SECTION 2 - PRELIMINARY DESIGN

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

- Design Analysis
- Drawings
- Outline or Draft Specifications
- Cost Estimate
- Completed Environmental Permit Matrix (if required by the Scope of Work)
- 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 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, Volume 3, Specifications. Requirements of the Cost Estimate are provided in the A-E Guide, Volume 2, Cost Estimating. Refer also to Chapter 11, "Presentation of Data**, of this Guide for design analysis format, drawing format, and quality requirements. See appropriate Appendices of this volume for Environmental Permit Matrix and Engineering Considerations and Instructions for Field Personnel Report requirements.

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

1.1.1. Verify that the User's (Customer's) functional and special technical needs have been met, including the minimum requirements stated in this section.

1.1.2. Verify to all reviewing agencies that 1.) all previous review comments have been appropriately addressed, 2.) the designer's approach to the solution of the technical aspects of the project is sound and 3.) appropriate controlling criteria (such as TM's, DM's, Guide Specifications, etc.) are being adhered to. Justification for non-compliance with criteria must be provided in the Design Analysis.

1.1.3. Prepare an accurate cost estimate to verify the project-programmed amount has been properly established.

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

1.2. Design Analysis - General Requirements. Expand upon and/or modify the narrative and calculations developed in the Concept submittal, as outlined in Section 1, to satisfy the Preliminary Submittal requirements. Update the narrative and calculations to include any changes brought about by review comments or changes in the Scope of Work.

1.3. Civil Design.

1.3.1. Design Analysis - Narrative/Calculations. Expand upon the discussion of civil features that was presented in the concept submittal to include the items described below as applicable to the project.

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

1.3.1.2. Water Supply Line and Distribution System:

1.3.1.2.1. Show adequacy of distribution system to supply controlling demands; include information basic to this determination, and support with hydraulic computations. If the water requirements for the project are considerable, state whether a determination has been made regarding the capability of the existing system to meet the additional demand or if further hydraulic analysis is needed.

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

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

1.3.1.2.4. Use a minimum cover over pipes of 2.5-feet in grassed areas, 3-feet under unpaved driveways or roadways, and 4 feet under railroad tracks. The bottom of the water main must be at least 12-inches above the top of the gravity sanitary sewer, and 24-inches above the top of a pressure sewer pipe. For irrigation systems, discuss types of sprinkler heads, effective coverage, spacing and zoning, automatic flow control valves, and back flow prevention units.

1.3.1.2.5. For projects that involve supply, collection, and/or distribution utility conduits, rigid or flexible, support with calculations the trench design (bedding, initial backfill, and final backfill) for each one of the pipe options given in the COE Guide Specifications. The trench design is to be based on American Water Works Association (AWWA) Standards, or American Society of Civil Engineers Manuals and Reports on Engineering practice, as applicable; a trench cross section for each one of the pipe options is to be shown on the drawings. A Soil classification of the native soil, including as a minimum: identification, gradation, group symbol, and Atterberg limits, is to be made part of the supporting data of the trench design. Any deletion of a pipe option, as called for in the COE Guide Specifications, must be supported with complete engineering calculations. The engineering based justification for the deletion of the pipe option must also be narrated in the Design Analysis.

Since controlled compaction is required during construction, hydraulic consolidation of bedding or backfill (initial or final) material is not to be allowed. Thrust block area is to be based on actual bearing soil capacity, and a pressure of not less than 1.5 times the maximum expected pressure including surge; provide the supporting computations.

1.3.1.2.6. The pipe embedment detail terminology, shown on the construction drawings, must match exactly that of CEGS "Excavation, Trenching, and Backfilling for Utilities Systems". For each one of the pipe options, the embedment terminology compatible with AWWA and ASTM calls for: Foundation (if required), Bedding, Haunching, Initial Backfill (all within the pipe embedment) and Final Backfill.

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

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

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

1.3.1.2.10. Outline a Pipeline Filling and Draining Procedure on the drawings. Fill the different

water lines from the lowest point in each individual line limiting the flow rate to 1 (one) foot per second; provide drain valves sized to provide a flushing velocity of 2.5 feet per second; show at which locations the pipeline is to be filled from; discuss air evacuation thru the combination air vacuum/air release valves (CAV/ARV).

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

1.3.1.3. Water Supply Works:

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

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

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

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

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

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

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

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

1.3.1.5. Building sewer connection. The minimum pipe diameter for a gravity building sewer connection is 6-inches on at least 0.6% slope. Calculations are required only for gravity building sewer connections larger than 6-inch diameter and for all pressurized building sewer connections.

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

1.3.1.7. Wastewater Treatment. Where waste treatment is included in the job, discuss the degree of treatment required to meet the applicable discharge standards. Describe the receiving stream and the elements of the design including the capacities and number of units, monitoring equipment and controls. List all criteria used for the design of the treatment process and operation; furnish all calculations. Provide a hydraulic profile of the wastewater treatment plant. The alternatives that were considered and the reason for selecting the design over the alternatives shall be discussed demonstrating how the design will achieve the treatment goals. Pilot plant testing programs which are to be conducted will be described, and in the case of land treatment, a soil testing program will be developed and described.

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

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

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

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

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

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

1.3.1.14. NPDES Permit: In projects where waste water is not discharged into an existing collection and disposal system, the NPDES permit will be referenced and appended to the Design Analysis.

1.3.1.15. Economic Analysis: Furnish economic comparisons between feasible alternatives for site

layout, facility orientation, utilities systems, paved areas, and other site improvements.

1.3.1.16. Environmental Impact: Review the Environmental Impact Analysis (Environmental Impact Assessment or Environmental Impact Statement) to determine whether any design feature changes the conclusions or recommendations of the analysis. Should changes to the analysis be required as a result of the design, a complete description of the required changes shall be included in the narrative portion of the Design Analysis. If no changes are required to the analysis, the designer shall include this conclusion in the Design Analysis narrative.

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

1.3.1.18. Surveying.

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

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

1.3.1.18.3. Provide enough spot elevations on the topography map to support the contours. No point on any top0 map should be more than one inch (1") from either a contour or a spot elevation.

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

1.3.1.18.5. At least two (2) horizontal and vertical control points should be shown on the topography drawings so that the construction contractor can not only initiate his survey but also check it for possible blunders. If aerial photogrammetric methods where used to obtain this mapping, a control diagram should be included with the topography maps.

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

1.3.1.18.7. Coordinates and elevations should only be shown to two (2) decimal places. Elevations on ground surfaces should only be shown to one (1) decimal place. Values displayed to more decimal places than required, indicate a greater precision than was required or obtained.

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

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

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

1.3.1.18.10.1. Survey base line with physical control points.

1.3.1.18.10.2. Existing physical features such as buildings, fences, structures, utilities, trees, and drainage systems.

1.3.1.18.10.3. Existing and proposed ground elevations along the centerline of the pipe shall be shown on the profile.

1.3.1.18.10.4. In plan, the proposed pipeline bearings and its relationship to the survey base line.

1.3.1.18.10.5. In profile, the centerline elevation of the proposed pipeline.

1.3.1.18.10.6. Beginning and ending points of the pipeline and all appurtenances.

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

1.3.1.20. Future expansion. Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble-free fashion. If no provisions have been made for future expansion, so state.

1.3.2. Drawings. Expand and fully develop drawings used in Concepts, as applicable. Add any new sheets necessary to complete the presentation, including the following:

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

1.3.2.2. Soil Explorations and Logs: The Sacramento District's drawings, showing the boring stations and logs of boring, will be incorporated into the final drawing set by the A-E.

1.3.2.3. Demolition. Provide sufficient dimensions of the structures to be demolished; for pavement

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

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

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

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

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

1.3.2.6. Utilities, Exterior.

1.3.2.6.1. Show all existing and new pipes with sizes (such as water, sanitary and industrial sewers, storm drain and gas lines), valves, manholes, fire hydrants, service boxes, inlets, culverts, headwalls and cleanouts. Show existing pipe's material if such information is available. Provide a north arrow on the utilities site plan and show the relation between the utilities and roads, buildings, sidewalks, etc. Provide the sizes, strengths or classes corresponding to the different material options. Indicate the invert elevations and points of entry to buildings for utility lines. Show the fire sprinkler data required in the Civil design analysis. Do not show lengths of utility runs on plan sheets for Lump Sum Bid. (See A-E Guide, Volume 3, Specifications.)

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

1.3.2.6.3. Furnish details of all features such as valves, manholes, fire hydrants, service boxes, inlets, headwalls, cleanouts, thrust blocks, pipe encasements, frames, grates, covers, steps, etc. For treatment facilities, provide details for treatment units. Show all inplant lines and process piping. In congested areas or in areas where data in unclear as to the exact location of utilities, the utilities drawings should contain the following note:

"Elevations of utilities are given to the extent of information available. Where elevations are not given at points of existing utilities crossings, such elevations shall be determined by the

contractor and reported to the Contracting Officer. When unknown lines are exposed, their location and elevation shall likewise be reported."

1.4. Landscaping Design:

1.4.1. Design Analysis - Narrative/Calculations. See prior submittal requirements.

1.4.2. Drawings. In addition to that required in prior submittals, provide the following:

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

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

1.4.2.3. If an irrigation system is required, provide the following: an irrigation plan showing connection to water service and the dynamic head at the point of connection; the main and branch lines; valves and, if an automatic system, the controller location(s).

1.5. Architectural Design.

1.5.1. Design Analysis - Narrative.

1.5.1.1. Functional and technical requirements.

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

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

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

1.5.1.1.2. Energy conservation including solar energy applications and energy budget goals.

1.5.1.1.3. Sound and vibration control.

1.5.1.1.4. Interior parking and service areas.

1.5.1.1.5. Physical security; lock and keying, intrusion detection, alarms, restricted access areas, interior guard/canine support and ties to local authorities. Coordinate with Anti-Terrorism requirements, Architectural/Engineering Instruction, Chapter 10, Paragraph 6.

1.5.1.1.6. Signage; directional, informational, and motivational.

1.5.1.1.7. Exterior and interior finish materials; textures, colors and resistances.

1.5.1.2. Design objectives and provisions.

1.5.1.2.1. Adaptation of the building to the size, Shape, and orientation of the site to include benefit from natural warming and cooling effects afforded by the site.

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

1.5.1.2.3. Organization of functional spaces to establish workable adjacency relationships.

1.5.1.2.4. Building layout to establish convenient circulation flows for materials, equipment, services and people and also to include evacuation during emergencies.

1.5.1.2.5. Consolidation of spaces into sound compatible zones and protective construction zones, e.g., for fire, storm, and fallout.

1.5.1.2.6. Space layout compatible with modular (structural and environmental) support systems.

1.5.1.2.7. Building expandability/changeability. Where buildings are to be designed for further expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble-free fashion. If no provisions have been made for future expansion, so state.

1.5.1.2.8. Physical security.

1.5.1.2.9. Barrier-free design.

1.5.1.2.10. Energy conservation.

1.5.1.2.11. Building wall and roof construction: Provide statement of required type of construction based on occupancy, area, and height. State required wall and roof "U" values.

1.5.1.2.12. Acoustical design for interior and exterior sound sources.

1.5.1.2.13. Composition of masses and spaces and architectural details to reflect the desired image, and the scale and nature of the activities involved.

1.5.1.2.14. Perception of the building details and volumes. (Specific provisions made, e.g., an identifiable sequence of viewing positions for experiencing the architectural and interior design).

1.5.1.2.15. Enhancement of materials and systems maintenance and operation.

1.5.1.2.16. Economy of building construction, operation and maintenance: Life cycle cost effectiveness. Provide an economic comparison of the in-place costs of three or more wall systems. The comparison will only consider systems which meet the required "U" factors, are suitable to the seismic zone, and meet the durability and esthetic requirements for the project. Present the first costs for each component of the wall system, combine these, and arrive at an overall cost per square foot of wall surface. Describe the maintenance requirements for each system that was

studied. Provide a section through each wall system and show all components of the wall. Attach the economic comparison to the Design Analysis as an appendix.

1.5.1.2.17. A narrative of the interior design objectives. The narrative shall be concise and clearly written and shall include the following:

1.5.1.2.17.1. Delineation of the designer's philosophy and intent relative to the interior design scheme before it is integrated into the contract documents. See DM 4-805-3 regarding interior design.

1.5.1.2.17.2. Discussion of how this particular interior design scheme will help humanize our Army environment by fostering desired behavior and eliminating negative responses; coordinate with installation Design Guide.

1.5.1.2.18. Roof clutter and the trade-off of cost versus acceptable aesthetics shall be discussed in the Design Analysis and at the Preliminary Review Conference. Concurrence of the user regarding acceptability of the roof aesthetics will be obtained and documented at the Preliminary Review Conference.

1.5.1.3. Coordination with installation or outside agencies.

1.5.1.3.1. Physical security support.

1.5.1.3.2. Blind vending operations.

1.5.1.3.3. Occupation safety and health, as required.

1.5.1.3.4. Government furnished equipment.

1.5.1.3.5. Make up of signage.

1.5.1.3.6. Operations and maintenance support.

1.5.1.4. Fire Protection. See Concept Design Fire Protection requirements.

1.5.1.5. Color Boards. Provide one color board for projects in which the construction cost of the structure only, exceeds $1,000,000.

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

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

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

1.5.2. Design Analysis - Calculations. See Concept Phase.

1.5.3. Drawings. Further refine and continue to develop the information required in Section 1 of this Chapter.

1.6. Structural Design.

1.6.1. Design Analysis - Narrative. Further refine and continue to develop the information required in Section 1 of this Chapter.

1.6.2. Design Analysis - Calculations. Show the development of all live and dead loadings. Also, provide calculations for the preliminary sizing of the main structural members and major elements of the foundation.

1.6.3. Drawings.

1.6.3.1. Foundation Plan: Provide overall foundation layout, showing column locations, grade beams, pile locations, slab-on-grade joint pattern, etc. Also, provide a representative section, showing a typical foundation element and typical slab-on-grade. See AFM 88-5 Chap. 2/TM-5-809-2 and COE Standard Details for Utilities, Foundation, Paving and Railroads, Sheets F-1 to F-9. Concrete slabs on grade shall not bear directly on or be tied to footings, pedestals, or walls. At least 6-inches of earth or gravel cushion shall be provided.

1.6.3.2.

1.6.3.3.

1.6.3.4. Floor/Roof Framing Plans: Provide overall framing layouts (with dimensions) of the main structural elements. Show horizontal and vertical bracing locations and seismic joint locations.

1.7. Mechanical Design.

1.7.1. Design Analysis - Narrative.

1.7.1.1. See Concept submittal requirements. The designer shall provide solutions to any problems identified in the Concept submittal and justify or refine all assumptions made at concept stage (user shall be contacted if required).

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

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

1.7.1.4. Indicate the pieces of equipment and controls that will be tied into a base wide EMCS. The A-E shall coordinate the selected points with the user.

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

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

1.7.1.7. Future expansion: Where buildings are to be designed for further expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble-free fashion. If no provisions have been made for future expansion, so state.

1.7.1.8. Meters. State type, number and location of Utility meters and environmental permits required IAW Architectural/Engineering Instruction.

1.7.2. Design Analysis - Calculations:

1.7.2.1. See Concept submittal requirements.

1.7.2.2. Provide all calculations, which are necessary to justify the systems selected on the basis of economic and environmental impact. If A/E uses computer calculations for cooling loads, he must fill out the enclosed load estimate form taking input and output from computer analysis. See Plate 20, Chapter IV.

1.7.2.3. Show plumbing calculations as necessary to determine equipment or capacities of miscellaneous and special systems.

1.7.3. Drawings.

1.7.3.1. See Concept submittal requirements.

1.7.3.2. Show the location of the Data Terminal Cabinet (DTC) on the plans (in the Mechanical room).

1.7.3.3. Prepare a ¼"=1' or ½"=1' scale partial floor plan of the bathroom areas and pipe chases of dormitory type facilities to insure that sufficient

room is available for the plumbing, heating, and air conditioning equipment.

1.7.3.4. Coordinate reflected ceiling plan with architectural and electrical designer.

1.7.3.5. Show a schematic piping diagram for heating and cooling systems.

1.7.3.6. Prohibition of the following types of construction where subterranean termite conditions are known to exist:

1.7.3.6.1. Buildings with sub-slab or intra-slab heating, ventilation, or air conditioning (HVAC) ducts.

1.7.3.6.2. Buildings with plenum-type, sub-floor HVAC systems, as currently defined in Federal Housing Administration minimum acceptable construction criteria guidance.

1.7.3.6.3. Buildings with HVAC ducts in enclosed crawl spaces which are exposed to the ground.

1.7.3.6.4. Buildings with outer HVAC systems where any part of the ducting is in contact with or exposed to the ground.

The above constraints do not apply to exhaust ducts.

1.7.3.7. Demolition: Indicate if any demolition is required for the product. Determine the extent of the required demolition. Provide demolition drawings with necessary information for contractor to be able to bid the job, i.e., size and length of pipe or ducts to be removed or relocated; size and location of equipment to be removed; clear identification of all new, existing to be removed or relocated, existing to remain items. NOTE: contractor is not obligated to visit the job site before the bid, so all above information shall be provided on demolition drawings.

1.8. Electrical Design.

1.8.1. Design Analysis - Narrative. Complete the discussion of electrical features that was presented in the Concept submittal. Update the narrative to include any changes brought about by review comments, and include the following:

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

1.8.1.2. Provide an economic comparison to justify selection of major pieces of electrical equipment. The Study will only consider alternatives which meet the design criteria and perform the functions intended. Provide the first cost for each alternative considered and list advantages/disadvantages of each. Attach the economic comparison as an appendix to the Design Analysis. The following items shall be studied:

1.8.1.2.1. Transformer types.

1.8.1.2.2. Main switch boards.

1.8.1.3. Provide present worth, economic/energy study for the various types of lighting fixtures considered. The study will show the annual costs of power and maintenance for each fixture type over its service lift. These costs will then be brought back to the present and combined with the first cost to determine the most economical fixture type. Assume an annual interest rate of 7%. Advantages and disadvantages of each will also be noted.

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

1.8.1.5. Discuss the following: Lightning protection, motor control centers, standby electric power, special purpose receptacles and outlets, grounding, D.C. or high frequency.

1.8.1.6. For airfield lighting projects, state whether cable is to be direct burial or in duct. Discuss provisions for standby power, and comment on type of lighting system (such as high intensity or medium intensity, runway, approach or taxiway lighting), lighting equipment, and any conditions peculiar to the installation.

1.8.1.7. For protective lighting systems, provide a statement of requirements for fence lighting, area lighting, building security lighting, etc. Include proposed type of luminary, wattage of lamps, type of lamp beam spread, and how mounted on poles, buildings, etc.

1.8.1.8. If cathodic protection is required, provide a description of the location, type, and extent of the system to be installed. State the basis for the design proposed.

1.8.1.9. Generating plants: In addition to a discussion of the design approach, provide the following for generating plants: estimated connected load, maximum demand load, number and size of units (including KW and PF ratings), engine governor and voltage regulating requirements, voltage and basis for selection, and justification for use of special equipment such as load sensing governors.

1.8.1.10. Future expansion: Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble-free fashion. If no provisions have been made for future expansion, so state.

1.8.2. Design Analysis - Calculations. Provide calculations to backup sizing of major pieces of electrical equipment. The degree of completion shall be comparable to that of the narrative and drawings.

1.8.3. Drawings.

1.8.3.1. Provide plans showing the locations of major pieces of electrical equipment and outside distribution system. (Transformers shall include KVA and voltage ratings; outside distribution system shall include number of ducts for each duct bank, duct

sizes, number of cables for each duct and cable size/types.)

1.8.3.2. Provide plans showing the locations of special receptacles, telephone outlets, fire alarm (F.A.) control panel, F.A. manual stations, F.A. bells/horns/smoke detectors, etc.

1.8.3.3. Coordinate with architectural designer in the preparation of the "Location of Exit Signs".

1.8.3.4. Coordinate with architectural designer in the preparation of facility elevations.

1.8.3.5. Coordinate with architectural and mechanical designers for reflected ceiling plan.