

CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

CHAPTER III (cont.)

SECTION 2 - EARLY PRELIMINARY DESIGN

<u>Paragraph</u> <u>Page</u>	<u>Subject</u>
2.0 III-9	Early Preliminary Design Submittal
2.1 III-9	Objective
2.2 III-10	Design Analysis - General Requirements
2.3 III-10	Drawings - General Requirements
2.4 III-10	Civil Design
2.5 III-12	Landscaping Design
2.6 III-12	Architectural Design
2.7 III-14	Structural Design
2.8 III-16	Mechanical Design
2.9 III-18	Electrical Design

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over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

CHAPTER III (cont.)

SECTION 2 - EARLY PRELIMINARY DESIGN

2.0. Early Preliminary Design Submittal. The Early Preliminary Design submittal shall consist of the following documents:

- Design Analysis
- Drawings
- Outline Specifications
- Cost Estimate
- Draft Environmental Permit Matrix (if required by Instructions for Field Personnel Report)
- Draft Engineering Considerations and Instructions for Field Personnel Report
- Other Items as Required by the Scope of Work

The designer must include the requirements of Section 1 in the early preliminary design documents whether or not a concept submittal was required. This chapter will define, by discipline, requirements of the Design Analysis and the Drawings. Guidance for the preparation of the Outline Specifications is described in the A-E Guide, Vol. 3. Requirements of the Cost Estimate are provided in the A-E Guide, Vol. 2. Refer also to Chapter II, "Presentation of Data" of this Guide for design analysis format, drawing format, and quality requirements. See appropriate Appendix of this volume for Environmental Permit Matrix and Engineering Considerations and Instructions for Field Personnel Report requirements.

2.1. Objective. The Early Preliminary Design data must be presented in sufficient detail to accomplish the following:

- a. Show the User (customer) how the proposed design satisfies his functional and special technical needs, including the minimum requirements stated in this section.
- b. Show all Reviewing Agencies that (1) all previous review

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but there's always enough time to do it over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

comments have been appropriately addressed, (2) the designer's approach to solution of technical aspects of the project is sound and (3) he intends to utilize appropriate controlling technical criteria (such as AFR's, AFM's, ETL's, Guide Specifications, etc.).

c. Provide an outline specification, and drafts of any A-E prepared specifications due to lack of COE guide specification(s) on subject(s).

d. Provide a current estimate of cost, commensurate with the stage of design. Prepare in the form of an Early Preliminary Estimate (Type B). Base the pricing upon the anticipated midpoint date of construction obtained from the COE Project Manager.

III-9

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-19

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

e. This submittal is heavily oriented toward creating the proper architectural treatment and establishing the design of the basic structural, mechanical and electrical systems based on economic analyses. It will show the District that the project has been sufficiently thought-out to enable design to proceed.

2.2. Design Analysis - General Requirements. Build upon the narrative and calculations developed for the concept submittal to satisfy the Early Preliminary submittal requirements. In addition, address the following:

a. Function. Describe the basic functional objective of the proposed facility and its estimated functional life. Discuss your solution to user required room adjacencies and project siting as a minimum.

b. Personnel and Equipment. Describe the range and number of civilian/military personnel and equipment to be accommodated.

c. Criteria. For each discipline, provide listing of all criteria used to establish the design, including reference to Design Instructions, Project Book, appropriate criteria chosen from Chapter V of this manual, and criteria prescribed by the scope of work and/or conference minutes. Summarize and enumerate all deviations from applicable criteria such as military construction criteria, building code, fire codes, life safety code, OSHA, and COE safety manual. Identify deviation, citing source and paragraph, what the criteria requires and nature of deviation, followed by authority granting waiver and date of waiver. Indicate if waiver has not been granted.

d. Economic Summary. For each discipline as hereinafter described provide a description of the economic factors influencing the choice of basic materials, equipment or systems, and an economic analysis which justifies the selection made over other alternatives. (For architectural, structural and mechanical features, a minimum of three (3) alternatives will be analyzed including the selected one.) These economic studies shall consider the initial costs and costs incurred over the projected life of the facility.

2.3. Drawings - General Requirements. Prepare the early

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

preliminary drawings to depict the required information in accordance with requirements hereinafter. If the size and/or complexity of the project requires additional information be presented to supplement the narrative description, show such information. When Office of the Chief of Engineers (OCE) Standard or Site Adaptive Plans are involved, include sufficient standard or site adaptive drawings to permit early preliminary review; these plans shall not be revised other than as required for seismic and site adaptation unless prior approval is obtained. Under no circumstances will an OCE title block be put out or replaced by a Sacramento District title block. (See Plates 4 and 5, Chapter IV.) They are Standard Drawings and any replacement of the title block would destroy their character as a Standard. See Chapter II for a complete discussion of Standard and Site Adaptive drawings.

2.4. Civil Design.

2.4.1. Design Analysis - Narrative/Calculations.

III-10

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-21

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

2.4.1.1. Siting. Discuss reasons for facility orientation. Address such factors as prevailing winds, existing structures, adjacent site conditions, solar loads, clearance restrictions and future development areas. Generally state why the building is sited as proposed if it has not been sited by the user.

2.4.1.2. Water Distribution System. Indicate whether additional fire hydrants are needed (see AFM 88-10 Chapter 5/TM5-813-5) and describe the proposed location of each hydrant.

2.4.1.3. Sanitary Sewer System. Where lift stations are required, state type of construction and tentative pump type and size. Indicate controlling elevations and compliance with AFM 88-11, Volume 1/TM 5-814-1 for minimum slopes and sizes. Confirm adequacy of existing sewers to carry additional flow. Discuss nature of industrial wastes. Unless quantity of flow is small and disposal will be by tile field or filtration and evaporation from a pond, include need for data concerning State requirements for pollution control. Provide permit applications as required.

2.4.1.4. Sewage Treatment Plant. Provide a complete description of the nature of waste involved, degree of treatment required, type of treatment plant proposed and anticipated effluent quality.

2.4.1.5. Storm Drainage and Grading. Discuss any changes in the proposed drainage design.

2.4.1.6. Corrosion Mitigation. For each new utility system and/or metallic structure that is buried, submerged, or in contact with either the ground or a substance which may promote corrosivity, a cathodic protection system shall be designed by the A-E. Coordinate with the electrical designer.

2.4.1.7. Roads, Streets, Parking, Open Storage, Hardstand and Sidewalks. The pavement design sections will be furnished by the District in a Geotechnical Report. This report which normally includes a Foundation Report and Pavement Design shall be referenced here and a copy included as an appendix to the Design Analysis.

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

2.4.1.8. Fencing. Describe type and height of fencing and gates, including features such as outriggers, barbed wire or tape and gate controllers.

2.4.1.9. Railroads. State type of service for which railroad tracks will be provided, anticipated volume and type of traffic, and the ruling grade. Discuss proposed type, source, and thickness of ballast, weight of rail, source, treatment, and dimensions of proposed ties. Identify any special subgrade compaction requirements; types of track accessories required, such as turnouts and switches, and the name of the operating agency.

2.4.1.10. Demolition. Describe the extent and type of any demolition required for this project. Discuss if the demolition will involve any hazardous materials such as asbestos and/or PCB's.

III-11

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-23

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

2.4.1.11. Hazardous and/or Toxic Waste. Describe the extent of any known or suspected hazardous or toxic waste problems associated with the site, and the remedial measures proposed.

2.4.2. Drawings. (See Chapter II for scale requirements.)

2.4.2.1. Soil Explorations. If available at this stage of design, provide drawings showing the boring locations and logs of borings which will be incorporated into the drawing set by the A/E. (See Plate 3, Chapter IV for instructions on completing the title block for these drawings.)

2.4.2.2. Demolition Plan. Show demolition requirements.

2.4.2.3. Site Plan. Show the facility superimposed on existing topography and reference the source of survey data. Provide sufficient horizontal and vertical control to clearly indicate the proposed siting of the facility.

2.4.2.4. Utility Plan. Show existing and proposed fire hydrants, fencing, and petroleum, oil and lubricants (POL) storage tanks.

2.5. Landscaping Design.

2.5.1. Design Analysis - Narrative/Calculations. See Concept submittal requirements. Also, discuss any unusual climatic or soil conditions or other local factors which may affect the design or selection of plant species.

2.5.2. Drawings. Show general site layout, and delineate all landscape treatment, including turf areas, shrub beds, tree locations, rock or gravel-covered areas, and areas for erosion control. Identify existing features that are not to be disturbed by construction activities. If an irrigation system is authorized, define areas to be watered.

2.6. Architectural Design.

2.6.1. Design Analysis - Narrative/Calculations.

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

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

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

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

(3) Government-Furnished - Government Installed (GF-GI) or not in contract (N.I.C.).

2.6.1.2. Occupational Safety and Health Act (OSHA): Designs shall be consistent with the standards issued by the Department of Labor under Section 6 of the Williams-Steiger Occupational Safety and Health Act. Basic materials, equipment, and functional requirements must be in accordance with the criteria contained in AFR 88-15, Technical Manuals (TM's) and Corps of Engineers Guide Specifications (CEGS). Any conflicts discovered shall be brought in writing to the attention of the PM for resolution.

III-12

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-25

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

2.6.1.3. Color Boards. Color boards shall be prepared in accordance with the following:

a. Color Boards shall be submitted in a standard 8-1/2" x 11" three-ring binder. Number of color boards shall be as called for in the project scope. Where special finishes such as carpet or pre-finished textured metal panels are required, samples not less than 8" x 10" shall be submitted with the boards.

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

c. The color board(s) shall consist of all samples mounted on a mat board or equivalent for structural stability.

d. Project title and location (base) shall occur in the lower right-hand corner of each board.

2.6.1.4. Interior Design. If a comprehensive interior design is required by the scope of work, DTL 1110-4-20 "Comprehensive Interior Design Requirements" will be furnished by the COE PM. See Appendix G.

2.6.1.5. Fire Protection Analysis. Coordinate with the mechanical and electrical designers and provide the following:

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

b. Building separation distances and

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

access thereto, based on paragraph 2.6.1.5.a. above, and Mil Handbook 1008.

c. Hour (Fire) ratings (show required, not actual) of exterior building walls, exit passageways, corridors, stairs, boiler/mechanical rooms, shafts, storage areas, janitor closets, and other hazard areas; fire and smoke floor areas; hourly rating of fire/smoke walls; corridor lengths and dead ends; corridor doors and other rated doors.

d. Extinguishing and/or fire sprinkler systems: Type (wet or dry system); special systems, such as "Carbon Dioxide", "Deluge", or "Standpipe", "AFFF" or "Halon" Systems. Coordinate with mechanical designer.

e. Fire alarm and evacuation system: Type, extent, and zoning. Coordinate with electrical designer.

III-13

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-27

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

f. Operations involving use or storage of flammable and explosive liquids and gases, or accumulation of dusts: Describe type of electrical equipment, lighting fixtures, ventilation and other related fire protection features required to minimize hazard(s).

g. The analysis shall list applicable NFPA and UBC number references as well as "required" and "design" conditions.

h. "Means of egress" sketch shall be provided for each floor indicating exit access, door swings in path of egress, required fire separations, stairs and rated exit passageways. In addition, provide a location of exit sign sketch indicating exit lights including direction and locations for which "Not An Exit" signs may be required. Illumination of means of egress and exit markings shall comply with NFPA 101.

i. Include a fire water flow curve, based on flow test data and determine if the available water quantities and pressures are adequate to meet project requirements. See Fire Protection Handbook, Section 16, Chapter 8C, Hydraulic Flow Curves and Chapter 8F, Analyzing Test Data. (Note that flow test data is normally provided by the Base Civil Engineer. Coordinate with your COE PM.)

2.6.2. Drawings. (See Chapter II for scale requirements.)

2.6.2.1. Floor Plan for each floor showing: 1.) overall dimensions, 2.) functional arrangement, 3.) type of occupancy of all areas, 4.) interior colors and finishes and exterior colors in tabular form. (Plates 10, 11, 12 and 13, Chapter IV.) Describe colors by words as well as a standard number designation, so that the customer will have no doubts as to what he will receive.

2.6.2.1.1. Draw all major equipment to scale.

2.6.2.2. Elevations: Provide an elevation of all four (4) building sides as a minimum. Show exterior mechanical and electrical equipment which affects the appearance of the structure.

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

2.6.2.3. Building Section: Provide at least two (2) complete building cross sections at 90 degrees to each other showing floor and roof framing, suspended ceilings, floor-to-floor heights, concealed or open ducts, relation of fenestration to supporting columns or walls, etc. Due to special needs, other primary transverse or longitudinal sections may be shown.

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

2.7. Structural Design.

2.7.1. Design Analysis - Narrative/Calculations.

2.7.1.1. Foundation Design: Provide a statement referencing the Geotechnical Report which will be attached as an Appendix to the completed Design Analysis. Regardless if the Geotechnical Report is provided

III-14

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but there's always enough time to do it  
over."

III-29

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

by the COE or the A-E, it will present factual data concerning corrosion control and soil bearing capacities for the various founding methods and may include recommendations for the method or procedure required. It should be recognized that there may be several methods of providing structural support that are acceptable. It is the responsibility of the A-E to select the most appropriate type of founding for each project based on overall economic considerations. The designer will describe the proposed foundation treatment including the depth of excavation, disposition of excavated material, whether in-place foundation will be compacted, whether compacted backfill will be utilized as foundation, whether frost governs the depth of foundation, and whether there is a need for drainage or a vapor barrier. State reason if foundation selected differs from the Geotechnical report.

2.7.1.2. Design Loadings (AFM 88-3, Ch. 1/TM 5-809-1): Provide a discussion of live loadings to be used, to include floor loads, wind, snow, earthquake, etc., together with data to justify deviations from established criteria. Seismic design shall be in accordance with AFM 88-3, Ch. 13. State the Seismic Zone, K, I, C, and Z values. State whether wind load or seismic load governs lateral design for each direction considered and for each independent structural system. For those cases in which additions are connected to existing structures (i.e., no seismic joints), the A-E shall provide calculations for the "integral structure" (i.e., new plus existing).

In no case shall the strength of an existing "below code" structure be reduced. Where practicable, the A-E shall upgrade the lateral resistance of the existing system to meet current code. In the projects involving alterations, modifications and/or additions, the A-E shall be responsible for the investigation and design necessary to strengthen existing structural members which are affected by additional loads. For pure alteration and repair projects, a seismic evaluation shall be performed per the following:

a. Major Alterations. Any building for which the cost of renovations or repairs, exclusive of seismic strengthening, exceeds 25 percent of the replacement cost of that building, must be modified to resist the appropriate level of earthquake forces. An appropriate

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

level of earthquake force is defined as that level prescribed in the latest edition of AFM 88-3, Chapter 13. The foregoing does not preclude the use of site specific response spectra if already available, or if deemed appropriate for critical facilities.

b. Minor Alterations. Minor structural alterations may be made in existing buildings and other structures in conjunction with the upgrading of the total structure. However, the building structure's ability to resist lateral seismic forces shall not be less than that which existed before such alterations were made.

c. Seismic Evaluation Submittal Requirements. The seismic evaluation study, complete with conceptual fix (if required) and associated costs shall be submitted. The seismic evaluation study shall be performed concurrent with other design work and coordinated with other design work to the maximum degree possible, i.e., be feasible from a functional/architectural standpoint, etc. The seismic evaluation study and its impact on the project current working estimate (CWE) shall be approved by the Air

III-15

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-31

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

Force prior to incorporation into the project bid documents.  
A minor alteration project's design documentation shall include routine structural narrative and calculations addressing structural modifications.

2.7.1.3. Working Stresses: Indicate selected stress where options are provided. Indicate any deviations from prescribed working stresses, together with justifications.

2.7.1.4. Structural System: Describe the selected structural framing system and the basis for the selection. Provide comparative, informal cost estimates for the system selected versus a minimum of two (2) other alternatives. Coordinate seismic design of anchors or restraints for mechanical and electrical equipment with designers for those systems.

2.7.2. Drawings. (See Chapter II for scale requirements.)

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

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

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

2.8. Mechanical Design.

2.8.1. Design Analysis - Narrative. Coordinate with architectural and electrical designers on energy conservation and fire protection analysis requirements.

2.8.1.1. Air Conditioning System. Briefly discuss temperature control system using AFR 88-15 requirements and appropriate Air Force ETL's. Direct Digital Controls (DDC) have not yet been approved by the Air Force and shall not be used except for equipment with built-in DDC controls.

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over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

2.8.1.2. Heating System. State type of heating system, i.e., forced warm air with direct fired furnace or hot water coil, forced hot water or steam with direct fired furnace or hot water coil, forced hot water or steam with direct radiation or unit heaters. State type of heat distribution system outside of buildings, i.e., steam, high temperature hot water, or hot water system and whether it is located above-ground or underground. State classification of underground system per CEGS 15705 (see paragraph on system requirements). Include soil investigations and survey, and type of conduit. Describe type of piping for heating system, insulation of, and if concealed or exposed.

2.8.1.3. Ventilating System. State whether it is a gravity or mechanical system. State requirement for outside air and basis for determination of quantity, i.e., number of air changes per hour, CFM per person, or other factors.

III-16

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but there's always enough time to do it  
over."

III-33

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

2.8.1.4. Evaporative Cooling Systems. Systems shall be designed in accordance with AFR 88-15. Note whether single or multi-stage process.

2.8.1.5. Other Systems. Include determination and capacity of compressed air, vacuum, or other service piping systems.

2.8.1.6. For cold storage projects, show approximate equipment sizes.

2.8.1.7. Fire Protection Analysis. See Architectural Section for requirements.

2.8.2.Design Analysis - Calculations.

2.8.2.1. Economic Comparison. When specific Air Force criteria does not indicate a preferred method for the various mechanical systems contained in the project, the designer shall consider three (3) alternative systems and base the final selection on a Life Cycle Cost Analysis in accordance with AFR 88-15.

2.8.2.2. HVAC Systems. Include heat gains and losses showing method for handling diversities in the air conditioning load. Provide calculations to verify equipment sizing. Complete draft of Air Force Form 108, "Air Conditioning Load Estimate", and include in Design Analysis. (See Plates 21 and 22 in Chapter IV.)

2.8.2.3. Plumbing Systems. Provide plumbing calculations necessary to determine number of fixtures and hot and cold water requirements. List types of fixtures per Federal Specification WW-P--541 (outfit series) and any others required for the project. State male and female building occupancy. Include description of domestic water heating and storage equipment including capacity, materials, piping types, preliminary pipe sizes and insulation requirements.

2.8.2.4. Energy Budget Figure. Provide Energy Budget Figure calculations in accordance with AFR 88-15, and appropriate Air Force ETL.

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but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

2.8.3. Drawings. (See Chapter II for scale requirements.)

2.8.3.1. General. Prepare floor plans, sections and details showing major heating, ventilating, and air conditioning equipment layout (chillers, refrigeration compressors, boilers, pumps, condensers or cooling towers, air handling units, fans), air distribution duct layout (may be single line), hoods and other major equipment items required for the facility. Design procedure to be used for support and anchorage or piping and mechanical equipment shall be as required in AFM 88-3 CH 13 (TM 5-809-10), including Section A for essential buildings. Show location of the Data Terminal Cabinet (DTC) for the EMCS (normally in the mechanical room).

2.8.3.2. Plumbing. Show fixture layout, floor and area drains, and plumbing equipment layout (hot water generator, storage tanks, pumps, air compressors, etc.). Provide legend, symbols and abbreviations lists.

III-17

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-35

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

2.8.3.3. Fire Sprinkler Systems. Do not show the layout of the sprinkler/suppression system piping and heads on the plans. (The contractor will design the system and provide shop drawings during the construction phase.) Show the riser location(s) and details, and add note at the top of the riser(s) stating "To Sprinkler System".

2.8.3.4. Mechanical Room. Provide mechanical room(s) sufficiently sized to allow for removal of tubes from boilers, chillers and condensers, and for removal of coils and filters from air handling units for maintenance or replacement. To save space, full use shall be made of knockout panels or doors on outside walls for tube and other equipment removal. Equipment shall be located to allow ample room for servicing and replacement. Piping and valves shall be arranged so that they will not prevent personnel movement within the mechanical room(s). All valves shall be located for ready accessibility. Where necessary, catwalks or permanent ladders shall be furnished for operating and servicing valves and headers. Gages and thermometers shall be of such size, scale and location as to be easily read by operating personnel. If an enclosed outdoor mechanical equipment yard is to be used provide for adequate air movement via openings in CMU walls, screened doors, louvers, etc.

2.8.3.5. Equipment Sizing. In concert with paragraph 2.8.3.4. above, prepare and submit a study of floor space in the mechanical room(s) (including mechanical equipment yards) and roof space on roof plan by selecting the largest and heaviest of three competing makes of each piece of equipment to be installed. Allow ample room for servicing and replacement of equipment. The mechanical designer shall inform the structural designer of the selections used so that the supporting roof structure can be properly designed. Provide catalog cuts of selected equipment in the design analysis.

2.9. Electrical Design.

2.9.1. Design Analysis - Narrative/Calculations.

2.9.1.1. Electrical Load Analysis. Include estimate of total connected load and of demand factors, diversity and resulting kilowatt demand. Provide breakdown of the

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but there's always enough time to do it  
over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

estimated connected and demand load to show: (1) Lighting and convenience outlet load; (2) power load for building equipment such as heating, air conditioning, etc.; (3) loads for special operating equipment such as air compressors, generators, pumps, and power receptacles being provided to energize special equipment. State power factor and size the transformers based on the estimated loads. Indicate voltage drop of service entrance and voltage drop basis for feeders and circuits.

2.9.1.2. Lighting. Describe the proposed standards of design for lighting intensities and the type of lighting fixtures for all interior and exterior areas. Lighting intensities shall be IAW IES Lighting Handbooks unless modified by AFR 88-15. Describe provisions for motor control, standby electric power, grounding, communications, television, and lightning protection, as applicable. Discuss special fixtures for hazardous areas (if applicable).

III-18

"There's never enough time to do it right,  
but there's always enough time to do it  
over."

III-37

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

2.9.1.3. Power Supply. Describe electrical characteristics of power supply to the base, or portion thereof involved in this project, including circuit interrupting requirements and voltage regulation. Verify the adequacy of the existing power supply at the point of take-off. If power source is not adequate, state measures proposed to correct the deficiency. If a new power source or local generation is required, discuss the various schemes and submit cost comparisons for the alternatives.

2.9.1.4. Fire Alarm. Discuss means for transmission of fire alarm signal (if applicable).

2.9.1.5. System Control. Discuss special control, i.e., generator paralleling, switchgear remote control, telemetering, central supervisory control (if applicable).

2.9.1.6. Grounding. Discuss special grounding requirements, i.e., for PMBL's, electronic labs, security communications areas, data processing and TEMPEST/EMP enclosures (if applicable).

2.9.1.7. Hospital Designs. Discuss hospital electrical criteria per NFPA, AFR 88-15, AFR 88-50, and TM 5-838-2 (if applicable).

2.9.1.8. Seismic Considerations. State that support and anchorage design for electrical equipment in seismic areas shall be in accordance with AFM 88-3 Ch 13/TM 5-809-10.

2.9.1.9. Raised Floor Systems. When raised floor systems are required, state that all stanchions and other metal parts of the raised floor shall be made electrically continuous for computer noise with 1 #1/0 BC brought from one point on the stanchions to a computer ground bar located within the raised floor areas. Bond this computer ground bar with 1 #1/0 BC to the service entrance ground bus.

2.9.1.10. TEMPEST/EMP Shielding. State the frequency spectrum for TEMPEST/EMP protection. Maximum spectrum/attenuation requirements for TEMPEST/EMP shall be in accordance with current DM 4-805-4 (see Chapter V). On Tempest, verify if low level or high level signal Limited Exclusion Area (LEA) design.

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CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

2.9.1.11. Cathodic Protection. Discuss Cathodic Protection systems applied to all buried or submerged ferrous piping, fittings, tanks and related facilities. See current Air Force ETL on subject.

2.9.1.11.1. Fire Protection. See Architectural for fire protection analysis requirements.

2.9.2. Drawings. (See Chapter II for scale requirements.)

2.9.2.1. Exterior Electrical Site Plan. Include the following:

- a. Show existing and new electrical lines, both overhead and underground, properly identified.
- b. Show removals and relocations, if any.

III-19

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III-39

CHAPTER 3  
SUBMITTAL REQUIREMENTS

<u>Chapter</u>	<u>Paragraph # and Subject</u>	<u>Page</u>
----------------	--------------------------------	-------------

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

d. Show new construction and location of major pieces of electrical equipment such as transformers, switchgear, etc.

e. Indicate the service to the facility and whether it is overhead or underground.

2.9.2.2. Interior Electrical. Provide the following:

a. Floor plans. Show the proposed locations of all major items of electrical equipment, including vaults, transformers, equipment rooms, switchgear, motor control centers, distribution panels, telephone terminal cabinets, and power and lighting panelboards. Coordinate space required for maintenance and future expansion with mechanical drawings and insure that National Electrical Code work space requirements are met.

b. Partial Lighting Layouts. Show a partial layout of typical lighting in the building indicating proposed fixtures and spacing. Locate exterior lighting on plans when applicable. Lighting intensities shall be based upon the requirements of AFR 88-15 and applicable ETL;s, I.E.S. Lighting Handbook, and criteria as applicable.

c. Single-line diagrams (not riser diagrams). Provide for all interior distribution systems. Diagrams of high and low voltage interior electrical distribution and communication systems shall show all of the important features, such as the following:

- (1) Auto transfer switches.
- (2) Emergency generators.
- (3) Emergency systems.
- (4) Major subpanels.

Show that the power to the Fire Alarm Control Panel is

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over."

CHAPTER 3  
SUBMITTAL REQUIREMENTS

Chapter                      Paragraph # and Subject                      Page

connected ahead of the main.

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

e. Telephone/Communications Plan. Show location and routing of nearest point of service for telephone to the Telephone Terminal Board.

f. TEMPEST/EMP Shielding Penetration Schedule. Prepare preliminary TEMPEST or EMP shielding penetration schedules for both mechanical and electrical penetrations.

g. See AFR 88-15 for conductor requirements. Do not specify "copper only" for bussing and/or conductors on the drawings.

III-20

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III-41