL ACTIVITIES	SOFTWARE VERSIONS
BIM – Models	ALL	REVIT 2020
BIM – CAD File Extractions	FINAL	AUTOCAD 2018
3D Interference Checks	ALL	NAVISWORK 2018 / REVIT 2020
CIM – Models	ALL	CIVIL 3D 2018
CIM – CAD Files	ALL	AUTOCAD 2018
GIS – Map Files	ALL	ArcGIS v10.6.1
GIS – Geodatabase Files	ALL	SDSFIE v.4
PDF - Drawing Files	ALL	ACROBAT PRO DC / BLUEBEAM
XLS – List of Submitted Files	ALL	MS 365 EXCEL
WRD – PxP for each project	BEFORE PROJECT STARTS	MS 365 WORD

5. **SUBMITTAL REQUIREMENTS:** Provide submittals in compliance with the PxP deliverables. For each Submittal as set forth in Section I: Quality Control.

SECTION M: DESIGN COORDINATION MEETINGS

1. **GENERAL INFORMATION:** For support and meeting requests e-mail DLL-CETAM-DP-ET-CADD@usace.army.mil.

2. **REFERENCE:** TAM DIM Chapter 22, Section M.22.2

3. **PxP MEETINGS COMPLETION:** Refer to Section N. PxP Legacy Log

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SECTION N: PxP LEGACY LOG

Log all milestones and changes to the approved PxP below providing a description and page number of the change. Consult with the Advanced Modeling Manager or Approved Delegate to determine if a resubmittal of the PxP is required.

DATE	DESCRIPTION	PxP REFERENCE	TAM DIM REFERENCE
YYYY-MM-DD	PxP Request	Section: M.1	Chapter 22, Section 22.2.m.1
YYYY-MM-DD	PxP Created	Section: M.2	Chapter 22, Section 22.2.m.2
YYYY-MM-DD	PxP Kick-Off Meeting (WITHIN (45) DAYS OF REQUEST)	Section: M.3	Chapter 22, Section 22.2.m.3
YYYY-MM-DD	PxP Approved	Section: ALL	Chapter 22, Sections ALL
YYYY-MM-DD	PxP Demonstration (WITHIN (30) DAYS OF APPROVAL)	Section: M.4	Chapter 22, Section 22.2.m.4
YYYY-MM-DD	35% Design Submittal	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	65% Design Submittal	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	95% Design Submittal	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	100% Design Submittal	Sections: M.5 & 6	Chapter 22, Section 22.2.m.5 &6
YYYY-MM-DD	RFP Design Submittal Meeting	Section: M.7	Chapter 22, Section 22.2.m.7
YYYY-MM-DD	AM Submittal Meeting	Section: M.8	Chapter 22, Section 22.2.m.8
YYYY-MM-DD	Pre-AWARD Submittal Meeting	Section: M.9	Chapter 22, Section 22.2.m.9
YYYY-MM-DD	AWARD Submittal Meeting	Section: M.10	Chapter 22, Section 22.2.m.10
YYYY-MM-DD	COP Submittal Meeting	Section: M.11	Chapter 22, Section 22.2.m.11
YYYY-MM-DD	AS-BUILT Submittal Meeting	Section: M.12	Chapter 22, Section 22.2.m.12
YYYY-MM-DD	BLM Handover Meeting	Section: M.13	Chapter 22 Section 22.m.13

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22.4 ADVANCED MODELING PxP STANDARD OPERATING PROCEDURES (SOP)

TAM Creating New Projects

AdM SOP 22.4.1

TAM DIM CHAPTER 22 – JUN 2020

AdM SOP 22.4.1: TAM Creating New Projects

AdM SOP 22.4.1 is a step by step instructional guide detailing specific activities for the TAM Creating New Projects. The actions listed below in multiple roles with the PDT.

1. DM fills out request for PxP Initial (PxP-I) Meeting from AdM Support Team. See TAM DIM Chapter 22 Section 22.3.m.2.

2. Upon receipt of information the AdM Support Team shall;

    a. Review the information for completeness.
    b. Schedule & host telephonic meeting with the DM.
    c. Prepare PxP word document for project PxP Kick-Off (PxP-KO) Meeting.
    d. Set-up ProjectWise (PW) project folder on TAM Winchester server.
    e. Review PxP in full with PDT, answer questions, gain approval and schedule PxP Demonstration (PxP-Demo) Meeting.

3. Upon PxP approval the PDT shall;

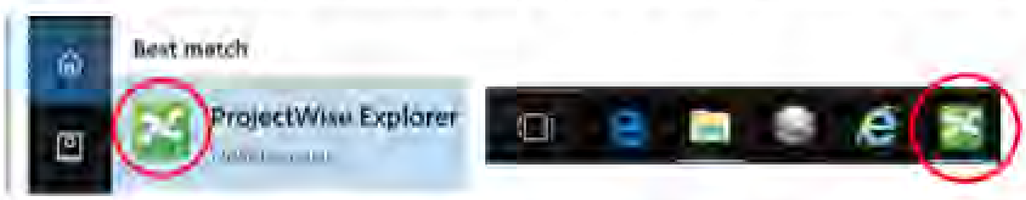
    a. Create & populate Revit or Civil 3D models and CAD 2D sheets.
    b. Attend PxP-Demo meeting and provide 2D PDF drawing sheet for review.
    c. Not work in design files until PDT receives "**100%**" GO rating.

****

1. Opening ProjectWise Explorer (PDT)

    a. Type "ProjectWise Explorer" in the search bar.

    b. The Double click on ProjectWise icon, or open directly from desktop shortcut.



    c. Congratulations!!! THE JOURNEY BEGINS ☺

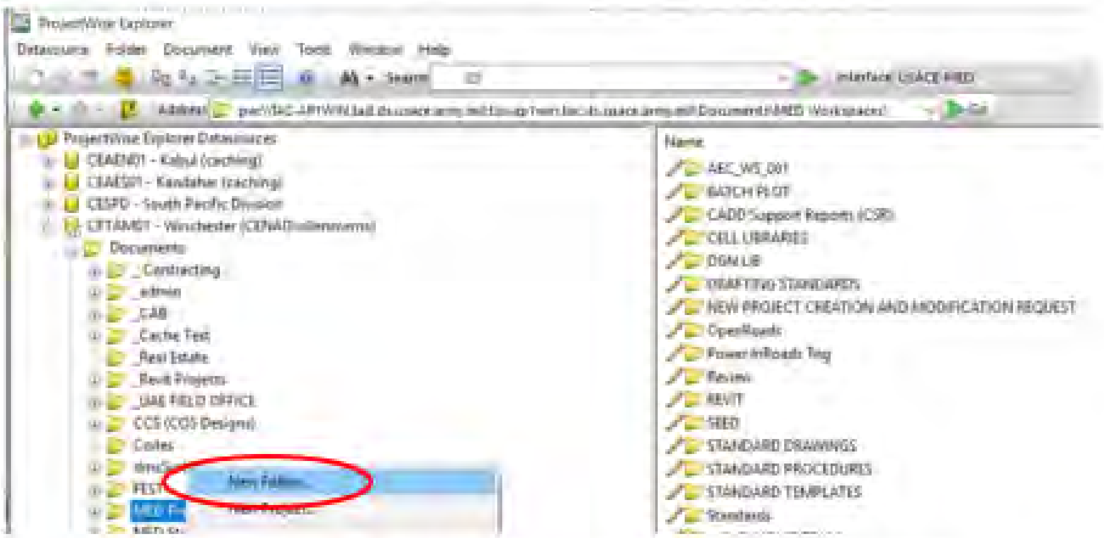
AdM SOP 22.4.1: TAM Creating New Projects

2. <u>Create New Country Folder</u> **(AdM PW Administrator ONLY)**

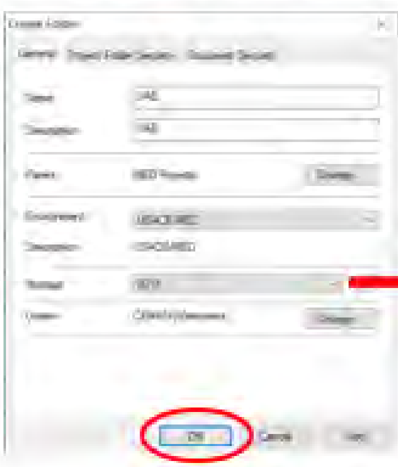
   a. Select ProjectWise Explorer Datasource “CETAM01 – Winchester”

   b. Select folder “Documents”

   c. Right click on “MED Projects” and select “New Folder”.



   d. Use Country Name for folder Name and Description*. Click “OK”



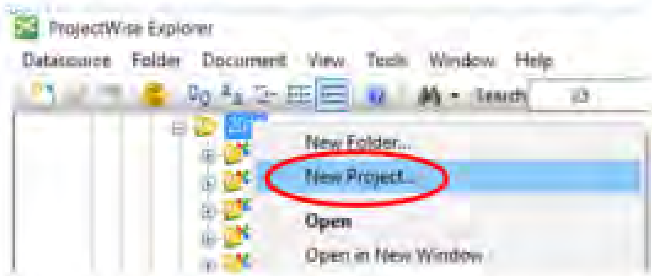
<u>Note:</u> Storage should show 2018 or 02 – MED Projects.

Note 1: If your Country already exists, you should skip to the next step.

AdM SOP 22.4.1: TAM Creating New Projects

3. <u>Create New Project Folder in ProjectWise</u> **(AdM PW Administrator ONLY)**

   a. Select Country Folder, then Year folder, the right click "New Project".



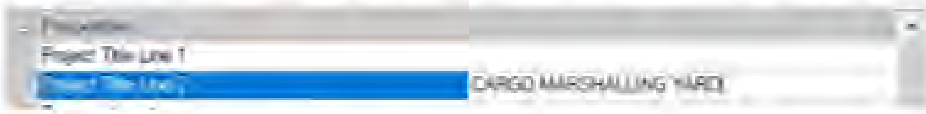
   b. Click "Next" and select "AEC WorksetMetric_Example" drop down list.

   c. Click "Next". Use the COUNTRY CODE and P2 NUMBER to name the project. Use the PROJECT TITLE to name the Description.

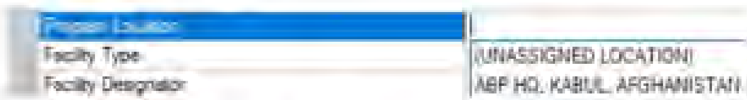
   d. Click "Next".

AdM SOP 22.4.1: TAM Creating New Projects

e. Fill out the Project Titles. If you only have one title then only use Title Line 2



f. Pick a Location from the drop down list. If your location is not present, then leave the field blank.



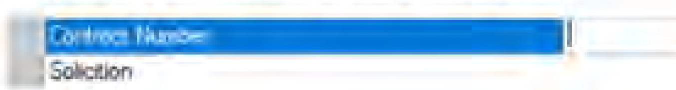
g. Leave Facility Type & Facility Designator Blank.

h. Use the current day's date for Project Create Date.

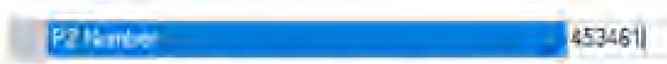
i. Select DOR Firm or NONE from drop-down menu.

j. Provide Project Number.

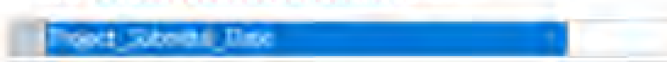
k. Leave Contract Number & Solicitation Blank.



l. Provide P2 Number.



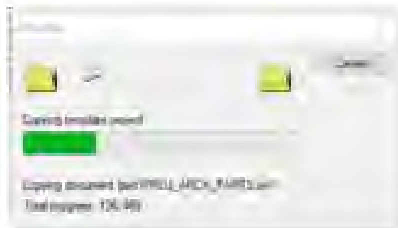
m. Leave Project_Submittal_Date Blank.



AdM SOP 22.4.1: TAM Creating New Projects

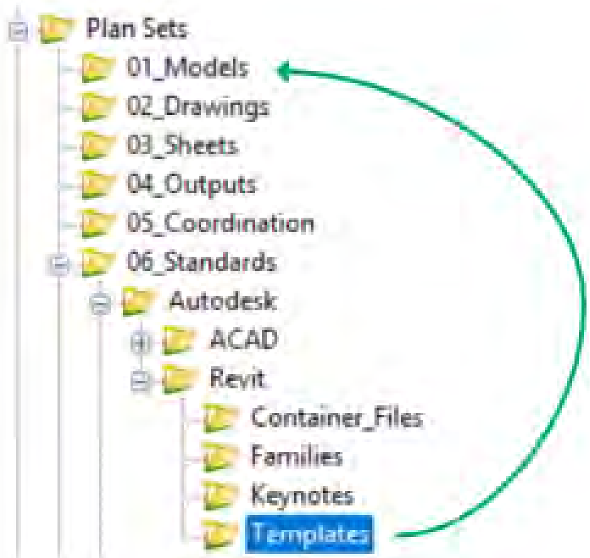
n. Click "Next" 3 Times.

o. Project Creation Wizard will begins, when finished click "OK".



4. Create Revit model for New Project **(PDT)**

a. With PW open, search for Revit template at;



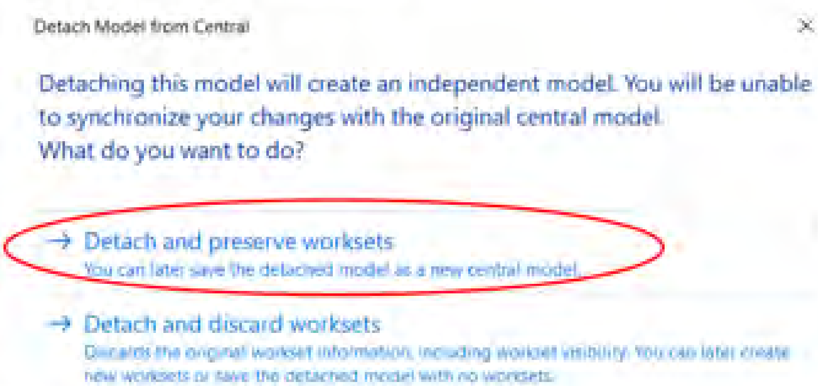
b. Copy discipline specific Revit template into 01_Models subfolder.

c. Select icon from desktop shortcut.

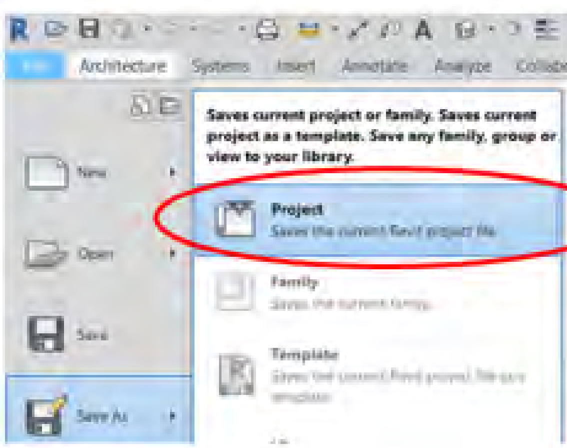
AdM SOP 22.4.1: TAM Creating New Projects

d. A screen similar to this will appear. Double click on "Projects/Open".

e. "Detach and preserve worksets".



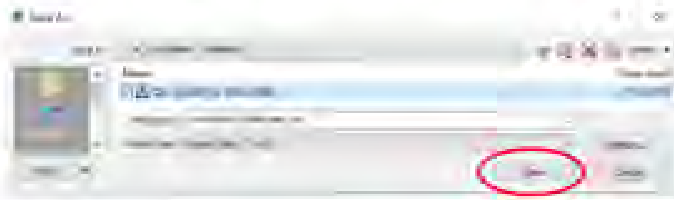
f. Once open, select "File/Save As/Project".



AdM SOP 22.4.1: TAM Creating New Projects

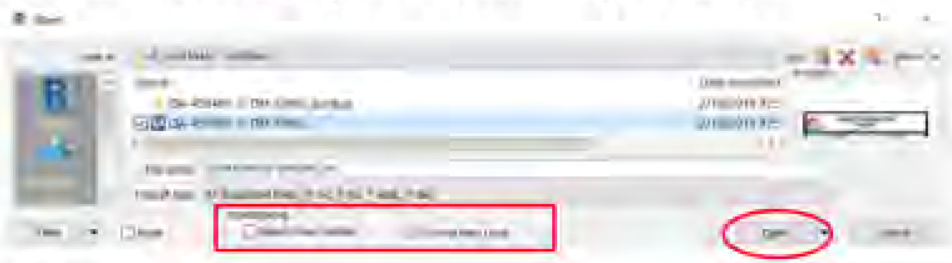
g. Select model, rename as directed in Section K of the PxP.

h. Click "Save", "Yes" and immediately close file when opened.



5. Create New Local Copy (PDT)

   a. Double click on "Projects/Open" and select renamed model. "Create New Local" box in Worksharing should automatically be checked.

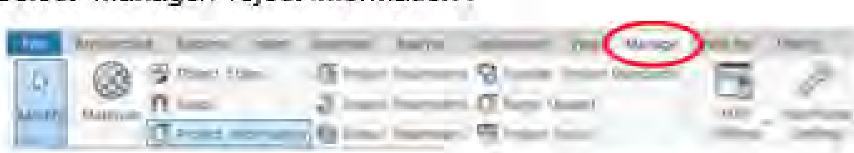
   b. Select "Open".

   Note 1: N0 Name appears after model name, showing this is local copy.

6. Edit Revit model Project Information (PDT)

   a. Select "Manage/Project Information".

   b. Edit Project Information in accordance with (IAW) the specific PxP information to populate the information located in the titleblock.

AdM SOP 22.4.1: TAM Creating New Projects

7. Edit the Titleblock Schedule (PDT)

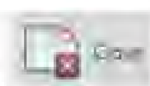
   a. Project Browser should automatically open on the left side of the screen. Select Drawing Index Schedule in Project Browser.

   b. If not, select "View/User Interface/Project Browser".

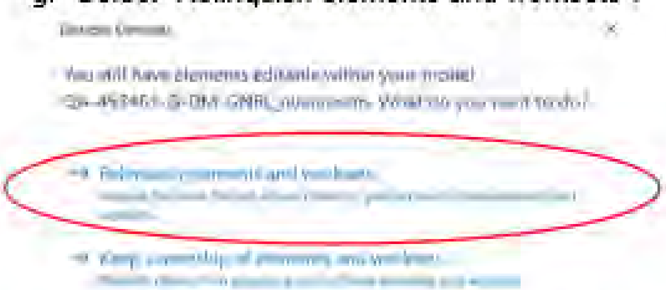
   c. Select Drawing Index Schedule in Project Browser.

   d. Update columns IAW specific PxP information. See TAM DIM Jun 2020, Chapter 22 Advanced Modeling, Section 22.2.k.6 for more information.

   e. Upon completion of updates, select Synchronize symbol or "Synchronize Now" text.

   f. Click "Save" icon, , then select "Big R", , and "Close". 

   g. Select "Relinquish elements and worksets".



   h. File will close. Revit Main screen will appear.

AdM SOP 22.4.1: TAM Creating New Projects

8. Manage Revit Model Links (PDT)

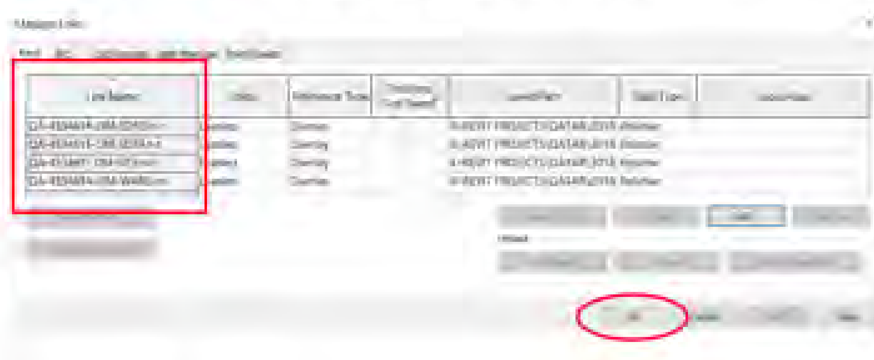
   a. You must be in the 3D view to add Revit Model. Select the "Dog House" icon. The Default 3D View will open.

   b. Select "Manage/Manage Links".

   c. The "Manage Links" dialog box will open. Select "Add" and "OK".

   d. Browse folders to attach Revit model, then select "Open".

   e. Link will be added. Repeat until all Revit models are linked. Repeat until all Revit models are linked. Click "OK" when finished.



TAM Navigating ProjectWise

AdM SOP 22.4.2

TAM DIM CHAPTER 22 –
JUN 2020

AdM SOP 22.4.2: TAM Navigating ProjectWise

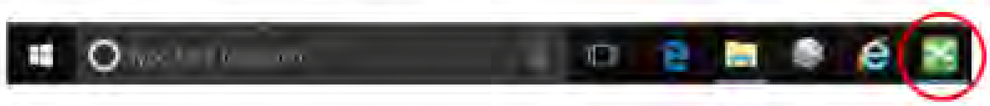
AdM SOP 22.4.2 is a step by step instructional guide detailing specific activities for the TAM Navigating ProjectWise. This SOP is provided to aid the PDT member while working with files on the PW server.

1. Opening ProjectWise Explorer

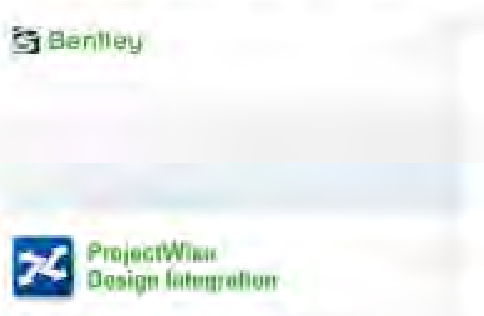
   a. Type "ProjectWise Explorer" in the search bar.

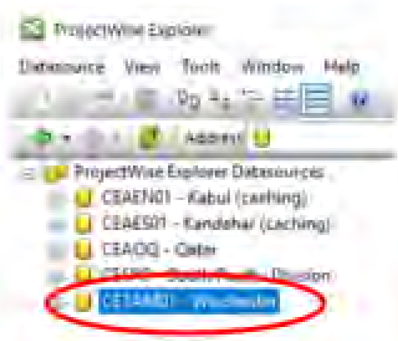
   b. The Double click on ProjectWise icon.

   c. Then save as "Desktop shortcut".



   d. To open program click on ProjectWise icon. These screens will appear:

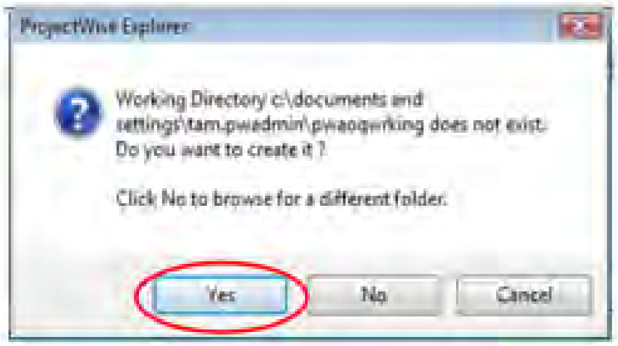




   e. Click Datasource: "CETAM01 – Winchester"

AdM SOP 22.4.2: TAM Navigating ProjectWise

f. The first time opening ProjectWise Explorer, select "YES" to creating a working folder.



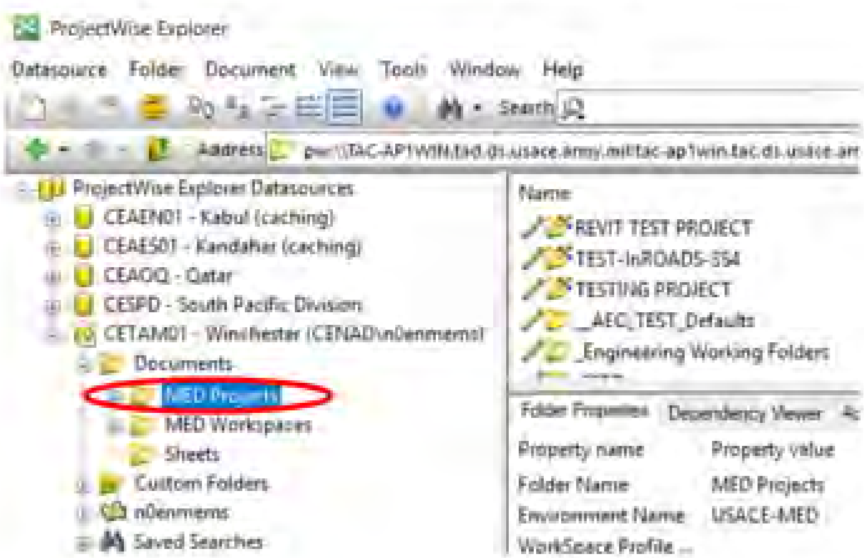
Note 1: The working folder lives on the hard drive of your computer.

Note 2: The speed of ProjectWise comes from the ability to push up ONLY changes made when editing checked out file.

2. Locating Projects

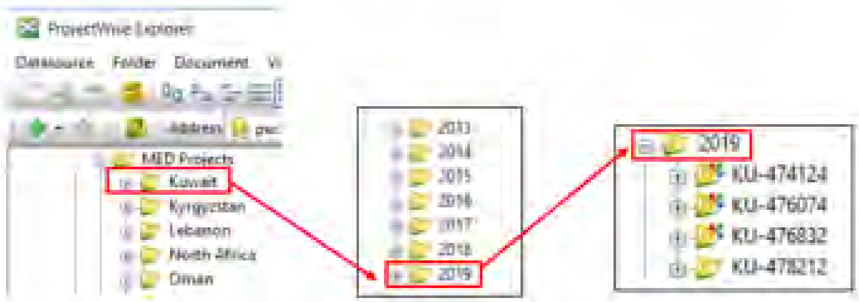
a. In ProjectWise Explorer, select Datasource: "CETAM01 – Winchester".

b. Then open subfolders "Documents/MED Projects"



AdM SOP 22.4.2: TAM Navigating ProjectWise

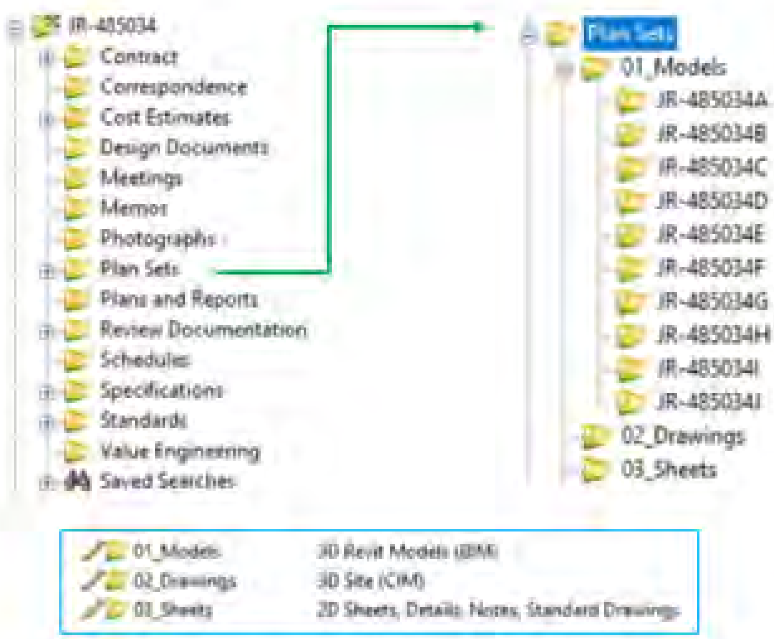
c. From MED Projects browse folders "Country/Year/Project Number" to locate the project.



d. Parent project folder is divided by multiple subfolders.

e. Child folder for Plan Sets contains 01_Model, 02_Drawings and 03_Sheets.

f. Step-child folders house individual facility, site design and standard facility details and notes the all AdM Files.



Note 1: Contact the TAM ProjectWise Systems Administrator for access control permissions.

AdM SOP 22.4.2: TAM Navigating ProjectWise

3. Opening a File in ProjectWise

   a. A file that displays a "Pencil" icon means it is available to be checked out.

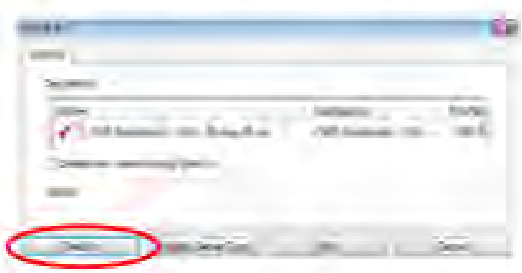
   b. Double click on the file.

   c. A file that is open displays a "Check" icon. The file is copied to your local C: drive.

   d. Others will see the file is checked out when a "Padlock" symbol is shown.

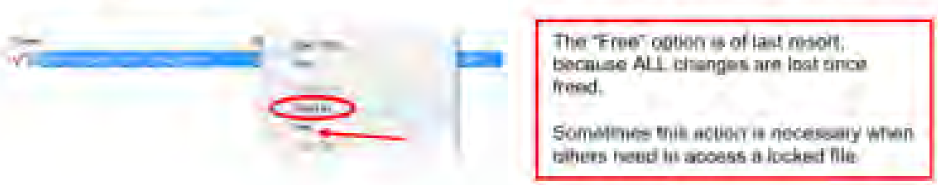
4. Closing a File in ProjectWise

   a. Upon closing your document a "Check In" dialog box will appear.



   b. When you click "Check In" your file is copied back to ProjectWise server.

   c. Manual "Check In" is also available. Right click and select "Check In".



AdM SOP 22.4.2: TAM Navigating ProjectWise

5. Deleting Files in ProjectWise

   a. File retrieval is a cumbersome task, **TAM Users WILL NOT have rights to delete files**.

   b. Instead "Rename" the file and add the text "DELETE" to the filename.

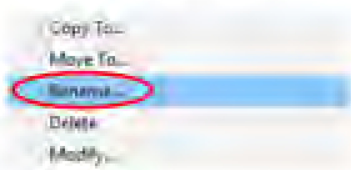
   c. Periodically files with the word "DELETE" are removed by a mass collection process.

6. Renaming Files in ProjectWise

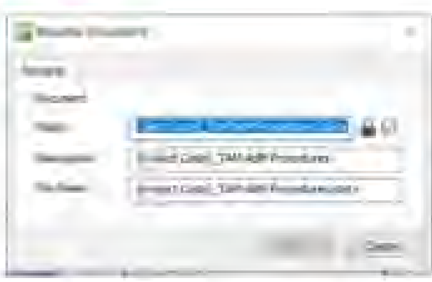
   a. Right click on file. 

   Select "Rename".

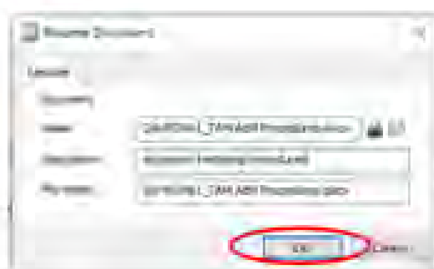
   b. When finished, select "OK". 



BEFORE



AFTER

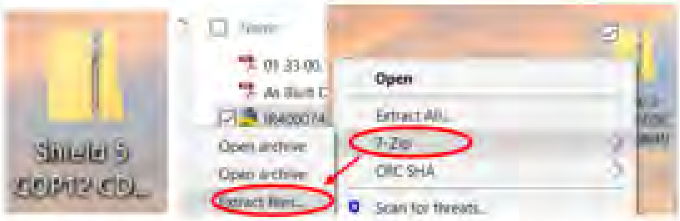


7. Uploading Files into ProjectWise

   a. ProjectWise holds a variety of file extensions, however "Zipped" folders uploaded in ProjectWise CANNOT be opened. ALWAYS Unzip folders before loading.

AdM SOP 22.4.2: TAM Navigating ProjectWise

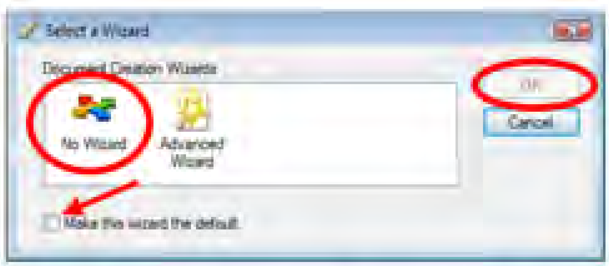
b. To unzip, right click on zipped folder, select “7-Zip/Extract files”.



c. The Extract” dialog box will appear. Click “OK”.

d. The folder will unzip at the same location of the zipped folder.

e. Locate the files on your desktop and “Drag and drop” into folders in ProjectWise.



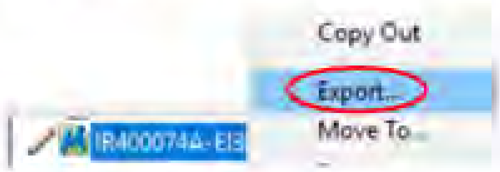
Note 1: If prompted, select “No Wizard” and this prompt won’t appear again.

f. Files will transfer into ProjectWise.

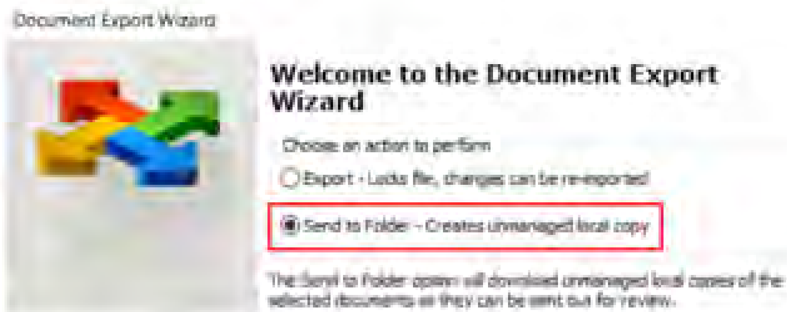
AdM SOP 22.4.2: TAM Navigating ProjectWise

8. Exporting Files out of ProjectWise

   a. Right click on folder or file, select "Export".

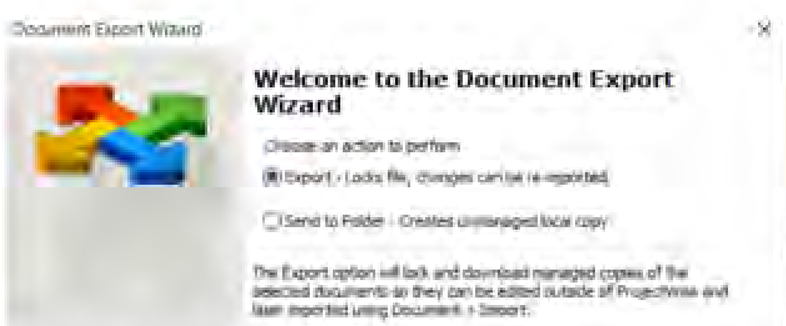


   b. The "Document Export Wizard" dialog box will appear. Select "Send to Folder".



Note 1: Unmanaged local copies will not be linked to ProjectWise.

Note 2: The other option "Export" is useful when you are working outside of ProjectWise and are making changes the file. However, while the file is checked out it cannot be accessed by others. **The "Send to Folder" option is preferred.**

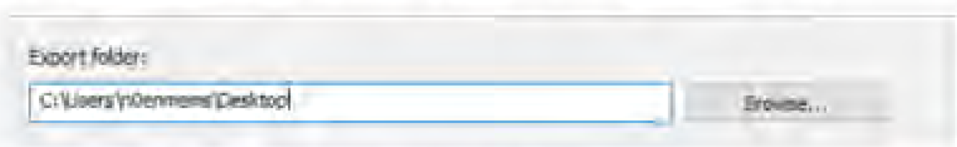


Note 3: Managed copy will lock file in ProjectWise until imported back into ProjectWise

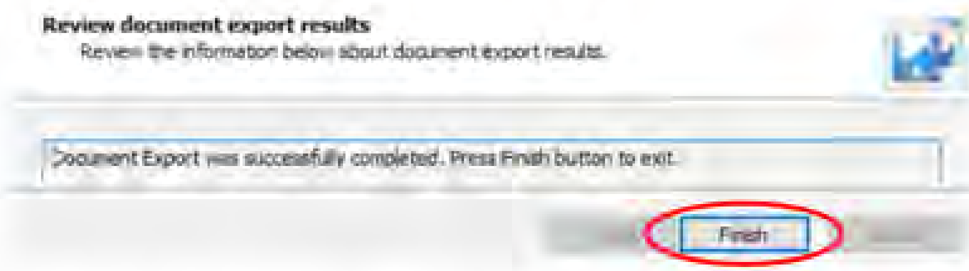
AdM SOP 22.4.2: TAM Navigating ProjectWise

Note 4: Decide which option is best for you, then click "Next".

c. Browse to the location you wish to send the file, then click "Next.



d. Transfer will begin, when done select "Finish".



9. Emailing Links to Files in ProjectWise

a. Right click on word document.

b. Select "Send To/Mail Recipient As Link"

c. Microsoft Outlook will automatically open.

d. Before sending, select "FORMAT TEXT". Verify "Aa HTML"

e. Populate Subject Line, To, Cc & Bcc., then click "Send."

AdM SOP 22.4.2: TAM Navigating ProjectWise

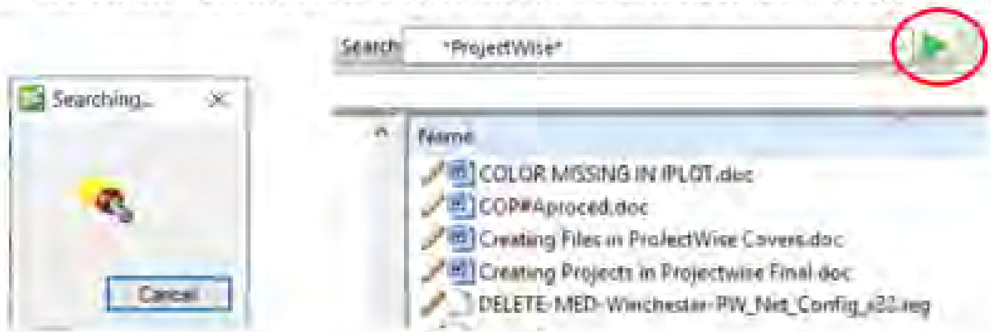
10. Searching Files in ProjectWise

a. Locate the folder you want to look in and type "search word" in the search bar window.

b. Use "Asterisk Wildcards" before and after Subject word.

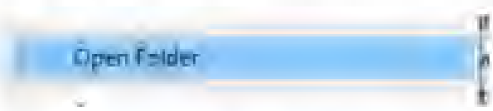
IE; if the subject word is "ProjectWise", then type "*ProjectWise*" in "Search" bar.

c. Select the "Green Arrow" icon to the right and the search will begin.



Note 1: "ProjectWise" search results will include file names showing "ProjectWise" and if the word was found within the actual file. This a very powerful search engine tool.

d. To locate the search results folder location, right click file and select "Open folder.



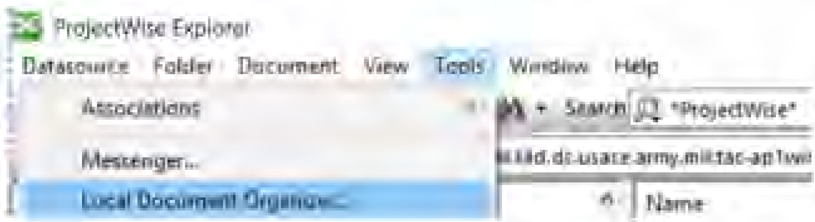
Scroll down to find selection.

e. Active location will open where the file is located.

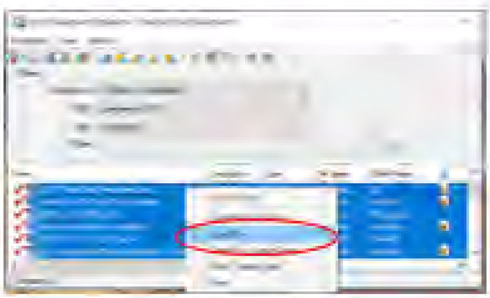
AdM SOP 22.4.2: TAM Navigating ProjectWise

11. <u>Locating if you have checked out Documents in ProjectWise</u>

a. Go to "Tools" and select "Local Document Organizer"



b. There are (21) files shown to be currently checked out. If not checked in properly, this work could be lost if it was necessary to "Free" the files.



c. To check back in, highlight ALL of the files, select "Check In" and "OK".

d. When the dialog display box is empty, all files have been checked back in properly.

Note: A good time to run this check is before heading out for the day, the weekend or when you are expecting extended leaves of absence. Be smart, save your work. ☺

TAM Request for Proposal Preparation

AdM SOP 22.4.3

TAM DIM CHAPTER 22 – JUN 2020

AdM SOP 22.4.3: TAM Request for Proposal Preparation

AdM SOP 22.4.3 is a step by step instructional guide detailing specific activities for the TAM Request for Proposal (RFP) Preparation.

1. DM fills out request for RFP Meeting from AdM Support Team. See TAM DIM Chapter 22 Section 22.3.m.7.
2. AdM Support Team contacts Specification Project Delivery Team (PDT) member to obtain the Solicitation number from the Contracting Officer (KO).
3. AdM Support Team hosts RFP Meeting.
    a. Update ADM PxP Section M.7. Fill all red areas.
    b. Email updated AdM PxP to DLL-CETAM-DP-E@usace.army.mil
4. Following the meeting PDT design members shall:
    a. Delete, unlink, or detach any unused information, models or files.
    b. Update status field to "**CONTRACT DOCUMENTS COMPLETE**".
    c. Update solicitation field in management block area of the titleblock with solicitation number in their respective AdM files.
    d. Verify Indices spreadsheet correctly populated.
    e. Create new RFP PDF's.
    f. Upload PDF's into ProjectWise (PW) and notify Design Manager (DM) when complete.
5. Following the meeting DM shall:
    a. DM will notify Technical Service (TS) when drawings are ready for package assembly.
6. Following the meeting TS shall:
    a. TS will process deliverables in accordance with (IAW) TAM DIM Chapter 22 Section 22.3.l.5

AdM SOP 22.4.3: TAM Request for Proposal Preparation

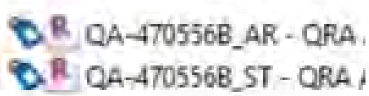
b. Upon completion TS will notify Specification PDT member to confirm drawings are ready.

c. Specification PDT member will send the final e-mail with the PW link to the KO when ALL solicitation pdf files are ready.

d. Specification PDT member will place a copy of this e-mail is placed in the "TAM INTERNAL USE ONLY" subfolder.

Figure 22.4.3-1: Typical TAM RFP Cover Sheet

e. Lock ALL files in PW by selecting Change State/Set Final Status.



f. Update your timesheet.

g. Take a break, you've earned it. ☺

TAM Amendment Preparation

AdM SOP 22.4.4

TAM DIM CHAPTER 22 –
JUN 2020

AdM SOP 22.4.4: TAM Amendment Preparation

AdM SOP 22.4.4 is a step by step instructional guide detailing specific activities for the TAM Amendment (AM) Preparation. (Note: Images may not reflect actual views. Refer to specific PxP for more information.)

1. DM fills out request for AM Meeting from AdM Support Team. See TAM DIM Chapter 22 Section 22.3.m.8.

2. AdM Support Team contacts Specification Project Delivery Team (PDT) member to obtain the AM number from the Contracting Officer (KO).

3. AdM Support Team hosts AM Meeting.

    a. Update ADM PxP Section M.7. Fill all red areas.

    b. Email updated AdM PxP to DLL-CETAM-DP-E@usace.army.mil

4. Following the AM meeting PDT shall:

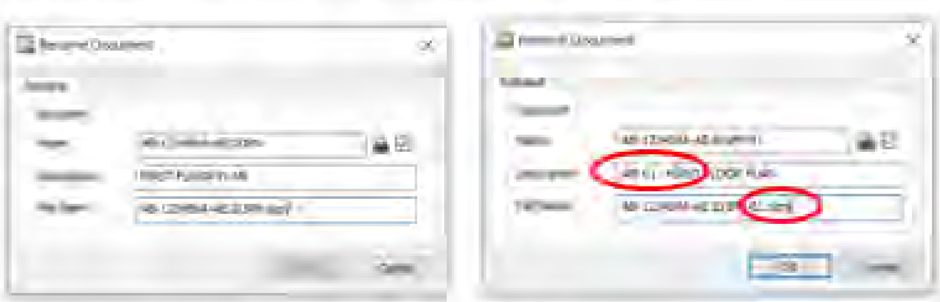
    a. Identify AdM Files to be amended.

    b. Notify Technical Services (TS) to unlock files.

    c. TS will archive a copy of the existing AdM file. 

    d. Rename original file to match current AM information by right-clicking on file and selecting 

Figure 22.4.4-1: AM File Naming Before & After

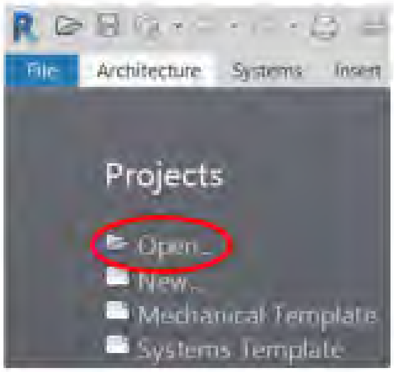


    e. Rename all ProjectWise (PW) property fields.

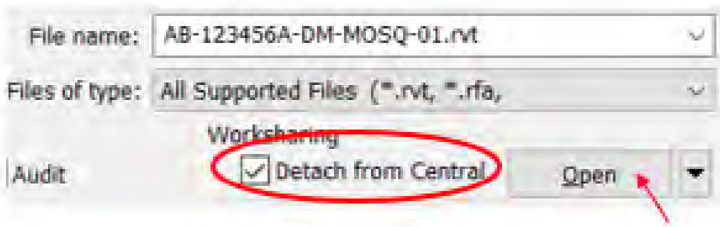
AdM SOP 22.4.4: TAM Amendment Preparation

f. Open Revit program, by double clicking on the desktop icon

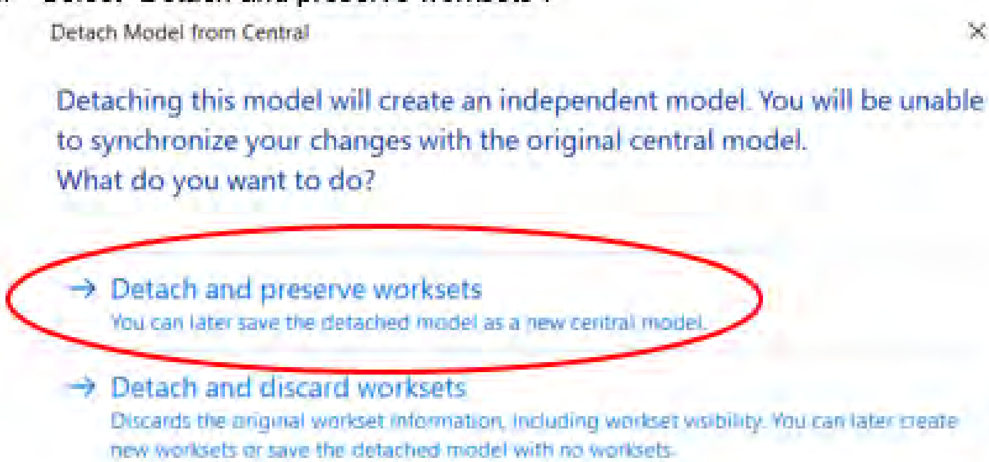
g. Open all Revit projects from by selecting File dialog box. Click Open.



h. Scroll to model location, select Revit model, click Detach from Central and then click Open.

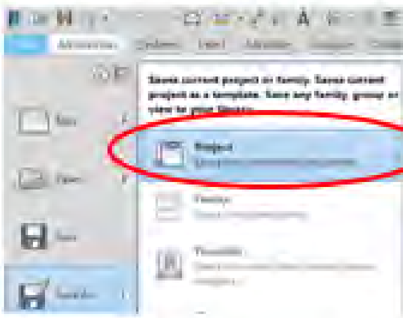


i. Select "Detach and preserve worksets".

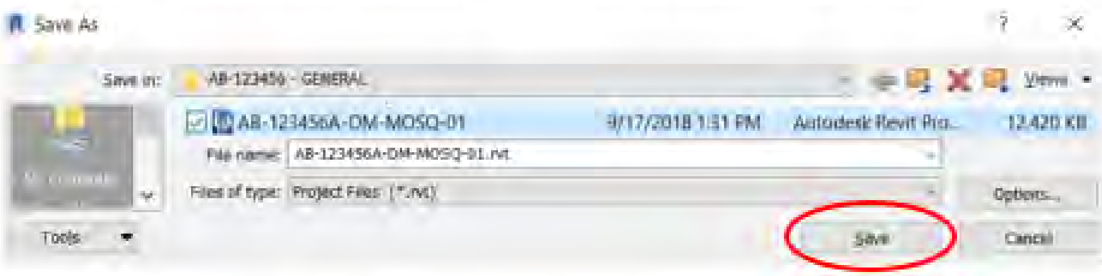


AdM SOP 22.4.4: TAM Amendment Preparation

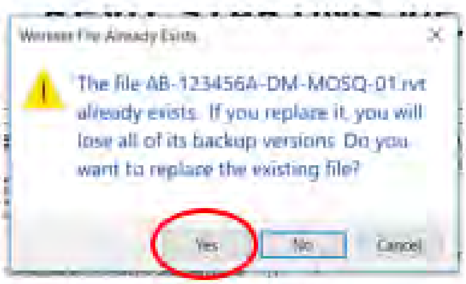
j. Once open, select File/Save As/Project.



k. Select model renamed with amendment number, then save.



l. Select Yes.



m. Synchronize file, then Close file. Select File/Close.

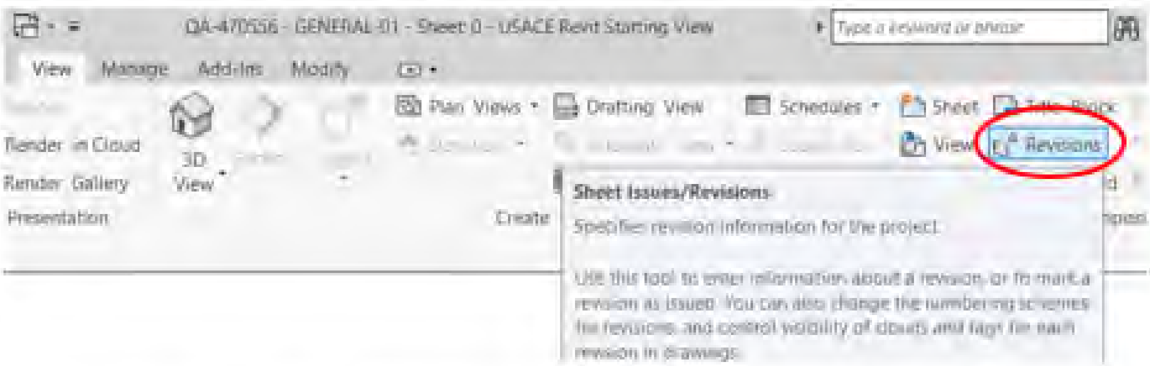
n. Repeat process for ALL Revit Models affected by Amendment.

o. Once all Models renamed go to Manage Links and update links.

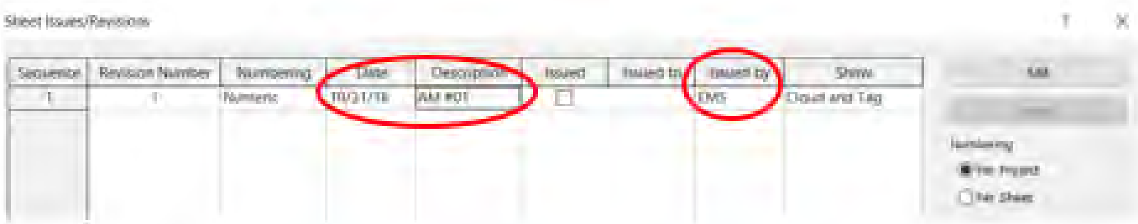
p. Update AdM files for AM information.

AdM SOP 22.4.4: TAM Amendment Preparation

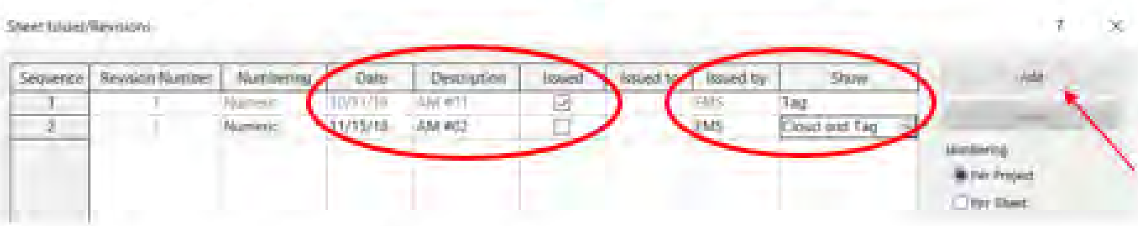
q. Select View/Revisions.



r. The first AM already has an issue line provided. Edit Date, Description & Issued By.



s. For subsequent Amendments, select Add, check the AM#01 Issued box, change the Show column to Tag & edit as instructed above.

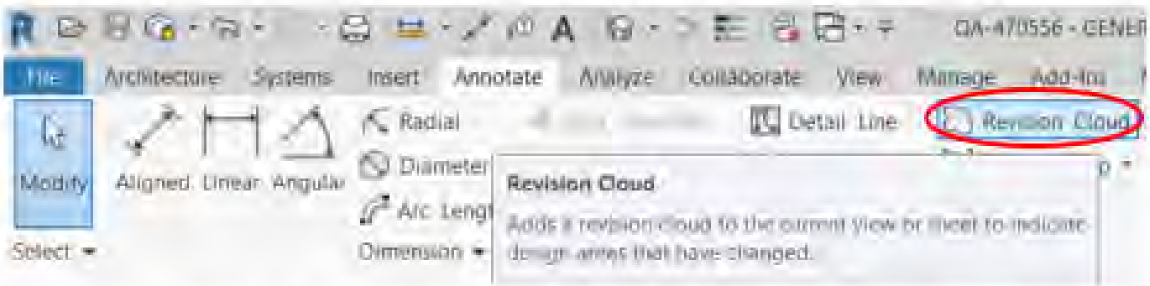


t. Select Apply & OK when finished.

u. Add revision clouds and delta symbols.

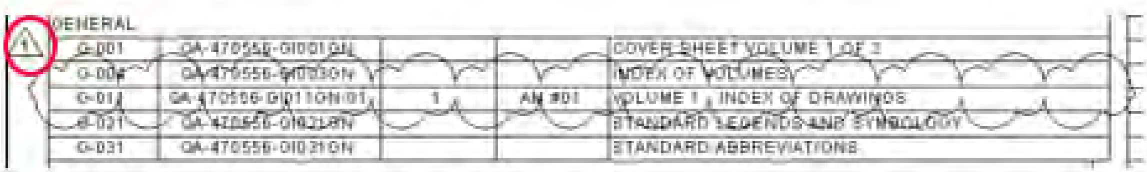
AdM SOP 22.4.4: TAM Amendment Preparation

v. Open sheet to be modified and select Annotate/Revision Cloud.

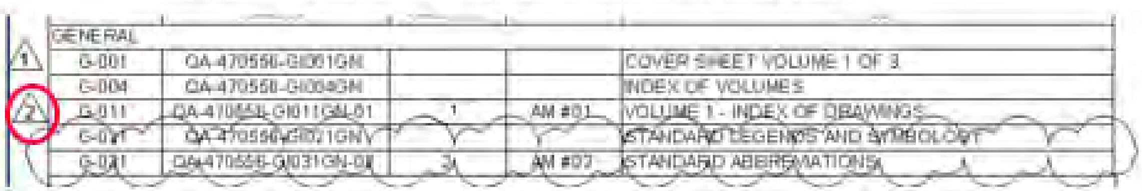


w. First, cloud changes on the sheet, then select green check at Mode.

x. Second, attach delta symbol. Select Annotate/Tag by Category. (Turn-off Leader)



y. For subsequent Amendments, Cloud ONLY the current amendment, but continue to show all previous amendment delta triangles.



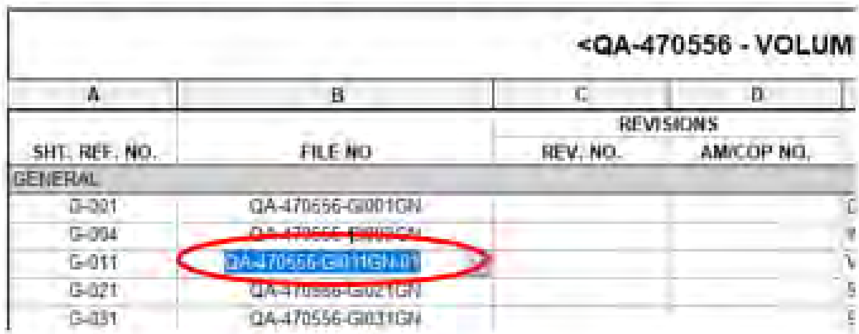
z. Issue block will automatically populate. Do not cloud issue block.

AdM SOP 22.4.4: TAM Amendment Preparation

aa. Update titleblock information schedule.

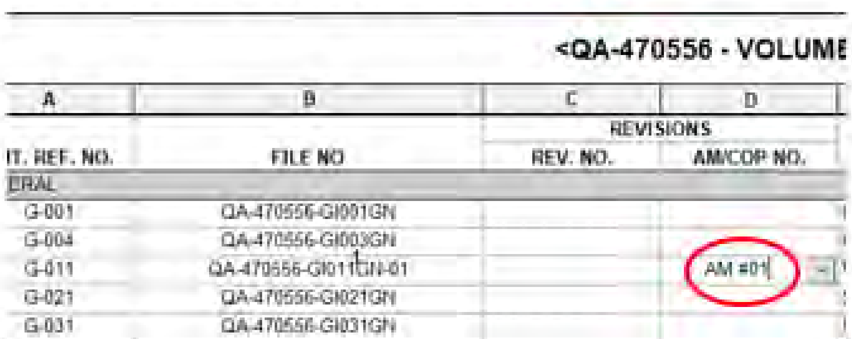
bb. Go to Project Browser, then double-click on appropriate schedule.

cc. Highlight File No. then add Amendment number.



*(FILE NO. in sheet titleblock will automatically update.)

dd. Update the AM/COP No. column with AM000#.

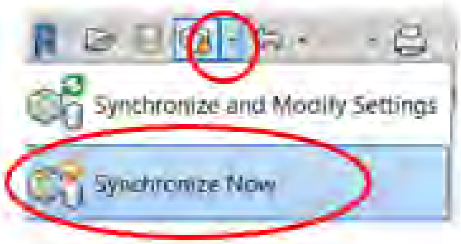


ee. Change status field to "**AMENDMENT 0001**".

ff. Repeat steps for ALL amended sheets within model.

AdM SOP 22.4.4: TAM Amendment Preparation

gg. Upon completion of updates, select Synchronize Now symbol or text.



hh. Open ALL other Revit models and repeat process.

5. After the Amendment has been issued TS shall;

    a. Lock ALL files in PW by selecting Change State/Set Final Status.

    b. Update your timesheet & take a break, you've earned it. ☺

TAM Project Awarded Preparation

AdM SOP 22.4.5

TAM DIM CHAPTER 22 – JUN 2020

AdM SOP 22.4.5_TAM Project Award Preparation

AdM SOP 22.4.5 is a step by step instructional guide detailing specific activities for the TAM Project Award Preparation. (Note: Images may not reflect actual views. Refer to specific PxP for more information.)

A. Preparation of Award AdM files to Award Winning Contractor

1. After the project is awarded, the Contracting Officer (KO) sends a district wide e-mail called the Notice of Task Order Award.

    Figure 22.4.5-1: KO Notice of Task Award

    Notice of Task Order Award - KMOD HQ A/E 35% Design - W912ER18F0003 (UNCLASSIFIED)

    CLASSIFICATION: UNCLASSIFIED

    THE FOLLOWING TASK ORDER WAS AWARDED ON: 24 October 2018

    PROJECT TITLE: Kuwait Ministry of Defense Headquarters (KMOD-HQ) A/E 35% Design, Task Order 03

    CONTRACT NUMBER: [illegible]

    TASK ORDER NUMBER: [illegible]

    PERIOD OF PERFORMANCE: 24 October 2018 - 10 June 2019

    TOTAL AWARD VALUE: [redacted]

    CONTRACTOR: [illegible] Project Management (MPM)

    CONTRACT SPECIALIST AND CONTACT #: [illegible]

    CONTRACTING OFFICER AND CONTACT #: [illegible]

    PROJECT MANAGER AND CONTACT #: [illegible]

2. Upon notification the DM fills out request for Award Meeting from AdM Support Team. See TAM DIM Chapter 22 Section 22.3.m.9.

3. AdM Support Team contacts Specification Project Delivery Team (PDT) member to obtain the contract number from the Contracting Officer (KO).

4. AdM Support Team hosts AM Meeting.

    a. Update ADM PxP Section M.7. Fill all red areas.

    b. Email updated AdM PxP to DLL-CETAM-DP-E@usace.army.mil

AdM SOP 22.4.5_TAM Project Award Preparation

5. Following the AM meeting PDT shall:

   a. "Clean" AdM files by removing ALL Amendment (AM) revision clouds and delta symbol information.

   b. Locate the all subfolders project ADM Drawings folder on the TAM ProjectWise (PW) server and search for the Revit models with the latest Amendment number.

   c. Rename the Revit models by adding "-AWD" to the end of Revit model name.

   d. Create new Award models. Follow steps as listed in SOP 22.4.4.

   e. Open newly created AWD Revit model to remove Amendment Properties.

   f. Select View/Revisions.

   g. Remove ALL amendment information, by first unchecking all the Issued boxes, then highlighting each line, then selecting Delete. Select OK when dialog box appears, repeat process for each line.

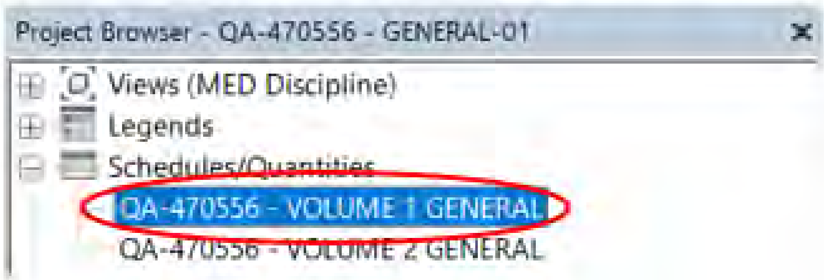
   h. Sequence line 1 cannot be deleted. Null out columns. Change Show & Numbering to None. Select Apply & OK when finished.

AdM SOP 22.4.5_TAM Project Award Preparation

i. All amendment delta triangles, issue block information and cloud symbology should be removed from the sheets.

j. Remove Amendment number & Revision text from Index.

k. Go to Project Browser, then double-click on appropriate schedule.



l. Remove Amendment number from File No. & Revisions columns

SHT. REF. NO.	FILE NO	REVISIONS	
		REV. NO.	AM/COP NO.
GENERAL			
G-001	QA-470556-GI001GN-04		AM #04
G-004	QA-470556-GI004GN		
G-011	QA-470556-GI011GN-04		AM #04
G-021	QA-470556-GI021GN		
G-031	QA-470556-GI031GN-03		AM #03

*(FILE NO. in sheet titleblock will automatically update.)

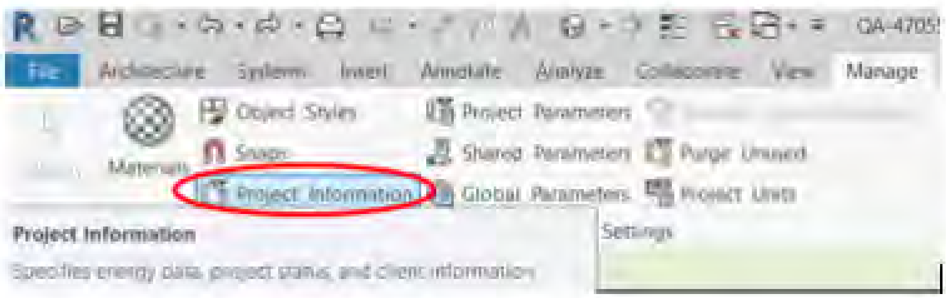
m. This is what a "cleaned" Index Schedule would look like.

SHT. REF. NO.	FILE NO	REVISIONS	
		REV. NO.	AM/COP NO.
GENERAL			
G-001	QA-470556-GI001GN		
G-004	QA-470556-GI004GN		
G-011	QA-470556-GI011GN		
G-021	QA-470556-GI021GN		
G-031	QA-470556-GI031GN		

AdM SOP 22.4.5_TAM Project Award Preparation

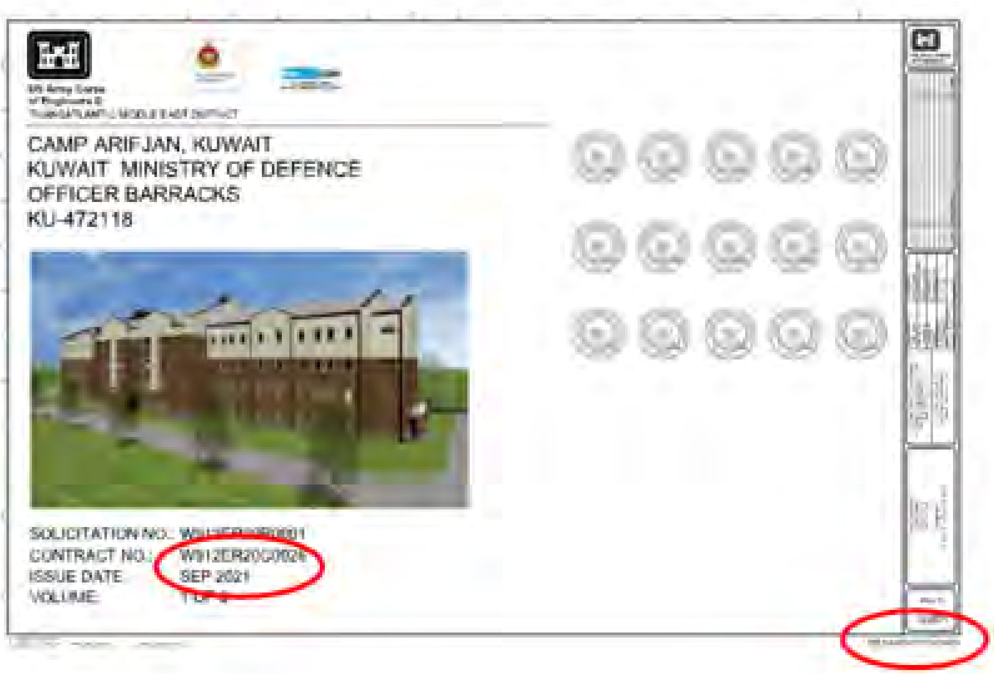
n. Add Award Contract Number.

o. Select Manage/Project Information.



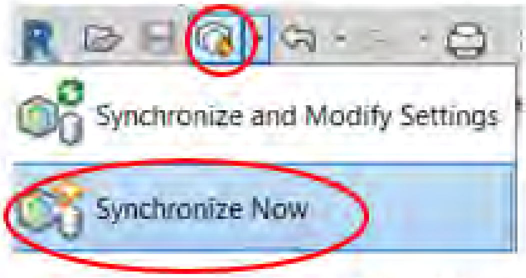
p. Keep Solicitation number, add contract number, and updated status field to "RELEASED FOR AWARD", & issue date to month year awarded.

Figure 22.4.5-1: Typical TAM AWARD Cover Sheet



AdM SOP 22.4.5_TAM Project Award Preparation

q. Upon completion of updates, select Synchronize Now symbol or text.



r. Repeat until all models are "cleaned" up.

s. Update Indices spreadsheet and remove references to Amendment (AM).

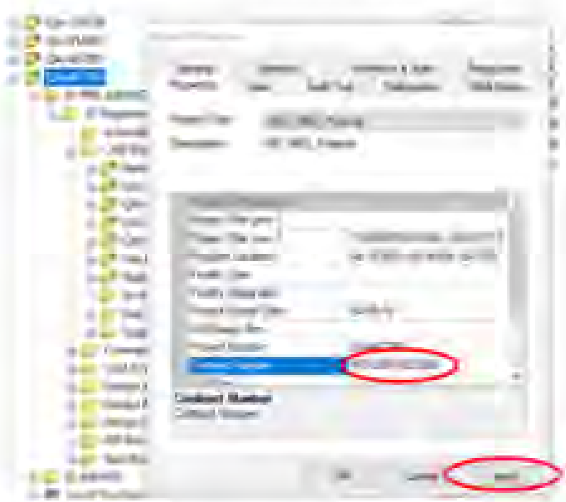
t. Create new Award PDF's.

u. Upload PDF's into ProjectWise (PW) and notify Design Manager (DM) when complete.

v. DM will notify Technical Service (TS) when drawings are ready for Award package assembly.

w. TS will process deliverables in accordance with (IAW) TAM DIM Chapter 22 Section 22.3.I.5

x. TS will update ProjectWise (PW) project properties fields.



AdM SOP 22.4.5_TAM Project Award Preparation

y. TS will delete unused PW folders.

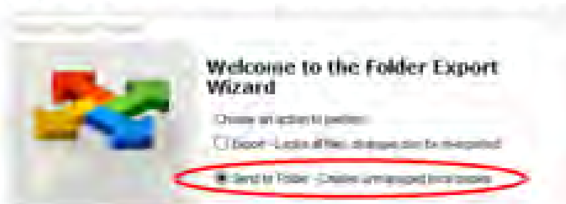
z. TS will lock ALL AdM files.

aa. Contracting Officer (KO) send ADM Files to Award Winning Contractor (AWC) within (45) days contract award.

bb. KO will export the AdM files from PW;

i. By right-clicking on "AdM Drawings",
ii. Selecting Export,
iii. Checking "Send to folder",

Figure 22.4.5-2: PW Folder Export Wizard



iv. Clicking "Next",

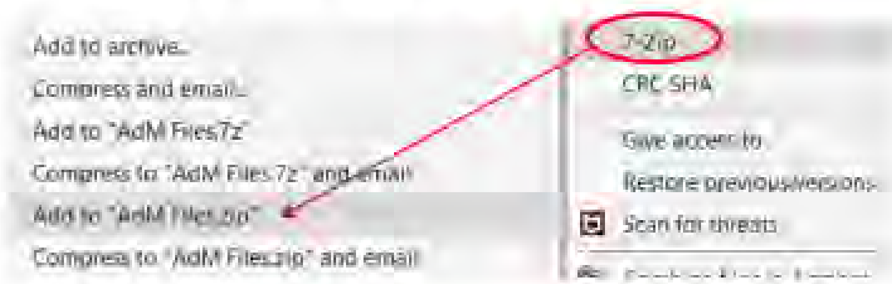
Figure 22.4.5-3: PW Export Settings

AdM SOP 22.4.5_TAM Project Award Preparation

v. Sending to desktop,
vi. Clicking "Next",
vii. Clicking "Finish".

c. KO will zip AdM Files on desktop,

i. By right-clicking on exported "AdM Drawings",
ii. Selecting 7-Zip,
iii. Selecting Add to "AdM File.zip"



B. Delivery of Award AdM files to Award Winning Contractor

1. KO will send AdM files via DOD SAFE (https://safe.apps.mil/verify.php).
2. KO will follow instructions for Drop-off.
3. KO will notify DM & TS that AdM files have been sent.
4. TS will update PxP Section M.10 and CAD tracker.
5. TS will update timesheet, take a break, you've earned it. ☺

TAM Change Order Preparation

AdM SOP 22.4.6

TAM DIM CHAPTER 22 – JUN 2020

AdM SOP 22.4.6: TAM Change Order Preparation

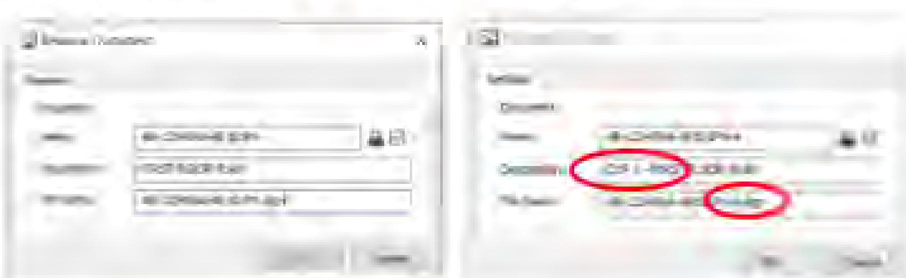
AdM SOP 22.4.4 is a step by step instructional guide detailing specific activities for the TAM Amendment (AM) Preparation. (Note: Images may not reflect actual views. Refer to specific PxP for more information.)

1. DM fills out request for COP Meeting from AdM Support Team. See TAM DIM Chapter 22 Section 22.3.m.11.
2. AdM Support Team contacts Specification Project Delivery Team (PDT) member to obtain the COP number from the Contracting Officer (KO).
3. AdM Support Team hosts COP Meeting.
    a. Update ADM PxP Section M.7. Fill all red areas.
    b. Email updated AdM PxP to DLL-CETAM-DP-E@usace.army.mil
4. Following the COP meeting PDT shall:
    a. Identify AdM Files to be amended.
    b. Notify Technical Services (TS) to unlock files.

    c. TS will archive a copy of the existing AdM file. 

    d. Rename original file to match current AM information by right-clicking on file and selecting 

Figure 22.4.4-1: AM File Naming Before & After

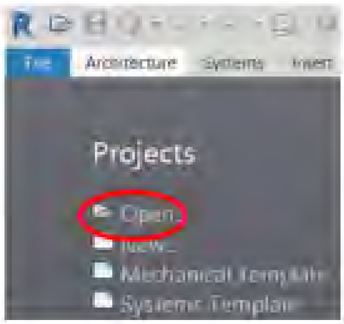


AdM SOP 22.4.6: TAM Change Order Preparation

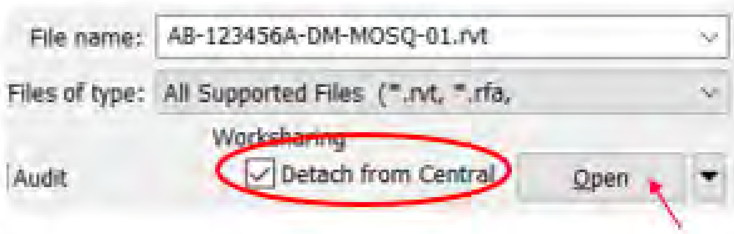
e. Rename all ProjectWise (PW) property fields.

f. Open Revit program, by double clicking on the desktop icon

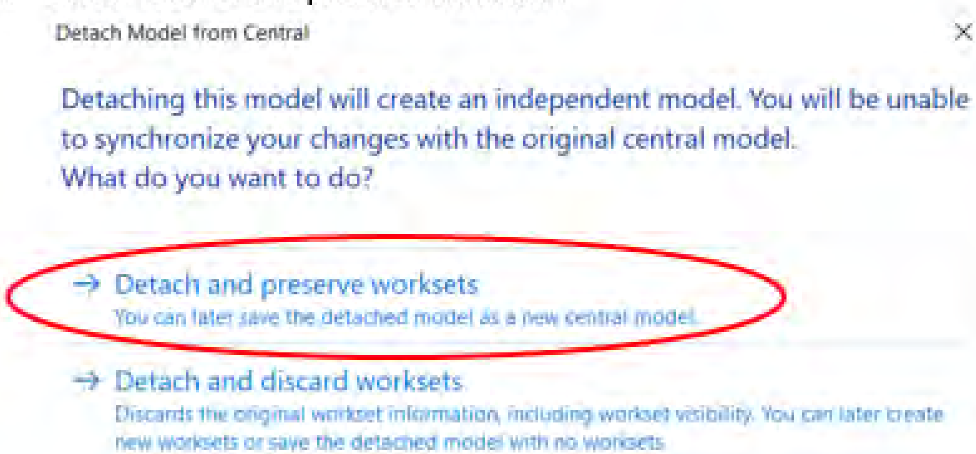
g. Open all Revit projects from by selecting File dialog box. Click Open.



h. Scroll to model location, select Revit model, click Detach from Central and then click Open.

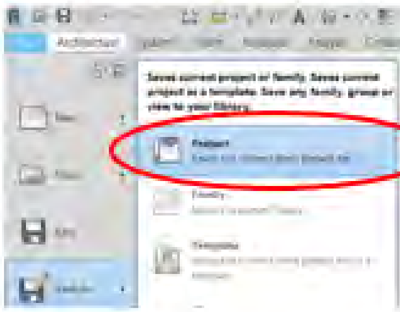


i. Select "Detach and preserve worksets".



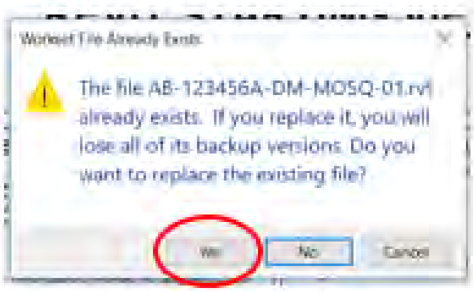
AdM SOP 22.4.6: TAM Change Order Preparation

j. Once open, select File/Save As/Project.

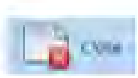


k. Select model renamed with COP letter, then save.

l. Select Yes.



m. Synchronize file, then Close file. Select File/Close.



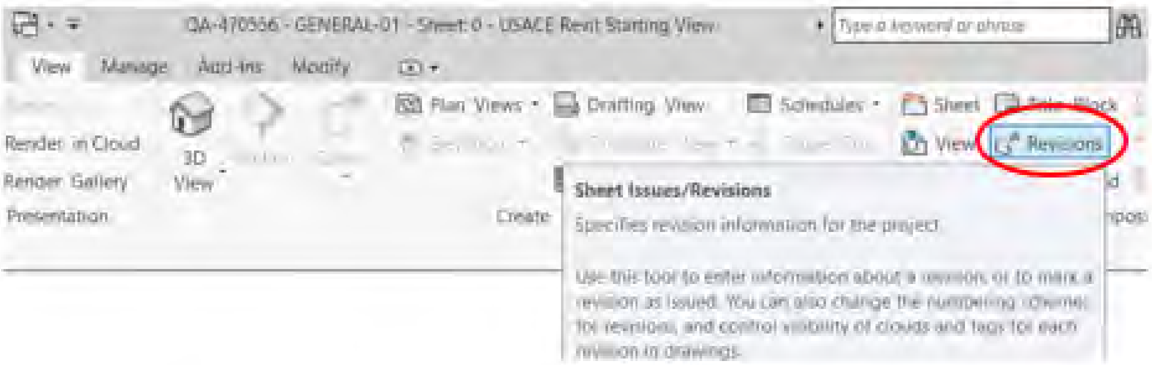
n. Repeat process for ALL Revit Models affected by COP

o. Once all Models renamed go to Manage Links and update links.

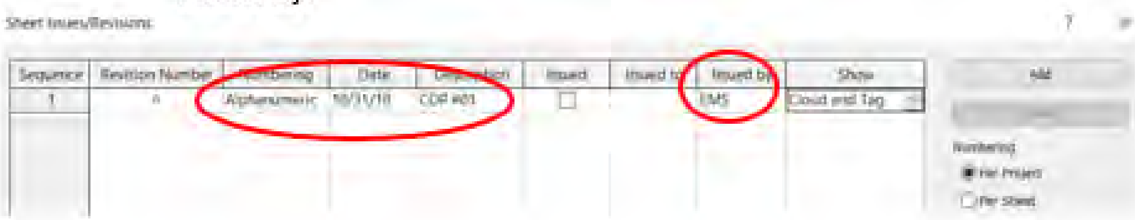
p. Update AdM files for COP information.

AdM SOP 22.4.6: TAM Change Order Preparation

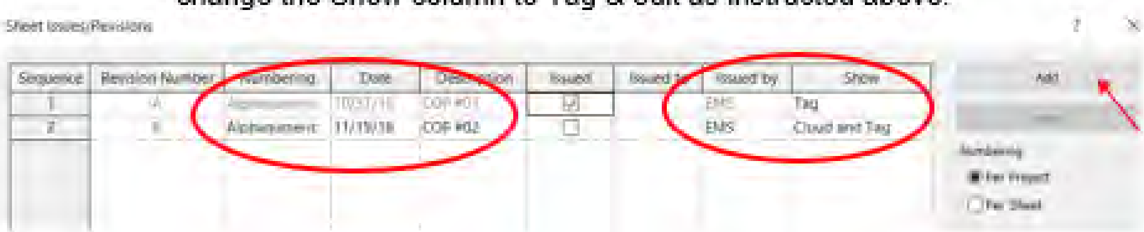
q. Select View/Revisions.



r. The first COP already has an issue line provided. Edit Date, Description & Issued By.



s. For subsequent Change Orders, select Add, check the AM#01 Issued box, change the Show column to Tag & edit as instructed above.

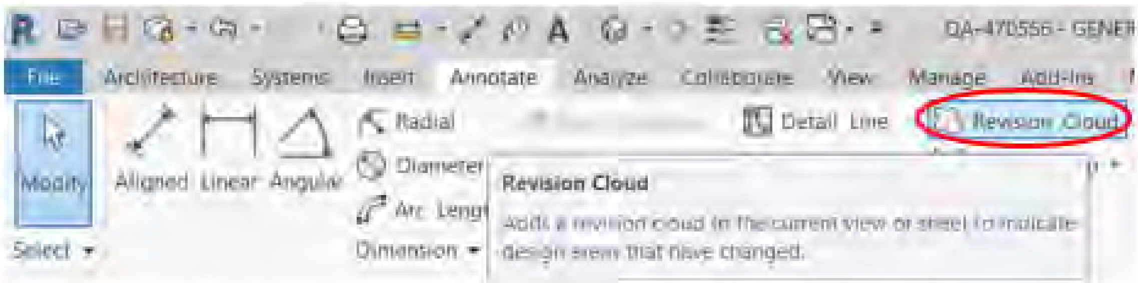


t. Select Apply & OK when finished.

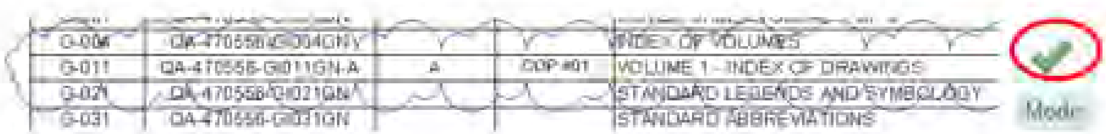
u. Add revision clouds and delta symbols.

AdM SOP 22.4.6: TAM Change Order Preparation

v. Open sheet to be modified and select Annotate/Revision Cloud.

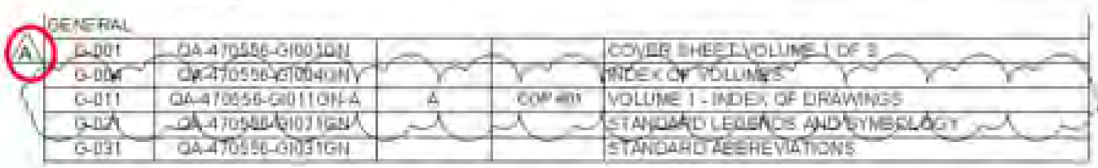


w. First, cloud changes on the sheet, then select green check at Mode.



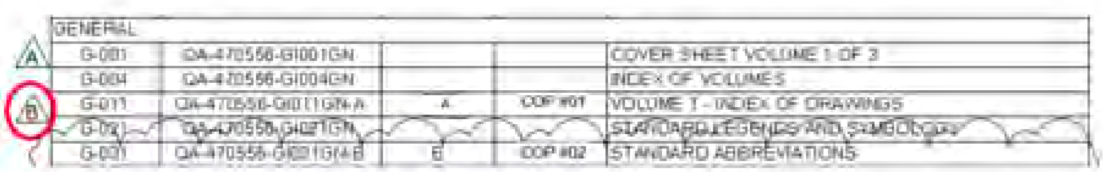
G-004	QA-470556-GI004GN			INDEX OF VOLUMES
G-011	QA-470556-GI011GN-A	A	COP #01	VOLUME 1 - INDEX OF DRAWINGS
G-021	QA-470556-GI021GN			STANDARD LEGENDS AND SYMBOLOGY
G-031	QA-470556-GI031GN			STANDARD ABBREVIATIONS

x. Second, attach delta symbol. Select Annotate/Tag by Category. (Turn-off Leader)



GENERAL				
G-001	QA-470556-GI001GN			COVER SHEET VOLUME 1 OF 3
G-004	QA-470556-GI004GN			INDEX OF VOLUMES
G-011	QA-470556-GI011GN-A	A	COP #01	VOLUME 1 - INDEX OF DRAWINGS
G-021	QA-470556-GI021GN			STANDARD LEGENDS AND SYMBOLOGY
G-031	QA-470556-GI031GN			STANDARD ABBREVIATIONS

y. For subsequent Amendments, Cloud ONLY the current amendment, but continue to show all previous amendment delta triangles.



GENERAL				
G-001	QA-470556-GI001GN			COVER SHEET VOLUME 1 OF 3
G-004	QA-470556-GI004GN			INDEX OF VOLUMES
G-011	QA-470556-GI011GN-A	A	COP #01	VOLUME 1 - INDEX OF DRAWINGS
G-021	QA-470556-GI021GN			STANDARD LEGENDS AND SYMBOLOGY
G-031	QA-470556-GI031GN-B	B	COP #02	STANDARD ABBREVIATIONS

z. Issue block will automatically populate. Do not cloud issue block.

E	GENERAL REVISION COP 0005	JUN 2021
D	GENERAL REVISION COP 0004	MAR 2021
B	GENERAL REVISION COP 0002	FEB 2021
MARK	DESCRIPTION	DATE

AdM SOP 22.4.6: TAM Change Order Preparation

aa. Update titleblock information schedule.

bb. Go to Project Browser, then double-click on appropriate schedule.

cc. Highlight File No. then add Amendment number.

<QA-470556 - VOLUM

A	B	C	D
		REVISIONS	
SHT. REF. NO.	FILE NO	REV. NO.	AM/COP NO.
GENERAL			
G-001	QA-470556-GI001GN		
G-004	QA-470556-GI004GN		
G-011	QA-470556-GI011GN-A	A	
G-021	QA-470556-GI021GN		
G-031	QA-470556-GI031GN		

*(FILE NO. in sheet titleblock will automatically update.)

FILE NO.: QA-470556-GI011GN-A

dd. Update the AM/COP No. column with COP##.

<QA-470556 - VOLUM

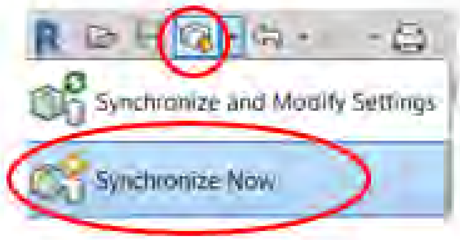
A	B	C	D
		REVISIONS	
SHT. REF. NO.	FILE NO	REV. NO.	AM/COP NO.
GENERAL			
G-001	QA-470556-GI001GN		
G-004	QA-470556-GI004GN		
G-011	QA-470556-GI011GN-A	A	COP A
G-021	QA-470556-GI021GN		
G-031	QA-470556-GI031GN		

ee. Change status field to "**COP 0001**".

ff. Repeat steps for ALL amended sheets within model.

AdM SOP 22.4.6: TAM Change Order Preparation

gg. Upon completion of updates, select Synchronize Now symbol or text.



hh. Open ALL other Revit models and repeat process.

5. After the COP has been issued TS shall;

   a. Lock ALL files in PW by selecting Change State/Set Final Status.

   b. Update your timesheet & take a break, you've earned it. ☺

TAM As-Built Archives

AdM SOP 22.4.7

TAM DIM CHAPTER 22 - JUN 2020

AdM SOP 22.4.7_TAM As-Built Archives

AdM SOP 22.4.7 is a step by step instructional guide detailing specific Award Winning Contractor (AWC) activities before delivery of the TAM As-Built (ASB) archives.

1. AWC fills out request for ASB Meeting from AdM Support Team. See TAM DIM Chapter 22 Section 22.3.m.12.

2. AdM Support Team hosts ASB Meeting and will;

    a. Update ADM PxP Section M.7. Fill all red areas.

3. Following the meeting AWC shall:

    a. "Clean" AdM files by removing ALL Change Order (COP) revision clouds and delta symbol information.

    b. Update AdM files status field to "AS-BUILT".

    c. Update issue date field in AdM titleblock border and ASB cover sheet.

Figure 22.4.7-1: Typical TAM AS-BUILT Cover Sheet

AdM SOP 22.4.7_TAM As-Built Archives

d. Create new ASB PDF's.

e. Send all AdM File to DLL-CETAM-DP-ET-CADD@usace.army.mil for review based on the requirements as noted in TAM DIM Chapter 22, JUN 2020. AWC will be notified of any errors, omission, or deficiencies found.

f. Will resubmit all AdM Files if errors, omission, or deficiencies found with AdM ASB files during TAM Technical Services (TS) review.

g. Satisfactory ASB deliverables will be sent to TAM KO along with DD Form 1354 (Transfer and Acceptance of DOD Real Property).

NOTE: TAM will NOT accept AdM ASB files without a DD Form 1354.

Figure 22.4.7-2: DD Form 1354 Example

TRANSFER AND ACCEPTANCE OF DOD REAL PROPERTY

[redacted]

4. Following the delivery of AdM ASB files KO shall:

   a. KO will upload AWC submission into ProjectWise (PW).

   b. KO will notify Project Manager (PM) and TS.

5. Nothing else follows.

End of Chapter 22 – Advanced Modeling

CHAPTER 23
STANDARD PROCEDURES FOR DESIGN OF MINOR PROJECTS

CHAPTER 23

STANDARD PROCEDURES FOR DESIGN OF MINOR PROJECTS

23.1 INTRODUCTION

23.1.1 General. Minor projects, such as those involving simple designs for installation support or relatively small projects shall be considered for Minor Project Design (MPD) procedures. For such projects a streamlined approach to design, resulting in construction documents similar to commercial documents, may be used. Streamlined procedures apply to activities within many offices including Project Management, Contracting, Office of Counsel, etc.; however, this chapter focuses only on activities which are the direct responsibility of the U.S. Army Corps of Engineers, Middle East District (CETAM), Engineering Branch (CETAM-EN-E) design team, Architect Engineer (A-E) firms, and other design elements preparing design for Corps of Engineers, Middle East District.

23.1.2 Purpose. The purpose of utilizing MPD procedures is to shorten design time, save design cost and facilitate reproduction of design documents while assuring that designs adequately describe the work for the construction contractor.

23.2 PLANNING AND IMPLEMENTATION

23.2.1 Planning. The suitability of the MPD process for a particular project must be evaluated on a case by case basis. Not all projects are appropriate for streamlined procedures, particularly those which are large, complex, or nonstandard, and those involving renovation of existing facilities. Also projects which require input from organizations or agencies other than CETAM, or the immediate customer (e.g. U.S. Army Corps of Engineers (USACE) centers of expertise), may not be good candidates for MPD.

23.2.1.1 The risk associated with utilizing MPD procedures on a given project must be identified during the planning phase of the project and steps must be taken to minimize that risk. By showing fewer details and simplifying specifications, the possibility of omissions and unintentional errors is increased. On relatively simple projects this risk is small. On larger, more complex projects, this risk can be significantly greater. The goal of the MPD procedure is to identify projects for which the risk is acceptable and savings in time and design cost will not adversely affect the construction product. Designers must be mindful of the fact that customers desire the shortest and least costly design effort consistent with producing quality construction products. Overly conservative decisions on design methodology will, in the long run, dissatisfy CETAM's customers.

23.2.1.2 Potential roadblocks to the MPD process, such as environmental or physical security issues, must be identified as early as possible. Project funding and schedule constraints must be considered to insure that a project is a true candidate for MPD. Customer input should be solicited through the Project Manager. The project scope must be clearly defined, or obtained, utilizing available data such as as-built drawings, shop drawing submittals, O&M manuals, survey reports, conference/meeting minutes and photographs, etc.

23.2.1.3 The determination of the method of design, whether full design, MPD, Design/Build or a combination of these, will be made by the Chief, CETAM-EC-E in coordination with the project team and the customer.

23.2.2 Implementation. The MPD project design team consisting of representatives from each technical design discipline shall be established. A Design Team Leader responsible for coordination between team members and verifying all external requirements with the PM shall be appointed. Balance between simplicity and quality must be maintained. Care must be taken not to shift undue risk to the construction contractor. Designers shall use common, three part specification format, and common standards for sketches and drawings within each design package. Although a variety of presentation methods and presentation media are used, there should be uniformity in title blocks, font sizes, etc.

23.3 DESIGN APPROACH

Considerations by discipline follow:

23.3.1 Architectural. Consider developing only two building elevations rather than four; one building section rather than two. A roof plan may be deemed unnecessary. The number of wall sections may be reduced. Evaluate the need for a reflected ceiling plan, etc. Minimize the use of design details and/or standard detail drawing sheets to the greatest extent possible.

23.3.2 Civil. Evaluate using more new spot elevations on the grading plan rather than developing some, or all of the new contouring required. Evaluate utilizing horizontal road alignment control and a typical road cross-section rather than developing separate drawings for plan and profile of roads. Consider developing a rigid pavement joint layout detail rather than providing joint layouts for all rigid pavement in the project. Require the contractor to submit joint layout plans for approval. Consider deleting some details and require the contractor to use manufacturers recommendations (i.e. fence details, water valve details, fire hydrant details, etc.), or to match existing features at the site (i.e. curbs, sidewalks, etc.).

23.3.3 Structural. Utilize a combined foundation/floor plan and maximize the use of standard drawings. Consider using a single size and type of spread footing, column and beam where economical.

23.3.4 Fire Protection. Coordinate the location of building section(s) with the Architect so that the Architectural sections can be utilized for sprinkler system. Use standard details to the maximum extent possible.

23.3.5 Heating, Ventilating & Air-Conditioning. Show ductwork in single line format. Evaluate the need for section(s) through mechanical rooms. Only the congested mechanical equipment rooms with very complex duct routing may need sections. Air flow diagrams are not required. Evaluate the need for diffuser, register, grille schedule vs. providing information for each outlet on the floor plan. Abbreviations and legend should be reduced to a minimum. Use standard details to the maximum extent possible. Usage of enlarged floor plans (scales: 1:50 or larger) should be minimized. Include mechanical equipment schedules.

23.3.6 Plumbing. Evaluate whether riser diagrams are necessary to clarify routing and sizes of drain, water and vent piping. Minimize the use of abbreviations and legend. Standard details should be used to the maximum extent possible. Usage of enlarged floor plans (scales: 1:50 or larger) should be minimized. Include equipment schedules for fixtures, pumps and water heaters.

23.3.7 Electrical. Major items such as switchgear, switchboards, transformers, generators, etc. must be clearly shown both schematically and in plan as should unusual components such as UPS systems, frequency converters, etc. One line diagrams should show feeder size and panelboard ratings and plan drawings should show panelboard locations and location of power for the service. One line diagrams for fire alarm, security, and telephone systems shall be shown. Plan locations for communication systems outlets are also needed. Lighting fixture locations and types must be identified. Switching locations and schemes should also be shown, especially where three-way switching schemes are needed. Power outlets, phone and data outlets, fire alarm initiating devices and alarms, and security system devices should be shown on the plans. Special circuit requirements for mechanical or specialized equipment should be clearly defined. Details such as specific branch circuit groupings could be left to the discretion of the contractor.

CHAPTER 24 23.4 CONTRACT DOCUMENTS

23.4.1 Drawings. Use of 8.5" X 11" and 11" X 17" sheet sizes shall be maximized to facilitate simple reproduction and faxing of drawings. Larger drawings may be used as necessary on an exception basis. Consideration should be given to developing schedules (door, window, finish, panel, louver, etc.) within word processing software for insertion into specifications rather than placement on drawings, if savings can be realized. Care should be taken to insure that the minimum text size on drawing sheets is in accordance with applicable CADD standards. Use of digital photographs on drawings should be included where possible to document existing conditions, particularly on renovation projects where demolition is involved. It is recommended that an identifier be developed, possibly integral within the sheet border, to differentiate MPD projects from those developed using conventional design procedures. Use notes on drawing sheets to identify work required as a supplement to, or replacement for, specification sections when possible.

23.4.2 Specifications. On very simple projects, through the use of notes on drawings and sketches, specifications may not be required. When specifications are needed, the 3-part format utilized in the Corps of Engineers Guide Specifications (CEGS) shall be used for familiarity and clarity. The minimum effort should be expended in the development of specifications. Local materials should be utilized as much as practicable. Local standards should be referenced where possible, in keeping with the overall intent of abbreviated design schedules. The requirements for contractor submittals shall be carefully evaluated. In general, the use of submittals should be minimized and when used, the requirement for government approval should be minimized. Submittals shall be requested only where those items are essential, or where details normally done by the designer have been “deferred” to the shop drawing stage. When the use of brand-name is considered for specifying products or equipment, the following must be complied with; Brand-name or equal descriptions, and other purchase descriptions that permit prospective contractors to offer products other than those specifically referenced by brand name, shall provide for full and open competition and do not require justifications and approvals to support their use. However, the Specifier must meet the requirements of FAR 11.0002, and Subpart 6.300, 6.301, 6.302 and 6.302-1. A submittal register is required and shall be developed with the MPD objectives in mind. Rely on shop drawings to work out specific details.

23.4.3 Design Analysis. As with any conventionally designed project, a design analysis is required as a means of documenting significant design assumptions and elements not shown in the contract documents, for future use. It will also contain any design calculations associated with the project. The MPD design analysis format shall be an abbreviated version of the format currently utilized for a conventionally designed project. Each design discipline shall make the determination of what information is appropriate for the design analysis. The use of design checklists within each design discipline is encouraged to address repetitive type issues. Use of existing documents such as copies of electronic messages as a means of documenting project evolution or clarifying project scope should be maximized. Photographs may be included in the project design analysis.

23.5 COST ESTIMATE

23.5.1 General. Development of the cost estimate should reflect the simplicity of the design. Use of “rule of thumb” data by cost engineers is encouraged by Headquarters U.S. Army Corps of Engineers (HQUSACE) as a means of checking adequacy of funding. Use of cost per square foot pricing may be required to prepare government estimates due to limitations in available design funds and brevity of project design schedules.

23.6 PROJECT SCHEDULE

23.6.1 General. A project schedule template tailored for use with MPD projects shall be used. Utilization of electronic transfer of contract documentation to the customer and other agencies for design reviews should be utilized, where possible, to eliminate shipping time. It is imperative that project scopes, facility locations, design/functional intent and funding are identified early in the project development to allow for adequate geotechnical investigations and engineering. Schedules and budgets must be established in concert with the geotechnical and site specific requirements for each project.

23.7 SURVEYS, INVESTIGATIONS AND STUDIES

23.7.1 General. Field surveys, geotechnical investigations and development of topographic mapping are long lead items which are critical to development of siting, grading, foundation and utility designs. Consequently, funding requests, scope-of-work and procurement actions must be initiated early to prevent project delay.

23.7.2 Geotechnical. Site-specific geotechnical field and laboratory data and engineering design parameters shall be developed by MED. Each project shall be examined by Building Design (Structural) and Site Design (Geotechnical) Sections (CETAM-EC-EA and CETAM-EC-EC) for ways to economize without compromising technical judgment and quality.

23.7.3 Topographic Mapping Survey. Accurate topographic mapping shall be developed or procured using in-house resources. At each site, a minimum of four permanent benchmarks shall be established outside the proposed construction areas. The horizontal and vertical control will be tied to the local recognized coordinate system. Mapping products shall be delivered to Site Design (Civil), CETAM-EC-EI in hard copy and in digital format, compatible with Microstation. The scale of mapping and contour interval necessary for each project shall be evaluated to determine if less than conventional mapping detail would be suitable.

23.7.4 Contractor Site Visit. Evaluate placing more responsibility on the contractor to collect information during the site visit, thereby reducing the design effort required with respect to developing demolition plans and site conditions.

CHAPTER 24
COST CONTROL DURING DESIGN (DESIGN-TO-COST)

CHAPTER 24
COST CONTROL DURING DESIGN
(Design-to-Cost)

24.1 GENERAL.

The intent of this chapter is to provide policy and guidance to the design disciplines of the Middle East District (MED) for all MED projects in order to control cost during design. Cost Control During Design is established to place more emphasis on accurate definition of project requirements, preparation of a parametric cost estimate (or equivalent) to establish cost targets based on these requirements and monitoring during the design. Each designer is responsible to assure construction costs remain within budget. When cost increases are caused by customer directed scope changes the design team must take immediate action to identify the impact and advise the Project Manager

24.2 REFERENCES.

a. Project DD Form 1391, Military Construction Project when applicable, in lieu of Foreign Military Sales (FMS).
b. UFC 3-740-05, Handbook: Construction Cost Estimating
c. MED Design Instructions Manual.
d. Corps of Engineers Unified Facility Guide Specifications (UFGS).
e. Corps of Engineers Cost Engineering Regulations and Manuals.
f. Federal Acquisition Regulation (FAR).
g. All MILCON and FMS established criteria.
h. UFC 3-740-01 Programming Cost Estimates for Military Construction

24.3 COST CONTROL DURING DESIGN.

a. Cost control during design is a process of identifying the full scope of a project and establishing cost targets before design starts to effect cost control throughout the course of design. This scope must be identified and verified with the user. Cost targets are identified using a system level work breakdown structure for every system (for both primary buildings and support facilities) being designed into the project. These system level cost targets are estimated using parametric cost estimating systems (and other detail methods for unique work) and adjusted where necessary so that the full scope is included in the total cost. The parametric cost estimates when approved by the Division Chief, customer, and Project Manager (PM) will then become the basis for establishing cost targets for the discipline designers responsible for those system designs.
b. The accuracy and reasonableness of the project (parametric) estimate is highly dependent on the input of the design team and its customers. Therefore, it should be developed based on the most complete requirements available. The estimate will be carefully reviewed by the design team to ensure that each system cost target is reasonable and that all the systems included within the estimate will accomplish all design requirements of the project. This will be a topic at design team meetings.

c. Designers must communicate constantly with the cost engineer/estimator and inform the cost engineer/estimator of all design decisions and changes affecting the cost. The cost engineer/estimator must maintain the up-to-date estimate to ensure that it stays current with the design. If the current estimate deviates from the target by greater than 5%, the cost engineer/estimator must call attention to and immediately advise the designer(s) about the cost variations. With this process the designers will have awareness of the cost impacts of their decisions and they will be more cost conscious. Key cost review milestones are identified during the process to ensure that the design proceeds on cost, schedule, and design target.

24.4 COST CONTROL PROCESS.

24.4.1 Project Definition (PD) Phase

1) The customer/user defines the total requirements for the project during the programming and project definition phases in order to minimize user changes during design.
2) The PD phase requires the preparation of a parametric estimate or equivalent using either of the two Department of Defense (DOD) systems, the Air Force Parametric Cost Estimating System (PACES) or Tri-Services Automated Cost Engineering System (TRACES) Parametric Building Models for Windows (PBMW). Estimate must be prepared to the systems level as shown in Appendix A.
3) The design team must then verify the cost estimates to ensure that there is clear agreement and understanding on scope and a commitment on the cost targets. If the scope and cost targets do not match, all conflicts must be resolved prior to proceeding with design.

24.4.2 Design Phase

1) The design schedule (as developed by the design team) will identify the phases at which revised estimates will be required. Updated estimates using the breakdown shown in Appendix A will be developed and distributed to the design team.
2) If cost targets are being met, design continues.
3) When the cost target at any system level is exceeded, the design discipline with assistance from Cost Engineering must identify the reasons for the overrun. The designer must review system components to identify if changes can be made to remain with the target estimate. If a cost increase must be made, the design team must advise the Design Team Leader and Project Manager who in turn must advise the customer of the reasons for increase, their construction costs, design costs, and schedule impacts. Options to the proposed design that would mitigate cost and schedule impacts will be identified. All decisions at this point must be based on agreement between the customer and MED.
4) At the Ready to Advertise (RTA) design review, a cost estimate review must be made prior to proceeding to final Request For Proposal (RFP) documents and formal solicitation.

5) Once cost and design issues have been resolved, the design will proceed to RFP. The Government Estimate (GE) is prepared and the project advertised. The estimate is expected to be complete at this stage except for quotation, bid period discoveries, and amendment impacts.

APPENDIX A
PARAMETRIC COST ESTIMATE

DATE: 11/26/1996
TIME: 08:21:38

PROJECT: CC1996

PROJECT DESCRIPTION: General Purpose Administration Building

PROJECT COMMENT: This is a parametric cost estimate for cost control during design.

BUILDING TOTAL GROSS FLOOR AREA: 25,000 SF
GEOLOCATION: ANDREWS AFB
ESTIMATED BY: USACE
ESTIMATE DATE: 11/20/1996
REPORT FILE: psyscc96.wpd
COST DATABASE: NAT95A
ESCALATION MODIFIER: Mid-Point of Construction

PARAMETRIC COST ESTIMATE
WBS SYSTEM CONSTRUCTION COST REPORT

SYSTEM DESCRIPTION	TOTAL	%TOTAL
PRIMARY FACILITY:		
ADMIN BUILDING		
01 SUBSTRUCTURE (TS) (TG)	87,171	3.2%
02 SUPERSTRUCTURE (TS)	298,952	11.0%
03 EXTERIOR CLOSURE (TA)	386,357	14.2%
04 ROOFING (TA)	63,617	2.3%
05 INTERIOR CONSTRUCTION (TA)	142,450	5.3%
06 INTERIOR FINISHES (TA)	185,137	6.8%
07 CONVEYING SYSTEMS (TM)	105,339	3.9%
08 PLUMBING (TM)	84,539	3.1%
09 H.V.A.C. (TM)	528,012	19.5%
10 FIRE PROTECTION SYSTEMS (TM)	44,176	1.6%
11 ELECTRIC POWER & LIGHTING (TE)	308,260	11.4%
12 ELECTRICAL SYSTEMS (TE)	107,720	4.0%
14 FURNISHINGS (TA)	307,552	13.7%
FACILITY TOTAL	$2,712,289	100.0%
SUPPORT FACILITIES:		
17 SITE PREPARATION (TI) (TG)	75,046	19.6%
18 SITE IMPROVEMENTS (TI)	54,918	14.3%
19 SITE CIVIL/MECHANICAL UTILITIES (TI)	185,845	48.4%
20 SITE ELECTRICAL UTILITIES (TE)	68,023	17.7%
SUPPORT FACILITY TOTAL	$383,833	100.0%
TOTAL CONSTRUCTION COST	**$3,096,122**	**100.0%**

Abbreviations:

TA – Architectural	TM –Mechanical
TI –Civil	TE –Electrical
TS –Structural	TG –Geotechnical

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CHAPTER 25
FORCE PROTECTION

CHAPTER 25
FORCE PROTECTION

25.1 INTRODUCTION.

Reference documents are in place to establish the security and antiterrorism design criteria that will be the basis for DoD facility designs. Those criteria include the assets to be protected, the threats to those assets, the levels to which those assets are to be protected against those threats, and any design constraints imposed by facility users.

The security engineering references apply to all DoD components and to all DoD assets and facilities that are owned, leased, privatized, or otherwise occupied, managed, or controlled by or for DoD. Projects include new construction, existing construction or expeditionary and temporary construction. For foreign military sales work that will not be used by DoD personnel, force protection requirements will be determined by close coordination and discussions with the customer.

25.2 REFERENCES.

UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings
UFC 4-010-03	Security Engineering: Physical Security Measures for High-Risk Personnel
UFC 4-020-01	DoD Security Engineering Facilities Planning Manual
UFC 4-020-02FA	Security Engineering: Concept Design (FOUO)
UFC 4-020-03FA	Security Engineering: Final Design (FOUO)
USCENTCOM	Operations Order (OPORD) 05-03, Antiterrorism (FOUO)

25.3 CONCEPT SUBMITTAL REQUIREMENTS.

25.3.1 Concept Design Analysis. Include a Design Analysis section to specifically address security engineering requirements. The Design Analysis is to include all security engineering requirements developed through the processes presented in UFC 4-020-01. The Design Basis Threat (DBT) and Level of Protection (LOP) Planning Documents developed are to be included in the Design Analysis. Any project specific security engineering requirements provided by Base Security shall be included in the Design Analysis. OPORD 05-03 governs the design requirements.

Identify number of DoD personnel that will occupy the facility. If DoD personnel will not occupy the facility, identify whether any Host Nation Antiterrorism/Force Protection (ATFP) design standards are required. If facility does not meet the UFC requirement to be classified as occupied, identify any Customer required design standards or state that no design standards are required for the project.

For DoD inhabited facilities, the Design Analysis shall include a list of all 26 minimum standards from OPORD 05-03 and state how each of the standards have been addressed for the project.

For DoD inhabited facilities, the Design Analysis is to include all project specific security engineering requirements from USCENTCOM OPORD 05-03. However, the Design Analysis should not reference USCENTCOM OPORD 05-03 or connect the project specific requirements to USCENTCOM OPORD 05-03 in any way.

25.3.2 Concept Design Drawings. Include general security requirements on the drawings. In general, the design drawings for other disciplines are adequate to describe the security requirements.

25.4 PRELIMINARY SUBMITTAL REQUIREMENTS.

25.4.1 Preliminary Design Analysis. The Design Analysis is to include the method of design, including assumptions, theories, formulas, and references used. The Design Analysis shall demonstrate that all reference requirements are being followed and all project specific security engineering requirements are being address properly in accordance with the references. Provide calculations for design of typical members under the most critical loading conditions.

Reasoning and procedures for waivers/variances are to be included in the preliminary design analysis.

25.4.1 Preliminary Design Drawings. Typical security elements shall be included on plans with sizing of typical elements indicated. Include typical details of security elements. In general, the design drawings for other disciplines are adequate to describe the security requirements.

25.5 FINAL SUBMITTAL REQUIREMENTS.

25.5.1 Final Design Analysis. The final design submittal shall include the completed design analysis including all security requirements. The design analysis shall incorporate all comments generated by the Concept and Preliminary design reviews. The design analysis shall contain complete descriptions of all security requirements and protection implemented in accordance with the references. Include waivers/variances in the design analysis with all supporting information. Provide complete calculations for all security elements.

25.5.2 Final Design Drawings. The final design submittal shall include the completed project drawings including all security requirements. The drawings are to incorporate all comments generated by the Concept and Preliminary design reviews. All security elements shall be detailed. In general, the design drawings for other disciplines are adequate to describe the security requirements.

25.5.3 Final Design Specifications. Provide final design specifications in accordance with Chapter 3: SPECIFICATIONS.

25.6 UFC CRITERIA

25.6.1 Introduction. The Security Engineering UFCs are a series of documents that cover minimum standards, planning, preliminary design, and detailed design for security and antiterrorism.

25.6.2 UFC 4-020-01, DoD Security Engineering Facilities Planning Manual. This UFC presents processes for developing the design criteria necessary to incorporate security and antiterrorism into DoD facilities. Those design criteria may be limited to the requirements of the minimum standards, or they may include protection of assets other than those in the minimum standards, or levels of protection beyond those required by the minimum standards.

This UFC is intended to be the starting point for any project that is likely to have security or antiterrorism requirements. By beginning with this UFC, the design criteria will be developed that establishes which of the other UFCs in the series will need to be applied. The design criteria may indicate that only the minimum standards need to be incorporated, or it may include additional requirements, resulting in the need for application of additional UFCs. Even if only the minimum standards are required other UFCs may need to be applied if sufficient standoff distances are unavailable.

25.6.3 UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings. These manuals establish standards that provide minimum levels of protection against terrorist attacks for the occupants of all DoD inhabited buildings. These UFCs identify the minimum requirements that must be incorporated into the design of all new construction and major renovations of inhabited DoD buildings.

25.6.4 UFC 4-020-02FA & UFC 4-020-03FA, Security Engineering: Concept & Final Design (FOUO). These manuals provide interdisciplinary design guidance for developing systems of protective measures to implement the design criteria established using UFC 4-020-01. Those protective measures include building and site elements, equipment, and the supporting manpower and procedures necessary to make them all work as a system.

25.6.5 Additional Security Engineering Support Manuals. In addition to the standards, planning and design UFCs mentioned above, there is a series of additional UFCs that provide detailed design guidance for developing final designs. These support manuals provide specialized, discipline specific design guidance. Some address specific tactics such as direct fire weapons, forced entry, or airborne contamination. Others address limited aspects of design such as resistance to progressive collapse or design of portions of building such as mail rooms. Still others address details of design for specific protective measures such as vehicle barriers or fences.

25.6.6 USCENTCOM OPORD 05-03 (FOUO)

Document requires vetting before receipt. Contact Project Manager for required documentation in order to receive a copy. USCENTCOM OPORD 05-03 provides security engineer construction standards that must be incorporated into construction for DoD inhabited buildings in the Middle East District's area of responsibility. These standards supercede UFC 4-010-01 Minimum Antiterrorism Standards where more stringent.

25.7 WAIVER/VARIANCE

A service component may request a variance/waiver of an otherwise applicable standard only if compliance with the standard at a particular installation or facility would seriously impair its actions, adversely affect relations with the host nation, or would require substantial expenditure of funds at an installation that forces will be relocated from in the near future.

Refer to the UFC and USCENTCOM reference documents for when waivers/variances are applicable and the procedures for the process. Contact the Middle East District for project specific waiver/variance requirements from USCENTCOM OPORD 05-03.

25.8 POINT OF CONTACT

MED is the primary construction agent for the design of facilities in the USCENTCOM AOR. MED will coordinate security engineering and design with the U.S. Army Corps of Engineers' Protective Design Center in Omaha, Nebraska, and other centers of expertise as necessary.

CHAPTER 26
SCIF DESIGN

CHAPTER 26

SCIF DESIGN

26.1 GENERAL.

Sensitive Compartmented Information (SCI) is classified Confidential, Secret or Top Secret information that is derived from intelligence sources, methods or analytical processes and is required to be handled within formal control systems established by the Director of National Intelligence. SCI can only be handled, processed, discussed, or stored in an accredited SCIF. SCIFs are only required for SCI and not necessarily required for Secret or Top Secret information. The need for a SCIF is determined by the Customer/User based on operational requirements and IAW applicable regulations.

26.1.1 Scope. This chapter states criteria, requirements, and guidance for Sensitive Compartmented Information Facility (SCIF) design. Specific submittal requirements in this chapter supplement the requirements of Chapter 1: GENERAL INSTRUCTIONS. All required documents, including the drawings and the design analysis, shall be prepared in accordance with Chapter 2: PRESENTATION OF DATA, and Chapter 22: COMPUTER ASSISTED DESIGN AND DRAFTING. If Building Information Modeling (BIM) technology is to be used on the project, the requirements shall be obtained from the CADD Coordinator at MED. Renovation design shall comply with the requirements of Chapter 19: RENOVATION DESIGN.

26.1.4 Clearance Requirements. Personnel assigned to design PDT's shall possess the level of clearance required for each stage of design and construction anticipated for their participation. PDT clearance requirements should be verified by the Site Security Manager (SSM) before project initiation. Design phase security requirements are generally no higher than the SECRET classification level, with construction PDT levels matching the facility requirement.

26.1.3 SCIF Design. Sensitive, Compartmented Information Facility requirements are governed by UFC 4-010-05 SCIF Facilities Planning Design and Construction and ICD/ICS 705 Technical Specifications for Construction and Management of SCIF. See Chapter 26: SCIF Design.

26.1.3 Sensitive Compartmented Information Facility (SCIF)

26.1.3.1 SCIF Classifications

The following SCIF classifications will impact design and construction requirements.

a. Secure Working Area: SCI is handled but not stored.
b. Temporary Secure working Area: One used less than 40 hours per month.
c. Temporary SCIF: Used to satisfy a limited tactical, emergency, or immediate operational need.
d. Closed Storage: SCI material stored in GSA containers when not in use, per AO approval.
e. Open Storage: SCI materials may be processed and store openly, normal office

environment.

f. Continuous Operation. SCIF shall be staffed 24/7 in fixed facility or certified modular unit.

26.1.3.2 Utilize UFC 4-010-05 SCIF FACILITIES PLANNING DESIGN AND CONSTRUCTION for design criteria following the Security in Depth approach. This method covers the three main areas of design, AT/FP planning, SCI Facilities, and Compartmented Areas.

The UFC 4-010-05 references ICD/ICS 705, TECHNICAL SPECIFICATIONS FOR CONSTRUCTION AND MANAGEMENT OF SCIF V1.4, 28 Sept 2017. Technical specifications apply to all type of SCIF facility construction and sets forth the standards for SCIF accreditation. These references provide planning and design criteria for DoD components and participating organizations applicable to all construction, renovation, and repair projects for SCIFs.

The ultimate goal of the SCIF design process is to obtain a SCIF letter of accreditation. A SCIF letter of accreditation is a formal statement on behalf of the Intelligence Community (IC) element head that a facility has been designed, constructed, inspected, and certified for the protection of all SCI compartments, programs or special activities.

26.1.3.3 Design PDT's should consist of a Site Security Manager (SSM), Physical Security Officer, Communications, Architecture, and supporting engineering designers. Certified TEMPEST Technical Authority (CTTA) may be required on PDT's to include electronic countermeasures for some locations indicated by the SSM.

PDT's participate in planning charrettes and prepare charrette reports, draft a DD 1391, prepare the design analysis, design drawings and specifications as required, specify products that meet design requirements, prepare input to the Fixed Facility Checklist, and review construction submittals for full design projects. The PDT reviews design submittals to ensure compliance with the SOW/SCIF design requirement in DB projects.

26.1.3.4 Mandatory review of proposed and constructed designs require an Accrediting Official and the Site Security Manager appointed by the base command. Mandatory reviews also includes the following USACE Centers of Expertise:

a. Protective Design Center, Omaha District NWO-PDC-MCX
b. Electronic Security Systems Design Center, Huntsville HNC-ESS-MCX

Before and during the approval process of design plans the SSM produces a Construction Security Plan (CSP). The CSP outlines security protective measures that will be applied to each phase of the construction project. The requirements set forth in this plan provide the baseline for construction security activities and may be supplemented as required, but may not be reduced without coordination and approval from the AO. The plan format and content should be developed by the element AO based upon the size, purpose and location of the SCIF. See ICD 705 chapter 13 for a CSP template.

c. Accrediting Officer (AO)

Reviews and approves the design concept and ensure the application of Risk Analysis in the SCIF planning, design and construction, CSP, and final design prior to the start of SCIF construction, oversees the accreditation of the facility, from planning, design, construction, to occupancy, and provides security oversight for all aspects of SCIF construction under their security purview. The AO must also determine if the SSM performs duties on a full-time, principal basis, or as an additional duty to on-site personnel, accredit SCIFs under their cognizance, and prepare waiver requests for the IC element head or designee.

d. Site Security Manager (SSM)

Performs Risk Analysis (Threat, Vulnerability, Probability, and Consequence) , compiles and delivers the Fixed Facility Checklist, in consultation with the AO, develops a CSP regarding implementation of the ICD 705 standards, implement the CSP during design and into construction, conducts periodic security inspections for the duration of the project to ensure compliance with the CSP, document security violations or deviations from the CSP and notify the AO, ensure that procedures to control site access are implemented.

e. Certified TEMPEST Technical Authority (CTTA)

Reviews SCIF construction or renovation plans to determine if TEMPEST counter measures are required and recommend solutions, to the maximum extent practicable. The CTTA will provide the Cognizant Security Authority (CSA) and AO with documented results of their review with recommendations. TEMPEST mitigation requirements must be incorporated into the SCIF design. The CTTA will also provide a validated Electronic Security System.

26.2 CONCEPT SUBMITTAL REQUIREMENTS.

26.2.1 Concept Design Analysis. Include a Design Analysis section to specifically address security engineering requirements. The Design Analysis is to include all security engineering requirements developed through the processes presented in ICD 705. The Design Basis Threat (DBT) and Level of Protection (LOP) Planning Documents developed for force protection criteria in Chapter 25 are to be referenced in the Design Analysis. Any project specific security engineering requirements provided by Base Security shall be included in the Design Analysis.

25.2.2 Concept Design Drawings. Include general security requirements on the drawings. Design drawings based on ICD 705 Chapter 3 typical sections are to describe the security requirements. Reference site component setbacks and layered security from Chapter 25.

26.2.3 Preliminary Design Specifications. Provide outline specifications in a table of contents format.

26.3 PRELIMINARY SUBMITTAL REQUIREMENTS.

26.3.1 Preliminary Design Analysis. The final design submittal shall include the interim Construction Security Plan (CSP), Fixed Facility Checklist, Risk Analysis. The design analysis shall incorporate all comments generated by the Concept and Preliminary design reviews. The design analysis shall contain complete descriptions of all security requirements and protection implemented in accordance with the references. Include waivers/variances in the design analysis with all supporting information. Provide complete calculations for all security elements. Provide preliminary ESS calculations from CTTA.

26.3.2 Preliminary Design Drawings. The final design submittal shall include the completed project drawings including all security requirements. The drawings are to incorporate all comments generated by the Concept and Preliminary design reviews

26.3.3 Preliminary Design Specifications. Provide final design specifications in accordance with Chapter 3: SPECIFICATIONS. Include the CSP in specification documents.

26.4 FINAL SUBMITTAL REQUIREMENTS.

26.4.1 Final Design Analysis. The final design submittal shall include the completed Construction Security Plan (CSP), Fixed Facility Checklist, Risk Analysis. The design analysis shall incorporate all comments generated by the Concept and Preliminary design reviews. The design analysis shall contain complete descriptions of all security requirements and protection implemented in accordance with the references. Include waivers/variances in the design analysis with all supporting information. Provide complete calculations for all security elements. Provide complete calculations for all security elements. Provide final ESS calculations from CTTA.

26.4.2 Final Design Drawings. The final design submittal shall include the completed project drawings including all security requirements. The drawings are to incorporate all comments generated by the Concept and Preliminary design reviews

26.4.3 Final Design Specifications. Provide final design specifications in accordance with Chapter 3: SPECIFICATIONS. Include the CSP in Construction Bid documents.